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## **Modifying sensory perceptions**

Augmented reality in the marketing of meat substitutes

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**ABSTRACT:**

Kuluttajien päivittäiset ruokaan liittyvät kulutusvalinnat vaikuttavat merkittävästi ympäristöön ja ilmastomuutokseen. Lihankulutus ja sen vaikutukset ympäristölle sekä siihen liittyvät eettiset kysymykset ovat nousseet universaaliksi keskustelunaiheeksi. Keskeiseksi teemaksi on muodostunut pohdinta siitä, miten kuluttajat saataisiin valitsemaan lihan sijaan lihaa korvaavia tuotteita.

Tässä tutkielmassa perehdytään lisätyn todellisuuden potentiaaliin mahdollisuuksiin lihankorvikkeiden markkinoinnissa. Tutkielma pyrkii vastaamaan pohdintaan siitä, voitaisiinko lisättyä todellisuutta hyödyntää lihankorvikkeiden markkinoinnissa lisäämällä kasvipohjaisten tuotteiden houkuttelevuutta. Tähän pohdintaan vastataan kahden tavoitteen avulla, joista ensimmäinen on tarkastella kokemuksellisen-, aisti- sekä lihankorvikkeiden markkinoinnin välistä yhteyttä ja sitä, miten lisätty todellisuus sopii mukaan. Toinen tavoite on tutkia, miten lisätty todellisuus vaikuttaa kuluttajien arvioihin lihankorvikkeista ja mikäli lisätty todellisuus voisi olla toimiva työkalu osana lihaa korvaavien tuotteiden markkinointia.

Tutkielmassa hyödynnettävä määrällinen aineisto kerättiin osana toimeksiantajan VTT:n Augmented Eating Experiences -tutkimusta. Kokeellisessa tutkimuksessa toteutettiin neljä eri tutkimusasetelmaa, joista kahdessa hyödynnettiin tuoksuaugmentaatiota, yhdessä visuaalista augmentaatiota ja yhdessä näiden kahden yhdistelmää. Tutkimuksessa osallistujat arvioivat sattumanvaraisessa järjestyksessä kolme kaupallista tuotetta: yhden lihatuotteen sekä kaksi samalaista kasvistuotetta, joista toisen aikana aistikokemusta muokattiin lisätyn todellisuuden avulla. Tuoksuaugmentaatioissa hyödynnettiin tuoksuliuosta sekä maistettavan oikean lihapullan tuoksua. Tuoksuaugmentaatioista tässä tutkielmassa käsitellään lihapullan tuoksulla toteutetun koeasetelman tuloksia. Visuaalinen augmentaatio toteutettiin AR-laseilla.

Tulososiossa tutkimuksen tuloksia käsitellään erityisesti tutkimusosallistujien suorittamien aistinvaraisten arvioiden näkökulmasta. Aistinvaraiset arviot tuotteista tehtiin sekä ennen tuotteen maistamista, että maistamisen jälkeen. Aistinvaraisten arvioiden tuloksia analysoidaan ja niihin syvennytään koeasetelman sisällä tarkastellen eroja sekä tuotteiden että ennen ja jälkeen maistamisen tehtyjen arvioiden välillä. Lisäksi eri augmentointien vaikutuksia vertaillaan ja niistä keskustellaan. Tulososiossa pohditaan myös kuluttajien kiinnostusta ostaa tuotteita, kuluttajien kokemia arvoja sekä lihankorvikkeiden tuttuuden merkitystä kiinnostukselle ostaa tuotteita. Johdopäätöksissä lisätyllä todellisuudella todetaan olevan potentiaalia erityisesti tuotteisiin liittyvien odotusten sekä ostokiinnostuksen lisäämisessä. Haasteeksi lisätyn todellisuuden hyödyntämisessä lihankorvikkeiden markkinoinnissa nousee kuitenkin lisätyllä todellisuudella muokattujen kokemusten ja todellisuuden epäyhdenmukaisuus sekä lisätyn todellisuuden hyödyntämisen toteuttaminen käytännössä.

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**KEYWORDS:** Augmented Reality, Consumer behaviour, Sensory marketing, Experiential marketing, Meat Substitutes, Plant Protein Products,

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## 1 Introduction

As the offering of branded products and services, information available and the amount of distribution channels increases, consumers are becoming more flexible in their decision making (Wiedmann et al. 2018). Purchasing goods and groceries has significantly changed in recent years (Shen et al., 2022; Verdon, 2022; Begley et al. 2020) and is still on continuous disruption (Denman, 2021, p. 58; Begley et al. 2020). Stone (2018) points out marketplace of food and beverages being diverse and competitive. Significant number of trends such as wellbeing, favoring of domestic products and responsibility (Niini-aho, 2021) are shaping the field of grocery shopping. Emerging number of technologies and technology-led trends such as ecommerce and personalization of the food experience (Denman, 2021; Mitzner, 2022) have come to change the business. Besides other trends COVID-19 pandemic has changed the business, and according to Verdon (2022) grocery was the category experiencing the biggest shift in shopping habits in the US due to COVID-19 pandemic. This is supported by Shen et al. (2022), who also state grocery shopping being one of the most affected things by pandemic.

Technological evolution has led to multiple technologies that are changing not only the field of business but the daily life of consumers. Previously the only way to purchase goods was to visit a store physically. Decades of development has led to wide variety of ways to buy goods. Major trends shaping retailing of groceries and consumers' habits in the future will be ecommerce, lifestyle trends, geovariety, sustainability, strategic partnerships, and personalization of the food experience (Mitzner, 2022).

Now almost everything can be purchased online, however, not only that; technologies like Augmented Reality (AR) are enabling new customer experiences such as realistic shopping experiences even in our homes. Now trying new furniture for the living room or comparing the look of new sunglasses on you is possible while sitting at home. Recently AR has reached more interest also in the field of marketing (Du et al, 2022; Rauschnabel et al, 2022a, p. 1). Hubspot lists Augmented and Virtual reality in their Marketing Trends of 2023 list (Bump, 2023).

Consumers' decisions on what they eat on their daily diets have significant impact on environment and climate change (Hartmann & Siegrist, 2017). Past couple of years have shown a shift in consumers' attitudes and behaviors towards healthy and sustainable eating (Starowicz et al. 2022). Especially meat consumption, its ethicalness, and effects from environmental and social point of view is a recent topic (Apostolidis & McLeay, 2016, p. 74; Profeta et al. 2021; Starowicz et al. 2022) even though the meat substitute industry started already during early 90's as vegetarians and vegans started consuming meat substitutes (Tziva et al. 2020). According to Tziva et al. (2020) the main drivers for this change were ethical, cultural, and religious factors. As meat production is consuming lots of resources, convincing consumers to reduce their meat consumption becomes necessary (Hartmann & Siegrist, 2017). According to Apostolidis and McLeay (2016) many studies have also proven that high level of meat consumption is a health risk. Increased risk of total mortality, cardiovascular diseases, colorectal cancer, and type 2 diabetes are being associated with increased levels of red meat consumption (Battaglia et al. 2015).

Better understanding behind the factors encouraging consumers to reduce their meat consumption as well as understanding the role of meat substituting products is needed to enable effective interventions on current level of meat consumption (Apostolidis and McLeay, 2016, p. 75; Graça et al., 2015). According to Apostolidis and McLeay (2016, p. 74) plant-based products substituting meat have been identified as a healthy source of protein. Meat substitutes are products that are rich in protein, and they are usually plant-based (Starowicz et al. 2022; Hoek et al. 2011).

Change in attitudes towards plant-based protein products has been recognized, and the market is growing (Starowicz et al., 2022). According to Starowicz et al. (2022) wide offering of meat substitutes on the market is important for consumers. The growing market is thus shaping the consumption of groceries. Innova Market Insights (2022) lists plant-based one of the top five trends for driving innovation and success in 2023, personal health and global sustainability being the drivers for this phenomenon. According to



forecasts by Statista (n.d.) the revenue of meat substitutes in Europe will keep growing on yearly level and the growth will accelerate. Hartmann and Siegrist (2017) however point out that increasing consumption of meat substitutes does not necessarily mean that the consumption of meat decreases.

Kumar et al. (2017) mention that “meat-like products, with similar texture, flavor, color, and nutritive value can be substituted directly for meat to all sections of the society”. According to Hoek et al. (2013) reducing meat consumption by increasing the consumption of meat substitutes requires products being considered attractive for consumers. Hoek et al. (2011, p. 672) for their part conclude that the main reason for people who do not use meat substitutes is the unfamiliarity of the products, but also low sensory appeal of the substitute products when they are compared to meat. Inventing an ideal alternative for replacing meat in the weekly diet is thus difficult challenge (Starowicz et al., 2022).

From this the importance of sensory perceptions of consumers can be concluded what comes to substituting meat with plant-based products. Fiorentini et al. (2020) state that to understand the physiochemical characteristics of plant-based proteins to increase consumers’ acceptance of meat substitutes, sensory data is an essential component. Hoek et al. (2011) note that the consumption of meat substitutes is increasing among people who want to avoid meat. This is supported by Starowicz et al. (2022) who highlight that using meat substitutes is increasing especially because of the increasing popularity of vegan and vegetarian lifestyles, however they also mention the role of flexitarians who are limiting their meat consumption yet not fully removing animal-based products from their diets. Acceptance of meat substitutes could make a significant advancement towards more sustainable and healthy foods (Fiorentini et al., 2020).

Research gives an indication in the direction of sensory marketing becoming an emerging trend (Harvard Business Review, 2015; Krishna & Schwarz, 2014; Peck & Childers, 2008). In 2015 it was stated in Harvard Business Review that “We’re about to enter an era in

which many more consumer products companies will take advantage of sense-based marketing.”. Sensory marketing refers to marketing that pays attention specifically to the sensory experience consumers have during purchasing and consuming goods and services (Krishna, 2012).

Sensory marketing can be seen having a strong connection to experiential marketing, as sensory experiences are important part of experiential marketing (Kardes et al, 2015; Schmitt, 1999). Experiential marketing concept is relatively new marketing concept, but it has been widely applied in the marketing field (Yuan & Wu, 2008). Experiential marketing is a marketing tactic in which marketing is implemented by taking the entire physical environment and operational processes into account to make it a whole experience for customers (Yuan & Wu, 2008). What makes the connection of sensory marketing and experiential marketing an interesting combination to explore is that according to Krishna and Schwarz (2014) representations people establish from sensory inputs are not automatically valid reflections of stimulus properties as they are influenced by individual’s experience and perception. Wörfel et al. (2022), in fact, classify experiential marketing as a part of sensory marketing.

AR (augmented reality) as a technology has a strong connection to sensory marketing and experiential marketing, as the technology itself enables modifying sensory experiences. With augmented reality technologies consumer experiences can be enriched, and thus it is transforming marketing (Du and others, 2022). Technology also enables consumers’ experiencing products virtually before purchasing (Tan et al., 2022). Interest in exploiting digital technologies to modify and enhance consumer’s food and drink experience has increased (Spence, 2023). Research on influencing consumers’ experiences with technologies that modify eating context have become more current topic recently as well (Pennanen et al, 2020, p. 1.) With expectations of exponential growth in food-tech industry, Chai et al. (2022) state that intersection between AR and food is becoming noticeable.

These topics: evolving technologies like AR, marketing trends, trends effecting on consumer behavior and especially trends around sustainable consuming of food formulate an interesting deliberation if modifying sensory experiences with AR can be utilized to influence on customers' experience on consuming meat substitute products. As AR is rather new interest in the marketing field (Du et al, 2022; Rauschnabel et al, 2022a, p. 1), this thesis provides value with its novelty. Combining AR technology and marketing and especially the marketing of meat substitutes, with an experimental part including product-tasting provides value for future research, as the combination is rather unexplored.

### **1.1 Purpose of the research and objectives**

This thesis explores AR's possible usability for marketing and especially marketing of meat substitutes. Data collected for the empiric part is quantitative. Analysis will be based on collected data that focuses on how AR effects on consumers' perceptions of meat substitute products compared to meat products and not augmented meat substitutes. The data gathered will be analyzed from the marketing perspective to provide an answer to the following question:

*“Could augmented reality be utilized in the marketing of meat substitute products to make plant-based products considered more attractive?”*

This research has two objectives. The first objective is to *reflect the connection between experiential marketing, sensory marketing, marketing of meat substitute products and how augmented reality fits in*. The second objective is to *examine how AR influences consumers' evaluations of meat substitute products and if AR could be reasonable tool for companies to shape customers' expectations and perceptions on meat replacing products*.

## 1.2 Delimitations and structure of the study

This thesis consists of five main chapters that are Introduction, Integrating AR into marketing of meat substitutes, Methodology, Results, and Conclusions. This thesis starts with this *Introduction* chapter that introduces the topics, discusses the purpose of the research, research objectives and delimitations and structure of the study. Introduction chapter is followed by *Integrating AR into marketing of meat substitutes*, which provides a theoretical background for the thesis. The second main chapter includes five sub-chapters: *Augmented Reality*, *Experiential marketing*, *Sensory marketing*, *Experiential and sensory marketing in the context of consuming food* and *Food experience, senses, and AR in the marketing context*. The last sub-chapter summarizes previous ones into theoretical framework of this thesis. This main chapter answers to the first research objective.

After theoretical background methodology of this research is introduced. Methodology chapter is divided in five sub-chapters, in which the client is introduced, then research approach, design and participants, research materials and procedures, measures and reliability and validity of the research are presented. In the fourth main chapter the results are presented and discussed. The fourth main chapter answers to the first half of the second research objective. The fifth and final chapter is the *Conclusions* of the research. Conclusions provide an answer to the second part of the second objective. Reference list and appendices of the study can be found after the conclusions chapter.

## 2 Integrating AR into marketing of meat substitutes

This main chapter is the theoretical background of this thesis. The chapter is divided in five sub-chapters. The first sub-chapter is focusing on Augmented Reality as a technology, the difference between AR and VR and AR in the field of Marketing. In the second sub-chapter experiential marketing is discussed. Third sub-chapter focuses on sensory marketing and its theoretical aspects. Fourth sub-chapter pays attention on experiential and sensory marketing from the food consumption perspective. In the fifth and final sub-chapter theoretical aspects on food consumption experiences, sensory marketing and AR are combined into theoretical framework of this research.

### 2.1 Augmented Reality

**Augmented reality (AR)** as a term refers to mix of technologies in which virtual contents are integrated and interacting with real-world scenes in real-time (Carmigniani et al., 2011; Du et al., 2022; Mullen et al., 2011, p. 29; Rauschnabel et al., 2022a, p. 1140; Tan et al., 2022; van Krevelen & Poelman, 2010; Javornik, 2016, p. 994; Parviainen, 2017, p. 199). AR can be implemented with stationary-, mobile-, wearable-, or somatosensory devices (Rauschnabel, 2018). According to Carmigniani et al. (2011, p. 346) the main devices are displays, input devices, tracking devices and computers.

According to Parviainen (2017, p. 199) AR enables enhancing all five human senses with the help of technology. AR is often connected to sense of visual, however Carmigniani et al. (2011, p. 342) and van Krevelen and Poelman (2010, p. 1) point out that AR can be implemented to enhance all senses; smell, touch, hear and taste as well as visual. Carmigniani et al. (2011, p. 342) emphasize that AR provides possibility to enhance missing senses for some users.

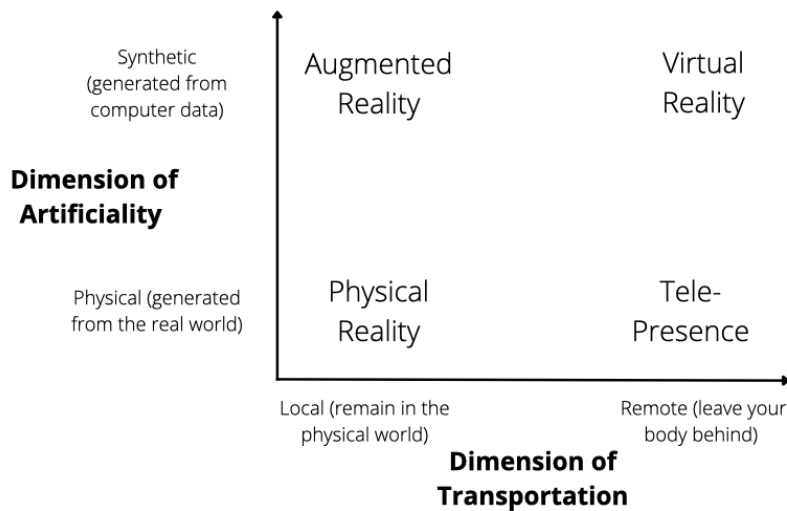
AR can be applied to multiple purposes. Carmigniani et al. (2011) divide applications in four groups, being advertising and commercial, entertainment and education, medical

applications, and mobile applications. Among medical and commercial use van Krevelen and Poelman (2010) mention military- and industrial applications as well. AR from the marketing point of view will be explored more in chapter 2.1.2.

Carmigniani et al. (2011) divide AR interfaces in four main ways of interaction, that are tangible-, collaborative- and hybrid AR interfaces and the emerging multimodal interfaces. In this study the chosen AR interaction is tangible AR interface. Tangible interfaces refer to a way of interaction in which the interaction with the real world is direct and executed using real physical objectives and tools (Carmigniani et al. 2011, p. 351). This AR interaction, used device, physical objectives and tools will be discussed more in the methodology part in chapter 3.3.

### **2.1.1 Difference to Virtual Reality**

Virtual Reality (VR) and AR (Augmented Reality) are distinct technologies (Rauschnabel et al., 2022a; Tan et al., 2022). In VR virtual environment is created by using devices (Cipresso et al., 2018). The difference between AR and VR is, that AR enables its user to see the real world as well (Parviainen, 2017, p. 199; Rauschnabel et al., 2022a; Rauschnabel et al., 2022b; Tan et al., 2022, p. 49) while in VR user is completely in a synthetic world (Carmigniani et al., 2011, p. 342, Tan et al., 2022, p. 49). Benford et al. (1998) structured a classification based on the dimensions of artificiality and transportation (figure 1).



**Figure 1.** Classification of shared spaces (Benford et al. 1998).

In the classification artificiality reflects the question if the space is synthetic or based on the physical world, as transportation reflects if the telepresence is remote or physical (Benford et al. 1998). VR combines remote and synthetic while AR is about overlaying synthetic on the local environment (Benford et al., 1998). From the sensation perspective the difference between VR and AR is the same as in general: Pennanen et al. (2020) emphasize that while VR is about creating alternative environments to replace the real ones, AR can be used to add sensations into environments digitally. Van Krevelen and Poelman (2010, p. 2) point out that compared to VR, AR requires more effort technologically and is thus later developed technology.

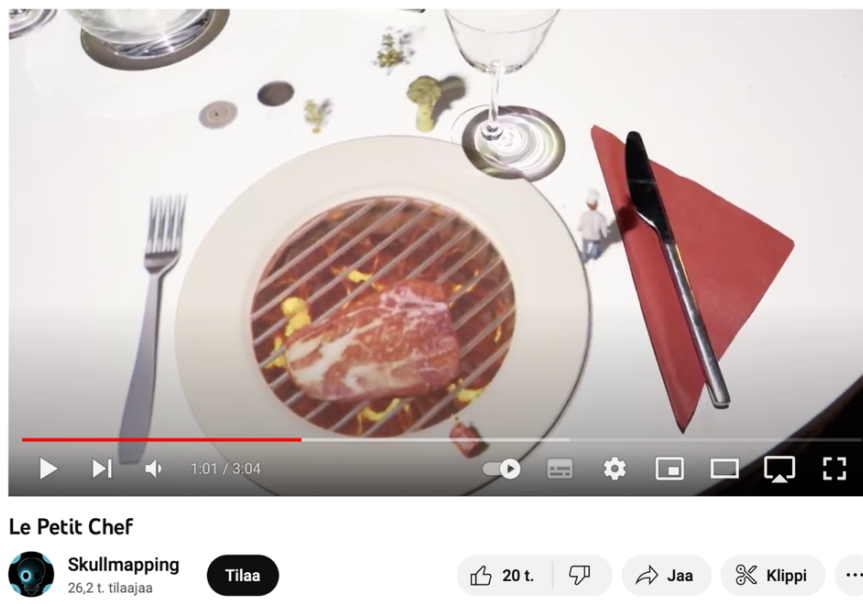
### 2.1.2 Augmented Reality in Marketing

In the field of marketing AR can now be considered as an emerging, cutting-edge technology (Du et al., 2022, p. 1) while more than ten years ago Carmigniani et al. (2011, p. 358) concluded that AR is mostly used by marketers to do online marketing for new products. AR can be applied to marketing strategies in different ways. According to Du et al. (2022) such ways can be divided into web-based AR and on-site AR: AR can be used to shape customer experiences online, but also to improve on-site experiences (Javornik,

2016; Yuan et al., 2021). Rauschnabel et al. (2022a) are proposing the following definition for AR Marketing:

*“AR marketing is defined as the strategic integration of AR experiences, alone or in combination with other media or brand-related cues, to achieve overarching marketing goals by creating value for the brand, its stakeholders, and societies at large, while considering ethical implications.”*

One example of on-site AR marketing in practice is restaurant Le Petit Chef. According to Batat (2021) Le Petit Chef exploits AR in their restaurant business by enabling consumers to see how their meals are prepared. The preparation is shown with projectors, and consumers are able to see the whole process real time (picture 1) (Batat, 2021). An example of web-based AR, in turn, is IKEA’s mobile app *IKEA Place* which enables its users to virtually check if IKEA’s products fit in their homes (IKEA, n.d.).



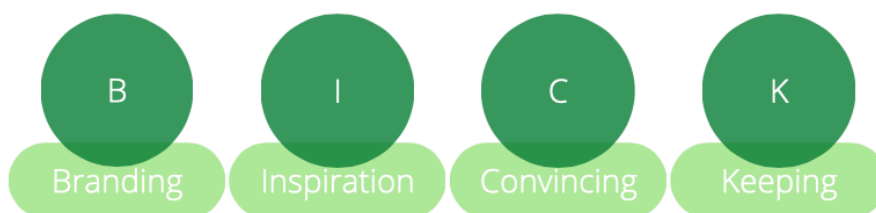
**Picture 1.** Le Petit Chef (Skullmapping, 2015).

Popularity of AR in marketing is surging (Du et al., 2022; Rauschnabel et al., 2019, p. 43). This can be seen from the literature review made by Du et al. (2022, p. 4) from which the



growing number of publications on the matter can be recognized. In 2020 Rauschnabel et al. (2022a) implemented an online study in Germany, in which none of the responding managers working in marketing or related fields saw AR marketing as not-potential in the future.

Rauschnabel et al. (2022a) introduce BICK FOUR framework that was created to summarize AR marketing (figure 2). Rauschnabel et al. (2022a) see AR marketing as a strategic concept due its nature; definition emphasizes concept over function, producing value with AR should be more goal-driven than technology-driven. According to them AR marketing could be used to accomplish a variety of marketing goals, and later even organizational goals.



**Figure 2.** BICK FOUR -framework (Rauschnabel et al., 2022a).

In BICK FOUR framework *Branding* refers to constructs such as building brand awareness, strengthening brand image and brand reaching new target groups (Rauschnabel et al., 2022a). *Inspiration* represents inspiring and generating new customer needs, and *Convincing* generating buying interest and sales and enforcing willingness to pay. *Keeping* refers to aspects such as increasing customer loyalty, improving customer service and offering added value through AR (Rauschnabel et al., 2022a).

Some big operators such as Ikea, Amazon, L'Oréal, and Sephora are already utilizing AR technologies in their marketing (Tan et al., 2022). Tan et al. (2022, p. 50) define four ways to utilize AR in retail: to educate, to entertain, to help customers to evaluate product fit and to enhance the post-purchase consumption experience. According to Rauschnabel

et al. (2022a) AR marketing creates a difference to typical customer journey maps as with AR marketing the journey can include combination of online and offline touchpoints. They also point out AR being relevant throughout the marketing mix of 4P's. Javornik (2016) concluded in his study that in the marketing context AR should be used to add visual simulations in the physical environment and to interact with consumer in real time instead of using AR only offering features websites already do. Some technologies, such as printed marketing materials including triggers for AR devices to activate other promotional materials, are already used in marketing (Palermos, 2017, p. 142). Rauschnabel et al. (2022a) mention the challenges AR marketing will face, being designing and integrating new or extending existing touchpoints into customer journeys. Du et al. (2022) also highlight the existence of negative issues regarding applying AR in the marketing – such as vicarious consumption. Rauschnabel (2018) brings up privacy issues and security risks as well. However, Du et al. (2022) point out that the negative effects of AR in the marketing field need more research in the future.

Rauschnabel et al. (2022a) highlight some examples of the ways how AR marketing could provide value. They bring up utilitarian, hedonic and experiential, social, eudaimonic, inspirational and edutainic values. Considering that AR marketing is bringing experiential value for customers gives an indication of the connection that can be recognized between AR marketing and experiential marketing. Furthermore, Rauschnabel et al. (2022a) list “understanding the user experience and unique characteristics within the AR customer journey” as one of the six premises in furthering the theory of AR marketing. As mentioned before, AR has a strong connection to senses, and thus connection to sensory marketing is evident as well. Both experiential and sensory marketing will be addressed in the following chapters.

## **2.2 Experiential marketing**

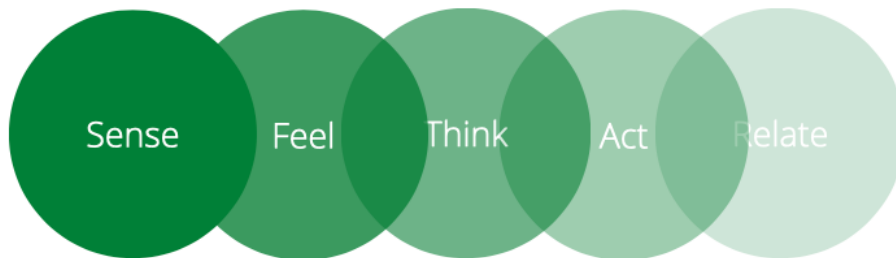
In 1982 Holbrook and Hirschman wrote that consuming has begun to be seen more from phenomenological perspective and regarding consumption more as a primarily

subjective state of consciousness with “a variety of symbolic meanings, hedonic responses and esthetic criteria.” It has been acknowledged that creating value for consumers is not realized only by selling products or services (Wiedmann et al., 2018). Instead of just buying products and services, consumers of today are looking for unique and memorable experiences (Schmitt, 2009; Brakus et al., 2009; Wiedmann et al., 2018). Brakus et al. (2009) found three different types of experience in consumer and marketing research literature: product experience, shopping and service experience and consumption experience.

Kardes et al. (2015, p. 472) define experiential marketing as marketing that “*allow consumers to experience the brand in sensory way that is usually unique, fun and entertaining*”. Wiedmann et. al. (2018) emphasize that the importance of providing experiences has also been acknowledged in the marketing field, and Yuan and Wu (2008) report that experiential marketing has been widely utilized in the marketing field, for example on branding and event marketing. Customers’ perceptions and reactions are compounded result from experiencing (Yuan & Wu, 2008).

Experiential marketing is a marketing tactic in which marketing is implemented by taking the entire physical environment and operational processes into account to make it a whole experience for customers (Yuan & Wu, 2008). Smilansky (2017, p.3) highlights experiential marketing as a methodology rather than marketing channel. On the contrary, Smith and Hanover (2016) list the possibility of combining the perks of marketing mix into one channel as one of the reasons why experiential marketing started its fast growing. The key characteristics of experiential marketing are focusing on customer experiences, seeing consumption as a holistic experience, considering customers as rational and emotional and seeing methods and tools wide-ranging (Schmitt, 1999). According to Yuan & Wu (2008) the main component of experiential marketing is the experience itself. Cambridge Dictionary (2022) defines experience as “something that happens to you that affects how you feel”.

According to Schmitt (1999) from the experiential marketing point of view consumers are seen as “rational and emotional human beings who are concerned with achieving pleasurable experiences”. Schmitt (1999) divides strategic experiential marketing into modules that are *sensory experiences, affective experiences, creative cognitive experiences, physical experiences, behaviours and lifestyles and social-identity experiences*. These modules are also presented in figure 3 with names *sense, feel, think, act, and relate*, as Schmitt (1999) presented in his theoretical framework created for managing experiences.



**Figure 3.** SEMs (Schmitt, 1999).

In this study the interest is especially in the *sense* aspect, which refers to marketing involving creation of sensory experiences through all five human senses: sight, sound, touch, taste, and smell (Schmitt, 1999). The five human senses together construct sensory experiences (Shah et al., 2019). Experiential marketing can be seen offering tools for consumers to differentiate products or services from each other by experiencing them and thus perceiving them personally.

*Experiential value* comes through perceptions which base either on direct usage or distanced appreciation of goods and services (Mathwick et al., 2001). Mathwick et al. (2001) define the typology of experiential value as active and reactive intrinsic and extrinsic values, active intrinsic value being playfulness and reactive value coming from aesthetics, active extrinsic value coming from ROI and reactive extrinsic value is service excellence.

Smith and Hanover (2016) are highlighting the long-lasting effect of live experiences as one of the main reasons for the rise of experiential marketing.

Yuan and Wu (2008) state that experiences for consumers are created by different stimulations that include environments, atmospheres, and layouts. Guedes et al. (2023) for example found out that music had a significant influence on how people precepted and accepted food samples used in the experiment, and Pennanen et al. (2020) found out differences on evaluations on different foods, which were eaten in different virtual surroundings.

Smilansky (2017, p. 12) lists three most important criteria for marketer to execute an integrated experiential marketing. First is experiential marketing being integrated methodology and thus requiring engaging target audiences with authentic and brand-relevant, value-adding communications. Second is building campaigns on one idea that include two-way interaction between the brand and the target audience, and third is integrating other marketing communication channels.

Experiencing leads to different perceptions and reactions (Yuan & Wu, 2008). Kardes et al. (2015) define the experience attributes as attributes that can be evaluated only by trying the products, using taste, smell or feel pertaining to sensory attributes as examples. Multisensory approach is vital for experiential marketing planning (Wiedmann et al., 2018). Experiential marketing is in strong connection with sensory marketing, as after being a blind spot in the marketing field for long, the importance of sensory elements was acknowledged in experiential marketing field (Holbrook & Hirschman, 1982). In their *Unified sensation-behavior framework* Wörfel et al. (2022) classify experiential marketing being one part of sensory marketing. Velasco and Obrist (2021) are pointing out that in fact, all experiences in life are multisensory by their nature.

The connection between experiential marketing, senses and thus sensory marketing can be recognized rather evidently. One connection can be seen from the already mentioned

definition of experiential marketing by Kardes et al. (2015, p. 472) in which they highlight consumers *experiencing the brand in sensory way*. Schmitt (2009) as well states that consumers want experiences that influence on both their senses and emotions. Brakus et al. (2009) propose model for brand experiences including four dimensions: *sensory*, affective, intellectual, and behavioral. In the next chapter sensory marketing will be discussed in more details.

### **2.3 Sensory marketing**

Despite their importance, human senses were widely neglected in marketing literature before (Hulten, 2011), but during past decades elements of vision, touch, audition, smell, and taste have been considered (Krishna, 2012) in both corporate and academic world (Krishna et al., 2016, p. 142). However, Sandell (2020) points out that from the consumer behavior point of view research into five human senses has accumulated over a long period of time.

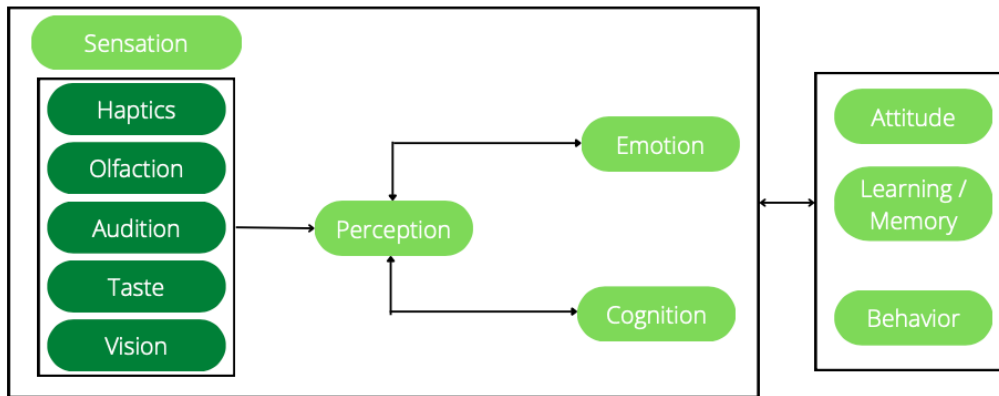
Taking human senses into account creates competitive advantage (Wörfel et al., 2022). According to Hulten (2011) human senses have an important role for brand image, in creating customer value, and sensory experiences. This is supported by Schmitt (1999) who states that experiences provide sensory values. However, sensory experiences as a topic have recently had emerging interest in the field of marketing (Krishna, 2012; Krishna & Schwarz, 2014; Peck & Childers, 2008) even though sensory aspect has been noticed in marketing literature already decades ago (Sandell, 2020).

Krishna (2012) defines sensory marketing as *“marketing that engages the consumers’ senses and affects their perception, judgment and behavior”*. In this research sensory marketing will be adopted and referred from this definition by Krishna. From a research perspective Krishna (2012) defines that *“sensory marketing implies an understanding of sensation and perception as it applies to consumer behavior”*.

In their conceptual model Wiedmann et al. (2018) use multisensory marketing as their starting point. According to them, multisensory marketing consists of visual, acoustic, haptic, olfactory, and gustatory aspects. Wiedmann et al. (2018) also prove that multisensory marketing has positive effect on customer perceived value and potential on creating memorable brand experiences. *Multisensory* refers to fact that sensory information is perceived and processed in multiple sensory modalities (Elder et. al., 2010).

Velasco and Obrist (2021) write that multisensory experiences can have sensory elements that are either physical, digital or a combination of them. This is an important remark as this thesis examines the effects of AR for product evaluations – and as already mentioned before AR is a mix of physical and digital elements (Carmigniani et al., 2011; Du et al., 2022; Mullen et al., 2011, p. 29; Rauschnabel et al., 2022a, p. 1140; Tan et al., 2022; van Krevelen & Poelman, 2010; Javornik, 2016, p. 994; Parviainen, 2017, p. 199).

Krishna (2012) points out in the light of previous research the importance of understanding the difference between sensation and perception (figure 4). Sensation takes place when “the stimulus impinges upon the receptor cells of a sensory organ” (Krishna, 2012). According to Krishna (2012) perception, for one’s part, is created from the awareness or understanding of the sensory information, which can also be seen from the conceptual framework presented in figure 4.



**Figure 4.** Conceptual framework of sensory marketing (Krishna, 2012).

According to Krishna and Schwarz (2014) and Ranaweera (2022) the world is perceived by humans “through their senses”. When consumers use sensory attributes as a part of their evaluations of products, they base evaluations on their personal perceptions (Chumngoen & Tan, 2015). This is important to acknowledge, as it means that identical sensory circumstances might result to significantly differing perceptions.

Next different sensations will be addressed in more depth, paying attention especially on olfactory and visual sensations as the augmentations in the experimental part of this thesis were implemented by using olfactory and visual augmentation as well as the combination of them. However, it is necessary to point out that in the experimental part of this research taste and haptic sensations had significant role as well, as experimental part included eating products. This is because tasting foods is the result of using all human senses (Krishna, 2012).

### 2.3.1 Haptics, audition, and taste in sensory marketing

The importance of touch has been known for long as already Aristotle mentioned it in literature (Krishna, 2012). According to Krishna (2012) touch is the first human sense to start developing in the womb being also the last sense lost with age. According to



Ranaweera (2022) the importance of touch has been recognized in consumption related research, but the focus has been in the individual differences in the need for touch.

Haptic information has a crucial role on the evaluation of products that differ in material properties related to texture, hardness, temperature, and weight (Peck & Childers, 2003). Hands especially are important source of input to touch (Peck & Childers, 2003). According to Peck and Childers (2003) product factors, instrumental and autotelic material properties and consumers' individual factors and situational factors influence product- and consuming related haptics.

According to Elder et al. (2010) like smell, audition is as well a sense that operates automatically: people cannot control over the auditory stimuli they are perceiving. Significant part of marketing communication is auditory (Krishna, 2012). According to Krishna (2012) auditory world includes lots of symbolism including languages and their own associations. According to Krishna (2012) sounds are full of symbolism.

Tastes are experienced not only through the sense of taste (Spence, 2015). Tasting different things is, in the matter of fact, result of using all five human senses – smell, touch, vision and audition (Krishna, 2012). Krishna (2012) concludes that humans are only capable to recognize five pure tastes; sweet, salty, sour, bitter and umami, and despite eating being constant routine, humans are not good at separating tastes from others by using only the sense of taste. According to Kakutani et. al. (2017) subjective taste intensity is enhanced by odours. They state that in our perception, taste and smell are closely related. Sense of taste is often used in in-store marketing.

### **2.3.2 Olfactory marketing**

Smelling happens while breathing, and thus cannot be turned off (Lindström, 2005). Krishna (2012) concludes the strong proven connection between scents and memory. Scents have been used widely in marketing and branding world, and Spence (2015) and

Anggie and Haryanto (2011) conclude the emerging awareness of the importance of olfactory cues in modifying the consumer behaviour when it comes to consuming foods and beverages. Spence (2002) points out that smell as a sense has the closest link to brain's emotional center, which explains why scents can cause powerful emotional reactions. Anggie and Haryanto (2011) found a positive connection between olfactory cues and experiential marketing in their experiment, as well as olfactory cues having positive influence toward purchase intention.

Spence (2015) defines three motives for companies to use olfactory marketing: 1) capturing attention; 2) increasing lingering, appetite, and likelihood of purchase/consumption; and 3) enhance flavor expectations. In the empirical part of this research olfactory cues are used to enhance the flavor expectations. In this research the focus is on the olfactory properties of products, however, scents in marketing can be utilized in various ways; Anggie and Haryanto (2011) for example studied the effects of scents in store and how they affect the store ambience.

### **2.3.3 Visual**

Out of all senses, the sense of vision is dominant in this world (Spence, 2002; Lindström, 2005, p. 18). Vision is the strongest human sense in many situations (Krishna, 2012) and thus the amount of available research on vision is enormous. In consumer research vision is the most studied sense (Rathee & Rajain, 2017). According to Rathee and Rajain (2017) colors and shapes seen are the first way for identification and differentiation of products. They state that from the sensory point of view using colors and lighting is a great opportunity to be used as tools.

To summarize, all the five senses can be taken into consideration while trying to enhance the marketing and marketing strategies of companies. Wiedmann et al. (2016) use luxury hotel sector as an example of marketing, where all senses can be exploited: high-quality decoration for visual sense, appealing background music for audition, rooms decorated

with comfortable materials responds to haptics, hotels can have their signature scents and to finalize offer locally inspired cuisines to fulfill the sense of taste.

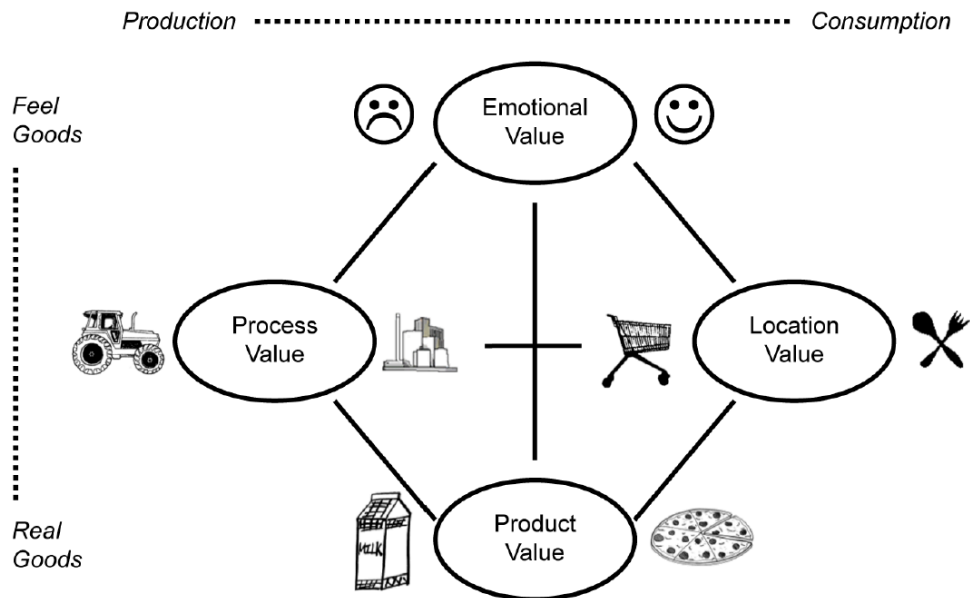
## **2.4 Experiential marketing and sensory marketing in the context of consuming food**

As already mentioned, one way for consumers to experience is during the consumption of product (Brakus et al., 2009). Food products are consumed by eating them. As also previously mentioned, according to Krishna (2012) tasting food is a result of using all human senses. From the food perspective customer experience includes at least three levels: pre-consumption, consumption, and post-consumption (Velasco and Obrist, 2021). According to them, pre-consumption comprises identifying needs considering food, search and expectations development, consumption comprises decision making; interacting with food and post-consumption involves everything after that, for example sharing the experience.

### **2.4.1 Experiential value of food**

According to Zeithaml (1988) perceived quality can be defined as “the consumer’s judgment about a product’s overall excellence or superiority”. She highlights that perceived quality is not the same as objective or actual quality. According to Maghnati and Ling (2013, p. 2) “*experiential value perceptions usually depend upon interactions involving direct usage or distanced admiration of goods and services*”. Value is central to consumers while choosing food as well as it plays key role in marketing strategies. Zeithaml (1988) captures the nature of perceived value as follows: “perceived value is the consumer’s overall assessment of the utility of a product based on perceptions of what is received and what is given”. In the experimental part of this thesis participants’ overall assessment on products’ properties play key role.

Food consumption value (FCV) includes physical characteristics of food and emotional associations evoked by characteristics of consuming it: the brand, site, or moment of consumption for example (Dagevos & van Ophem, 2013). In their theoretical framework (figure 5) for food consumption value Dagevos and van Ophem (2013) divide perceived value of food consumption in four different types of values: emotional value, location value, product value and process value. *Product value* refers to physical attributes of the product including sensory features and nutritional value as well as the price-quality relation of foods (Dagevos and Ophem, 2013). From the experiential point of view also *location value* and *emotional value* are significant, as they both include experiencing characteristics (Dagevos and van Ophem, 2013).



**Figure 5.** FCV (Dagevos and van Ophem, 2013).

Dagevos and van Ophem (2013) point out that in the food market value can be acquired also through experiences, and the experiential value comes from tangible and intangible assets. For example, Guedes et al. (2023) write that it has been proven that eating experience can be modified by adjusting the sonic atmosphere. Experiential marketing can be used by food companies; for example, restaurants, food truck businesses and retail

food products have utilized experiential marketing in their marketing strategies (Greenseed Group, n.d.). Pennanen et al. (2020) concluded from their research results, that different eating environments could be potential solution to shape consumer's eating experiences and thus their eating habits. In the context of food, Dagevos and van Ophem (2013) highlight the importance of considering the role of intangibility of value and value being based on not exclusively on objective features and functionalities of food but on consumer's varying feelings as well.

In FCV framework emotional value is the most ambiguous element, as it consists of experience, entertainment, self-indulgence, and identity (Dagevos & van Ophem, 2013). It emerges through the moral and symbolic meanings food products have as well as through the pros and cons of food production processes and the reputation of the producing and selling companies and brands. Despite the complexity of emotional value, Dagevos and van Ophem (2013) point out the growing role of emotional aspects in purchasing and consumption behavior. Sweeney and Soutar (2001) found a way to divide consumer perceived value in four dimensions, emotional value being one of them. Additionally, they defined functional, social and price value. Dimensions by Sweeney and Soutar (2001) were used in the experimental part of the research and will be discussed further.

#### **2.4.2 Sensory aspect of food consumption**

Our perceptions on what we eat, according to Zampini and Spence (2005) derives from the integration of multisensory cues. Spence (2015) states that the perception of flavor might be the most multisensory experience in people's everyday experiences. This is supported by Krishna (2012) who wrote, as mentioned before, that tasting involves all human senses. Batat et al. (2019) state that multisensory experiences: what we see, hear, smell, touch, and taste result in pleasurable food experiences.

Interest in sensory aspects of food as research topic has grown as well as research on consumer responses to foods (Tuorila & Moneleone, 2009). Humans use sensory attributes in evaluating the quality of the food (Chumngoen & Tan, 2015). According to Chumngoen and Tan (2015) sensory attributes of food include odour, appearance, flavor, taste, and texture. According to Kumar et al. (2017) resulting from a multifaceted group of components, texture is a sensory property of food. Food consumption is a multisensory experience, as flavor itself is considered a multisensory construct involving taste, gustation, and olfaction (Kakutani et al., 2017). Spence (2015) points out the importance of olfaction for flavor perception, which has been acknowledged more important than the taste itself. However, Guedes et al. (2023) are also pointing out that multisensory influences shaping the perception of taste are not only intrinsic properties of foods, but also extrinsic sensory aspects.

According to Zampini and Spence (2005) auditory part of the eating experience plays an important role as well as other senses. For example, they state that sounds produced while biting food together with other cues can be used to evaluate ripeness for the fruits. Lindström (2005, p. 12) stated as well, that Rice Krispies that do not snap and crack are considered to be stale. Vanhatalo et al. (2022) also found differences in lunch restaurant consuming with multisensory experiment including auditory aspects such as birdsong soundtrack and fast-paced music soundtrack. Velasco et al. (2018) state that people usually have a prediction of the taste on what they are about to put in their mouth. According to them, these predictions are mostly based on seeing and smelling, but hearing and feeling might as well have an impact on the prediction.

The connection between experiential and sensory marketing and eating experience is strong. In their research Batat et al. (2019) define the experiential pleasure of food as *“the enduring cognitive and emotional value consumers gain from savoring the multisensory, communal, and cultural meaning in food experiences”*. In their EPF (experiential pleasure of food) journey framework sensory aspect is seen as a starting point for the whole EPF journey. In their conclusions they also emphasize sensory marketing as a tool

to utilize the “natural vibrancy and beauty of fruits, vegetables, and other healthy foods”. Batat et al. (2019) point out that from the sensory point of view modifying food experiences to more pleasurable is viable. Food-associated consumer journey includes numerous sensory elements that can possibly be modified with technology (Velasco and Obrist (2021).

### **2.4.3 Experiential and sensory aspect of meat substitutes**

Meat substitute as a term is usually used to refer protein containing vegetable-based products made from pulses, cereal protein, or fungi that can be used in a meal to replace meat (Hoek et al., 2011, p. 662; Starowicz et al., 2022). According to Starowicz et al. (2022) edible insects and cultured meat should also be considered as meat alternatives. Meat substitutes are usually rich in protein and meat substitute market is growing constantly (Starowicz et al., 2022).

Meat substitutes replacing meat on everyday diets successfully requires bringing products that are accepted in overall liking to markets (Fiorentini et al. 2020; Starowicz et al., 2022). Fiorentini et al. (2020) state that among wide offering, meat substitutes need to satisfy multiple factors such as appearance, flavor, and texture. These properties are physical features of meat substitute products, which can be considered as sensory properties. For example, Torquati et al. (2018) included evaluation of these properties of meat products in their research as a part of sensory evaluations. Profeta et al. (2021) support this point of view regarding meat consumption by stating that there is a consensus that consumers’ preferences are affected by sensory characteristics of the products, and Hartmann and Siegrist (2017) define the role of sensory properties of foods as crucial for acceptance. However, they also state that completely vegetable-made meat substitutes on the market are not like meat by their taste, texture and smell which is the reason why the market share is limited to people who are willing to consume plant-based products.

Hoek et al. (2011) found that non-users of meat-substituting products found meat more sensory attractive than substitute products. From substitute products they preferred the ones meat-like from texture, taste, smell, and appearance. Non-users rated substitutes high for ethical aspect and weight control. This is supported by Profeta et al. (2021) as they state that meat substitutes “must catch up with real meat products concerning the sensory characteristics”. According to them not altering the sensory characteristics of plant proteins is vital challenge if meat should be replaced by them. However, the results from Hoek et al. (2011) also showed that the more respondents consumed meat substitutes, the less they desired similarity of sensory properties to meat.

Batat et al. (2019) conclude that consumers want products to have positive attributes such as good taste and being organic. Hoek et al. (2013) state that reducing meat consumption by using plant-based substituting products is only possible if substitutes are found attractive by consumers, they are directly competitive and need to be substitutable for meat. According to Resurreccion (2004) from the sensory aspect of meat consumption preferences among consumers are affected by appearance, tenderness, flavor, and juiciness. He also states that intentions and willingness to purchase are important in defining the preferences. From the marketing point of view meat substitutes have positive future view as its cheap source of protein, suitable for non-vegetarians as well as for lactose intolerants, people who have eating-related restrictions due to religion but also to address ethical qualities and nutritional issues for vegetarians (Kumar et al. 2017).

As already mentioned in the sensory marketing chapter (2.3) Chumngoen and Tan (2015) are annotating the role of individual’s personal perceptions on what comes to evaluating the products and their sensory attributes. Fiorentini et al. (2020) support this by stating that in addition to product’s sensory properties, person-related factors influence on predicting the consumer acceptance of meat substitutes as well. They state that individuals are influenced by ethical aspects, political values as well as ecological welfare involved in the production – and these can function either as drivers or barriers to acceptance. Fiorentini et al. (2020) note that to advance the acceptance of meat analogs are often



marketed with slogans that refer to real meat and its taste. Hartmann and Siegrist (2017) note as well that the acceptance of product is determined by how consumers perceive it; despite the sensory features of product knowledge of the production for example can affect how individuals perceive the product. In this study sensory properties of a food are evaluated before and after tasting. Fiorentini et al. (2020) write that “sensory properties of a food product play a collective role in forming positive expectations both before and during consumption”.

As established, many plant-based products have been invented to replace meat in the daily diets of people completely or partially. To explore the reasons behind why some people are more willing or reluctant to reduce their meat consumption, Graça et al. (2015) created the Meat Attachment Questionnaire (MAQ). MAQ is an instrument that can be used to measure how attached an individual is to meat in a positive matter. Based on their study Graça et al. (2015) found four factors explaining the level of attachment to meat: hedonism, affinity, entitlement, and dependence. They conclude that positive bond towards meat consumption showed negative associations with both reducing meat as well as preferring more plant-based diet.

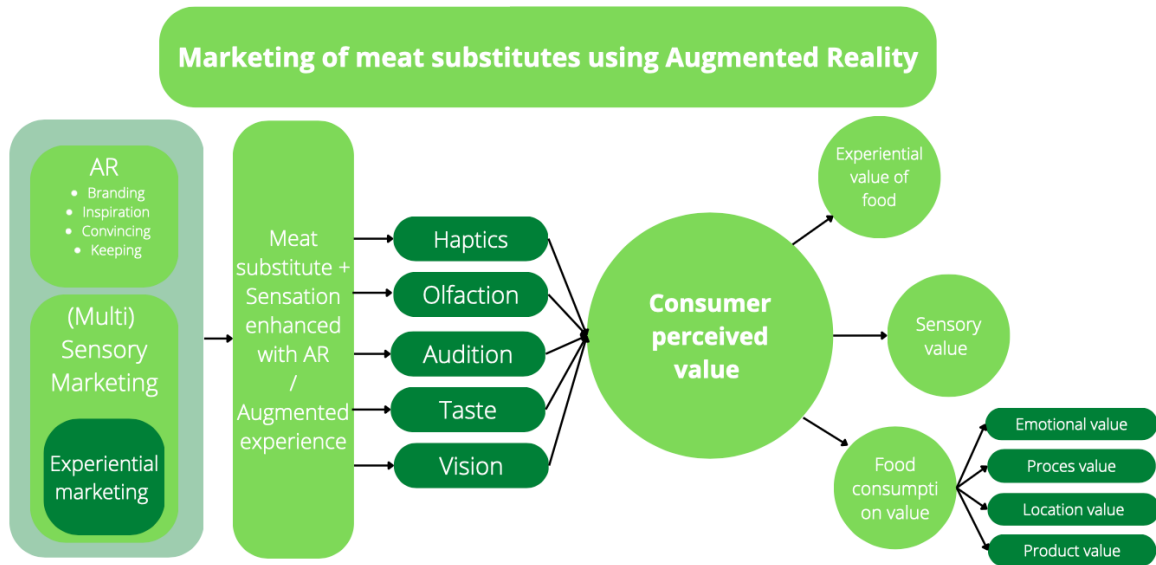
## **2.5 Food experience, senses, and augmented reality in the marketing context**

As food experience is influenced by multisensory stimulus, it can be modified using technologies that affect the sensory perception. As already mentioned, Spence (2023) pointed out the significant increase in interest to exploit digital technologies in modifying the food experience. Velasco et al. (2018) argue that using available technologies to augment flavor perception people’s consuming behavior can be shaped. As already concluded above, AR can be used to modify all human senses, and thus shaping the sensory experiencing of food is technologically possible. The complexity of the issue becomes when considering how it could be executed in an efficient and successful way. According to Velasco et al. (2018) AR has been adopted in flavor- and food-related technology

research and practice purposes faster than VR. Spence (2023) points out about the existing risk of sensory incongruency while utilizing digital technologies to modify sensory experiencing.

Velasco et al. (2018) point out that flavor augmentation has been used modifying visual, auditory, tactile/haptic, and multisensory sensations as well as olfactory. They state that there is potential in multisensory technologies to enable modifying flavor perceptions and experiences, nudging people toward healthier food behaviors, facilitating food choices before ordering or buying as well as making dining more entertaining. In their research Nishizawa et al. (2016) found out by visually augmenting color that saturation and perceived sweetness correlated. From these examples the strong connection to experiential marketing can be withdrawn.

From FCV point of view the part of food consumption experience that can especially be influenced with AR is product value, which according to Dagevos and von Ophem (2013) focuses on physical product attributes and price-quality relation of foods. They define product value consists of sensory properties of the product (texture, color, freshness, taste, and flavor), which have central role in the experimental part of this study as well. Location value in the definition by Dagevos and von Ophem (2013) means the physical settings and experience characteristics surrounding the consumer. Location value can easily be customized, and this could be another opportunity to benefit from AR technologies. However, in this study the focus is on the product value and in the sensory aspects of the food product itself. Different theoretical aspects of this thesis discussed above are combined into theoretical framework of this thesis (figure 6).



**Figure 6.** Theoretical framework of the thesis.

### **3 Methodology**

In this chapter the methodology of the thesis is presented. First VTT, the client is being introduced followed by information on research approach, design and participants, research materials and procedures and measures. Last sub-chapter of this main chapter focuses on evaluating reliability and validity of the research.

#### **3.1 Introduction of the client (VTT)**

The client of this thesis is VTT. VTT Technical Research Centre of Finland Ltd is one of the leading research and technology organizations in Europe (VTT, 2022). VTT meets Quality Management System Standard ISO 9001:2000 valid for research, testing, analysis, consulting services and development of new technology. According to VTT (2022) their duties as an independent and impartial research centre include especially promoting “wide-ranging utilization and commercialization of research and technology in commerce and society”.

This thesis is a part of an Augmented Eating Experiences -research project which is funded by the Academy of Finland and VTT, and Tampere University. The experimental work including data collection, handling, and analysis as well as reporting, were conducted for the project.

#### **3.2 Research approach, design, and participants**

Empiric approach of this research is experimental. The experiment provided quantitative data. In experimental research hypothesis is tested in specific circumstances (Heikkilä, 2014, p. 19). The experiment consisted of four different within-subject conditions; two odour augmentations, visual augmentation, and combined augmentation. Three out of four conditions were analyzed and will be discussed in this thesis: one olfactory

augmentation, visual augmentation and combined augmentation. All four samples were independent samples.

A total of 152 participants were recruited to take part in this study. *N* consists of four different experimental settings (figure 7). The sample was aged between 18 and 64. The sample included 107 participants who identified as *women*, 44 participants as *men*, and one as *other*.

<b>Samples</b>	Odour (wildboar)	Odour (meatball)	Visual	Combined
<b>N</b>	41	37	35	39
<b>Age</b>				
<i>M</i>	43,634	42,95	39,66	39,64
<i>SD</i>	8,2848	8,787	11,394	10,742
<b>Gender %</b>				
Female	73,2	73	65,7	69,2
Male	26,8	24,3	34,3	30,8
Other		2,7	0	
<b>Education level %</b>				
Elementary	4,9	2,7	2,9	2,6
Upper secondary	39	32,4	28,6	30,8
Higher education	53,7	56,8	65,7	66,7
Can not say	2,4	8,1	2,9	
<b>Income %</b>				
Low	43,9	29,7	37,1	35,9
Medium	53,7	67,6	54,3	53,8
High	2,4	2,7	8,6	10,3

**Figure 7.** Descriptives of demographics.

The following inclusion criteria were set for the participants: a) age between 18-60, b) unfamiliarity with VR and AR technologies, c) habitually eating red meat at least twice per week. However, occasional use of some VR or AR devices was not considered as excluding factor. Excluding criteria were a) diagnosed allergy, b) subjective intolerance or unwillingness to eat the listed ingredients, c) previously noted nausea from using VR goggles, d) hypersensitivity for scents, e) flu, f) chronically blocked nose, g) smoking, h) pregnancy and i) lactation.

At the end of the questionnaire participants answered to some meat-substitute related questions (appendix 1). From the answers it can be ensured that all augmentations were executed with rather homogenous groups what comes to familiarity and usage of meat substitutes (figure 8) There were no statistically significant differences on how often participants tend to eat meat substitutes or how familiar they are with meat substitutes.

	How often do you eat meat substitutes? (0=Never, 10=Very often)				How familiar you are with meat substitutes? (0=Not at all, 10=Very familiar)			
	<5	>5	Mean	Standard deviation	<5	>5	Mean	Standard deviation
Olfactory	49 %	51 %	4,122	2,623	24 %	76 %	6,172	2,5053
Visual	46 %	54 %	4,597	2,3806	20 %	80 %	6,5	2,2075
Combined	51 %	49 %	4,536	2,4987	18 %	82 %	6,551	2,1234

**Figure 8.** Participants' familiarity and usage of meat substitutes.

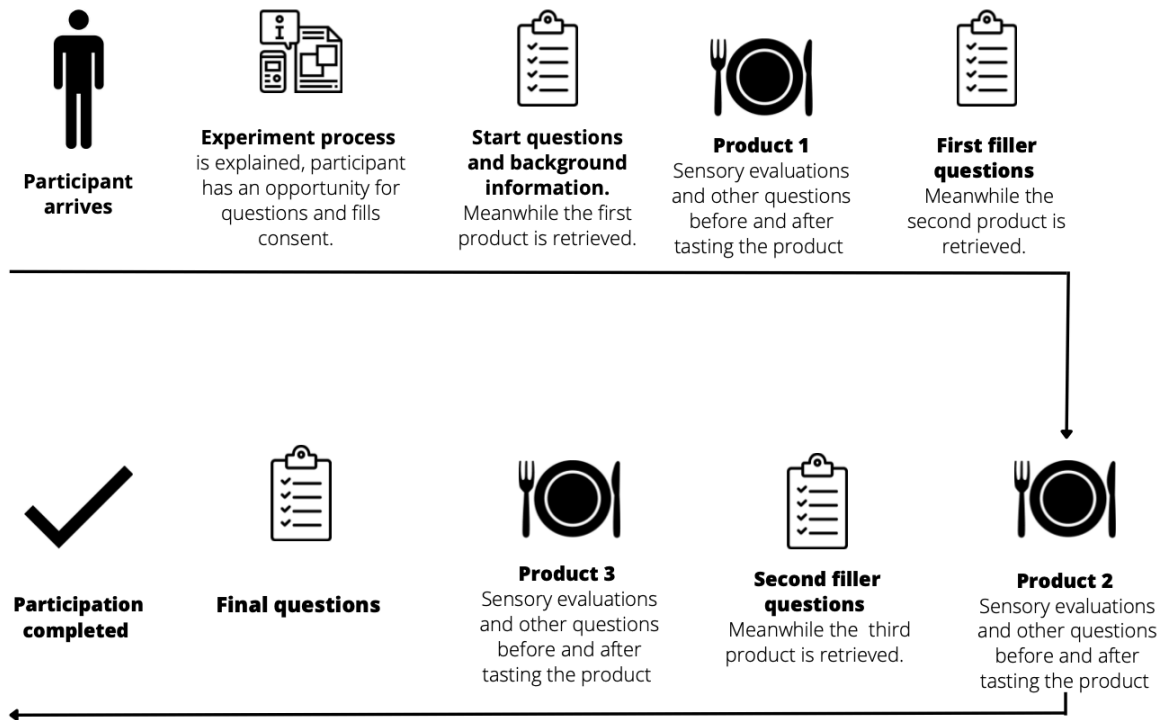
### 3.3 Research materials and procedures

The study was approved by the ethical committee of VTT, which concludes that the study follows good and ethical principles and general regulations. The experimental part of this study was conducted as follows: recruiting of the participants was outsourced to a recruiting company. Experiment included four different samples, which included sensory evaluations for olfactory augmentation, visual augmentation, and combined augmentation of visual and olfactory. Olfactory augmentations were implemented in two samples. Participants were asked to avoid eating and drinking for one hour before participating. Data collection took place in TAUCHI, Tampere Unit for Computer-Human Interaction in the University of Tampere. All data were collected during October-December 2022.

Data collected is subjective data. Data were collected by means of a questionnaire (appendix 1), which was answered by using tablet. Questionnaire was started after providing informed consent. Questionnaire started (figure 9) with sociodemographic information and questions on current mood, level of tiredness and satiety. Three different products were evaluated by each participant; one meatball and two equivalent plant-

based products, out of which during the other one augmentation was used. Augmentation was used to modify the sensory properties of food (Dagevos and von Ophem, 2013). Participants were not informed the exact details of experiment products, only list of allergens was provided.

First two samples were implemented by using odour augmentation, third one by using visual augmentation and for the last sample both augmentations were used simultaneously, combined. Products were served in randomized order for each participant, and product-related questions were answered both before and after tasting the products.



**Figure 9.** Experiment process.

Filler questions included questions on individual's subjective sensitivity to different odours and tastes, as well as items from meat attachment questionnaire by Graça et al.

(2015). Final questions measured attitudes towards plant-based products in general (see appendix 1).

### 3.3.1 Products

Two different commercial products (picture 2) were used in this study: a plant-based ball (Muu Pyörykkä, Meeat) and a meatball (Mestari Forsman lihapyörykkä, Atria). Products were heated in microwave oven for 20-30 seconds and put in 70 °C water in plastic bags to keep them warm. Products were served on disposable plates, hidden under a hood until the start of the sensory evaluation. Products were picked from the water pad one at a time to retain the warmth until eating.



**Picture 2.** Plant-based ball on the left (Muu Pyörykkä, Meeat) and meatball on the right (Mestari Forsman lihapyörykkä, Atria).

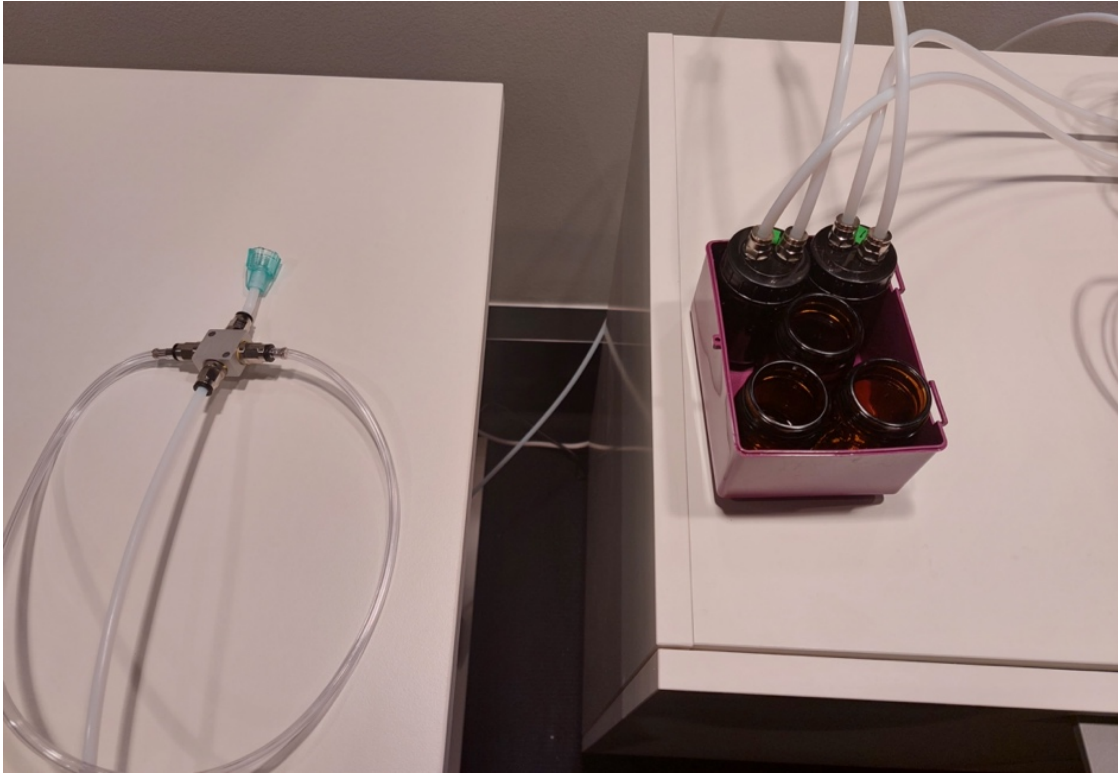
To be able to follow which product is discussed, further products will be referred as meatball, plant-based ball/product, and augmented ball/product, although plant-based and augmented product are in fact same kind of products.

### 3.3.2 Olfactory augmentations

Olfactory augmentation was executed with an odour necklace (picture 3). Participants were asked to put the necklace on before starting to answer the questionnaire, and they



wore it during the whole participation. The height of the table was adjusted according to the necklace as well as possible, and due to this it was adjusted slightly higher as most would recommend the normal, comfortable height.



**Picture 3.** Odour necklace and odour bottles attached to odour device.

Olfactory augmentations were executed in two samples. First odour sample was executed with 2% wild boar odour solution. For the second sample one meatball was heated, sliced in four pieces, and put in the bottle which was attached to the odour machine. During the augmented product, the odour was put on while serving the product. Odour function was on until the participant seemed to be ready with chewing or spit the product. The whole set up for olfactory augmentations can be seen in picture 4. Apart from the used odour, both odour sets were executed in the same way. During participants evaluated and ate meat- and plant-based products no odour came from necklace.



**Picture 4.** Olfactory augmentation set up.

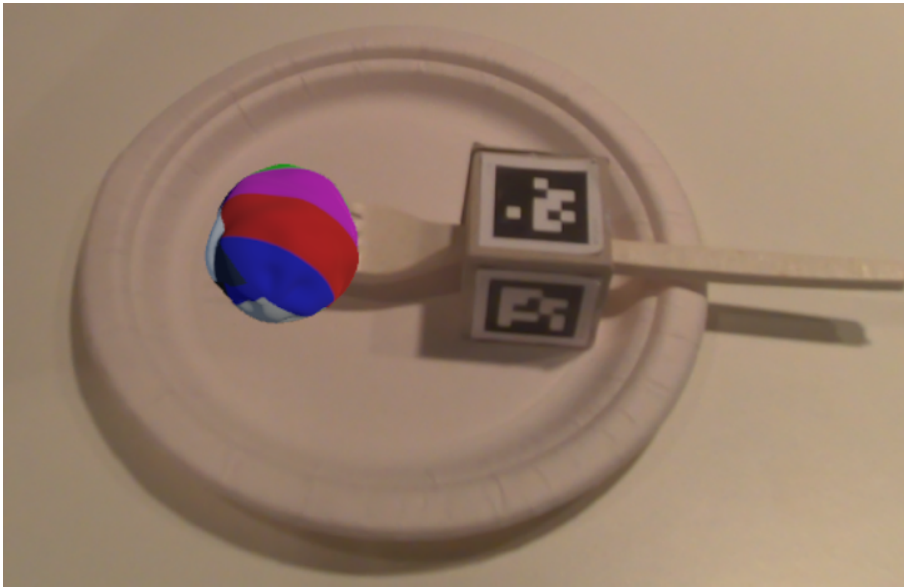
### **3.3.3 Visual augmentations**

In visual augmentations the device used to execute the augmentation technology was head mounted display. Head mounted displays are one of the three major types of displays used in Augmented Reality (Carmigniani et al., 2011, p. 346). According to Carmigniani et al. (2011, p. 349) the disadvantage of using HMD is the unnatural looks of the real environment.

AR applications can be executed using marker-based and marker-less tracking (Chai et al. 2022). In this experiment wooden cube with QR-code was attached to fork to function as a marker. Technology determined where in fork to locate the virtual product from the wooden marker cube. In visual augmentation participants saw all products as virtual ones, meatball and one plant-based (“augmented” one) looking like meatball and the

other plant-based product looking more like the plant-based product. In pictures 5, 6 and 7 the virtual versions of the products are presented.

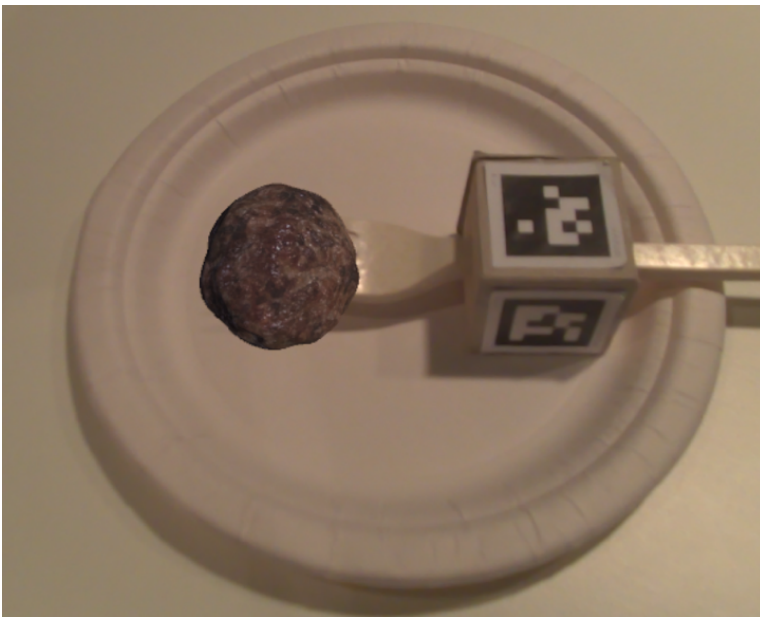
After 12 first participants the practice ball (picture 5) was decided to be included in the research for participants to be able to test HMD and how to move the fork, so that there was more time to instruct the participants to move peacefully to enable the functioning of the technology as well as possible. Due to technical reasons, unlike in the olfactory augmentations, the products had to be covered while participants were filling the questionnaire, as answering with HMD on would have been challenging or at least uncomfortable.



**Picture 5.** Practice ball.



**Picture 6.** Visually augmented plant-based ball.



**Picture 7.** Visually augmented meatball and augmented ball.

### 3.3.4 Combined augmentations

In the combined augmentation both odour necklace and HMD were used (picture 8.). After evaluating the odour samples, the meatball odour sample was chosen to be used in this condition, as the difference between evaluations of products were clearer. In this

augmentation the practice ball was used with all participants. In combined augmentations the odour was not coming from necklace during answering the questionnaire, as the products had to be covered during.



**Picture 8.** Combined augmentation set up.

### **3.4 Measures**

All three food samples were evaluated in multiple attributes with visual analog scales (VAS) from 0 to 10 before and after tasting the product (see the questionnaire in appendix 1). First was the sensory evaluation part of the questionnaire, in which participants were asked to define the pleasantness of the product based on four aspects: i)

appearance, ii) smell, iii) flavor and iv) overall liking, where 0=Very unpleasant, 10= Very pleasant.

Other variables discussed in this research measured with VAS were *interest to buy the product* (before and after tasting), *how interested would you be in buying meat substitute products* (asked at the end of questionnaire not related to any specific product) and consumer perceived values, which were answered before and after tasting as well consisting of eight variables, here 0= not at all, 10= A lot.

### **3.5 Reliability and validity of the research**

The quality of a research can be measured through their reliability and validity (Heale & Twycross, 2015). According to Heale and Twycross (2015) reliable study provides results that are consistent and thus would exist in repeated occasions. Heikkilä (2014, p. 27) indicates valid research is missing a systematic error. According to Heikkilä (2014, p. 27) achieving validity requires precisely defining the variables and what is measured to enable getting valid results.

Validity can be either extrinsic or intrinsic (Metsämuuronen, 2003, p. 35). Metsämuuronen (2003) defines extrinsic validity meaning that the study can be generalized, while intrinsic validity is the reliability of the study, for example, are the concepts correctly used, is the theory well chosen, how the measures are chosen. In valid research issues are measured in accurate way (Heale & Twycross, 2015).

Reliable research refers to accuracy of the results (Heikkilä, 2014, p. 28). Heikkilä (2014, p. 28) writes that reliability requires achieving similar results if the experiment was repeated by anyone, anywhere in similar circumstances with same arrangements, and the samples need to be large enough or else the results can be coincidental.

In this research the effects of olfactory and visual augmentations on consumers' perception on plant-based product were investigated. Theoretically results could be generalized, but it is important to note that only one kind of meat substitute product was used. Later in this research findings are used to conclude what is the potential of augmentation in the marketing of meat substitutes, but in the light of the scope of this study it is important to highlight that results may vary in case of different products. This is common, as results of academic research are often not reliable in all societies during all times (Heikkilä, 2014, p. 28).

In this research the experimental part included multiple variables. Despite all efforts to standardize, it is possible that situational variables might have affected the evaluations of individuals – such as fault in the visualization or due to longer response time decreased temperature of the tasted product. In the experimental part visual augmentation caused some technical challenges, thus the practice ball (picture 5) was decided to be included. First 12 participants in the visual set had no chance to practice the eating and evaluation situation before starting the actual experiment part. However, the visual sample was divided in two groups for analyzing any significant differences between the evaluations of participants who used and did not use the practice ball (see more in 4.1.3).

Due to nature of the empiric part of this research, it is important to highlight the subjectiveness of the evaluations. It is possible and likely, that individuals' personal preferences have major role in the results of the study, especially in the sensory evaluations. This came up in the discussions with the participants after completing the participation in the study. Many participants shared information on their eating habits, and for some using plant-based products to substitute meat was already a habit, as some wanted to highlight their negative feelings and evaluations towards plant-based products.

## 4 Results

In this main chapter the results of the research will be presented and discussed. Going through the results starts from sub-chapter *4.1 Sensory evaluations* which focuses on evaluations of the sensory properties of the products used in the experiment. In further sub-chapters between groups analysis of chosen sensory properties, consumer perceived values and buying interests will be presented. In the last sub-chapter of results interest to buy -results are discussed in more details and in relation to participants' interest to buy meat substitutes in general.

### 4.1 Sensory evaluations (within group effects)

Sensory evaluations had a crucial role in the empiric part of this research. In the questionnaire (appendix 1) the evaluation of every product started with evaluating the sensory properties of the product, first before and then after tasting. In this sub-chapter the results of the sensory properties' evaluations are discussed alone, and all implemented augmentations; olfactory augmentation with meatball odour, visual augmentation and combined augmentation are discussed. Sensory evaluation results are discussed in matter of means, standard deviations, significant differences in evaluations between different products and comparisons between augmentations. As products' sensory properties were evaluated by their pleasantness, pleasantness being rather subjective dimension, the differences between minimum and maximum were big (see standard deviations in figures 10, 12 and 14). Evaluating sensory attributes is in general subjective and personal (Chumngoen & Tan, 2015).

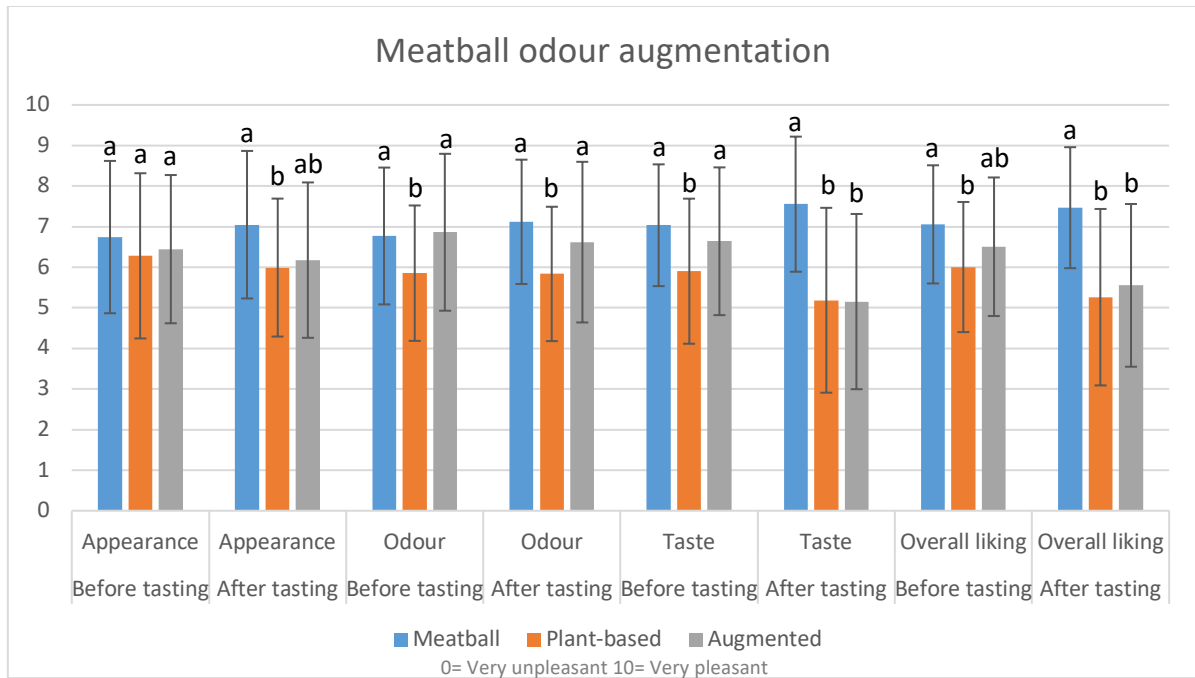
Any possible significancy in differences between the products for sensory variables were tested with t-tests. T-tests were used to each sensory variable both before and after tasting, and all three products were included (figures 10, 12 and 14). Statistically significant differences between before and after tasting the same product were tested with T-tests



as well (figures 11,13 and 15). In the following sub-chapters, the results of all three augmentation conditions are presented starting from olfactory augmentation.

#### 4.1.1 Olfactory augmentation

Olfactory augmentation executed with meatball odour resulted in most differences between the products that were statistically significant. Only appearance before tasting had no significant differences between products (figure 10). For appearance after tasting there was a significant difference between meatball and a plant-based product.



**Figure 10.** Sensory evaluations, meatball odour augmentation.

Pleasantness of plant-based product's odour was significantly lower than the odour of meatball and augmented product both before and after tasting. An interesting observation can be made as the odour of augmented product was considered the most pleasant before tasting, while after tasting meatball was considered more pleasant. The perceived pleasantness of the meatball's odour increased significantly after tasting the product while the pleasantness of the augmented product's odour decreased yet not significantly

(figure 11). It can be concluded that the odour of meatball was considered more pleasant than the odour of plant-based product, however the odour was possibly not strong enough to cover the odour of plant-based product while eating, as the mean for augmented product decreased after tasting. It could also be deliberated if the meat-like odour mixed with the taste of the plant-based product was confusing participants' evaluation process and thus resulted in slightly, yet not significantly decreased perceived pleasantness of the odour. This deliberation is in line with what Spence (2023) wrote about the risk of rising sensory incongruency when using augmentation technologies. Fiorentini et al. (2020) wrote that consumer uncertainty towards meat analogs is often marked by using slogans like "tastes like meat".

The taste of the plant-based product was evaluated significantly less pleasant than the taste of the meatball and the augmented product before tasting, however after tasting the meatball was considered significantly more pleasant than plant-based and augmented product. From figure 10 it can be seen that in fact, the pleasantness of the taste of the augmented product after tasting was considered even less pleasant than the pleasantness of the taste of the plant-based product. This could also be due to incongruency in sensory experiencing. However, the change between before and after tasting for meatball and augmented products were not significant, while the perceived pleasantness of the taste of the plant-based product decreased statistically significantly after tasting (figure 11).

	Mean	Std. Deviation	Std. Error Mean	Paired differences		t	df	Significance	
				95% Confidence Interval of the Difference lower	95% Confidence Interval of the Difference upper			One-Sided p	Two-Sided p
Appearance, meatball	-0,3054	1,0052	0,1653	-0,6406	0,0298	-1,848	36	0,036	0,073
Appearance, plant-based	0,2892	1,2701	0,2088	-0,1343	0,7127	1,385	36	0,087	0,175
Appearance, augmented	0,2703	1,3882	0,2282	-0,1926	0,7331	1,184	36	0,122	0,244
Odour meatball	-0,3486	0,7680	0,1263	-0,6047	-0,0926	-2,761	36	0,005	<b>0,009</b>
Odour plant-based	0,0189	0,6328	0,1040	-0,1921	0,2299	0,182	36	0,428	0,857
Odour augmented	0,2432	0,8119	0,1335	-0,0275	0,5139	1,822	36	0,038	0,077
Taste, meatball	-0,5189	1,6399	0,2696	-1,0657	0,0279	-1,925	36	0,031	0,062
Taste, plant-based	0,7162	1,7516	0,2880	0,1322	1,3002	2,487	36	0,009	<b>0,018</b>
Taste, augmented	1,4865	1,9105	0,3141	0,8495	2,1235	4,733	36	0,000	0,000
Overall liking, meatball	-0,4108	0,9862	0,1621	-0,7396	-0,0820	-2,534	36	0,008	<b>0,016</b>
Overall liking, plant-based	0,7432	1,6988	0,2793	0,1768	1,3096	2,661	36	0,006	<b>0,012</b>
Overall liking, augmented	0,9514	1,6399	0,2696	0,4046	1,4981	3,529	36	0,001	<b>0,001</b>
Interest to buy, meatball	-0,3000	1,4386	0,2365	-0,7796	0,1796	-1,269	36	0,106	0,213
Interest to buy, plant-based	0,6243	2,2393	0,3681	-0,1223	1,3710	1,696	36	0,049	0,099
Interest to buy, augmented	0,8432	2,1142	0,3476	0,1383	1,5481	2,426	36	0,010	<b>0,020</b>

**Figure 11.** Pleasantness: before and after tasting –comparison, olfactory augmentation.

In overall liking before tasting the difference was significant between meatball and plant-based product, but after tasting overall liking of the augmented product decreased, while overall liking of the meatball increased and thus the difference between them grew significant as well (figure 10). From figure 11 it can be seen that all changes for overall liking between product's before and after tasting evaluation were statistically significant.

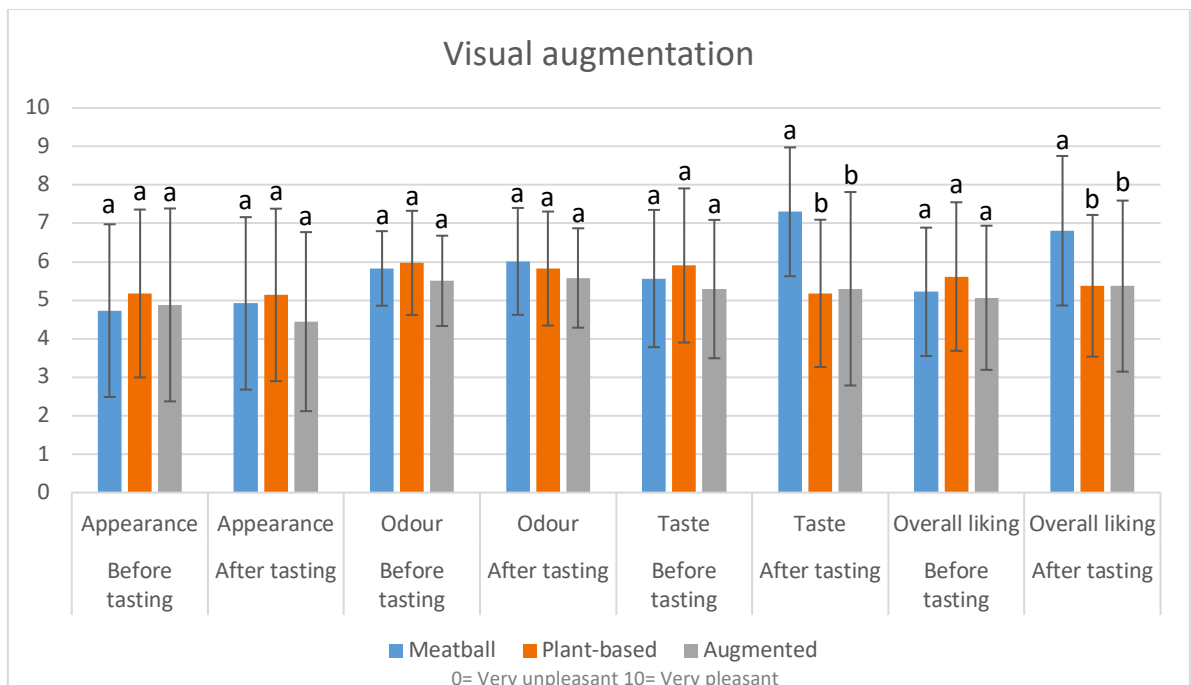
The most important comparison is between plant-based and augmented product in relation to meatball, as there was an assumption of the superiority of the meat product and as the aim was to make plant-based product more pleasant with augmentation. However, we can see that in meatball odour augmentation (figure 10) augmented product is considered more pleasant than plant-based in all criteria, except in taste after tasting in which the difference between the two is minor. Significant differences in change before versus after tasting between plant-based and augmented products were tested, resulting that the only statistically significant difference in means was for taste in olfactory augmentation (plant-based before tasting – plant-based after tasting,  $M=0,7162$ ,  $SD=1,75159$ , and augmented before tasting – augmented after tasting,  $M=1,4865$ ,  $SD=1,91052$ ).

It might be worth to consider, if the meat-like odour created higher expectations for the taste and the actual taste did not meet the expectations, which resulted in sensory

incongruity and thus the taste was perceived even less pleasant compared to plant-based product. Important observation in these results is, that even values that decreased after tasting are still above five, which is the neutral value in the middle, as 0= very unpleasant and 10=very pleasant.

#### 4.1.2 Visual augmentation

In visual augmentations differences between products' considered pleasantness were not significant what came to appearance and odour both before and after tasting (figure 12). Taste before tasting and overall liking before tasting showed no statistically significant differences between products either. However, significant differences between products were found in taste after tasting and overall liking after tasting. Both plant-based and augmented products were considered significantly less pleasant than meatball.



**Figure 12.** Sensory evaluations, visual augmentation.

Only two statistically significant changes were found between before and after tasting evaluations. The other significant change was between the expected and experienced taste of the meatball, which increased significantly after tasting  $p < .05$  (figure 13). The overall liking of the meatball increased significantly after tasting as well as  $p < .05$  (figure 13).

	Paired differences							Significance	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
				lower	upper				
Appearance, meatball	-0,1886	1,0991	0,1858	-0,5661	0,1890	-1,015	34	0,159	0,317
Appearance, plant-based	0,0371	1,4751	0,2493	-0,4696	0,5439	0,149	34	0,441	0,882
Appearance, augmented	0,4343	1,5528	0,2625	-0,0991	0,9677	1,655	34	0,054	0,107
Odour meatball	-0,1829	1,1625	0,1965	-0,5822	0,2165	-0,931	34	0,179	0,359
Odour plant-based	0,1457	0,9069	0,1533	-0,1658	0,4573	0,951	34	0,174	0,349
Odour augmented	-0,0743	0,8759	0,1481	-0,3752	0,2266	-0,502	34	0,310	0,619
Taste, meatball	-1,7343	1,9876	0,3360	-2,4171	-1,0515	-5,162	34	<0,001	<0,001
Taste, plant-based	0,7257	2,7440	0,4638	-0,2169	1,6683	1,565	34	0,063	0,127
Taste, augmented	-0,0086	2,5976	0,4391	-0,9009	0,8837	-0,020	34	0,492	0,985
Overall liking, meatball	-1,5886	1,6148	0,2729	-2,1433	-1,0339	-5,820	34	<0,001	<0,001
Overall liking, plant-based	0,2400	2,3793	0,4022	-0,5773	1,0573	0,597	34	0,277	0,555
Overall liking, augmented	-0,3029	2,5515	0,4313	-1,1793	0,5736	-0,702	34	0,244	0,487

**Figure 13.** Pleasantness: before and after tasting -comparison, visual augmentation.

However, different compared to the olfactory augmentation is that the plant-based product was considered the most pleasant in appearance (figure 12). As there was an expectation of the superiority of the meatball, and the aim was to augment the plant-based product to be more pleasant, it can be concluded here that the visual augmentation did not completely function as it was hoped for.

Overall liking (figure 12) for meatball increased after tasting, as the pleasantness of the plant-based and augmented product slightly decreased after tasting. Compared to olfactory augmentation, the means for overall likings both before and after tasting are lower in the visual augmentation. Despite the decreasing, it is important to note that the means still remain close to value 5, which indicates products being considered not very unpleasant or very pleasant. However, compared to meatball odour augmentation, the means are lower in general.

Comparing results of the plant-based and the augmented product in this augmentation results in quite different outcome than in the meatball odour augmentation, as the plant-based product has higher mean for every other variable than taste after tasting, mean being only slightly higher than the mean for the plant-based product's pleasantness. Any differences between plant-based and augmented products were not statistically significant.

#### 4.1.3 Practice ball

As mentioned in the methodology part of the research, so called "practice ball" was included in the experiment in the middle of the visual augmentation experiments. 35 participants took part in the visual augmentation, and 12 of them participated before the practice ball was included. To see if the possibility to practice and see one virtual product (picture 5) before the actual experiment products had an effect, T-tests were made to see any significant differences on sensory evaluations between the ones who were able to practice and who were not.

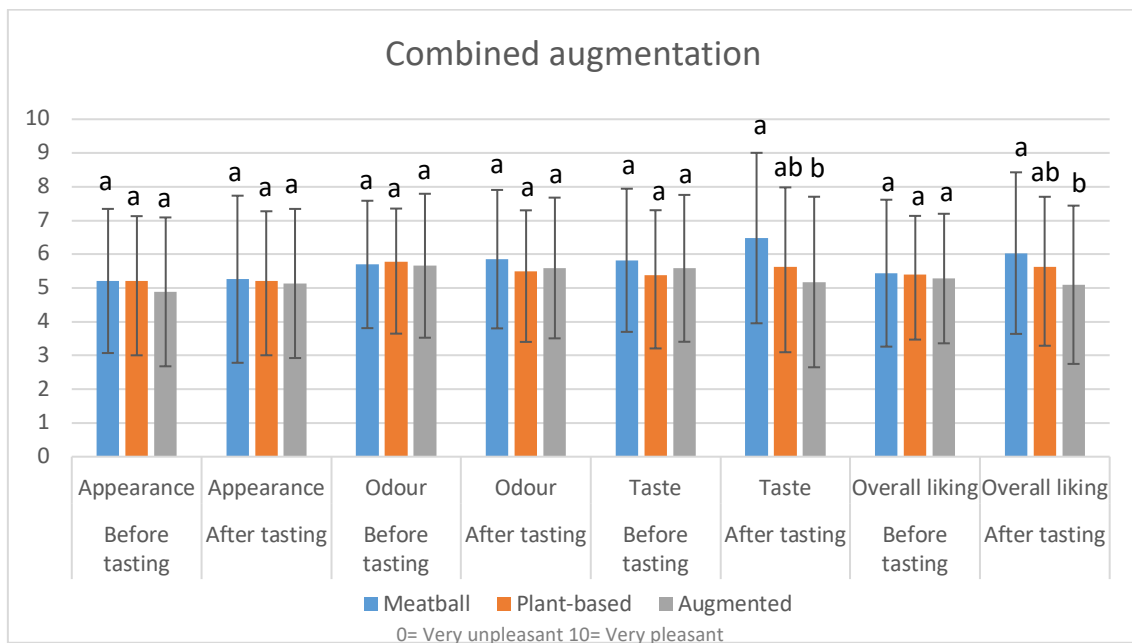
In fact, some statistically significant differences were found between the groups in evaluating the **taste after tasting** for plant-based product and **overall liking for** augmented product. For the plant-based product the ones who used practice ball got values  $M=6,296$  and  $SD=1,5$  and the ones who did not use the practice ball  $M=4,567$  and  $SD=3,0330$ . Overall liking for augmented product after eating had significant differences between groups as well, for practice ball-users  $M=6,691$  and  $SD=1,9391$  and non-users  $M=4,750$ ,  $SD=2,8833$ .

However, no significant differences for appearance were not found, which could be considered as the most significant variable here from the visual augmentation point of view. The significances in taste and overall liking could have been found due to small samples consisting of 12 (no practice ball) and 13 (practice ball) participants. Standard deviations for the group not using practice ball were higher, which might explain the significances

in differences at least partially if the sample had participants with very strong opinions. The foreignness of the technology could be one confusing factor, and it is possible that the ones who were able to practice were less disrupted by the novelty of the technology. However, in further analysis participants of the visual augmentation will be considered as one group.

#### 4.1.4 Combined augmentation

In combined augmentation differences on pleasantness of the appearance and the odour before and after tasting were not significant between products (figure 14). Taste before tasting showed no significant differences between products as well, but after tasting there was a significant difference between meatball and augmented product. For overall liking before tasting there were no significant differences either, but after tasting difference between meatball and augmented product increased to be statistically significant.



**Figure 14.** Sensory evaluations, combined augmentation.

Comparing means for before and after tasting for each product, the only statistically significant differences were found for the taste and overall liking of meatball (figure 15) which is similar with the results of the visual augmentation as well (figure 13).

	Mean	Std. Deviation	Std. Error Mean	Paired differences 95% Confidence Interval of the Difference		t	df	Significance	
				lower	upper			One-Sided p	Two-Sided p
Appearance, meatball	-0,0513	0,8525	0,1365	-0,3276	0,2251	-0,376	38	0,355	0,709
Appearance, plant-based	-0,0051	1,2528	0,2006	-0,4112	0,4010	-0,026	38	0,490	0,980
Appearance, augmented	-0,2487	1,1454	0,1834	-0,6200	0,1226	-1,356	38	0,092	0,183
Odour meatball	-0,1564	1,1818	0,1892	-0,5395	0,2267	-0,826	38	0,207	0,414
Odour plant-based	0,2923	1,0484	0,1679	-0,0475	0,6322	1,741	38	0,045	0,090
Odour augmented	0,0667	1,2926	0,2070	-0,3523	0,4857	0,322	38	0,375	0,749
Taste, meatball	-0,6590	2,0341	0,3257	-1,3184	0,0004	-2,023	38	0,025	<b>0,050</b>
Taste, plant-based	-0,2385	2,2901	0,3667	-0,9808	0,5039	-0,650	38	0,260	0,519
Taste, augmented	0,4051	2,3458	0,3756	-0,3553	1,1655	1,079	38	0,144	0,288
Overall liking, meatball	-0,5949	1,7085	0,2736	-1,1487	-0,0410	-2,174	38	0,018	<b>0,036</b>
Overall liking, plant-based	-0,2436	2,0247	0,3242	-0,8999	0,4127	-0,751	38	0,229	0,457
Overall liking, augmented	0,1846	1,9805	0,3171	-0,4574	0,8266	0,582	38	0,282	0,564

**Figure 15.** Pleasantness: before and after tasting –comparison, combined augmentation.

Results for appearance are not surprising, as visual augmentation showed similar results and the means being quite similar in both augmentation conditions. What can be found surprising is the non-existing differences in the pleasantness of the odour, as the used odour in the augmentation is same than in the olfactory augmentation, in which the augmentation resulted in significant differences between plant-based product and two others (figure 10). Here the reason behind the difference between these two augmentations can only be speculated, one possible reason behind the results being covering the products in combined augmentation during answering the questionnaire. It can be considered as well if the visual augmentation and the utilization of HMD got participants more focused on the visual side and thus lacking focus on the odour.

Comparing the means of pleasantness between plant-based and augmented product, this augmentation had more variation on which of the products was considered more pleasant for which sensory property. As in bare visual augmentations, appearance of the plant-based product was considered slightly more pleasant than the appearance of the augmented one, but as already concluded, surprisingly the odour before tasting was



considered better. So was the taste after tasting and overall likings, as augmented product was considered more pleasant for taste after tasting and odour after tasting.

#### **4.1.5 Perceived pleasantness of sensory properties between samples**

Out of all three augmentations, the meatball odour augmentation gave clearest results and had most significant differences between different products. To summarize, the pleasantness of appearance was evaluated better in odour samples, from which it can be concluded that the appearance of the real products was considered more pleasant than the appearance of the virtual products. This could be due to unfamiliarity of the looks of virtual products, which would be supported by the statement of Hoek et al. (2011) who highlighted the significance of unfamiliarity as a barrier for accepting meat substitutes.

For odours the means got values little under and above six. For the meatball odour sample meatball and augmented before tasting got rather high value  $M=6,770$  and  $M=6,862$ . After tasting meatball's pleasantness even increased to  $M=7,119$ , as mean for augmented slightly decreased to  $M=6,619$ . However, out of all sensory properties' evaluations, the superiority of the meatball odour was clear for taste after tasting. In relation to results in the meatball odour augmentation, surprisingly in visual augmentation the odour of the plant-based product before tasting was considered the most pleasant. The reason behind this result remains unclear, but it is possible that covering the product while answering the questionnaire had an effect, as in the odour sample the participants were able to smell the product while answering as well.

In all conditions, meatball was considered to have the most pleasant taste, except in visual augmentations' plant-based product before tasting evaluations had the highest mean. This could also indicate that the appearance of the virtual product made for plant-based product was the most pleasant having an impact on other before evaluations as well. In meatball odour augmentation the mean of meatball's taste increased after

tasting, while for plant-based and augmented the mean decreased clearly. In combined augmentation the expected pleasantness' of tastes were lower compared to olfactory augmentation. In the combined augmentation the means of the taste for the meatball and the plant-based ball increased after tasting, while for the augmented it decreased. However, in the visual augmentation the taste of the plant-based product was considered less pleasant after tasting, as in combined the mean increased after tasting. In visual augmentation the pleasantness of the taste remains almost the same before and after tasting.

Overall liking of the meatball increased after tasting in all augmentations. For the plant-based product the mean decreased after tasting in meatball odour and visual sample and increased in combined sample. For augmented product, the means decreased after tasting in olfactory and combined augmentation but increased in visual augmentation. From this it could be concluded that olfactory and combined augmentation succeeded in increasing the expectations for the augmented product.

#### **4.2 Effects of augmentations on consumer's taste perception, overall liking, interest to buy the products and perceived values (between groups effects)**

In this chapter between groups comparisons are presented. Comparisons were made for chosen variables, which are consumer's perceptions on taste, overall liking, interest to buy and consumer perceived values. All variables chosen were analyzed and discussed with **after tasting** evaluation results. Means and standard deviations for each product in all three augmentations are presented (figure 18, 19 and 20). Statistically significant differences between augmentations were analyzed with one-way ANOVA.

"Interest to buy" was measured with one question "How interested would you be in buying the product?" that was answered both before and after tasting with visual analog

scale from 0 to 10, where 0=Not at all and 10=A lot. Consumer perceived values (CPVs) were measured with eight variables in the questionnaire (appendix 1). Evaluations were done both before and after tasting. Participants answered to statements: *“To me, the product seems to be...”* with visual analog scales from 0 to 10 in which 0= Not at all and 10= A lot. Statements were taken from Sweeney’s and Soutar’s (2001) research. One variable “environmentally sustainable” was added, as environmental aspect is quite fundamental point of view when discussing about substituting meat. Functional value -dimensions were modified to fit better the purpose and products of this research.

Following the factor analysis by Sweeney and Soutar (2001) these eight variables were combined into 5 variables (figure 16). Added variable “environmentally sustainable” was kept as one variable by itself, and price value was measured with one question as well. Cronbach’s alphas (figure 17) were confirmed for the variables before further analysis.

<b>variables</b>	
<b>Functional value</b>	"To me, the product seems to be healthy" + "To me, the product seems to be nutritious"
<b>Emotional value</b>	"To me, the product seems to be one that I would enjoy" + "To me, the product seems to be one that would make me want to use it"
<b>Social value</b>	"To me, the product like it would make a good impression on other people" + "To me, the product seems like it would give its owner social approval"
<b>Price value</b>	"To me, the product seems like one offering value for money"
<b>Environmental value</b>	"To me, the product seems to be environmentally sustainable"

**Figure 16.** Consumer perceived value -variables.

	Meatball	Plant-based	Augmented
Functional	,917	,904	,935
Emotional	,937	,957	,963
Social	,897	,948	,956

**Figure 17.** Cronbach's alphas for CPV's.

#### 4.2.1 Meatball

For after tasting evaluations, meatball was superior compared to plant-based and augmented products in taste and overall liking (figures 18, 19, and 20). Thus, it can be concluded, that the expected superiority of the meat product was realized. For taste the differences between augmentations did not differ significantly, however significant differences between augmentations were found for overall liking and interest to buy the product. Means for overall liking and interest to buy are clearly different in all augmentations, with highest value in olfactory and lowest in combined augmentation.

	Olfactory augmentation	Visual augmentation	Combined augmentation	F	P-value
Taste after tasting	M=7,554 SD=1,6646	M=7,300 SD=1,6745	M=6,479 SD=2,5256	2,968	,056
Overall liking	M=7,468 SD=1,4905	M=6,809 SD=1,9535	M=6,033 SD=2,3942	4,966	,009
Interest to buy	M=6,884 SD=2,4837	M=6,066 SD=2,6084	M=5,100 SD=3,0163	4,098	,019
Functional value	M=6,0284 SD=1,91048	M=5,3729 SD=2,14179	M=5,1590 SD=2,35341	1,671	,193
Emotional value	M=6,9892 SD=1,94469	M=6,2586 SD=1,88853	M=5,4231 SD=2,63231	4,843	,010
Social value	M=6,0176 SD=2,04940	M=5,0443 SD=2,20330	M=5,2013 SD=2,01803	2,295	,106
Price value	M=6,973 SD=2,0249	M=6,046 SD=1,8289	M=5,638 SD=2,3990	3,962	,022
Environmental value	M=5,438 SD=2,1537	M=4,717 SD=2,3288	M=4,236 SD=2,3010	2,706	,071

**Figure 18.** Meatball in all augmentations (*after tasting* -values).

In olfactory augmentation meatball was experienced to provide most emotional and price value, of which means were above 6,9 (figure 18.). In visual augmentation meatball was experienced to provide most emotional value, and in combined augmentation price value. In all augmentations meatball was experienced providing least environmental

value. Experiencing values differed significantly between augmentations for emotional- and price value as  $P < .05$ . Most environmental- and price value was perceived in olfactory augmentation and least in combined augmentation.

#### 4.2.2 Plant-based ball

Examining the results on plant-based ball (figure 19.) it can be noticed that the taste of the plant-based product was not considered very unpleasant nor very pleasant with means a bit above 5 (0= very unpleasant, 10= very pleasant) in all augmentations. Plant-based product was considered most pleasant in combined augmentations, and results for overall liking are quite similar.

Plant-based after tasting					
	Olfactory augmentation	Visual augmentation	Combined augmentation	F	P-value
Taste after tasting	M=5,186 SD=2,2777	M=5,180 SD=1,9149	M=5,623 SD=2,3582	,505	,605
Overall liking after tasting	M=5,262 SD=2,1744	M=5,377 SD=1,8423	M=5,633 SD=2,0692	,332	,719
Interest to buy	M=4,527 SD=3,0548	M=4,217 SD=2,3974	M=4,836 SD=2,4945	,497	,610
Functional value	M=5,7500 SD=2,13659	M=5,0400 SD=2,30507	M=5,3256 SD=2,03240	,992	,374
Emotional value	M=4,7662 SD=2,58919	M=4,4000 SD=2,18440	M=4,8628 SD=2,38743	,376	,687
Social value	M=5,6568 SD=2,29771	M=4,7900 SD=2,22092	M=5,3474 SD=1,84473	1,533	,220
Price value	M=5,138 SD=2,4465	M=4,674 SD=2,3785	M=5,174 SD=2,3113	,495	,611
Environmental value	M=6,424 SD=2,1045	M=4,986 SD=2,3510	M=5,641 SD=1,9401	4,118	,019

**Figure 19.** Plant-based ball in all augmentations (*after tasting* -values).

Means for interest to buy were rather low with means below five, highest interest to buy being in combined augmentation (M=4,836). Plant-based product was perceived to provide most environmental and functional value – from which it can be considered if the product was recognized to be plant-based as plant-based products are often associated with health (Apostolidis and McLeay, 2016) and environmental issues, as meat is often associated with negative environmental impact (Apostolidis & McLeay, 2016, p. 74; Pro-feta et al. 2021; Starowicz et al. 2022). However, the only statistically significant

differences between augmentations for plant-based product were found for environmental value with  $P < .05$ .

### 4.2.3 Augmented ball

Perceiving the augmented product did not differ statistically significantly between different augmentations (figure 20.,  $P > .05$ ). Augmented product's taste and overall liking got similar means with plant-based ball, however in combined augmentation plant-based got approximately 0,5 higher mean for both.

Augmented after tasting					
	Olfactory augmentation	Visual augmentation	Combined augmentation	F	P-value
Taste after tasting	M=5,154 SD=2,1590	M=5,300 SD=2,5145	M=5,177 SD=2,5271	,038	,963
Overall liking after tasting	M=5,554 SD=2,0049	M=5,369 SD=2,2236	M=5,095 SD=2,3452	,421	,658
Interest to buy after tasting	M=4,878 SD=2,7654	M=4,626 SD=2,6480	M=4,364 SD=2,8531	,330	,720
Functional value	M=5,9554 SD=2,10075	M=5,5229 SD=2,41665	M=5,2385 SD=2,34912	,939	,394
Emotional value	M=4,9122 SD=2,33338	M=4,7029 SD=2,42208	M=5,4231 SD=2,63231	,112	,894
Social value	M=6,0730 SD=2,07263	M=5,0371 SD=2,39768	M=5,4718 SD=1,95545	2,130	,124
Price value	M=5,389 SD=2,2256	M=4,911 SD=2,5234	M=4,928 SD=2,4644	,469	,627
Environmental value	M=6,457 SD=1,9042	M=5,311 SD=2,6182	M=5,813 SD=2,3457	2,243	,112

**Figure 20.** Augmented ball in all augmentations (*after tasting* -values).

Means for interest to buy the augmented product remained below five as they did with plant-based product as well. However, different to plant-based product, the highest interest to buy for augmented product was achieved in olfactory augmentation (figure 18). This supports the previous evaluations of the success of olfactory augmentation (see chapter 4.1.1). The augmented product in olfactory augmentation was perceived to provide most environmental value following social and functional values. In visual augmentation the most perceived value was functional value, and in combined augmentation environmental value got the highest mean.

#### **4.2.4 Effects of augmentations summarized**

Previous results will be shortly discussed here to summarize the effects of augmentations on perceived pleasantness of taste, overall liking, interest to buy and consumer perceived values. Comparing the perceived pleasantness of taste and overall liking between the products, it can be concluded that means of chosen variables support the expected superiority of the meat product. Interesting in particular was, that the plant-based and augmented products were perceived to provide more environmental value, which could indicate participants' ability to make a difference between meat and plant-based products despite the augmentations.

Examining the pleasantness of the products' perceived pleasantness of taste and overall liking with price value shows that consumers prefer consuming their money on products they find pleasant and likeable. For example, meatball in olfactory and visual augmentations got rather high means for taste and overall liking, and price value was perceived as well.

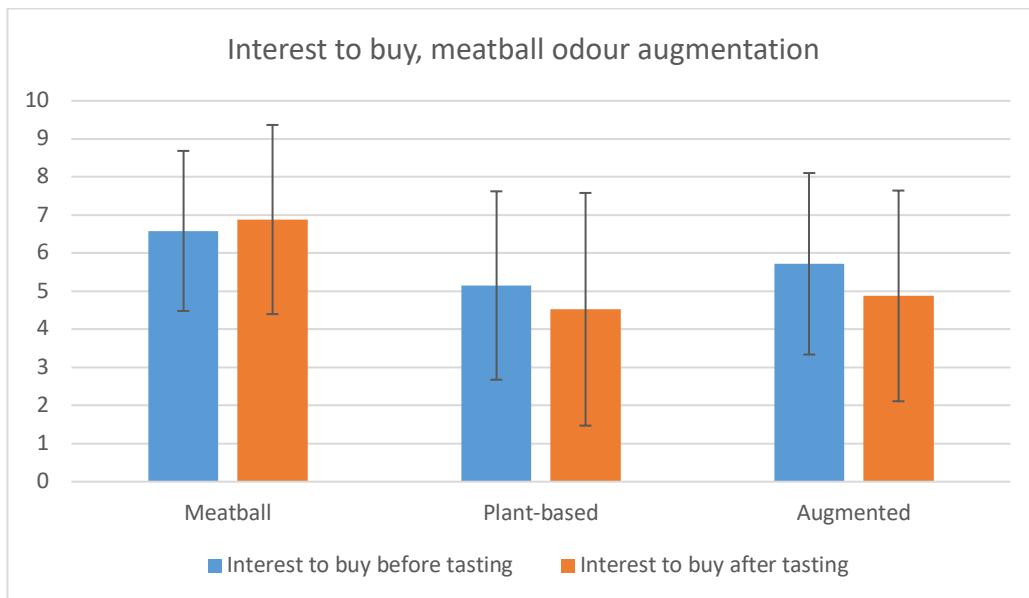
### **4.3 Interest to buy**

Above consumers' perceptions on products based on sensory evaluations were discussed as well as consumer perceived values and interest to buy. Some effects from augmentation were recognized in the perceptions on sensory properties. However, from the marketing point of view for AR to be beneficial, it would be important to have an influence on consumers' buying behavior. In this subchapter the results on interest to buy will be discussed in more depth.

In the experimental part the questionnaire included question "How interested would you be in buying the product?" that was answered both before and after tasting with visual analog scale from 0 to 10, where 0=Not at all and 10=A lot. From correlations between interest to buy and sensory evaluations (appendix 2) it can be recognized that

positive perception on products' sensory properties is connected to consumers' interest to buy the product. In figures 21, 22 and 23 means and standard deviations on interest to buy in all three augmentations are presented.

In meatball odour augmentation (figure 21) means for interest to buy for plant-based product and augmented product, in fact, decreased after tasting unlike interest to buy the meatball. Considering the result on sensory evaluations before and after tasting, results indicate that using meatball odour to augment the plant-based product, potentially, increased the expectations for the product. However, tasting could have resulted in slight disappointment as possible expectations of meat-like taste were not met. This would explain the decreased interest to buy the product as well. This is supported, as sensory properties (figure 10), especially taste and overall liking decreased after tasting the product.



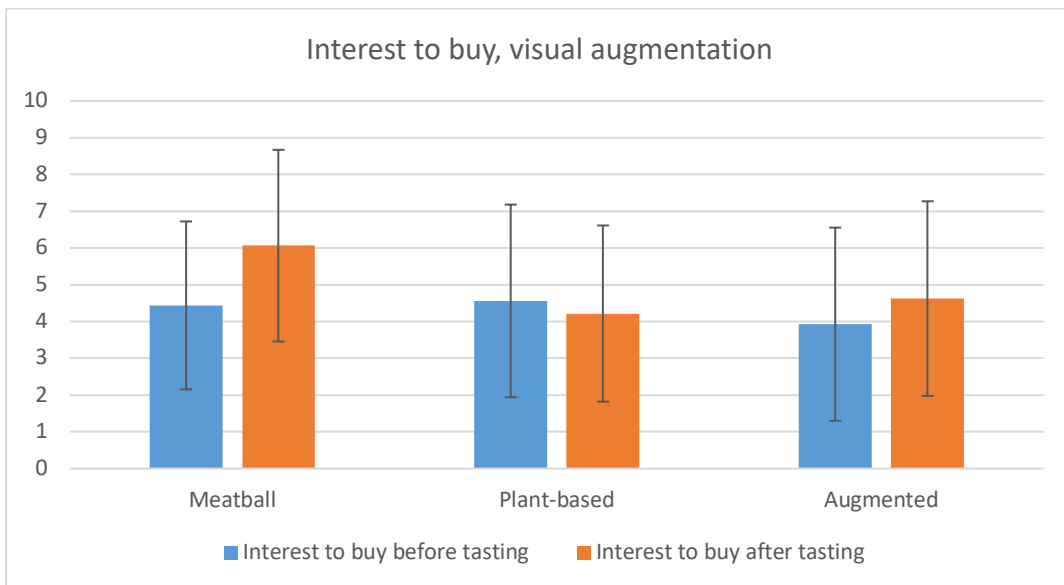
**Figure 21.** Interest to buy, meatball odour augmentation (means and standard deviations).

Interest to buy the augmented product is higher than interest to buy the plant-based product, from which it can be reasoned that olfactory augmentation with meatball odour increased the participants' interest to buy the product. However, interest to buy the meatball was still highest. In fact, interest to buy the meatball after tasting was



significantly higher than interest to buy the plant-based or augmented products. Before tasting only meatball and plant-based differed significantly. To conclude, olfactory augmentation executed with meatball odour had a positive effect especially on interest to buy before tasting, as the mean for augmented product is higher than for plant-based product without olfactory augmentation. Nevertheless, it is important to note that even after tasting the interest to buy was slightly higher for augmented than for plant-based product.

Interest to buy in visual augmentation differed from meatball odour augmentation (figure 22). The reason behind this result is unrecognized. However, considering the evaluation of sensory properties as well, it could be concluded that visually augmented products were considered less pleasant or strange, as the products participants saw looked unreal enough to be recognized artificial. This could explain decreased values, but not the reason why the mean for augmented product increased after tasting while plant-based decreased as the taste of the products are same.



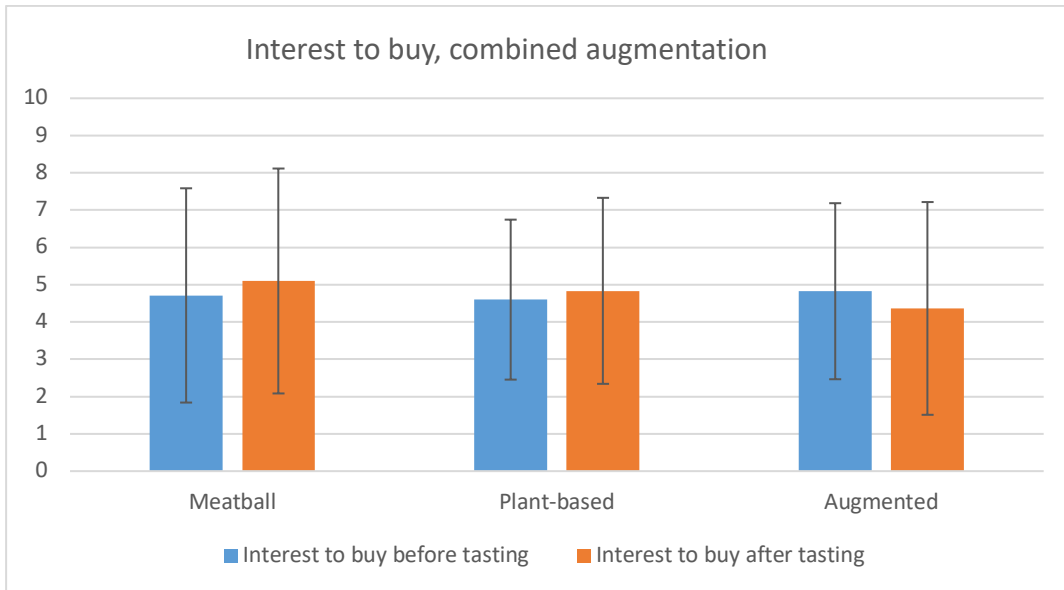
**Figure 22.** Interest to buy, visual augmentation (means and standard deviations).

One explanation for this increasing and decreasing could have been, that the virtual plant-based product was creating higher expectations. However, when examining the

evaluated pleasantness of products' appearance (figure 10) it can be noticed that the augmented product got higher means for pleasantness of the appearance, so this explanation is excluded.

Before tasting means between product had no significant differences. Means are lower compared to the olfactory augmentation results, the difference between before and after tasting for meatball in visual augmentation is bigger, and interest to buy for augmented product increased after tasting. Interest to buy meatball increased to be statistically significantly higher than plant-based and augmented products.

Interest to buy in combined augmentation is presented in figure 23. As in visual augmentation, means in combined augmentation are lower than in olfactory augmentation. There were no significant differences between products' means neither before nor after tasting. Means for meatball and plant-based products increased after tasting, as mean for augmented product decreased after tasting. It can be concluded that interest to buy changed differently in all sets after tasting. In combined augmentation interest to buy increased for meatball and plant-based, as interested to buy the augmented product decreased.



**Figure 23.** Interest to buy, combined augmentation (means and standard deviations).

#### 4.3.1 Interest to buy meat substitutes

The questionnaire included question “*how interested would you be in buying meat substitute products*” which was answered from 0 to 10 once at the end of the questionnaire, where 0= not at all and 10= a lot. In this sub-chapter the answers’ correlations will be examined in relation to interest to buy -questions (discussed above).

In the olfactory augmentation interest to buy meat substitutes varied between 0,5 to 10 means being 6,986 with standard deviation of 2,3336. Interest to buy meat substitutes correlated with the other interest to buy -variables except with interest to buy meatball (figure 24). This supports the previous deliberations if participants were able to differentiate the plant-based ball even more. However, supporting the success of olfactory augmentation, is the result that interest to buy plant-based product after tasting had stronger correlation with interest to buy meat substitutes than the augmented product after tasting had.

**Interest to buy -correlation matrix, olfactory augmentation**

	Interest to buy meat substitutes
Meatball, before	.090
Plant-based, before	.348*
Augmented, before	.327*
Meatball, after	.103
Plant-based, after	.509**
Augmented, after	.401*

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Figure 24.** Interest to buy, correlation matrix meatball odour augmentation.

In the visual augmentation interest to buy meat substitutes varied through the whole range from 0 to 10, with  $M=6,780$  and  $SD=2,3066$ . Correlations between interests to buy (figure 25) were negative with all products before tasting, and with meatball after tasting as well.

**Interest to buy -correlation matrix, visual augmentation**

	Interest to buy meat substitutes
Meatball, before	-.133
Plant-based, before	-.226
Augmented, before	-.057
Meatball, after	-.097
Plant-based, after	.244
Augmented, after	.290

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Figure 25.** Interest to buy, correlation matrix visual augmentation.

After tasting plant-based and augmented product got positive correlation values, but correlations were not significant. This gives more indications for the failure or inefficiency of the visual augmentation, as some significant correlations were found in meatball odour augmentation and in combined augmentation (figure 26) as well.

In combined augmentation the range in interest to buy meat substitutes varied from 0 to 10 as it did in visual augmentation,  $M= 6,941$   $SD= 2,4487$ . Correlations between interest to buy meat substitutes and interest to buy the products used in the experiment in combined augmentation (figure 26) showed an outcome where meatball and augmented product, in fact, got rather similar correlations, as interest to buy the plant-based product correlated clearly more strongly with interest to buy meat substitutes.

<b>Interest to buy -correlation matrix, combined augmentation</b>	
	Interest to buy meat substitutes
Meatball, before	.137
Plant-based, before	.369*
Augmented, before	.160
Meatball, after	.037
Plant-based, after	.583**
Augmented, after	.145

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Figure 26.** Interest to buy, correlation matrix combined augmentation.

From these correlation results in meatball and combined augmentation it can be deliberated that the augmentation had an impact of some level, as there was no significant correlation between interest to buy the augmented product and interest to buy meat substitutes. It could be concluded, that if the augmented product was evidently recognized to be plant-based, it should have rather similar correlations as the correlations between interest to buy plant-based products and interest to buy meat substitutes were.

#### **4.3.2 An impact of the augmentation and the role of meat substitutes for interest to buy**

In sub-chapter 3.2 two questions of meat substitutes' role for participants were presented: how familiar participants are with meat substitutes and how often they use

them. These two variables were combined into one variable describing participants' relation to meat substitutes after testing Cronbach's alpha which got value .840.

The impact of the role of the meat substitutes and augmentation method for interest to buy products (after tasting) was tested with a 2-way ANOVA. For meatball (figure 27) only augmentation had a significant effect. The role of substitutes revealed no significant effect on interest to buy the meatball. Non-significant effect resulted from the augmentation and the role of substitutes together as well.

**Dependent Variable: Interest to buy meatball (after tasting)**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	807,267 <sup>a</sup>	97	8,322	2,061	,072
Intercept	3602,451	1	3602,451	892,333	<,001
Augmentation	46,699	2	23,349	5,784	,016
Role of substitutes	667,937	80	8,349	2,068	,072
Augmentation * Role of substitutes	87,952	15	5,863	1,452	,253
Error	52,483	13	4,037		
Total	4854,550	111			
Corrected Total	859,750	110			

a. R Squared = ,939 (Adjusted R Squared = ,483)

**Figure 27.** 2-way ANOVA on interest to buy meatball.

The same analysis for plant-based ball established non-significant results on both variables (figure 28). Furthermore, augmentation and role of substitutes together did not explain the interest to buy plant-based product.

<b>Dependent Variable: Interest to buy plant-based ball (after tasting)</b>					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	630,606 <sup>a</sup>	97	6,501	0,586	,929
Intercept	2168,450	1	2168,450	195,390	<,001
Augmentation	8,483	2	4,242	0,382	,690
Role of substitutes	536,750	80	6,709	0,605	,912
Augmentation * Role of substitutes	86,479	15	5,765	0,519	,887
Error	144,275	13	11,098		
Total	3060,590	111			
Corrected Total	774,881	110			

a. R Squared = ,814 (Adjusted R Squared = -,575)

**Figure 28.** 2-way ANOVA on interest to buy plant-based ball.

Last, the same 2-way ANOVA analysis was executed for the augmented product. Non-significant effects were found, as  $P > .05$  (figure 29). To summarize the outcome for all three experiment products, for none of them augmentation and the role of substitutes for participant together increased participants' interest to buy the products. Role of substitutes alone had only non-significant effects, and augmentation had significant effect only in the case of the interest to buy the meatball.

<b>Dependent Variable: Interest to buy augmented ball (after tasting)</b>					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	706,679 <sup>a</sup>	97	7,285	0,780	,763
Intercept	2252,545	1	2252,545	241,241	<,001
Augmentation	41,021	2	20,511	2,197	,150
Role of substitutes	596,729	80	7,459	0,799	,740
Augmentation * Role of substitutes	109,796	15	7,320	0,784	,677
Error	121,385	13	9,337		
Total	3195,260	111			
Corrected Total	828,064	110			

a. R Squared = ,853 (Adjusted R Squared = -,240)

**Figure 29.** 2-way ANOVA on interest to buy augmented ball.

## 5 Conclusions

In this thesis AR's possible usability in the marketing of meat substitutes was explored. The research question was *"Could augmented reality be utilized in the marketing of meat substitute products to make plant-based products considered more attractive?"*. To answer this question two objectives were set:

1. To reflect the connection between experiential marketing, sensory marketing, marketing of meat substitute products and how augmented reality fits in.
2. To examine how AR influences consumers' evaluations of meat substitute products and if AR could be reasonable tool for companies to shape consumers' expectations and perceptions on meat replacing products.

The first objective was reached in chapter 2, in which the result was constituting a theoretical framework which considered AR, (multi)sensory- and experiential marketing, consumer perceived values including experiential value of food, sensory value, and food consumption value.

The first part of the second objective was answered in third and fourth main chapters, where the methodology and results of the experimental part of the study were explained. The second part – concluding if AR could be reasonable tool for companies – will be discussed next in chapter 5.1 among conclusions.

### 5.1 Important findings

As one of the interests in the experiment was to see if augmentation could make the plant-based product more likeable, it can be concluded that from this point of view the olfactory augmentation executed with the scent of a real meatball provided most clear results as in the sensory evaluations there can be seen differences between the three



products, and differences between before and after evaluations. However, the explanation for smaller differences in visual and combined sets remains unidentified, one possible explanation being the technology and the artificial look of products in visual augmentation. It is important to note as well, that in visual and combined sets participants did not have the product in front of them during the whole evaluation unlike in odour sets, and thus for example to smell the product again the participant would have needed to ask to see the product again as well as put the AR glasses back on. This could possibly have had an impact especially for the sensory evaluation of odour before tasting.

Considering the results of sensory evaluations, it can be concluded, that from customer experience point of view, defined by Velasco and Obrist (2021) AR could be utilized in the marketing of meat substitutes at least during pre-consumption and consumption phases. Especially from meatball odour augmentation it can be concluded that meaty odour of meatball possibly increased the expected taste of the plant-based product. Velasco and Obrist (2021) defined expectations development being part of pre-consumption phase.

Considering the BICK FOUR framework by Rauschnabel et al. (2022) and looking especially the results of sensory properties' evaluations in the meatball odour augmentation, where augmented product got higher values for pleasantness before tasting AR could be exploited at least for *convincing*. As written in the chapter 2 of this research, convincing in the BICK FOUR framework is about generating buying interest, sales, and enforcing willingness to pay (Rauschnabel et al., 2022a). This is supported by the "interest to buy" -results (chapter 4.3) as in meatball odour augmentation the augmented product got higher values than plant-based product both before and after tasting, in visual set after tasting and in combined before tasting.

According to Hoek et al. (2011) for non-users of meat substitutes the biggest barrier for using is the unfamiliarity of the products. Considering especially the differences between meatball odour set and wild boar odour set, it could be deliberated if the familiarity of

the meatball odour made the augmented product more pleasant, especially when compared to results from wild boar odour augmentation. Based on this it could be considered if the familiar odour would be enough to break the barrier on trying a new product – however, the challenge then would be in *keeping* the consumers referring to BICK framework by Rauschnabel et al. (2022a). Keeping could be challenge as after tasting the product perceived pleasantness decreased as well as interest to buy the product.

Referring to results discussed in chapter 4.1, it must be noted that as the intention of the experimental part was to increase the likeability of the plant-based product with augmentations, it can be stated that visual and combined augmentations did not function as efficiently as wished. However, it does not mean that visual augmentation has no potential in the marketing of meat substitutes as the results can be consequence of the unfamiliar appearance of products or smaller differences between virtual than real food products. Considering discussions on experiential value of food (chapter 2.4.1) exploiting AR in the marketing of meat substitutes would add or at least modify the perceived product value, as product value includes all the sensory properties and physical attributes of the products.

## 5.2 Challenges

As concluded above, AR has potential in the marketing of meat substitutes. However, as Rauschnabel et al. (2022a) mentioned one of the major challenges for AR in the marketing of food products will be how to execute AR strategies in practice. For example, from the results of this research it was concluded that meatball-like olfactory augmentation made perceived pleasantness of the plant-based product before tasting higher than expectations for plant-based product without the augmentation were. The challenge will be how to exploit the augmentation technologies to make consumers interested in the product in real purchasing-decision moment. Another challenge would be how to get people purchase again, if the conclusion, that augmentation created higher expectations than the product eventually is capable come up to, is correct.

As presented in chapter 2.1.2, AR has been already used in restaurants. Considering augmentation of meat-substitute products with olfactory and visual augmentations, starting from the restaurant business could be a solution for the execution challenges. One opportunity could be free tastings in grocery stores – here however the problem compared to restaurants would be the lack of augmentations while consumers get home – if the augmentation made them want to buy the products in the first place. Exploiting technologies in restaurant would exclude the problem of missing augmentation when actually consuming the product. However, in this case the problem of incongruence between the odour and taste, for example, would remain.

From the meat substitute marketing point of view the major challenge will be how to execute using AR to influence on consumer's buying decisions, as convincing consumers is more dependent on time and place compared to operators like Ikea in the example mentioned in chapter 2.1.2. It is important to note that negative effects of AR are not researched thoroughly, and Rauschnabel et al. (2022a) mention possibilities of distraction from real-world resulting in putting users in danger – however, time and place dependency of using AR for the marketing of meat substitutes could prevent its users from bigger dangers. One major challenge for using AR in the marketing of meat substitutes may be the sensory incongruence, the possible effect which was also seen in the results of this study (chapter 4.1.1).

The final conclusion to research question *“Could augmented reality be utilized in the marketing of meat substitute products to make plant-based products considered more attractive?”* is, that augmented reality could be used to modify the way meat substitutes are perceived. However, how to execute the augmentations to be able to benefit from the technology and make an impact on consumers' daily buying decisions needs more research for companies to be able to exploit the technology profitably.

### 5.3 Limitations and future research

As the results of visual and combined augmentations did not show any major results, it would be beneficial to examine how more explicit difference between the appearance of virtual products would work. In this research all products were visually augmented, as using augmentation only for one product would have made it easy to recognize which one is modified with technology. From visual point of view two different ideas could be explored in future: a) augmentation with more clearly “plant-based” virtual ball, for example by creating the virtual product more green and orange colored and b) using visual augmentation only for the augmented product. However, the latter might need to wait for even more advanced technologies, although it might be interesting to figure out how the evaluations of same participants would differ between real and virtual products used in the augmentations, as in this research many participants commented after or during answering the questionnaire that the virtual products seemed very similar to each other, but odd as well.

For companies to be able to exploit AR in their marketing of meat substitutes and other food products, the possible ways to execute the augmentation need to be explored more thoroughly. This topic was also highlighted by Rauschnabel et al. (2022a) as something that needs to be studied in the future as well as how to manage AR marketing. In this research the comparability of different conditions declined as the serving of the products had to be modified after executing the odour sets. For future research it would be important to take the possible technological restrictions into account for all study conditions, as here different way of serving the products could have influenced the perceived pleasantness for odours at least.

One interesting question that resulted from this study was the reason behind no significant differences in the pleasantness of the odour in combined augmentation. One potential explanation could be, that the fact that for most participants using AR-classes was new and exciting experience and thus could have possibly taken the focus from the odour. However, this conclusion has no evidence and is based on participants’ comments about

excitement given after the experiment, and thus would need to be measured. As already mentioned before, another explanation for such results could be covering of the product while answering to questions. Thus, it could be interesting to explore how much and if the attention paid to odours decrease while wearing the AR classes and if there are differences between people who are already familiar with AR technologies and people who are not.

Referring to familiarity topic discussed before, it would be interesting to see more results executed with both familiar and unfamiliar odours or visuals to compare the effects of familiarity mentioned by Hoek et al (2011). If companies want to start exploiting augmented reality in their marketing strategies of meat substitutes in the future, research and experiments on execution will need more research and innovations. In this research the data was collected in laboratory, but research and experiments on how to achieve similar effects without the similar equipment and laboratory conditions would be needed in the future.

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## Appendix

### Appendix 1. Research questionnaire

Tervetuloa arvioimaan ruokatuotteita!

Ennen tuotteisiin liittyviä kysymyksiä, vastaathan seuraaviin taustakysymyksiin.

#### 1: Mikä on sukupuolesi?

- Nainen
- Mies
- Muu
- En halua kertoa

#### Kuinka vanha olet (vuosina)?

#### Mikä on korkein suorittamasi tutkinto?

- Perusaste tai alempi (perus-, kansa- tai keskikoulu)
- Toisen asteen ammatillinen tutkinto (ammatillinen perustutkinto, ammattikoulu tai vastaava)
- Toisen asteen tutkinto (lukio)
- Kolmannen asteen tutkinto tai toisen asteen jälkeinen ammatillinen tutkinto (op-  
piasteen ammattitutkinto)
- Korkea-asteen ensimmäinen taso (ammattikorkeakoulu)
- Korkea-aste (yliopisto, kandidaatin tutkinto)
- Korkea-aste (yliopisto, maisterin tutkinto tai korkeampi esim. FM, FT, tohtori)
- Jokin muu/en osaa sanoa

#### Mikä seuraavista kuvaa parhaiten tulotasoasi?



- Korkea tulotaso
- Keskimääräinen tulotaso
- Matala tulotaso

**Kuinka väsyneeksi tunnet itsesi tällä hetkellä? Vastaa asteikolla 1-5 sen mukaan, kumpi vastausvaihtoehtoista pitää kohdallasi paremmin paikkansa.**

Erittäin väsynyt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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**Kuinka nälkäiseksi tunnet itsesi tällä hetkellä? Vastaa asteikolla 1-5 sen mukaan, kumpi vastausvaihtoehtoista pitää kohdallasi paremmin paikkansa.**

Erittäin nälkäinen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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**Millainen on mielialasi juuri nyt? Vastaa asteikolla 1-5 sen mukaan, kumpi vastausvaihtoehtoista pitää kohdallasi paremmin paikkansa.**

Surullinen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Huono	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ärtynyt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Masentunut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Seuraavaksi tulet saamaan 3 tuotetta arvioitavaksi. Näiden ohella kysymme tuotteisiin liittymättömiä kysymyksiä.

Lue seuraavilla sivuilla olevat ohjeet huolellisesti ennen arviointeja. Noudata myös tutkimuksen järjestäjän ohjeita ja kysy, jos jokin on epäselvää. Muista juoda vettä näytteen välillä.

Pääset arviointikysymyksissä eteenpäin valitsemalla seuraava (**next**). Huomaa, ettet voi siirtyä kyselyssä takaisin päin. Luota ensivaikutelmaan arvioissasi.

Tarjoilemme seuraavaksi ensimmäisen näytteesi.

Aloita arviointi, kun tutkimuksen järjestäjä antaa siihen luvan.

Edessäsi on tuote **\$\$code:product\$\$**.

**Älä maista tuotetta** vielä vaan **tarkastele sitä**.

Ethän vielä siirrä tuotetta lautaselta, äläkä liikuta lautasta.

Vastaa alla oleviin kysymyksiin klikkaamalla arviotasi vastaavaa kohtaa janalla.

Arvioi tuotteen miellyttävyyttä asteikolla nollasta kymmeneen, jossa 0 = Erittäin epämiellyttävä ja 10 = Erittäin miellyttävä.

**Ulkonäkö**

**Tuoksu**

**Odotettavissa oleva maku**

**Yleinen miellyttävyys**

**Arvioi, kuinka paljon haluaisit syödä edessäsi olevan tuotteen? Käytä arvioinnissa asteikkoa 0= En ollenkaan 10= Erittäin paljon**

Olet nyt tarkastellut tuotetta. Arvioi seuraavalla sivulla tuotteen antamaa vaikutelmaa asteikolla nollasta kymmeneen, jossa 0= ei ollenkaan ja 10= erittäin paljon.

**Tuote vaikuttaa minusta terveelliseltä**

**Tuote vaikuttaa minusta ravinteikkaalta**

**Tuote vaikuttaa minusta nautinnolliselta**

22: Tuote vaikuttaa minusta houkuttevalta

23: Tuote vaikuttaa minusta sellaiselta, jota muut ihmiset pitäisivät hyväksyttävänä

24: Tuote vaikuttaa minusta sellaiselta, jonka ostaminen tekisi hyvän vaikutuksen muihin ihmisiin.

25: Tuote vaikuttaa minusta sellaiselta, joka antaa rahoilleni vastinetta

26: Tuote vaikuttaa minusta ympäristön kannalta kestävältä tuotteelta

27: Arvioi, kuinka kiinnostunut olisit ostamaan tuotteen asteikolla nollasta kymmeneen, jossa 0= En ollenkaan ja 10=Erittäin paljon

Edessäsi on tuote **\$\$code:product\$\$**.  
Voit nyt **maistaa tuotetta**.

Maista tuotetta ottamalla yksi pyörykkä haarukkaan ja **laittamalla pyörykkä kokonaan suuhun**. Pyörykän saa syödä. Jos ei halua syödä pyörykkää, sen voi sylkäistä ohessa olevaa astiaan.

Arvioi tuotteen miellyttävyyttä asteikolla nollasta kymmeneen, jossa 0 = erittäin epämiellyttävä ja 10 = erittäin miellyttävä.

**Ulkonäkö**

**Tuoksu**

**Maku**

**Yleinen miellyttävyys**

Tuotteen maistaminen saa minut **tuntemaan..**

Tyyty- mättö- myyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tylsisty- nei- syyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Syylli- syyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Välinpi- tämät- tö- myyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Häpeää	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pelkoa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surua	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inhoa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Arvioi tuotteen antamaa vaikutelmaa nyt maistamisen jälkeen asteikolla nolasta kym-  
meneen, jossa 0= ei ollenkaan ja 10= erittäin paljon.

**Tuote vaikuttaa minusta terveelliseltä**

**Tuote vaikuttaa minusta ravinteikkaalta**

**Tuote vaikuttaa minusta nautinnolliselta**

**Tuote vaikuttaa minusta houkuttevalta**

**Tuote vaikuttaa minusta sellaiselta, jota muut ihmiset pitäisivät hyväksyttävänä**

**Tuote vaikuttaa minusta sellaiselta, jonka ostaminen tekisi hyvän vaikutuksen muihin ihmisiin.**

**Tuote vaikuttaa minusta ympäristön kannalta kestävältä tuotteelta**

**Tuote vaikuttaa minusta sellaiselta, joka antaa rahoilleni vastinetta**

**Arvioi kuinka kiinnostunut olisit ostamaan tuotteen asteikolla nolasta kymmeneen, jossa 0= En ollenkaan ja 10=Erittäin paljon**

Tutkimuksen järjestäjä hakee sinulle seuraavan tuotteen.  
Vastaathan sillä välin seuraaviin kysymyksiin.

**Valitse kunkin väittämän kohdalla vaihtoehto, joka kuvaa mielipidettäsi parhaiten.**

	Täysin eri mieltä	Osittain eri mieltä	En eri enkä samaa mieltä	Osittain samaa mieltä	Täysin samaa mieltä
En kykenisi haistamaan grillaimista 20 metrin päästä.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
En kykenisi erottamaan pilaantunutta maitoa ainoastaan haistamalla.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
En pysty päättämään vaatteit- teni puh- tautta tai likai- suutta yksin hajun perus- teella.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

En huomaisi hajun perusteella, mikäli joku vaihtaisi käyttämänsä hajuvettä.



Edessäsi on tuote **\$\$code:product\$\$**.

**Älä maista tuotetta** vielä vaan **tarkastele sitä**.

Ehän vielä siirrä tuotetta lautaselta, äläkä liikuta lautasta.

Vastaa alla oleviin kysymyksiin klikkaamalla arviotasi vastaavaa kohtaa janalla.

Arvioi tuotteen miellyttävyyttä asteikolla nollasta kymmeneen, jossa 0 = Erittäin epämiellyttävä ja 10 = Erittäin miellyttävä.

**Ulkonäkö**

**Tuoksu**

**Odotettavissa oleva maku**

**Yleinen miellyttävyys**

**Arvioi, kuinka paljon haluaisit syödä edessäsi olevan tuotteen? Käytä arvioinnissa asteikkoa 0= En ollenkaan 10= Erittäin paljon**

Olet nyt tarkastellut tuotetta. Arvioi seuraavalla sivulla tuotteen antamaa vaikutelmaa asteikolla nollasta kymmeneen, jossa 0= ei ollenkaan ja 10= erittäin paljon.

**Tuote vaikuttaa minusta terveelliseltä**

**Tuote vaikuttaa minusta ravinteikkaalta**

**Tuote vaikuttaa minusta nautinnolliselta**

**Tuote vaikuttaa minusta houkuttelevalta**

**Tuote vaikuttaa minusta sellaiselta, jota muut ihmiset pitäisivät hyväksyttävänä**

**Tuote vaikuttaa minusta sellaiselta, jonka ostaminen tekisi hyvän vaikutuksen muihin ihmisiin.**

**Tuote vaikuttaa minusta sellaiselta, joka antaa rahoilleni vastinetta**

**Tuote vaikuttaa minusta ympäristön kannalta kestävältä tuotteelta**

**Arvioi, kuinka kiinnostunut olisit ostamaan tuotteen asteikolla nollasta kymmeneen, jossa 0= En ollenkaan ja 10=Erittäin paljon**

Edessäsi on tuote **\$\$code:product\$\$**.  
Voit nyt **maistaa tuotetta**.

Maista tuotetta ottamalla yksi pyörykkä haarukkaan ja **laittamalla pyörykkä kokonaan suuhun**. Pyörykän saa syödä. Jos ei halua syödä pyörykkää, sen voi sylkäistä ohessa olevaa astiaan.

Arvioi tuotteen miellyttävyyttä asteikolla nollasta kymmeneen, jossa 0 = erittäin epämiellyttävä ja 10 = erittäin miellyttävä.

**Ulkonäkö**

**Tuoksu**

**Maku****Yleinen miellyttävyys**

Tuotteen maistaminen saa minut **tuntemaan..**

Tyyty- mättö- myyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tylsisty- nei- syyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Syylli- syyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Välinpi- tämät- tö- myyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Häpeää	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pelkoa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surua	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inhoa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Arvioi tuotteen antamaa vaikutelmaa nyt maistamisen jälkeen asteikolla nollasta kymmeneen, jossa 0= ei ollenkaan ja 10= erittäin paljon.

**Tuote vaikuttaa minusta terveelliseltä**

**Tuote vaikuttaa minusta ravinteikkaalta**

**Tuote vaikuttaa minusta nautinnolliselta**

**Tuote vaikuttaa minusta houkuttevalta**

**Tuote vaikuttaa minusta sellaiselta, jota muut ihmiset pitäisivät hyväksyttävänä**



**Tuote vaikuttaa minusta sellaiselta, jonka ostaminen tekisi hyvän vaikutuksen muihin ihmisiin.**

**Tuote vaikuttaa minusta ympäristön kannalta kestävältä tuotteelta**

**Tuote vaikuttaa minusta sellaiselta, joka antaa rahoilleni vastinetta**

**Arvioi kuinka kiinnostunut olisit ostamaan tuotteen asteikolla nollasta kymmeneen, jossa 0= En ollenkaan ja 10=Erittäin paljon**

Tutkimuksen järjestäjä hakee sinulle seuraavan tuotteen.

Vastaathan sillä välin seuraaviin kysymyksiin.

**Valitse kunkin väittämän kohdalla vaihtoehto, joka kuvaa mielipidettäsi parhaiten.**

	<b>Täysin eri mieltä</b>	<b>Osittain eri mieltä</b>	<b>En eri enkä samaa mieltä</b>	<b>Osittain samaa mieltä</b>	<b>Täysin samaa mieltä</b>
Kykenisin erottamaan maitosuklaan ja tumman suklaan toisistaan ainoastaan maun perusteella.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kykenisin erottamaan kaksi eri perunastubrandiä toisistaan maun perusteella.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Voin juoda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

teetä/kah-  
via pel-  
kästään il-  
man tar-  
vetta li-  
sätä mai-  
toa tai so-  
keria

Kykenisin  
puraise-  
maan sit-  
ruunaa  
ongel-  
mitta

**Valitse kunkin väittämän kohdalla vaihtoehto, joka kuvastaa mielipidettäsi parhaiten.**

**Täysin eri  
mieltä**

**Osittain eri  
mieltä**

**En eri enkä sa-  
maa mieltä**

**Osittain samaa  
mieltä**

**Täysin samaa  
mieltä**

Mikään  
ei vedä  
vertoja  
lihan  
herkulli-  
selle  
maulle.

En voi  
kuvitella  
olevani  
syö-  
mättä li-  
haa  
säännöl-  
lisesti.

Lihan  
syömi-  
nen  
osoittaa  
kunnioi-  
tuksen  
puutetta  
elämää  
ja ympä-  
ristöä  
kohtaan.

Ihmisen  
on tar-  
koitus  
syödä li-  
haa  
osana  
ruokava-  
liotaan.

Rakas-  
tan liha-  
ruokia.

Lihan  
syömi-  
nen on  
jokaisen  
ihmisen  
kiistaton  
oikeus.

Tuntisin  
oloni hy-  
väksi,  
vaikka  
en söisi  
lihaa.

Lihan  
syömi-  
nen tuo  
mieleeni  
eläinten  
kärsi-  
myksen  
ja kuole-  
man.

Jos en  
voisi  
syödä li-  
haa,  
tuntisin  
itseni  
heikoksi.

Edessäsi on tuote **\$\$code:product\$\$**.

**Älä maista tuotetta vielä vaan tarkastele sitä.**

Ehän vielä siirrä tuotetta lautaselta, äläkä liikuta lautasta.

Vastaa alla oleviin kysymyksiin klikkaamalla arviotasi vastaavaa kohtaa janalla.

Arvioi tuotteen miellyttävyyttä asteikolla nollasta kymmeneen, jossa 0 = Erittäin epämiellyttävä ja 10 = Erittäin miellyttävä.

**Ulkonäkö**

**Tuoksu**

**Odotettavissa oleva maku**

**Yleinen miellyttävyys**

**Arvioi, kuinka paljon haluaisit syödä edessäsi olevan tuotteen? Käytä arvioinnissa asteikkoa 0= En ollenkaan 10= Erittäin paljon**

Olet nyt tarkastellut tuotetta. Arvioi seuraavalla sivulla tuotteen antamaa vaikutelmaa asteikolla nollasta kymmeneen, jossa 0= ei ollenkaan ja 10= erittäin paljon.

**Tuote vaikuttaa minusta terveelliseltä**

**Tuote vaikuttaa minusta ravinteikkaalta**

**Tuote vaikuttaa minusta nautinnolliselta**

**Tuote vaikuttaa minusta houkuttelevalta**

**Tuote vaikuttaa minusta sellaiselta, jota muut ihmiset pitäisivät hyväksyttävänä**

**Tuote vaikuttaa minusta sellaiselta, jonka ostaminen tekisi hyvän vaikutuksen muihin ihmisiin.**

**Tuote vaikuttaa minusta sellaiselta, joka antaa rahoilleni vastinetta**

**Tuote vaikuttaa minusta ympäristön kannalta kestävältä tuotteelta**

**Arvioi, kuinka kiinnostunut olisit ostamaan tuotteen asteikolla nollasta kymmeneen, jossa 0= En ollenkaan ja 10=Erittäin paljon**

Edessäsi on tuote **\$\$code:product\$\$**.  
Voit nyt **maistaa tuotetta**.

Maista tuotetta ottamalla yksi pyörykkä haarukkaan ja **laittamalla pyörykkä kokonaan suuhun**. Pyörykän saa syödä. Jos ei halua syödä pyörykkää, sen voi sylkäistä ohessa olevaa astiaan.

Arvioi tuotteen miellyttävyyttä asteikolla nollasta kymmeneen, jossa 0 = erittäin epämiellyttävä ja 10 = erittäin miellyttävä.

**Ulkonäkö**

**Tuoksu**

**Maku**

**Yleinen miellyttävyys**

Tuotteen maistaminen saa minut **tuntemaan..**

Tyyty-	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
mättö-					
myyttä					
Tylsisty-	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
nei-					
syyttä					

Syyllisyyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Välinpitämättömyyttä	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Häpeää	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pelkoa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surua	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inhoa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Arvioi tuotteen antamaa vaikutelmaa nyt maistamisen jälkeen asteikolla nolasta kymmeneen, jossa 0= ei ollenkaan ja 10= erittäin paljon.

**Tuote vaikuttaa minusta terveelliseltä**

**Tuote vaikuttaa minusta ravinteikkaalta**

**Tuote vaikuttaa minusta nautinnolliselta**

**Tuote vaikuttaa minusta houkuttevalta**

**Tuote vaikuttaa minusta sellaiselta, jota muut ihmiset pitäisivät hyväksyttävänä**

**Tuote vaikuttaa minusta sellaiselta, jonka ostaminen tekisi hyvän vaikutuksen muihin ihmisiin.**

**Tuote vaikuttaa minusta ympäristön kannalta kestävältä tuotteelta**

**Tuote vaikuttaa minusta sellaiselta, joka antaa rahoilleni vastinetta**

Arvioi kuinka kiinnostunut olisit ostamaan tuotteen asteikolla nolasta kymmeneen, jossa 0= En ollenkaan ja 10=Erittäin paljon

Olet nyt arvioinut kaikki tuotteet. Lue seuraava kuvaus ja vastaa vielä alla oleviin kysymyksiin.

*Lihaa korvaavat tuotteet eivät sisällä lihaa, mutta niiden katsotaan korvaavan lihatuotteet aterian pääasiallisena proteiininlähteenä. Lihaa korvaavat tuotteet on yleensä valmistettu kasvipohjaisista raaka-aineista, kuten soijasta, härkävavuista tai muista palkokasveista tai kaurasta. Yleisimpiä lihaa korvaavia tuotteita ovat pihvit, makkarat, jauhelihan korvikkeena käytettävä rouhe, leikkeleet ja suikaleet.*

### Mitä mieltä olet lihaa korvaavista tuotteista?

#### Lihaa korvaavat tuotteet vaikuttavat minusta...

Erittäin huonolta ajatukselta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vastustamisen arvoilta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Arvioi, kuinka kiinnostunut olet ostamaan lihaa korvaavia tuotteita asteikolla nollasta kymmeneen, jossa 0= en ollenkaan ja 10= erittäin paljon**

**Arvioi, kuinka tuttuja lihaa korvaavat tuotteet ovat sinulle asteikolla nollasta kymmeneen, jossa 0= ei ollenkaan ja 10= erittäin tuttuja**

**Arvioi, kuinka usein syöt lihaa korvaavia tuotteita asteikolla nollasta kymmeneen, jossa 0= en koskaan ja 10=hyvin usein**

**Uskotko tietäväsi mistä tutkimuksessa oli kyse?**

- Kyllä  
 En

**Mikäli vastasit edelliseen kyllä, kirjoita lyhyesti ajatuksiasi tutkimuksen tarkoituksesta.**

**Kiitokset vastauksistasi!**

**Paina vielä lähetä-painiketta, niin vastauksesi tallentuvat.**





### Appendix 3. Correlations between interests to buy and sensory properties.

<b>Product</b>	<b>Interest to buy, olfactory</b>	<b>Interest to buy, visual</b>	<b>Interest to buy, combined</b>
<b>Meatball before tasting</b>			
Appearance	.683**	.754**	.867**
Odour	.648**	.257	.513**
Taste	.845**	.720**	.683**
<b>Overall liking</b>	.834**	.769**	.859**
<b>Meatball after tasting</b>			
Appearance	.697**	.555**	.601**
Odour	.623**	.326	.639**
Taste	.707**	.774**	.870**
<b>Overall liking</b>	.869**	.843**	.880**
<b>Plant-based before tasting</b>			
Appearance	.732**	.817**	.669**
Odour	.600**	.297	.540**
Taste	.810**	.696**	.708**
<b>Overall liking</b>	.733**	.783**	.795**
<b>Plant-based after tasting</b>			
Appearance	.592**	.436**	.579**
Odour	.462**	.372*	.699**
Taste	.830**	.689**	.813**
<b>Overall liking</b>	.878**	.728**	.833**
<b>Augmented before tasting</b>			
Appearance	.585**	.744**	.759**
Odour	.628**	.564**	.754**
Taste	.765**	.634**	.759**
<b>Overall liking</b>	.734**	.799**	.838**
<b>Augmented after tasting</b>			
Appearance	.479**	.456**	.698**
Odour	.418**	.574**	.713**
Taste	.793**	.807**	.851**
<b>Overall liking</b>	.762**	.848**	.862**

\*\* Correlation is significant at the 0.01 level (2-tailed)