Psychological and Behavioural Science

Reducing the Consumer Rejection of Cultivated Meat

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CM	Cultivated meat
GHG	Greenhouse gas
GM	Genetically-modified
US	United States

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Background

Meat consumption is a key driver of climate change and accounts for 14.5% of global annual greenhouse gas (GHG) emissions (Edenhofer et al., 2014). Unmitigated climate change will likely cause severe social and economic consequences, such as a reduced gross-domestic production (GDP) (Carleton & Hsiang, 2016). Although meat consumption is expected to slightly decline in *developed* countries in the upcoming decades (EC, 2012), meat consumption is expected to grow proportionally with GDP per capita in most *developing* countries (Henchion, McCarthy, Resconi, & Troy, 2014). As a result, global meat consumption is expected to double by 2050 (Steinfeld et al., 2006). Unless a more sustainable substitute for conventional meat is adopted by consumers, the absolute emissions by meat consumption will continue to rise.

GHG levels emitted by meat differ based on the type of meat and ruminant meats, e.g. beef and lamb, are the highest contributors of GHG emissions. In comparison to pork and poultry, ruminant meat has much higher emissions per serving (Clark & Tilman, 2017; Tilman & Clark, 2014). Worldwide, ruminant animals account for only 40% of the livestock but approximately 80% of meat-related GHG emissions (Clark & Tilman, 2017; FAO, 2014). Hence, substituting for ruminant meat for a more sustainable protein source would be an effective way to lower GHG emissions. Figure 1 below shows GHG emissions by their source.

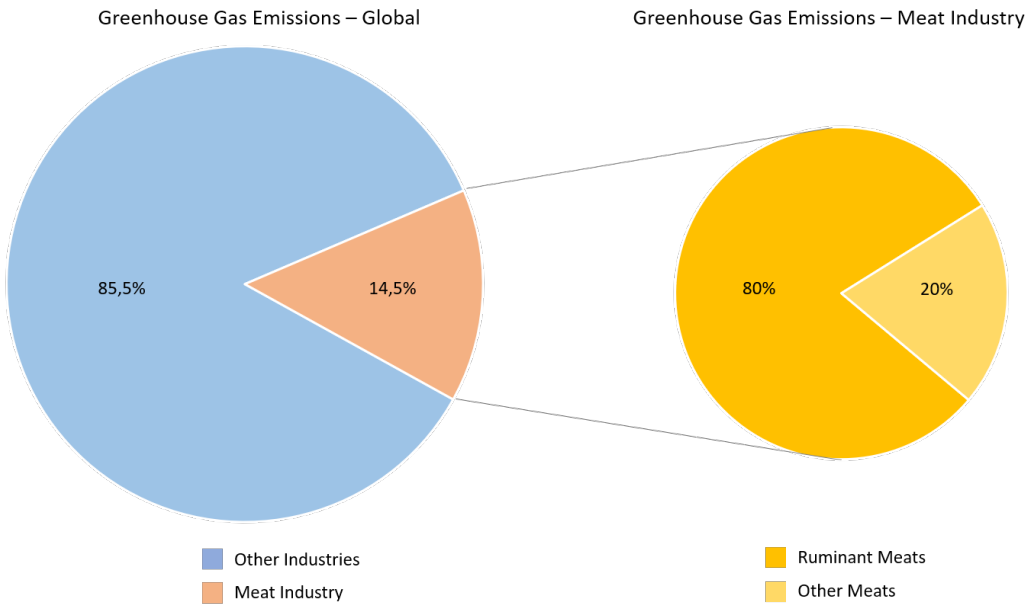


Figure 1: Greenhouse Gas Emissions by Source (edited after Clark & Tilman, 2017; FAO, 2014).

Cultivated meat (CM), also called in-vitro or lab-grown meat, is a promising meat substitute candidate. CM is meat grown directly from cells - without the rest of the animal. It is produced in three steps (e.g. Sharma, Thind, & Kaur, 2015): First, stem or muscle cells are extracted from livestock. Second, those cells are placed in a nutrient-rich medium to stimulate growth. Third, once the cells divide and multiply, their growth is structured by scaffolds - typically plant-based materials (Siegelbaum, 2008). After a few weeks, the CM is in the shape of thin layers of meat and can be harvested and processed. At its current technological state, the final CM product looks and tastes like a paler, blander minced meat. With further technological development, CM can potentially look, taste, and smell like a variety of conventional meat cuts, including steak (Post, 2018).

The GHG emissions of CM are currently similar to that of pork and poultry (Mattick, Landis, Allenby, & Genovese, 2015; Tuomisto, Ellis, & Haastrup, 2014). Accordingly, CM appears to be a particularly promising substitute for ruminant meats, as it could reduce emissions from meat consumption by a factor of 5-7 per serving (Clark & Tilman, 2017; Mattick et al., 2015).

Further societal benefits of CM could be observed in the areas of public health and animal welfare (Bhat, Kumar, & Fayaz, 2015). Since conventional meat production often requires the use of antibiotics that are detectable in the finished product (Donovan, 2015; Wang et al., 2017), public health may be improved through the elimination

of those antibiotics. Antibiotic residues in conventional meat are under suspicion of creating antibiotic resistance in humans and bacteria (Ghorbani, Ghorbani, Abedi, & Tayebi, 2016; Sutherland, 2015). In comparison, CM is produced in a sterile environment and does not require the use of antibiotics (McHugh, 2010). Moreover, animal welfare could be improved because CM does not require the breeding and slaughtering of animals. This contrasts with conventional meat production that often involves "factory farms" that cause animal suffering through overbreeding, overcrowding, and caging (Matheny & Leahy, 2007). In summary, CM may have three societal benefits if it substitutes ruminant meats: mitigating climate change, improving public health, and improving animal welfare.

Besides its societal benefits, the commercial potential of CM appears to be very high. Producing CM could, in the future, be cheaper than producing conventional meat (Bhat et al., 2015), as CM's economies of scale could be higher. If these predictions hold true, much of the conventional meat industry would become obsolete in the long-run (Post, 2018).

Currently, CM is still in its technological development. The first CM beef burger was released in 2013 by the Dutch pioneer Mark Post and his company Meso Meat (Jha, 2013). Since then, several start-ups have become active in developing CM, including Memphis Meats (Bunge, 2016) and JUST Inc. (Peters, 2018). Overall, there are around 20 start-ups active in the CM sector and the first CM products are intended to get launched as early as 2019 (Post, 2018) However, despite its societal benefits and commercial potential, CM may see difficulties in consumer acceptance (Hocquette, 2016; Verbeke, Marcu, et al., 2015; Verbeke, Sans, & Van Loo, 2015). Reducing these potential problems in consumer acceptance is the topic of this essay.

1. Introduction

"We shall escape the absurdity of growing a whole chicken in order to eat a breast or a wing, by growing these parts separately under a suitable medium" - Winston Churchill (1931)

Cultivated meat (CM) could be an effective means to mitigate climate change and improve public health and animal welfare, while also offering a very high commercial potential (see Background).

However, a positive reaction by consumers to CM and its acceptance in the marketplace cannot be assumed. Consumers often initially react with disgust to CM and raise concerns about its associated health and safety risks, nutritional value and sustainability, as well as concerns about ethical and regulatory aspects (J. Anderson & Bryant, 2018; Bryant & Barnett, 2018; Siegrist, Sütterlin, & Hartmann, 2018; Verbeke, Marcu, et al., 2015; Verbeke, Sans, et al., 2015; Wilks & Phillips, 2017). While the initial reactions are direct affective reactions, the further reflections are conscious evaluations of CM as a food option. These two types of negative reactions by consumers to CM were confirmed through our own survey (see Appendix A: Survey on Reactions to Cultivated Meat). A 2015 study qualified these reactions: of 180 Belgian students, more than half of the respondents said they would only *maybe* purchase CM if it was made available (Verbeke, Sans, et al., 2015). Although purchase intention does not determine purchase behaviour (Glasman & Albarracín, 2006) and this study had a limited sample, it establishes that large-scale consumer acceptance of CM is not assured. If consumers choose not to purchase CM, the product may encounter "consumer rejection" (compare Rogers, 2003). Some claim that consumer rejection could even be the biggest barrier that CM faces (Sharma et al., 2015). For realising CM's potential, it is of key importance to overcome consumer rejection.

Therefore, the research question this essay seeks to answer is: *how could consumer rejection of cultivated meat be reduced?* The scope of this essay is set on, where relevant, cultivated ruminant meats, as we identify these meats to have the highest potential to reduce emissions (see Background), and the United States (US), as it is the country with the highest consumption of these meats (OECD-FAO, 2018). The target audience of this essay is a firm producing CM.

The essay is structured as follows. In section 2, Problem Analysis, we seek to understand the psychological mechanisms for consumer rejection of CM. In section 3, Solution Framework, we establish how a solution to address that rejection could be conceptualised. In section 4, Solution Recommendations, building upon the prior sections, we suggest solutions to reduce consumer rejection of CM. Finally, the essay concludes with a Discussion in section 5.

2. Problem Analysis

In this section, we analyse the psychological mechanisms explaining consumer rejection of CM. Figure 2 provides an overview of the analysis of this section. In our analysis, we focus on individual decision-processes explaining consumer reaction to CM. We focus on these processes as they appear to be the best researched part of consumer reaction to CM. In reality, decision-making is the result of a complex interaction of cognitive, social, cultural, environmental, and other contextual factors (e.g. Dolan et al., 2012; Lahlou, 2018). Considering the whole complexity of decision-making is not feasible given the scope of this essay.

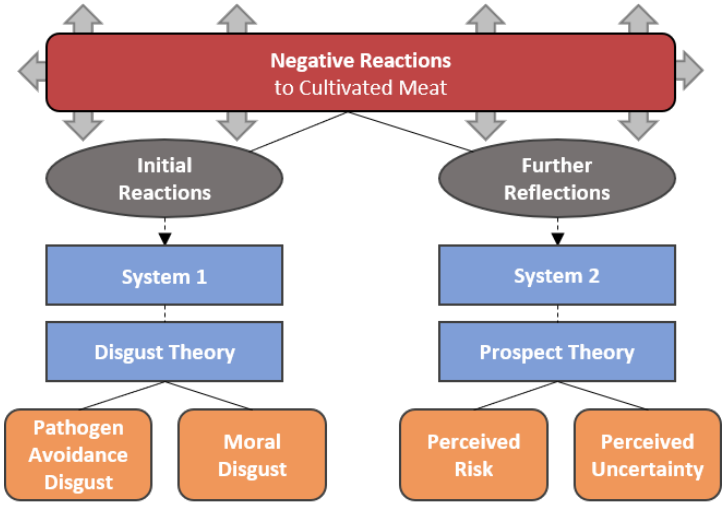


Figure 2: Overview of the Problem Analysis.

2.1. Dual Process Theory

The Dual Process Theory explains the functions of individual decision-making (Evans, 2003; Mukherjee, 2010; Yaari, 1987) and posits that humans possess two distinct information processing systems: "system 1" and "system 2" (Kahneman, 2011)[1].

Decisions made by system 1 are automatic, unconscious, intuitive, and fast (Evans, 2003). System 1 contextualises information based on past experiences, is shaped by shortcut reasoning modules, and expresses itself often through emotions, "algorithms" that probabilistically seek to maximise survival (Bach & Dayan, 2017). Since system 1 helps to simplify the world and is cognitively-efficient (i.e. consumes less energy), it is responsible for approximately 95% of all decisions humans make (Kahneman, 2011).

Decisions made by system 2, on the other hand, are deliberate, conscious, sequential, and slow (Evans, 2003). System 2 processes information discreetly, step-by-step, and is shaped by available working memory (Barrett, Tugade, & Engle, 2004). System 2 is, in comparison to system 1, more effortful and energy-consuming (Kahneman, 2011).

As mentioned in the Introduction, Verbeke, Marcu, et al. (2015) drew for the negative reactions of consumers to CM a difference between "initial reactions" (e.g. disgust) and "further reflections" (e.g. health concerns). In our interpretation, these two types of reactions can be accounted for by the two systems. We assume that the affective "initial reactions" are rooted in system 1, while the conscious "further reflections" can be attributed to system 2[2]. Subsequently, we explain how these two types of negative consumer reactions may origin in the respective system.

[1] These systems do not exist on a physiological level, but merely *describe* two different ways of how humans process information that shape decisions.

[2] If system 2 would be interpreted as 'pure rationality', all negative consumer reactions should be accounted to system 1. However, we interpret system 1 as unconscious reactions, and system 2 as *all* conscious thoughts.

2.2. System 1 Reactions explained by Disgust Theory

Prior research identifies *disgust* as the most important negative initial response to CM (Siegrist et al., 2018). Disgust is an emotion that has an evolutionary foundation (compare Bach & Dayan, 2017). In their Disgust Theory, Tybur, Lieberman, Kurzban, & DeScioli (2013) differentiate between two evolutionary functions of disgust relevant to our analysis: *pathogen avoidance disgust*, evolved to protect from harmful bacteria that could enter the body (Oaten, J Stevenson, & Case, 2009), and *moral disgust*, evolved to protect from un-cooperative and anti-social behaviours (Schnall, Haidt, Clore, & Jordan, 2008)[3].

Pathogen Avoidance Disgust

Pathogen avoidance disgust is triggered as soon as system 1 *estimates* that a given food might contain something that could cause harm to the body. This may explain why unfamiliar food is avoided: if system 1 cannot tell whether a new food is "safe" it rejects it. People tend to try food to which they feel disgusted only when they are food deprived (Hoefling et al., 2009), indicating that disgust follows the probabilistic logic of system 1 to ensure survival. Similarly, pathogen avoidance disgust may be triggered if a food has an appearance or taste that is associated with non-edible or degraded food, for instance the intuitive disgust towards mould cheese, which needs to be unlearned (Egolf, Siegrist, & Hartmann, 2018).

Moral Disgust

Moral disgust, in comparison, is triggered as soon as system 1 perceives that something is in opposition to the welfare of others. It appears to be particularly linked to people disliking *unnatural* or artificial things (Siegrist et al., 2018; Tenbült, de Vries, Dreezens, & Martijn, 2005; van den Belt, 2009). Examples of moral disgust to CM can be found when CM is called "Frankenfood" (Johnson, 2018) or said that growing CM is "playing God" (Stone, 2016). This phenomenon of rejecting something 'unnatural' can be explained by Psychological Essentialism: people have an intuition about the "essence" of entities (e.g. meat) that vaguely *characterizes* those entities (e.g. 'meat comes from an animal') (Cimpian & Salomon, 2014). However, if there is a disconnect between an entity and its essence (e.g. meat that does not come from an animal), people cannot categorize them into existing mental categories (compare Freeman, 1992). If such a disconnect is encountered, people may react with moral disgust, to protect from the unknown. Therefore, whether the categorisation of CM is positive or negative will depend on whether its "essence" is categorised as positive or negative. If the "essence" of CM is perceived to be something negative, people may be triggered to feel moral disgust towards it and prevent others from eating it as well (compare Schnall et al., 2008).

2.3. System 2 Reactions explained by Prospect Theory

Negative concerns regarding health, safety etc. of CM (see Introduction) can be explained by Prospect Theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). Prospect Theory suggests that people react differently to potential losses than to potential gains. Particularly, people are inherently *loss averse*: losses are (cognitively) weighted around twice as heavily as gains. The psychological root of loss aversion is likely to be found in survival instinct: by minimising risk and eliminating uncertainty, people maximise their own probability of survival and thus reproduction (e.g. Dawkins, 2006). Prospect Theory applies to both *risk* (Kahneman & Tversky, 1979), where decision outcomes can be attributed a probability and potential outcomes are known, and *uncertainty* (Tversky & Kahneman, 1992), where the potential outcomes are not known due to a lack of information, and therefore no probability can be attributed. In reality, reactions to risk and uncertainty interact and cannot be clearly disentangled.

Perceived Risk

Prospect theory predicts that consumer risk perceptions are skewed to overestimate the likelihood of a negative outcome if potential losses appear high (Sjöberg, 2000; Slovic, 1987; Tversky & Kahneman, 1992). If the negative *losses* associated with a technology are potentially very high (e.g. in the case of nuclear reactor accidents) the potential gains of the technology must be extraordinarily high to outweigh these losses. For a new technology, potential benefits must not only be slightly higher than disadvantages but must clearly outweigh disadvantages. This is particularly relevant to CM as prior research demonstrates that the perceived riskiness of a food is a

[3] This theory of disgust is not without critics (e.g. Rozin & Haidt, 2013) and alternative theories exist (e.g. Haidt, Rozin, McCauley, & Imada, 1997). Yet, we consider it most appropriate to understand the phenomenon.

strong determinant of choosing to eat that food (Stewart-Knox, 2000; Yeung & Morris, 2001). Consumer concerns regarding CM that link to risk perception are for instance those on health, safety, and nutritional value.

Perceived Uncertainty

Prospect theory further predicts that consumers seek to avoid *uncertainty* if possible, and substitute it, whenever possible, with a measurable risk, i.e. consumers prefer knowns over unknowns (Tversky & Kahneman, 1992). This phenomenon is called "ambiguity aversion" (Fox & Poldrack, 2009). It explains for instance why people would rather eat a 'safe option' such as conventional meat rather than trying CM if they do not know sufficient about CM. Reducing uncertainty has been shown to predict the diffusion of innovations including that of new foods (Ronteltap, Van Trijp, Renes, & Frewer, 2007). If an innovation is superior to competing products, the speed of the adoption of the product can be explained by how well these three types of uncertainty have been addressed (Rogers, 2003). The consumer concerns that can be linked to perceived uncertainty are for instance those about ethics, regulations, and sustainability.

3. Solution Framework

In this section, based on our analysis of the potential barriers to consumer rejection of CM, we propose a framework to address psychological mechanisms leading to rejection identified before. This framework answers on a generic level the research question (see Introduction) of this essay. Figure 3 gives on overview of the solution framework and connects it to the Problem Analysis.

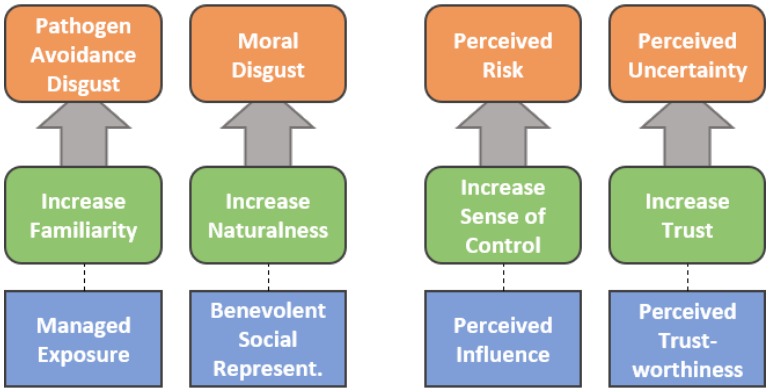


Figure 3: Overview of the Solution Framework.

3.1. Framework to Mitigate System 1 Reactions

To address disgust, we explore exposure-based interventions to increase CM's familiarity and benevolent social representations to reducing CM's perceived unnaturalness.

Reducing Pathogen Avoidance Disgust by Managed Exposure

In section 2.2, we identified that pathogen avoidance disgust toward CM is caused by a lack of familiarity with the product and is based on an evolutionary avoidance of potentially harmful food. We suggest that pathogen avoidance disgust can be mitigated by an Exposure Therapy inspired management of the exposure of CM as a way to gradually increase familiarity with the product. In Exposure Therapy, people are *gradually* exposed to an object that causes them disgust (Craske et al., 2014). By repeated interaction with, and slowly increasing the frequency of exposure to an unfamiliar object, people learn that their emotional reaction to the object may be inappropriate or overactive. Exposure Therapy have been shown to reduce disgust in several conditions, particularly in the food context (Rachman, Shafran, Radomsky, & Zysk, 2011; Smits, Telch, & Randall, 2002; Steinglass et al., 2012). For example, exposure-based interventions significantly reduced disgust and increased willingness to eat processed insects of Western consumers in an experiment (Hartmann & Siegrist, 2016).

Reducing Moral Disgust by Creating Benevolent Social Representations

In section 2.2, we also identified that moral disgust toward CM is caused by perceived unnaturalness, which originates because consumers do not have a mental category of CM's source. We suggest that Social Representation Theory can be used to explain how such mental categories can be created. In Social Representation Theory, an individual's understanding of a new object is mediated by collective, *social representations* of the object (Bauer & Gaskell, 2008). Hence: the social sense-making or "idea" of an object influences an individual's perception of that object. These representations play an important role in the acceptance of new foods by relating them to other, naturally occurring entities (Bäckström, Pirttilä-Backman, & Tuorila, 2003). Creating a more natural representation for CM could be achieved through anchoring it to other entities that already have a natural representation, i.e. "settling a new, and therefore strange, meaning into the established geography of symbols of a community" (Jovchelovitch, 2001, p. 6). The case of Surimi, imitated crab meat, is illustrative of how creating a benevolent social representation can reduce potential consumer rejection. Surimi was initially perceived to be unnatural since it entails luminescent bacteria, making it glow (Sado, 1998). By linking Surimi to the more benevolent social representations of naturally occurring crab and other 'familiar' shellfish (Park & Tom, 2011) this perception was overcome. Since consumers created a benevolent social representation it never faced strong consumer rejection and is widely consumed today (Parvathy & George, 2014).

The Link of Managed Exposure and Social Representations

In our interpretation, managed exposure and social representations appear to be connected. Through creating regular interaction with a new food product by exposure, a social representation of the source of that new food product is created. However, if doubtful consumers are over-exposed to CM, this may lead to a negative social representation of CM. In comparison, if people are gradually exposed and disgust is gradually reduced, a subsequent social representation may be more benevolent in nature. Thus, creating benevolent social representations is intrinsically linked to a gradual or systematic management of consumer's exposure to CM.

3.2. Framework to Mitigate System 2 Reactions

To address perceived risk and uncertainty, we suggest increasing consumer trust towards CM producer and increasing a sense of control by consumers.

Reducing Perceived Risk by Increasing Sense of Control

In section 2.3, we identified that concerns of consumers regarding e.g. safety of CM are often caused by an overestimation of risk, as predicted by Prospect Theory. A sense of control, having a feeling of "command over the outcome" of events (Nordgren, van der Pligt, & van Harreveld, 2007, p. 533), leads to reduced perception of risk (C. Anderson & Galinsky, 2006). A sense of control leads to an "optimism bias" (DeJoy, 1989): people perceive things to be more manageable, and neglect inherent probabilities of event. To be more precise, a higher sense of control leads proportionally to higher risk *denial* (Sjöberg, 2000). For instance, while a person may feel little control over their safety when sitting on an airplane, the same person may feel a stronger command over her safety while driving a car because she can command the steering wheel etc. Hence: Although airplanes are probabilistically less likely to crash, driving a car is often perceived to be safer than flying. While flying phobia is a common phenomenon with an estimated prevalence of 10-40% in the general population (Van Gerwen, Spinhoven, Diekstra, & Van Dyck, 1997), only 2-6% of people have a phobia of driving (Taylor, Deane, & Podd, 2002). A sense of control appears to counterbalance risk over-perception so effectively that it can eliminate the risk aversion as predicted by prospect theory.

Reducing Perceived Uncertainty by Increasing Trust

In section 2.3, we also identified that other consumer concerns, e.g. regarding ethical aspects of CM, are caused by the urge to avoid uncertainty, as also predicted by Prospect Theory. Trust, "the psychological willingness of a party to be vulnerable to the actions of another party" (Pirson & Malhotra, 2011, p. 1088), reduces ambiguity avoidance by forwarding the responsibility for handling the uncertainty to another party. In other words: trust follows the belief that the uncertainty oneself perceives, e.g. not knowing whether CM is healthy, is not uncertain to another party and that this party acts in one's interest, e.g. trusting that a CM producer knows whether CM is harmful and that they would not sell harmful food. For this reason, the trustworthiness of an organisation depends on a variety of variables (Mayer, Davis, & Schoorman, 1995; Pirson & Malhotra, 2011), for instance its ability, benevolence, and transparency. Improving any of these variables increases trust towards an organisations and its products (Kang & Hustvedt, 2014; Pirson & Malhotra, 2011; Schnackenberg & Tomlinson, 2016; Shockley-Zalabak, Ellis, & Winograd, 2000), also in the food sector (e.g. Choe, Park, Chung, & Moon, 2009; Siegrist, 2008; Siegrist, Cousin, Kastenholz, & Wiek, 2007). Yet, we identify transparency as most important for the case of CM. Why is illustrated at the GM food case: the public concerns towards GM food safety multiplied by intransparency of GM food producers (Bawa & Anilakumar, 2013; Costa-Font, Gil, & Traill, 2008).

4. Solution Recommendations

Based on Problem Analysis and Solution Framework, this section presents our recommendations to reduce consumer rejection of CM, and thereby provides a more specific answer to the research question. Figure 4 provides an overview of the solution recommendations and links them to the solution framework.

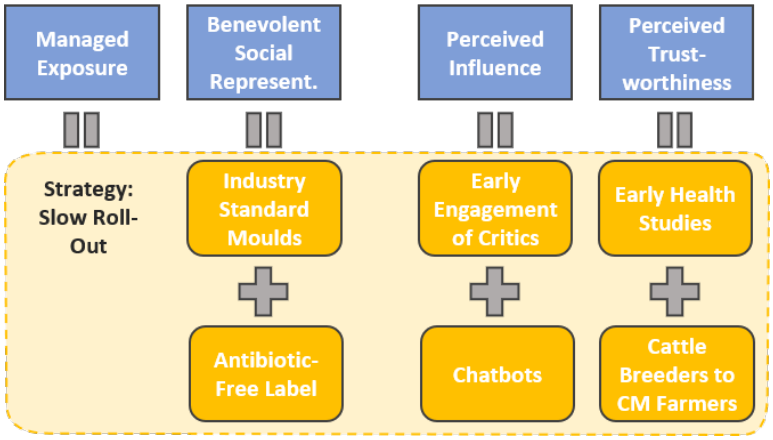


Figure 4: Overview of the Solution Recommendations.

4.1. Slow-Roll Out to Decrease Pathogen Avoidance Disgust

Our strategic recommendation towards decreasing pathogen avoidance disgust is a slow-roll out of CM. Based on our understanding of the psychology of consumers' perceptions of CM, if CM producers follow the roll-out strategies currently popular among start-ups, there could be widespread rejection of the product despite its societal benefits. The pushing of GM foods into the market without taking consumer concerns seriously is one prime example: GM crops are banned today in several countries such as Germany (ISAAA, 2017) as a result of movements against the product (Bauer, 2015; Lucht, 2015; Zhang, Wohlhueter, & Zhang, 2016). We have analysed this phenomenon to be directly linked to an initial system 1 reaction of pathogen avoidance disgust, which we identify as being mitigated by managing exposure.

A slow introduction of CM to the market entailing an initial bounded exposure to people without negative reactions to CM and a subsequent, gradual exposure to those with negative reactions could minimise potential pathogen avoidance disgust by consumers. This roll-out strategy also allows for a lot of opportunity to create trust, transparency and a sense of control for consumers. Moreover, this allows for strategizing to involve key stakeholders in the industry, and creating a benevolent collective social representation of CM, over a period of time. In the following sections we recommend interventions within this roll-out strategy that will target each of the psychological barriers to adopting CM that we have identified in our analysis. The targeting of the interventions focuses on high influence and high interest stakeholders, see Appendix B: Stakeholder Analysis for a complete overview. For further considerations regarding the slow roll-out strategy and implementing the following recommendations, also see Appendix C: Considerations on Implementation of Recommendations.

4.2. Creating Benevolent Social Representation to Decrease Moral Disgust

Our recommendations to reduce moral disgust consist of two interventions that aim to create benevolent social representations.

Intervention 1: Industry Standard Moulds

As mentioned in Problem Analysis, we hypothesize that the unfamiliarity, and the lack of a conceptual representation for CM's source, will likely lead to system-1-based disgust. To counteract this reaction, we suggest creating a standardized representation of what CM looks like before it is cut and packaged for the supermarket. By implementing an industry-standard mould into which the meat is grown, a conceptualization of how CM existed before it was cut is created. Consequently, a more coherent social representation will contribute towards creating an "essence" for CM. Moreover, having these moulds will allow a tangible customer experience, making it possible for CM to be cut out of these moulds by the butcher in the supermarket e.g. how ham is presented in supermarkets in whole and then cut into pieces. The key here will be *standardisation in the*

CM industry. By using industry-standard moulds for CM, we hope to create a benevolent social representation of CM to make it more familiar, thereby reducing moral disgust.

Intervention 2: Antibiotic-Free Label

We aim to implement an antibiotic-free label, comparable to the current organic food or free-trade labels in use. Although similar labels exist already, they do not focus on the main public health issue associated with conventional meat i.e. antibiotics residues (Ajuda, James, & Sampson, 2018). In working with organic meat producers to create a label identifying CM and organic meat as antibiotic-free, we achieve two objectives simultaneously. Firstly, we seek to establish a benevolent social representation for CM by anchoring it to the existing representation towards organic food producers (Dimitri & Greene, 2002). Secondly, we seek to create a contrast between 'the good meat', i.e. CM and organic meat, and 'the bad meat', i.e. conventional meat. Hence, by presenting CM as antibiotic-free, we are highlighting the unnaturalness of non-organic conventional meat by bringing attention to the fact that it contains antibiotics. As shown by a recent study, framing conventional meat as unnatural resulted in higher acceptance for CM (J. Anderson & Bryant, 2018). Thus, by labelling CM as antibiotic-free, we would be suggesting that the product is as natural as organic meat, and that it is also more natural than conventional meat containing antibiotics.

4.3. Increasing Sense of Control to Decrease Perceived Risk

Our recommendations to decrease perceived risk consist of two interventions that aim to increase consumer sense of control.

Intervention 3: Early Engagement with Critics

By engaging critics of CM as early in the process as possible through stakeholder dialogues, we aim to foster involvement in the improvement of CM, thereby enabling consumers to feel a sense of control over the form that the product takes (following Cuppen, 2012; De Bruijn & Ten Heuvelhof, 2018; De Bruijn, Ten Heuvelhof, & in 't Veld, 2010).

In our suggested dialogues, critics and other stakeholders (e.g. regulators) are encouraged to openly discuss their concerns regarding CM. These dialogues may be aimed at opinion leaders among potential critics, i.e. those with high social capital who can strongly influence the behaviour of social groups (Granovetter, 1983; Rogers, 2003; Spekkink & Boons, 2015). The feedback can then be incorporated into the product development and the participants be informed of how their opinions were taken into consideration (compare Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010). Hence, instead of trying to reduce resistance to CM by *increasing* force *for* it, this participatory approach seeks to reduce resistance by *decreasing* force *against* it (compare Lewin, 1947). By involving critics in the product development process, we seek to give them a sense of control, thereby reducing perceived risk i.e. negative system 2 reaction.

Intervention 4: Chatbots

This recommendation is designed to tackle system 2 perceptions of risk and uncertainty. A chatbot is an artificial intelligence-based computer program capable of conducting textual/audio conversations. The main advantage of chatbots in comparison to e.g. websites or telephone hotlines are that they enable direct on-demand two-way communication (Cui et al., 2017). While website is one-sided, a chatbot responds dynamically to content the user inputs. And in comparison to a hotline, a chatbot does not come with a cost per request. A chatbot will be able to respond to any doubts or concerns the consumer has towards CM. We propose installing a sign in the meat aisle of supermarkets where CM is placed with a QR code linking to the chatbot or placing tablet computers that run the chatbot on a stand in the aisle. Engaging consumers cognitively through a chatbot in evaluating benefits of CM may counteract its negative perceptions (Marcu et al., 2015) and thereby reduce both risk and uncertainty reactions. The chatbot works to create a sense of control, because people are not *'left alone'* with their doubts, and is transparent about information and resources available about CM.

4.4. Increasing Trust to Decrease Perceived Uncertainty

Our recommendations to decrease uncertainty consist of two interventions that aim to increase consumer trust towards a CM producing-firm.

Intervention 5: Early Health Studies

By conducting early longitudinal health studies, this recommendation seeks to address perceived uncertainty regarding CM. Although taking consumers seriously may appear obvious, it goes against industry practice (compare Bauer, 2015).

We suggest conducting these studies by recruiting a significant sample of people, who *regularly* consume CM, through initial subscription-based e-commerce sales of CM. Starting as early as possible and collecting data over a period time will be an effective way to use first-hand information to respond to critics. These studies could be financed by a CM start-up but should be conducted independently by credible external university researchers to reinforce the trustworthiness of the results. Finally, we suggest that the CM- related risk assessment studies i.e. those evaluating health and safety, aim to achieve a degree of validity (e.g. through a significant number) *beyond* what is required by the U.S. Food and Drug Administration (compare FDA, 2018). By acting with transparency and signalling that we take consumer concerns seriously, we hope to reduce consumer uncertainties, i.e. negative system 2 reactions.

Intervention 6: Cattle Breeders to Cultivated Meat Farmers

As mentioned in the Background, innovation in CM could result in conventional meat production becoming obsolete in the long-run (Bhat et al., 2015), potentially causing negative system-2-based reactions towards CM by consumers. If it is perceived that CM pushes cattle breeders out of business, it could be evaluated as a loss not *worth the risk* of adopting CM for. However, cattle breeders could repurpose their business to process crops into the required substrate for CM's cellular agriculture to contribute towards CM production (Cosgrove, 2017; Post, 2018).

Moreover, the taste of CM can be varied, potentially promoting the case for 'local' variants of the produce (Post, 2018). If cattle breeders can turn into *CM farmer*s, there may not be a negative association towards CM. By providing them with the requisite knowledge and financial resources (e.g. Isaksson, Simeth, & Seifert, 2016; Miles & Snow, 2007; Petersen, Handfield, & Ragatz, 2005), this production partnership may culminate into a distributed production system for local *CM farmers*. By producing CM locally, we hope to create trust among consumers and thereby reducing consumer uncertainty, i.e. negative system 2 reactions. Similar approaches - to produce locally - appear to have been effective in the past (e.g. Paloviita, 2010; Porter & Kramer, 2011; Steenkamp & de Jong, 2010).

5. Discussion

In this section, we discuss some limitations of our approach and close with a conclusion.

5.1. Limitations

This essay's main limitations stem from the characteristics of CM itself. For instance, if the price of CM does not become competitive to conventional meat, CM might end up as more of a luxury good (Jetter & Cassady, 2006). This might be reinforced if the tissue-engineering technology does not develop to a point where CM's taste and texture improves. Moreover, other meat alternatives such as plant-based and insect-based products often have lower GHG emissions than CM (van Huis & Oonincx, 2017). Hence, CM is arguably only a sustainable alternative to conventional meat insofar as it could reduce the consumption impact of people who would not eat the other, even more sustainable meat alternatives.

The Problem Analysis has two limitations in our interpretation. Firstly, in its limited scope, the analysis does not consider social, cultural, environmental, and other contextual factors (e.g. Dolan et al., 2012; Lahlou, 2018) that shape consumer decision-making. Further research in this domain could enhance our understanding of the contextual factors that shape consumer rejection of CM. Secondly, we have not considered regulatory challenges as they relate more to law than to psychology. For instance, the US Cattlemen's Association has already filed a petition to the US Department of Agriculture asking for 'meat' to be strictly defined as slaughtered animals, and that plant-based and lab-grown meat products should not be labelled meat at all so as not to confuse customers (Garfield, 2018)

Similarly, our Solution Framework and Solution Recommendations may have two limitations. Firstly, we do not consider the name of the CM itself, a topic of key importance (Marcu et al., 2015). A suggested new name for CM, *'clean meat'*, was withdrawn to not create resistance by the meat industry (Brodwin, 2018), in spite of promising consumer reception (Bryant & Barnett, 2018). However, since finding new names is a more creative than an analytical task, we did not consider this issue. Secondly, 'conventional' marketing tactics were not considered because of the limited scope. For instance, the packing of the CM could indicate from which local CM farmer it was produced, thereby anchoring it to familiar, more natural products. Giving free samples would be another key component of a managed exposure of CM.

5.2. Conclusion

The research question this essay sought to answer was: *how could consumer rejection of cultivated meat be reduced?* Our essay suggests that a managed exposure to CM, the creation of benevolent social representations, increasing consumer's sense of control and increasing trust towards CM-producing firms could reduce consumer rejection of CM. These general strategies were qualified though a strategic approach and six interventions in the Solution Recommendations. Consumer rejection of CM could in summary be reduced by tackling systematically the underlying psychological mechanisms that cause them, namely disgust and the perception of risk and uncertainty. Figure 5 provides a visual summary of the essay's content. If our recommendations were implemented, they could potentially help fulfilling CM's potential societal benefits, especially with regards to sustainability.

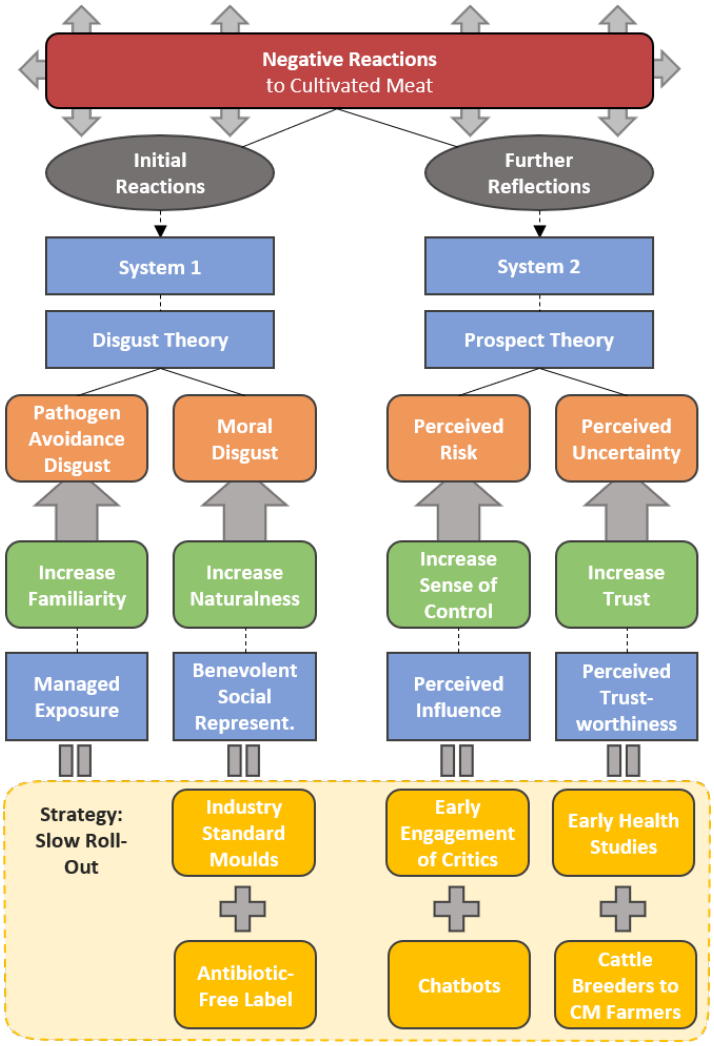


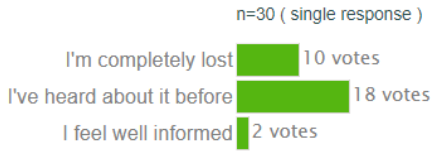
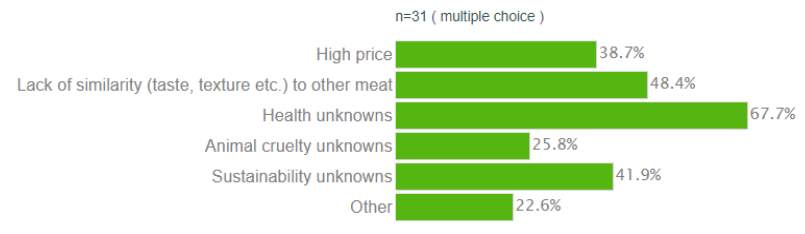
Figure 5: Combined Overview of Problem Analysis, Solution Framework, and Solution Recommendations.

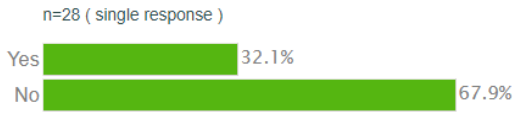
Appendices

Appendix A: Survey on Reactions to Cultivated Meat

We conducted a survey in the PB403 class with 34 students of the Master in Psychology of Economic Life and 2 professors of the program. In a 10-minute project-status presentation we needed to present, we asked students on their attitudes towards CM using the online survey tool VoxVote. Participants could enter the survey and directly respond in-class. We asked in total 5 questions. After the first 3 questions, we showed a short information video about CM (see Eater, 2015). The goal of the survey was twofold: on one hand, to gather concerns of consumers towards CM in comparison to prior studies (e.g. Verbeke, Marcu, et al., 2015), and secondly to test (although not with validity) the effect of informing consumers about CM. The question and responses are summarised in the table below. Table 1 blow summarises the answers to the survey.

Table 1: Summary of Responses to Class Survey.

#	Question	Number of responses	Responses
1	What is your main concern with lab-grown meat?	30	• 6x Taste • Are long-term effects investigated?, possible side effects • Don't say it … It sounds DISGUSTING • Environmental issues • Health-concerns. Is it safe? • How people will perceive it at the supermarket • I don't know it's made out of • I don't really have a concern with lab-grown meat because I eat a lot of meat alternatives and I'm excited to be able to eat meat again and still be vegetarian :) • I think there is an ethical concern and a dissociation from culture by artifically growing a piece that should come from a "happy living" farm animal • Is it healthy? • Is not real • It feels very unnatural to eat • It hinders the experience of eating (it is not the same) • It's currently too foreign • Its artificial, it can be greatly altered by corporations • It's just weird. How is it grown? Does it have the same "ingredients"/nutritions as animal meat? I don't have a clue about it • It's not natural • Nutrients • Nutrition (what are the effects on my health) • Price (won't consume it as long as its more expensive than normal meat) • Prices • Taste, price, time in production • That it's made in a lab • That not enough people are buying it! Where do I find myself? • The health aspect of the meat (chemicals, etc)
2	Which of the following most closely represents your prior exposure to lab-grown meat?	30	
3	What would prevent you from purchasing lab-grown meat?	31	
Video (see Eater, 2015)			

4	Has your main concern around lab-grown meat been addressed?	28	
5	Remaining concerns, questions or general thoughts you'd like to share?	22	• Are there any longitudinal studies regarding consuming lab-grown food? • Availability in the future • Can't we do this also for vegetables? They have feelings too and are full of unpleasant chemical residues • Do you think regular meat eaters would accept an alternative that has a bland taste? Maybe it is an option for vegetarian because they won't compare the taste but will people trade off taste for sustainability…? Present bias etc. • Hamburgers for lunch today? • Health condition • How are agricultural lobbies reacting to the development of artificial meat? • How are you going to change social habits? How do you take in consideration studies that say that red meat is unhealthy • How to control health safety of lab produced meat? • I still feel like it would feel very unnatural to eat something like this • Inequality. This tech is available in rich countries, how expensive/easy will it be for this technology to be used in developing countries where increase in meat consumption is an issue as population keeps increasing. • Is a big stakeholder businesses that can improve the taste of lab grown meat? E.g. experimenting with different flavours, spices etc. • Is it "cannibalism" to eat grown human meat? • Is procedure of taking cells from animals harming them? • Loss of culture. Picking meat is really big deal and having the best quality meat is almost a bragging right. Especially because you can really taste a difference. If artifical meat is more bland (and still more expensive!) then it's pretty close to tofu and really would only play on people who want to be vegetarian but are addicted to meat • Main concern has been addressed (price) but I feel like the point where lab grown burger costs as much as a normal burger is pretty far in the future (so for this essay, maybe focus on the time period, when lab grown meat can be expected to be more pricy than usual meat) (is there a projection when the prices will be the same?) • Recent production method/technological advances? Gov't funding? • So it will be less tasty? • Still nutrients concern. What happens to all the current beef cows? • The animals you need to take these stem cells from, how would you ensure that they were treated fairly and were safe? And with regards to sustainability how much technology is required to make it and how does that effect its level of sustainability • Very cool topic! And think could be used for the dissertation. • We need to think about what this should be called (how we "language" it) -- will have big impact on consumer perception, yes?

Appendix B: Stakeholder Analysis

We conducted a stakeholder analysis (following Bryson, 2004). The result is depicted in Figure 6 below.

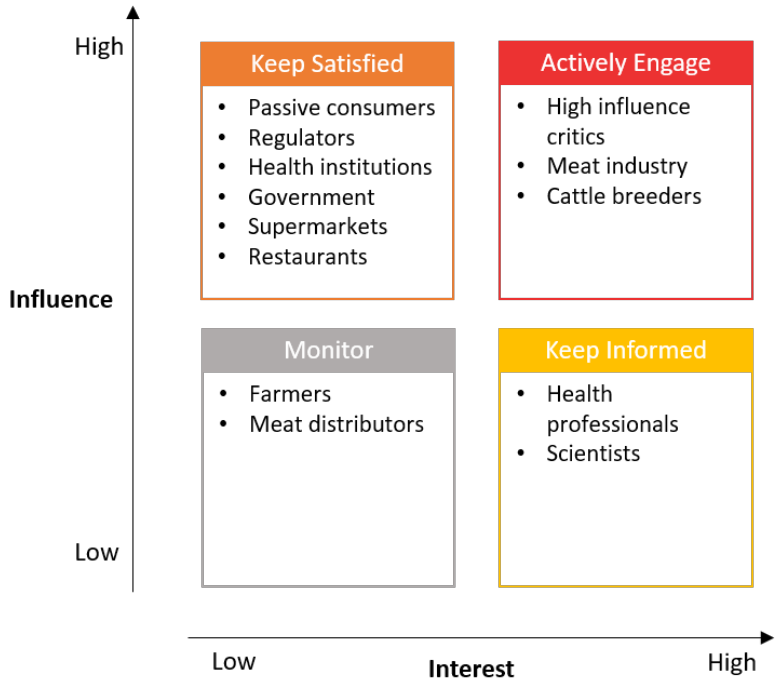


Figure 6: Stakeholder Analysis.

The stakeholder analysis was used to target our interventions. All our interventions focus on high influence and high interest stakeholders, i.e. that one should actively engage. Intervention 3: Early Engagement with Critics engages high influence critics of CM. Intervention 2: Antibiotic-Free Label involves the meat industry. Intervention 6: Cattle Breeders to Cultivated Meat Farmers engages cattle breeders. The other stakeholders could likely get appropriately considered by conventional stakeholder management, e.g. by reacting to voiced demands from stakeholders in the Keep Satisfied category, and not closing communication channels to stakeholders in the Keep Informed category.

Appendix C: Considerations on Implementation of Recommendations

In this appendix we list considerations relevant to the implementation of the recommendations we mentioned.

Implementation of Slow-Roll Out

- Conceptualisation of bounded-exposure-phase to people without negative reactions: The focus of this phase would be to prepare grounds for a reduced perception of risk and uncertainty once CM is exposed to people who have negative reactions. This bounded exposure phase would include limited sales of CM via online channels i.e. e-commerce. Thereby, consumers with positive reactions to CM could self-select into purchasing it. Our goal would be to bind consumers to repeated purchases through a subscription model, for enabling the health studies in Intervention 5: Early Health Studies. The earliest customers should optimally be affluent, educated, urban, and high-status individuals (Rogers, 2003). The key principle behind this phase is that *consumers are not exposed to CM unless they deliberately want it* while *preparing grounds for the subsequent large-scale market introduction.* This should avoid an overreaction by consumers as seen with GM foods.
- Conceptualisation of subsequent gradual-exposure-phase to consumers with negative reactions to CM: This phase should focus on reducing system-1-based disgust reactions to CM. It incorporates the whole process of large-scale market introduction. Sales in this phase would typically begin to slowly broaden the scope of exposure - based on the piecemeal approach of Exposure Therapy - for instance first in luxury restaurants, then premium supermarkets, and finally regular supermarkets. The key here is to ensure that consumers are not overwhelmed. Moreover, much emphasis should be put creating positive social representations of CM (see Intervention 1: Industry Standard Moulds and Intervention 2: Antibiotic-Free Label). This gradual-exposure-phase ends once CM has reached a cumulative 16% share in the target-market, as then its diffusion will likely continue organically (Rogers, 2003; Roland Ortt, 2010). Our recommendations do not need to stop when this 16% share is reached, but we assume that with the end of this phase our goal will be successfully reached i.e. reduced consumer rejection of CM.

Implementation of Intervention 1: Industry Standard Moulds

- Shape of the moulds: What would be the final shape of the moulds needs to be determined by field experiments. It is difficult to forecast how consumers would react to a specific shape beforehand. We could imagine for instance using wooden planks, based on a wooden flavour this adds to the meat (comparable to whiskey barrels). Generally, we suggest trying a wide variety of shapes, if possible with a 'natural touch', i.e. wood over steel.
- Usefulness of the moulds: From a production standpoint, there are likely no advantages of using industry-standard moulds for CM. This is different to other industry standards, which are typically put into place to increase costs by using network effects: if everyone does it, it becomes cheaper for everyone (e.g. Shapiro, 2000). An example of such type are the European pallets used for transportation of goods in Europe. The standardisation of the moulds would be created purely from a marketing standpoint and are as such comparable to standardisation in communication tactics of products (see e.g. Kreutzer, 1988). Potentially, these moulds could be adjusted to local preferences to match a country's culture (compare Vrontis, Thrassou, & Lamprianou, 2009).
- Feasibility: Cost structures would need to be taken into account in producing moulds that do not serve an actual functional purpose in growing the meat.

Implementation of Intervention 2: Antibiotic-Free Label

- How to engage organic meat producers: As mentioned, to our knowledge no clear antibiotic-free label exists in most countries. We suppose that such a label could increase the sales of organic meat versus conventional meat. Although many organic labels automatically imply antibiotics free, consumers who are not particularly influenced by sustainability may not have a purchase intention for these goods. Hence: with such a label the consumption of organic meat could increase by *non* Lifestyle of Health and Sustainability ("LOHAS") customers, which constitute only around 16% of the population (French & Rogers, 2007). A cooperation with CM producers could be insofar interesting to organic meat producers as such a partnership could be seen as a thematic alliance to increase sustainability. By cooperating with CM producers, organic meat producers make themselves robust for the future: they make one of

their greatest competitor - CM producers - a partner in the first place. Thereby, CM and organic meat could be placed in a mutually beneficial alliance that could sustain in the future - CM as the mass-market option, organic meat as the premium option.
- Feasibility: Similar to calling CM 'clean meat', a label like this could face pushback from and antagonise the conventional meat industry.

Implementation of Intervention 3: Early Engagement with Critics
- When to conduct the dialogues: The dialogues should be tied to the media coverage of CM – the more negative press on CM, the more dialogues should be hosted, as thereby concerns can be circumscribed before they gain momentum (compare e.g. Downs, 1972).
- Targeting: The dialogues should be aimed at opinion leaders among potential critics, i.e. those with high social capital & influence, as the behaviour of social groups (e.g. the group of critics) are strongly influenced by such individuals (Granovetter, 1983; Rogers, 2003; Spekkink & Boons, 2015).
- Timing / location: The dialogues should be held recurrently over the whole period of bounded-exposure-phase in major US cities.
- Feasibility: If social movements form against CM, such as in the case of anti-vaccination, it is likely that no amount of dialogue will be able to mitigate the doubts of critics. For instance, despite the repeated debunking of a study claiming a link between vaccines and autism, there still exists a large group of critics of vaccinations.

Implementation of Intervention 4: Chatbots
- How the chatbot works: Chatbots are typically based on machine learning, a statistical algorithm that is attributed to artificial intelligence. These algorithms get better the more responses they receive. Hence: the more requests people provide the chatbot, the better and more diverse the responses will become. At the beginning, a predefined set of answers to questions is defined for the chatbot. If a user asks a question, e.g. "Is cultivated meat save?" the chatbot will automatically respond based on keywords it identifies in the message (e.g. "save" -> safety). If the chatbot does not find a matching answer in its database, it would typically respond with a question such as "I'm not sure I understood your question. Did you maybe mean X?". Alternatively, the chatbot could then forward the question to a human operator. To further enrich the possible responses by the chatbot, a human operator user would need to look through the not-answerable questions and write further content or connect them to other responses, to refine the keyword-matching for the future. Over time, the chatbot would lead to better and more precise answers, being able to dynamically respond to all sorts of consumers questions.
- Targeting: Consumers should be reminded by shields such as "Questions? Talk to the cultivated meat chatbot" to use the application at home.
- Feasibility: Since artificial intelligence is still an emerging technology, and it might prove difficult to develop one that can effectively engage in conversations with consumers and mitigate their concerns.

Implementation of Intervention 5: Early Health Studies
- How to conduct the studies: When people order CM online, they have the option to subscribe to a continuous delivery by marking a check-box in the shop check-out. If not enough consumers opt-in for this way, we can at least recruit participants over this channel. Consumers would in this case e.g. receive an email asking whether they want to participate in these studies, and we would ship them free CM every week. The amount of CM people need to eat on a weekly or daily basis would depends on the regular consumption of comparable ruminant meats and would probably be separated by type of consumption to allow qualification (e.g. occasional consumption, heavy consumption, etc.).
- How to finance: The studies can be financed by our client, but the research should be made truly independently by external university researchers. A third party, e.g. a non-governmental agency, should ensure in the best case that the research was conducted independently. Without such a procedure, stakeholders may doubt the value of the resulting research, as lobby organisations by e.g. the tobacco industry published doubtable research (Ong & Glantz, 2000).
- Timing / significance: It could be that because of competitive pressures gradual-exposure-phase of your phased roll-out would need to start before the studies capture any long-term results for the continuous

consumption of CM (of a period of e.g. 5 or 10 years). Nonetheless, our approach would allow to capture longitudinal results *as fast as possible*, independent of whether gradual-exposure-phase needs to start prematurely or not.

- Feasibility: It is worth considering the cost and resources required for recruiting participants and conducting these studies. Receiving approval for such studies is also generally a long and difficult process and might simply delay CM's introduction into the market.

Implementation of Intervention 6: Cattle Breeders to Cultivated Meat Farmers

- How to engage cattle breeders: Cattle breeders will need to have an incentive to cooperate with a CM producer in the first place. We think it would be advisable to approach smaller cattle breeders first, as they have a lower profit margin than big cattle breeders (Crosson, Finneran, & McGee, 2016). They earn less money in the current production system and are thus potentially more approachable for a change in the first place.
- Financing: In cooperation with the cattle breeder's banks, it would be advisable to convert the upfront investment costs (required by cattle breeders to repurpose their equipment to become CM farmers) to a monthly rate. This would shift the frame for the breeders from a drastic change to a smooth transition (compare Kahneman & Tversky, 1984)
- Feasibility: It might prove to be difficult to retrain farmers in producing CM and transition them all out of farming. Furthermore, the Animal Slaughtering and Processing industry in the US employs over 500,000 people (Bureau of Labor Statistics, 2017), and it might be difficult for such a large industry to adapt to CM replacing conventional meat.

References

Ajuda, I. S., James, V. K., & Sampson, J. L. (2018). Antibiotic use in animals. In *The Business of Farm Animal Welfare* (1st ed., Vol. 264, pp. 264–271). Routledge.

Anderson, C., & Galinsky, A. D. (2006). Power, optimism, and risk-taking. *European Journal of Social Psychology*, *36*(4), 511–536. https://doi.org/https://doi.org/10.1002/ejsp.324

Anderson, J., & Bryant, C. (2018). *Messages to Overcome Naturalness Concerns in Clean Meat Acceptance: Primary Findings*. Retrieved from https://gastronomiaycia.republica.com/wp-content/uploads/2018/08/informe_faunalytics.pdf

Bach, D. R., & Dayan, P. (2017). Algorithms for survival: a comparative perspective on emotions. *Nature Reviews Neuroscience*, *18*(5), 311.

Bäckström, A., Pirttilä-Backman, A.-M., & Tuorila, H. (2003). Dimensions of novelty: a social representation approach to new foods. *Appetite*, *40*(3), 299–307. https://doi.org/10.1016/S0195-6663(03)00005-9

Barrett, L. F., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin*, *130*(4), 553.

Bauer, M. W. (2015). *Atoms, bytes and genes: public resistance and techno-scientific responses*. Routledge.

Bauer, M. W., & Gaskell, G. (2008). Social Representations Theory: A Progressive Research Programme for Social Psychology. *Journal for the Theory of Social Behaviour*, *38*(4), 335–353. https://doi.org/10.1111/j.1468-5914.2008.00374.x

Bawa, A. S., & Anilakumar, K. R. (2013). Genetically modified foods: safety, risks and public concerns—a review. *Journal of Food Science and Technology*, *50*(6), 1035–1046. https://doi.org/10.1007/s13197-012-0899-1

Bhat, Z. F., Kumar, S., & Fayaz, H. (2015). In vitro meat production: Challenges and benefits over conventional meat production. *Journal of Integrative Agriculture*, *14*(2), 241–248. https://doi.org/10.1016/S2095-3119(14)60887-X

Brodwin, E. (2018). There's a Push For Lab-Grown Meat to Get a New Name. Here's The Alternative. Retrieved December 14, 2018, from https://www.sciencealert.com/meat-grown-in-labs-will-no-longer-be-called-clean-meat-here-s-why

Bryant, C., & Barnett, J. (2018). Consumer acceptance of cultured meat: A systematic review. *Meat Science*, *143*(September), 8–17.

Bryson, J. M. (2004). What to do when stakeholders matter: stakeholder identification and analysis techniques. *Public Management Review*, *6*(1), 21–53.

Bunge, J. (2016, February 1). Sizzling Steaks May Soon Be Lab-Grown. *The Wall Street Journal*. Retrieved from https://www.wsj.com/articles/sizzling-steaks-may-soon-be-lab-grown-1454302862

Bureau of Labor Statistics. (2017). *May 2017 National Industry-Specific Occupational Employment and Wage Estimates*. Retrieved from https://www.bls.gov/oes/2017/may/naics4_311600.htm

Carleton, T. A., & Hsiang, S. M. (2016). Social and economic impacts of climate. *Science*, *353*(6304). https://doi.org/10.1126/science.aad9837

Choe, Y. C., Park, J., Chung, M., & Moon, J. (2009). Effect of the food traceability system for building trust: Price premium and buying behavior. *Information Systems Frontiers*, *11*(2), 167–179. https://doi.org/10.1007/s10796-008-9134-z

Churchill, W. (1931, December). Fifty Years Hence. *Strand Magazine*. Retrieved from http://teachingamericanhistory.org/library/document/fifty-years-hence/

Cimpian, A., & Salomon, E. (2014). The inherence heuristic: An intuitive means of making sense of the world, and a potential precursor to psychological essentialism. *Behavioral and Brain Sciences*, *37*(5), 461–480. https://doi.org/10.1017/S0140525X13002197

Clark, M., & Tilman, D. (2017). Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. *Environmental Research Letters*, *12*(6), 64016.

Cosgrove, E. (2017). What Do Farmers Think About Cultured Meat? Retrieved December 10, 2018, from https://agfundernews.com/what-do-farmers-think-about-cultured-meat.html/

Costa-Font, M., Gil, J. M., & Traill, W. B. (2008). Consumer acceptance, valuation of and attitudes towards genetically modified food: Review and implications for food policy. *Food Policy*, *33*(2), 99–111. https://doi.org/10.1016/j.foodpol.2007.07.002

Crosson, P., Finneran, E., & McGee, M. (2016). *Drivers of profit for Beef Production Systems*. Retrieved from

https://www.teagasc.ie/media/website/publications/2016/Beef-Manual-Section2.pdf

Cui, L., Huang, S., Wei, F., Tan, C., Duan, C., & Zhou, M. (2017). Superagent: a customer service chatbot for e-commerce websites. *Proceedings of ACL 2017, System Demonstrations*, 97–102. Retrieved from https://www.microsoft.com/en-us/research/publication/superagent-customer-service-chatbot-e-commerce-websites/

Cuppen, E. (2012). Diversity and constructive conflict in stakeholder dialogue: considerations for design and methods. *Policy Sciences*, *45*(1), 23–46.

Dawkins, R. (2006). The selfish gene: with a new introduction by the author. *UK: Oxford University Press.(Originally Published in 1976)*.

De Bruijn, H., & Ten Heuvelhof, E. (2018). *Management in networks*. Routledge.

De Bruijn, H., Ten Heuvelhof, E., & in 't Veld, R. (2010). *Process Management: Why Project Management Fails in Complex Decision Making Processes*. Berlin Heidelberg: Springer-Verlag.

DeJoy, D. M. (1989). The optimism bias and traffic accident risk perception. *Accident Analysis & Prevention*, *21*(4), 333–340. https://doi.org/10.1016/0001-4575(89)90024-9

Dimitri, C., & Greene, C. (2002). *Recent growth patterns in the US organic foods market*. *Agricultural Information Bulletins 33715*. Retrieved from https://www.researchgate.net/publication/23516866

Dolan, P., Hallsworth, M., Halpern, D., King, D., Metcalfe, R., & Vlaev, I. (2012). Influencing behaviour: The mindspace way. *Journal of Economic Psychology*, *33*(1), 264–277. https://doi.org/10.1016/j.joep.2011.10.009

Donovan, C. (2015). If FDA does not regulate food, who will? A study of hormones and antibiotics in meat production. *American Journal of Law & Medicine*, *41*(2–3), 459–482.

Downs, A. (1972). Up and down with ecology: The issue-attention cycle. *Public Interest*. Retrieved from https://www.nationalaffairs.com/public_interest/detail/up-and-down-with-ecologythe-issue-attention-cycle

Eater. (2015). The Meat of the Future: How Lab-Grown Meat Is Made. Retrieved from https://www.youtube.com/watch?v=u468xY1T8fw

EC. (2012). *Agriculture in the European Union*. Retrieved from https://ec.europa.eu/agriculture/sites/agriculture/files/statistics/agricultural/2012/pdf/full-report_en.pdf

Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., … Eickemeier, P. (2014). Summary for policymakers climate change 2014, mitigation of climate change. *IPCC 2014, Climate Change 2014: Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Egolf, A., Siegrist, M., & Hartmann, C. (2018). How people's food disgust sensitivity shapes their eating and food behaviour. *Appetite*, *127*, 28–36.

Evans, J. S. B. T. (2003). In two minds: dual-process accounts of reasoning. *Trends in Cognitive Sciences*, *7*(10), 454–459.

FAO. (2014). Sources of Meat. Retrieved November 11, 2018, from http://www.fao.org/ag/againfo/themes/en/meat/backgr_sources.html

FDA. (2018). *Benefit-Risk Assessment in Drug Regulatory Decision-Making*. Retrieved from https://www.fda.gov/downloads/ForIndustry/UserFees/PrescriptionDrugUserFee/UCM602885.pdf

Fox, C. R., & Poldrack, R. A. (2009). Prospect theory and the brain. In *Neuroeconomics* (pp. 145–173). Elsevier.

Freeman, L. C. (1992). Filling in the blanks: A theory of cognitive categories and the structure of social affiliation. *Social Psychology Quarterly*, *55*(2), 118–127. https://doi.org/10.2307/2786941

French, S., & Rogers, G. (2007). Understanding the LOHAS consumer: The rise of ethical consumerism. *The LOHAS Journal, Natural Marketing Institute, Harleysville, PA*.

Garfield, L. (2018, February 22). There's a growing battle between fake meat startups and Big Meat, and neither side is backing down. *Business Insider*. Retrieved from https://www.businessinsider.com.au/beef-companies-file-petition-against-lab-grown-meat-startups-2018-2

Ghorbani, B., Ghorbani, M., Abedi, M., & Tayebi, M. (2016). Effect of antibiotics overuse in animal food and its link with public health risk. *Int J Sci Res Sci Technol*, *2*, 46–50.

Glasman, L. R., & Albarracín, D. (2006). Forming attitudes that predict future behavior: A meta-analysis of the attitude-behavior relation. *Psychological Bulletin*, *132*(5), 778–822. https://doi.org/10.1037/0033-

2909.132.5.778

Granovetter, M. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory*, *1*, 201–233. https://doi.org/10.2307/202051

Haidt, J., Rozin, P., McCauley, C., & Imada, S. (1997). Body, psyche, and culture: The relationship between disgust and morality. *Psychology and Developing Societies*, *9*(1), 107–131.

Hartmann, C., & Siegrist, M. (2016). Becoming an insectivore: Results of an experiment. *Food Quality and Preference*, *51*, 118–122. https://doi.org/10.1016/J.FOODQUAL.2016.03.003

Henchion, M., McCarthy, M., Resconi, V. C., & Troy, D. (2014). Meat consumption: Trends and quality matters. *Meat Science*, *98*(3), 561–568.

Hocquette, J.-F. (2016). Is in vitro meat the solution for the future? *Meat Science*, *120*, 167–176.

Hoefling, A., Likowski, K. U., Deutsch, R., Häfner, M., Seibt, B., Mühlberger, A., … Strack, F. (2009). When hunger finds no fault with moldy corn: food deprivation reduces food-related disgust. *Emotion*, *9*(1), 50.

Hoyer, W. D., Chandy, R., Dorotic, M., Krafft, M., & Singh, S. S. (2010). Consumer Cocreation in New Product Development. *Journal of Service Research*, *13*(3), 283–296. https://doi.org/10.1177/1094670510375604

ISAAA. (2017). *Global Status of Commercialized Biotech/GM Crops in 2017*. Retrieved from http://www.isaaa.org/resources/publications/briefs/53/download/isaaa-brief-53-2017.pdf

Isaksson, O. H. D., Simeth, M., & Seifert, R. W. (2016). Knowledge spillovers in the supply chain: Evidence from the high tech sectors. *Research Policy*, *45*(3), 699–706.

Jetter, K. M., & Cassady, D. L. (2006). The Availability and Cost of Healthier Food Alternatives. *American Journal of Preventive Medicine*, *30*(1), 38–44. https://doi.org/10.1016/J.AMEPRE.2005.08.039

Jha, A. (2013, August 6). First lab-grown hamburger gets full marks for "mouth feel." *The Guardian*. Retrieved from https://www.theguardian.com/science/2013/aug/05/world-first-synthetic-hamburger-mouth-feel

Johnson, H. (2018). Should lab-grown meat be labelled as meat when it's available for sale? *The Conversation*. Retrieved from http://theconversation.com/should-lab-grown-meat-be-labelled-as-meat-when-its-available-for-sale-93129

Jovchelovitch, S. (2001). Social representations, public life and social construction. In *Representations of the Social: Bridging Theoretical Traditions*. Blackwell Publishing. Retrieved from http://eprints.lse.ac.uk/2649/

Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux New York.

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263–292.

Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *American Psychologist*, *39*(4), 341.

Kang, J., & Hustvedt, G. (2014). Building Trust Between Consumers and Corporations: The Role of Consumer Perceptions of Transparency and Social Responsibility. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-013-1916-7

Kreutzer, R. T. (1988). Marketing-mix standardisation: an integrated approach in global marketing. *European Journal of Marketing*, *22*(10), 19–30.

Lahlou, S. (2018). *Installation theory: the societal construction and regulation of behaviour*. Cambridge University Press.

Lewin, K. (1947). Group decision and social change. *Readings in Social Psychology*, *3*(1), 197–211.

Lucht, J. M. (2015). Public acceptance of plant biotechnology and GM crops. *Viruses*, *7*(8), 4254–4281.

Marcu, A., Gaspar, R., Rutsaert, P., Seibt, B., Fletcher, D., Verbeke, W., & Barnett, J. (2015). Analogies, metaphors, and wondering about the future: Lay sense-making around synthetic meat. *Public Understanding of Science*, *24*(5), 547–562. https://doi.org/10.1177/0963662514521106

Matheny, G., & Leahy, C. (2007). Farm-animal welfare, legislation, and trade. *Law and Contemporary Problems*, *70*(1), 325–358.

Mattick, C. S., Landis, A. E., Allenby, B. R., & Genovese, N. J. (2015). Anticipatory life cycle analysis of in vitro biomass cultivation for cultured meat production in the United States. *Environmental Science & Technology*, *49*(19), 11941–11949.

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, *20*(3), 709–734.

McHugh, S. (2010). Real Artificial: Tissue-cultured Meat, Genetically Modified Farm Animals, and Fictions. *Configurations*, *18*(1), 181–197. Retrieved from

https://www.researchgate.net/publication/236711588_Real_Artificial_Tissue-cultured_Meat_Genetically_Modified_Farm_Animals_and_Fictions

Miles, R. E., & Snow, C. C. (2007). Organization theory and supply chain management: An evolving research perspective. *Journal of Operations Management*, *25*(2), 459–463.

Mukherjee, K. (2010). A dual system model of preferences under risk. *Psychological Review*, *117*(1), 243.

Nordgren, L. F., van der Pligt, J., & van Harreveld, F. (2007). Unpacking Perceived Control in Risk Perception: The Mediating Role of Anticipated Regret. *Journal of Behavioral Decision Making*, *20*, 533–544. https://doi.org/10.1002/bdm.565

Oaten, M., J Stevenson, R., & Case, T. (2009). Disgust as a Disease-Avoidance Mechanism. *Psychological Bulletin*, *135*, 303–321. https://doi.org/10.1037/a0014823

OECD-FAO. (2018). *OECD-FAO Agricultural Outlook 2018-2027*. Retrieved from http://www.fao.org/publications/oecd-fao-agricultural-outlook/2018-2027/en/

Ong, E. K., & Glantz, S. A. (2000). Tobacco industry efforts subverting International Agency for Research on Cancer's second-hand smoke study. *The Lancet*, *355*(9211), 1253–1259.

Paloviita, A. (2010). Consumers' sustainability perceptions of the supply chain of locally produced food. *Sustainability*, *2*(6), 1492–1509.

Park, J. W., & Tom, P. (2011). *What are Surimi and Surimi Seafood?* Retrieved from www.trans-ocean.com/recipe_ideas.html

Parvathy, U., & George, S. (2014). Influence of cryoprotectant levels on storage stability of surimi from Nemipterus japonicus and quality of surimi-based products. *Journal of Food Science and Technology*, *51*(5), 982–987. https://doi.org/10.1007/s13197-011-0590-y

Peters, A. (2018, November). The meat growing in this San Francisco lab will soon be available at restaurants. *Fast Company*. Retrieved from https://www.fastcompany.com/90278853/the-meat-growing-in-this-san-francisco-lab-will-soon-be-available-at-restaurants

Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management*, *23*(3–4), 371–388.

Pirson, M., & Malhotra, D. (2011). Foundations of organizational trust: What matters to different stakeholders? *Organization Science*, *22*(4), 1087–1104.

Porter, M. E., & Kramer, M. R. (2011). Creating Shared Value. *Harvard Business Review*, (January-February). Retrieved from https://hbr.org/2011/01/the-big-idea-creating-shared-value

Post, M. (2018). Artificial Meat. LSE Public Lectures. Retrieved from http://www.lse.ac.uk/lse-player?id=4526

Rachman, S., Shafran, R., Radomsky, A. S., & Zysk, E. (2011). Reducing contamination by exposure plus safety behaviour. *Journal of Behavior Therapy and Experimental Psychiatry*, *42*(3), 397–404. https://doi.org/10.1016/J.JBTEP.2011.02.010

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Roland Ortt, J. (2010). Understanding the pre-diffusion phases. In *Gaining Momentum: Managing the Diffusion of Innovations* (pp. 47–80). World Scientific.

Ronteltap, A., Van Trijp, J. C. M., Renes, R. J., & Frewer, L. J. (2007). Consumer acceptance of technology-based food innovations: lessons for the future of nutrigenomics. *Appetite*, *49*(1), 1–17.

Rozin, P., & Haidt, J. (2013). The domains of disgust and their origins: Contrasting biological and cultural evolutionary accounts. *Trends in Cognitive Sciences*, *17*(8), 367–368. https://doi.org/10.1016/j.tics.2013.06.001

Sado, P. N. (1998). *"Glowing" Seafood?* Retrieved from http://web.archive.org/web/20080225162926/http://vm.cfsan.fda.gov/~ea...

Schnackenberg, A. K., & Tomlinson, E. C. (2016). Organizational transparency: A new perspective on managing trust in organization-stakeholder relationships. *Journal of Management*, *42*(7), 1784–1810.

Schnall, S., Haidt, J., Clore, G. L., & Jordan, A. H. (2008). Disgust as Embodied Moral Judgment. *Personality and Social Psychology Bulletin*, *34*(8), 1096–1109. https://doi.org/10.1177/0146167208317771

Shapiro, C. (2000). Navigating the patent thicket: Cross licenses, patent pools, and standard setting. *Innovation Policy and the Economy*, *1*, 119–150.

Sharma, S., Thind, S. S., & Kaur, A. (2015). In vitro meat production system: why and how? *Journal of Food Science and Technology*, *52*(12), 7599–7607.

Shockley-Zalabak, P., Ellis, K., & Winograd, G. (2000). Organizational trust: What it means, why it matters. *Organization Development Journal*, *18*(4), 35.

Siegelbaum, D. J. (2008, April). In Search of a Test-Tube Hamburger. *Time*. Retrieved from http://content.time.com/time/health/article/0,8599,1734630,00.html?imw=Y

Siegrist, M. (2008). Factors influencing public acceptance of innovative food technologies and products. *Trends in Food Science & Technology*, *19*(11), 603–608.

Siegrist, M., Cousin, M.-E., Kastenholz, H., & Wiek, A. (2007). Public acceptance of nanotechnology foods and food packaging: The influence of affect and trust. *Appetite*, *49*(2), 459–466.

Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, *139*(August 2017), 213–219. https://doi.org/10.1016/j.meatsci.2018.02.007

Sjöberg, L. (2000). Factors in risk perception. *Risk Analysis*, *20*(1), 1–12. https://doi.org/10.1111/0272-4332.00001

Slovic, P. (1987). Perception of risk. *Science*, *236*(4799), 280–285.

Smits, J. A. J., Telch, M. J., & Randall, P. K. (2002). An examination of the decline in fear and disgust during exposure-based treatment. *Behaviour Research and Therapy*, *40*(11), 1243–1253.

Spekkink, W. A. H., & Boons, F. A. A. (2015). The Emergence of Collaborations. *Journal of Public Administration Research And Theory*, 1–15. https://doi.org/10.1093/jopart/muv030

Steenkamp, J.-B. E. M., & de Jong, M. G. (2010). A global investigation into the constellation of consumer attitudes toward global and local products. *Journal of Marketing*, *74*(6), 18–40.

Steinfeld, H., Gerber, P., Wassenaar, T. D., Castel, V., Rosales, M., Rosales, M., & de Haan, C. (2006). *Livestock's long shadow: environmental issues and options*. Retrieved from http://www.fao.org/docrep/010/a0701e/a0701e00.HTM

Steinglass, J., Albano, A. M., Simpson, H. B., Carpenter, K., Schebendach, J., & Attia, E. (2012). Fear of food as a treatment target: exposure and response prevention for anorexia nervosa in an open series. *International Journal of Eating Disorders*, *45*(4), 615–621.

Stewart-Knox, B. (2000). Consumer perception and understanding of risk from food. *British Medical Bulletin*, *56*, 97–109. https://doi.org/10.1258/0007142001903003

Stone, M. (2016). The Future Will Be Full of Lab Grown Meat. *Gizmodo*. Retrieved from https://gizmodo.com/the-future-will-be-full-of-lab-grown-meat-1720874704

Sutherland, K. (2015). *Antimicrobial resistance in agriculture and its effects on human health*. University of Pittsburgh. Retrieved from http://d-scholarship.pitt.edu/24514/1/Sutherland_Kendra_MPHessay_4_2015.docx

Taylor, J., Deane, F., & Podd, J. (2002). Driving-related fear: A review. *Clinical Psychology Review*, *22*(5), 631–645. https://doi.org/10.1016/S0272-7358(01)00114-3

Tenbült, P., de Vries, N. K., Dreezens, E., & Martijn, C. (2005). Perceived naturalness and acceptance of genetically modified food. *Appetite*, *45*(1), 47–50. https://doi.org/10.1016/J.APPET.2005.03.004

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518.

Tuomisto, H. L., Ellis, M. J., & Haastrup, P. (2014). Environmental impacts of cultured meat: alternative production scenarios. In *Proceedings of the 9th international conference on life cycle assessment in the agri-food sector* (pp. 8–10).

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, *5*(4), 297–323.

Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review*, *120*(1), 65–84. https://doi.org/10.1037/a0030778

van den Belt, H. (2009). Playing god in frankenstein's footsteps: Synthetic biology and the meaning of life. *NanoEthics*, *3*(3), 257–268. https://doi.org/10.1007/s11569-009-0079-6

Van Gerwen, L. J., Spinhoven, P., Diekstra, R. F. W., & Van Dyck, R. (1997). People who seek help for fear of flying: Typology of flying phobics. *Behavior Therapy*, *28*(2), 237–251.

van Huis, A., & Oonincx, D. G. A. B. (2017). The environmental sustainability of insects as food and feed. A review. *Agronomy for Sustainable Development*, *37*(43). https://doi.org/10.1007/s13593-017-0452-8

Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D., & Barnett, J. (2015). "Would you eat

cultured meat?": Consumers' reactions and attitude formation in Belgium, Portugal and the United Kingdom. *Meat Science*, *102*, 49–58. https://doi.org/10.1016/j.meatsci.2014.11.013

Verbeke, W., Sans, P., & Van Loo, E. J. (2015). Challenges and prospects for consumer acceptance of cultured meat. *Journal of Integrative Agriculture*, *14*(2), 285–294. https://doi.org/10.1016/S2095-3119(14)60884-4

Vrontis, D., Thrassou, A., & Lamprianou, I. (2009). International marketing adaptation versus standardisation of multinational companies. *International Marketing Review*, *26*(4/5), 477–500.

Wang, H., Ren, L., Yu, X., Hu, J., Chen, Y., He, G., & Jiang, Q. (2017). Antibiotic residues in meat, milk and aquatic products in Shanghai and human exposure assessment. *Food Control*, *80*, 217–225.

Wilks, M., & Phillips, C. J. C. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PloS One*, *12*(2), e0171904.

Yaari, M. E. (1987). The dual theory of choice under risk. *Econometrica: Journal of the Econometric Society*, *55*(1), 95–115.

Yeung, R., & Morris, J. (2001). Food safety risk—Consumer perception and purchase behavior. *British Food Journal*, *103*, 170–187. https://doi.org/10.1108/00070700110386728

Zhang, C., Wohlhueter, R., & Zhang, H. (2016). Genetically modified foods: A critical review of their promise and problems. *Food Science and Human Wellness*, *5*(3), 116–123. https://doi.org/10.1016/j.fshw.2016.04.002