Undergraduate Dissertation

Customer experience with augmented reality in the context of healthy food

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INFORMATION

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ABSTRACT

New technologies are present in all our daily life activities. In the field of marketing, it is important to know their effects in order to make the most of them. This undergraduate dissertation focuses on augmented reality (AR), one of the 4.0 technologies which enables the integration of virtual elements with the physical environment through electronic devices. Specifically, and taking into account the society's emerging concern about adopting healthier habits, it is aimed to analyze the possible effects of AR in promoting healthier food consumption. To this end, an in-depth literature review is carried out about the tool AR and its applications in marketing and specifically in the field of food consumption. After that, a quantitative study in the form of a questionnaire aimed to examine the possible influence of AR applications on consumer behavior, specifically in the context of choosing a menu in a restaurant that varied in terms of healthiness and with different presentation modes (AR vs pictures). The analysis offers conclusions that can be useful to understand the capabilities and limitations of AR in food consumption, providing useful information for developing more effective strategies and approaches to promote healthy eating habits.

RESUMEN

Las nuevas tecnologías están presentes en todas las actividades de nuestra vida cotidiana. En el campo del marketing, es importante conocer sus efectos para sacarles el máximo partido. Este TFG se centra en la realidad aumentada (RA), una de las tecnologías 4.0 que permite integrar elementos virtuales con el entorno físico a través de dispositivos electrónicos. En concreto, y teniendo en cuenta la emergente preocupación de la sociedad por adoptar hábitos más saludables, se pretende analizar los posibles efectos de la RA en la promoción y fomento de un consumo de alimentos más saludable. Para ello, se realiza una revisión bibliográfica en profundidad sobre la herramienta de la RA y sus aplicaciones en marketing y específicamente en el ámbito alimentario. Posteriormente, un estudio cuantitativo en forma de cuestionario pretende examinar la posible influencia de las aplicaciones de RA en el comportamiento del consumidor, concretamente en el contexto de la elección de un menú en un restaurante que variaba en términos de salubridad y con diferentes modos de presentación (RA vs imágenes). El análisis ofrece conclusiones que pueden ser útiles para comprender las capacidades y limitaciones de la RA en el consumo de alimentos, proporcionando información útil para desarrollar estrategias y enfoques más eficaces para promover hábitos alimentarios saludables.

INDEX

1. INTRODUCTION 6
2. THEORETICAL FRAMEWORK 8
   2.1. 4.0 Technologies 8
      1.1.1. Immersive technologies 10
      1.1.2. Augmented reality 13
         1.1.2.1. Definition and history 13
         1.1.2.2. Classification and characteristics 15
         1.1.2.3. AR in marketing 16
   2.2. Customer experience 20
   2.3. Research context and proposal 21
      1.1.3. AR in the food consumption 21
      1.1.4. Impact of AR in healthy food consumption 23
3. METHODOLOGY 24
   3.1. Research method: questionnaire 24
   3.2. Design of the questionnaire 25
4. ANALYSIS AND RESULTS 26
   4.1. Sample characteristics 26
      4.1.1. Socio-demographic characteristics 26
      4.1.2. Eating habits and dining out 27
      4.1.3. Experience with AR technology 29
   4.2. Effect of presentation mode: AR versus pictures 29
5. CONCLUSIONS 33
6. BIBLIOGRAPHY 36
7. APPENDIX 42

INDEX OF FIGURES

Figure 1. Top 10 Industry 4.0. Trends & Innovations (StartUs Insights, 2023) 9
Figure 2. Styles of interaction and interfaces (Rubio-Tamayo et al., 2017) 10
Figure 3. Reality-Virtuality Continuum (Milgram and Kishino, 1994).....11
Figure 4. Updated Reality-Virtuality Continuum (Flavián et al. 2019).....12
Figure 5. "EPI" cube and examples of technologies. (Flavián et al., 2019).....12
Figure 6. 1: Sutherland's HMD, 1968. 2:Krueger's Videoplace, 1975.....14
Figure 7. 1:AR Quake, 2000. 2: Invizimals, 2009. 3: Pokemon Go, 2016 15
Figure 8. Classification of AR use cases. Rauschnabel et al. (2022).....16
Figure 9. AR marketing usage (Rauschnabel, Babin et al. 2022) 17
Figure 10. AR marketing examples (1: Topshop VTO screen 2:IKEA Place App) 19
Figure 11. AR for grocery shopping (1: List & Go, 2: Scan & Save).....22
Figure 12. AR for receipts (Ibercook Food Service AR) 22
Figure 13. Kabaq App 23
Figure 14. AR uses (number of respondents).....29

INDEX OF TABLES

Table 1. Socio-demographic characteristics.....27
Table 2. Frequency of consuming particular food items.....27
Table 3. Frequencies of eating at restaurants and ordering delivery food 28
Table 4. Attributes and situations influencing when dining out 28
Table 5. Chosen dishes.....30
Table 6. Starter and menus chosen by male and female participants.....31
Table 7. Reason for choosing the dish with AR or with pictures.....31
Table 9. Characteristics for the menus' prices.....32
Table 10. Prices' characteristics according to menu and method 33

1. INTRODUCTION

Nowadays we live in a world of constant change and development in which we have to adapt in order not to be left behind. The world of new technologies represents this fact perfectly, as they are constantly evolving, creating the need of always be up to date in areas such as marketing. This dissertation focuses on immersive technologies, which merge the virtual world with the real one through electronic devices providing a sensation of immersion, and more specifically on augmented reality (AR), which integrates virtual elements into the real world (Javornik, 2016).

AR is slowly being explored by customers and there are still many regional and age differences between users. According to a PricewaterhouseCoopers survey, only around 25% of respondents have made use of metaverse in the last six months, mainly among people between 9 and 40 years old (67%), being India, Vietnam and Hong Kong the countries in which this technology is more employed and Japan, Canada and Ireland the least (PwC, 2023). This tools may not yet be as recognized as artificial intelligence or robotics, however it offers many possibilities within the marketing domain, as it has the power to significantly influence consumer behavior and transform their experiences (Tom Dieck & Han, 2022). An illustrative example of AR's applications is the use of in store mirrors in fashion stores such as Uniqlo, where customers can virtually try-on clothes, enhancing their shopping experience and influencing their purchase decisions (Heller et al., 2019).

This dissertation is intended to explore a less known topic of AR applications, and this is healthy lifestyles. The relevance of carrying out this way of living arises from its numerous benefits for our overall well-being. By adopting healthy habits, we can improve our quality of life, prevent disease and enjoy greater physical and mental well-being. Specifically, the paper will focus on healthy eating. This is important for several reasons: it provides the body with the nutrients it needs to function properly; it helps to maintain a healthy weight by avoiding obesity and overweight; it has a significant impact on mental and emotional welfare by reducing the chances of having anxiety and depression; it improves concentration, memory and cognitive performance; by choosing fresh and local food, it promotes sustainability and the ecological footprint is reduced, among others (Eikenberry & Smith, 2004). It is therefore essential to adopt and promote healthy eating habits as part of our way of living.

AR has not yet been extensively explored in this particular field as it has been in areas such as entertainment, fashion, or education. Some examples are apps that allow to make a shopping list and be guided through the supermarket depending on the food wanted to be bought, or others that provide additional information by scanning a product with a phone's camera in the supermarket (Wagaine, 2022). There also exist apps for restaurants or delivery services which allow the visualization of the dishes on the menu as if they were on the table through AR technology via an electronic device.

The overall objective of the dissertation is to investigate the potential impact of AR applications on individuals' food choices and healthy behaviors. In order to achieve this general objective, more specific objectives are specified. Firstly, it is analyzed whether AR applications that present dishes from restaurant menus or delivery services can influence consumers to choose healthier options due to their high technological development that allows them to show dishes almost as they are seen in real life. Secondly, the aim is to evaluate whether AR is a more useful method than photographs in this sense, as it could be interesting if restaurants themselves offer and promote this type of dishes with this method instead of pictures or simple descriptions, contributing to improving the habits of the society. By studying these objectives, the aim is to contribute to knowledge about the influence and benefits of augmented reality in the field of healthy lifestyles, offering valuable insights for academic research and for the development of future applications and health promotion strategies.

To do so, the dissertation's structure is as follows: it begins with a comprehensive literature review, providing the necessary context for the correct understanding of study. It deals with the new technologies, focusing on immersive technologies and more concretely AR. About the latter, its evolution, classification, characteristics, and marketing applications are developed. The customer experience is also examined, initially in a general context, and subsequently in relation to new technologies, highlighting its significance within the field of marketing. As last point of the literature review, and to contextualize better the objectives aimed in this paper, the importance of healthy lifestyles and the diverse applications of AR in this context are assessed. Secondly, the research method used, that is, the questionnaire, is described with its advantages and disadvantages, and its concrete structure and design is explained. Thirdly, a descriptive analysis of the results obtained from the survey is carried out and, finally, the conclusions drawn from the dissertation will be discussed.

2. THEORETICAL FRAMEWORK

This first section is going to focus on the dissertation's contextualization. To do so, it will be divided into three main blocks. Firstly, technology, which will define and explain in depth 4.0 technologies and augmented reality, secondly, customer experience, and finally the research context and proposal, related to healthy food consumption.

2.1. 4.0 Technologies

An industrial revolution involves a series of interconnected changes in the economy, society, and politics that influence and create each other (Moll, 2021). In this way, the fourth industrial revolution refers to the incorporation of digital technologies into the industrial sector, resulting in greater automation and efficiency in industrial processes, as well as the emergence of new business models and opportunities for innovation (Schwab, 2021). This new phenomenon is affecting the success of many companies, as those which implement them in the right way tend to prosper more (Hoffman and Klepper, 2008), and this does not only happen to businesses, but to the whole society.

According to Sony (2020), new technologies imply a wide number of advantages: "strategic competitive advantage, organizational efficiency and effectiveness, organization agility, manufacturing innovation, profitability, improved product safety and quality, delightful customer experience, improved operations and environmental and social benefits" (p. 253). Nevertheless, he also concludes that there are some drawbacks: "the negative impact of data sharing in a competitive environment, total implementation […] is necessary for success, handling employees and trade unions apprehensions, need for highly skilled labour, socio-technical implications of Industry 4.0, cybersecurity and high initial cost" (p. 263).

There are many technologies that are considered into the so-called industry 4.0, and according to the article "Top 10 Industry 4.0 Trends & Innovations in 2023" (StartUs Insights, 2023), artificial intelligence (AI henceforth) is leading the year 2023 with a 16% (see Figure 1). Xu et al.'s (2021) AI definition "refers to the simulation of human intelligence by a system or a machine" (p. 1) and some examples of this kind of technology are voice assistants such as Siri and Alexa, or the controversial tool Chat GPT, which provides users with any kind of information immediately after they ask for it.

Edge, fog and cloud computing are the three components which enable the data storage on the internet, each year more popular, portraying an 11%. Edge represents the

device used, such as mobile phones or computers, fog is the node which transfers the information from the edge to the cloud, being the latter the place where it is kept (Satyabrata, 2022). Known examples of this technology would be Dropbox and iCloud. Network and connectivity, accounting for the same percentage as the previous technology, are the processes and tools which enable that everything is connected to the internet. These are ethernet cables, DSL, 3/4/5G, VPN and Bluetooth, among others (Pathak, 2022).

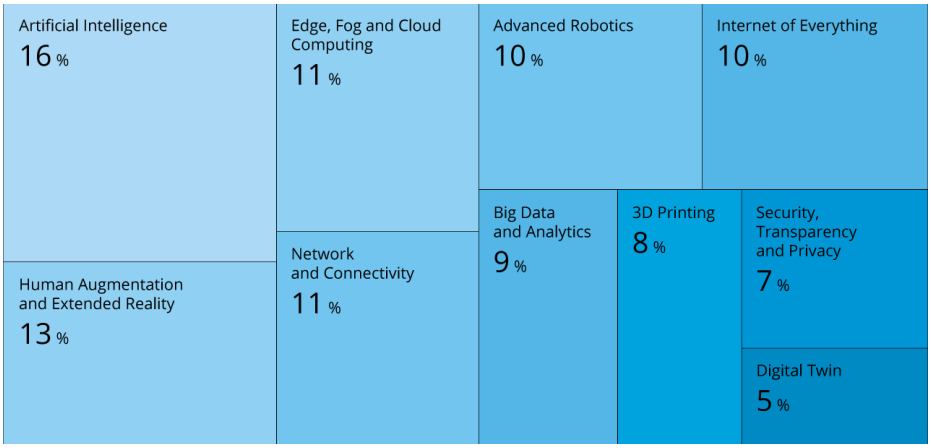


Figure 1. Top 10 Industry 4.0. Trends & Innovations (StartUs Insights, 2023)

Advanced robotics try to imitate to the intelligence of human beings and they can be applied in many sectors such as the manufacturing, nuclear and medicine (Myers, 2023) and Internet of Everything is how all physical, virtual, alive and inanimate elements are interconnected through the internet (The internet of everything, n.d.). Each of them represents a 10%.

Big Data is the huge amount of existing information, and its analysis is made through databases and software (9%). 3D printing (8%) enables the printing of objects in three dimensions, highly useful for industries such as automobile, manufacturing, healthcare and aerospace (Alabi, 2020).

Finally, human augmentation and extended reality, as part of immersive technologies, set in the second position (13%), will be the focal point of the dissertation. Furthermore, the emphasis will be directed towards augmented reality, as it holds a significant power for the industry and is able to impact the consumer experience to a large extent, as discussed by many researchers such as Flavián et al. (2019) and Hoyer et al. (2020).

1.1.1. Immersive technologies

Immersive technologies are defined as “any form of technology that allows the blurring of virtual and real worlds while providing a sense of immersion” (Tom Dieck & Han, 2022, p. 110), enabling the creation of virtual situations which do not exist in the real world (Li et al., 2022). As a result of what it is capable of, its popularity is rapidly increasing and is expected to continue to do so, with wider adoption projected in the coming years (Fujo et al., 2022).

Augmented reality (AR) is a type of immersive technology that provides the user with an experience which integrates virtual elements into the real world. Virtual reality (VR), being another type of immersive technology, allows users to experience situations being fully immersed in the virtual environment.

Figure 2 shows the approach of styles when interacting with these technologies, firstly introduced by Rekimoto and Nagao (1995) and recently updated by Rubio-Tamayo et al. (2017). When immersive technologies are not being used there exists a gap between the electronic devices and the real surroundings. However, when employed, immersive technologies can create a new reality for the user. With virtual reality, the real world disappears from the user's perception, while augmented reality allows users to interact with the real world by overlaying virtual elements onto it through electronic devices. Mixed Reality (MR) is the third type of these kind of technology. It achieves that the integration of virtual content with the physical world becomes seamless, resulting in a perfect integration of virtual content with the physical world (Flavián & Barta, 2022).

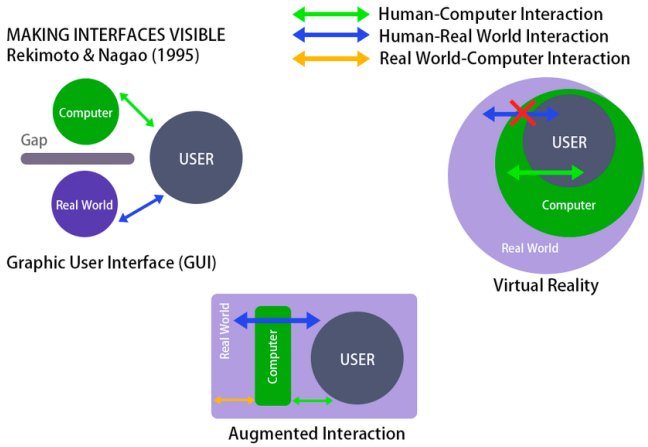


Figure 2. Styles of interaction and interfaces (Rubio-Tamayo et al., 2017)

These three types of immersive technologies lead us to the term Metaverse, which encompasses “the post-reality universe”, and represent all the environments generated by computers, combining the physical and virtual surroundings (Mystakidis, 2022).

Individuals can get a deeper understanding of the degrees in which immersive technologies can take users by visualizing the concept of the Reality-Virtuality Continuum (Figure 3), introduced by Milgram and Kishino (1994) and recently updated by Flavián et al. (2019). At one end the real environment can be found, in which the world is presented without virtual objects, that is to say, there is no modification conducted by technology. At the other extreme, there is the virtual environment, in which the real world cannot even be perceived, meaning that the entire environment is composed of virtual elements integrated by means of immersive technologies. Therefore, when the immersive technologies are integrated into the real environment, the latter is augmented and virtuality is introduced. There is a range of technology-mediated experiences that blend these two physical and virtual environments to varying degrees, situated somewhere between the two extremes (Flavián et al., 2019).

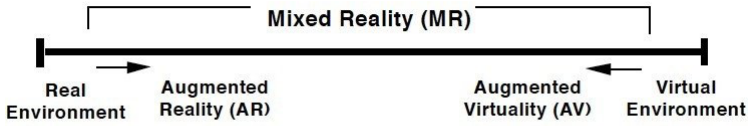


Figure 3. Reality-Virtuality Continuum (Milgram and Kishino, 1994)

According to Milgram and Kishino (1994), mixed reality was considered a term which referred to both augmented reality and augmented virtuality. Flavián et al. (2019) propose an updated Reality-Virtuality Continuum, aiming to differentiate between the three concepts (Figure 4). They proposed that pure mixed reality should be considered a separate reality, without including other forms in it, representing a perfect combination of reality and virtuality, with none prevailing over the other, alike augmented reality, in which virtuality overlaps reality, and augmented virtuality, in which just the opposite happens. Therefore, they distinguished between these different concepts and set boundaries, instead of blending them together, possible to the fast development of technologies during the last decades.

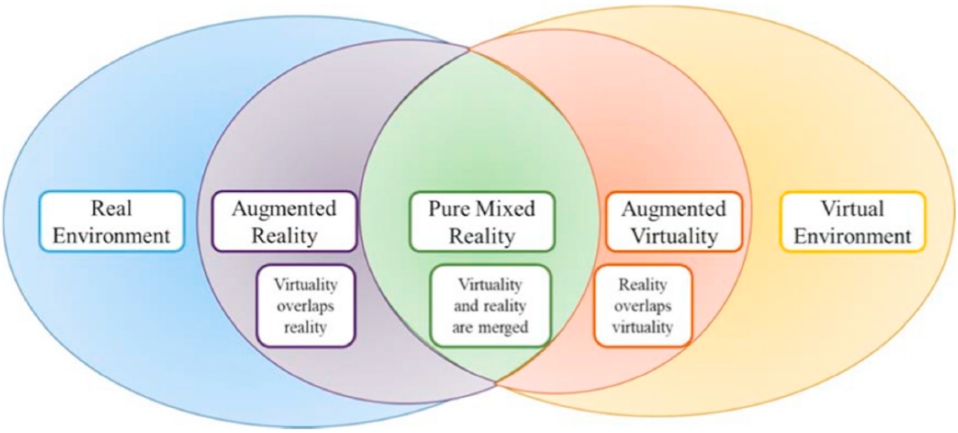
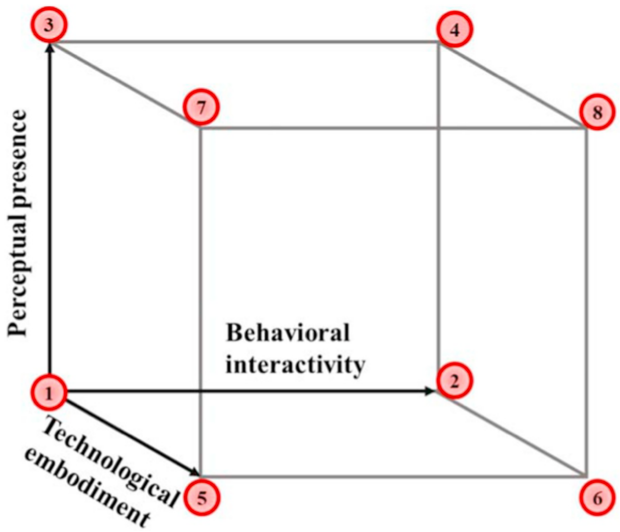


Figure 4. Updated Reality-Virtuality Continuum (Flavián et al. 2019)

Another highly interesting term introduced by Flavián et al. (2019) is the "EPI cube" of technologies (Figure 5). The cube offers a classification of technologies, depending on three dimensions of human-computer interaction, one technological (embodiment), one human or psychological (presence), and one resulting from the interaction between the human and the technology (interactivity).

Specifically, technological embodiment is the degree to which a technology is physically integrated into the user's body. Psychological presence refers to the extent to which a user feels to be in a concrete environment. Finally, interactivity is regarded as the degree to which a technology allows interaction between the user and the environment. The level of these three dimensions can range from low to high, as there exist different degrees of the three dimensions (Flavián et al., 2019).



Vertex	Radical examples of technologies
1	Computer Web 1.0.
2	Website online simulators
3	Video Wall
4	Virtual Worlds (Second Life)
5	Augmented reality glasses
6	Mixed reality glasses (Holographic devices)
7	360-degree video HMD (fixed position)
8	Virtual reality HMD with haptic devices

Figure 5. "EPI" cube and examples of technologies. (Flavián et al., 2019)

Furthermore, vertex 2 (online simulators), 3 (video walls) and 5 (Augmented Reality glasses), are examples of technologies that enable only one dimension of human-computer interaction. However, it is possible that multiple dimensions occur simultaneously. The extreme case is the 8th vertex, virtual reality HMD with haptic devices, a technology which enables the user to interact with the virtual environment, feel a sense of presence and experience embodiment of the device.

Reality glasses, one of the devices belonging to the technology upon which this dissertation is focused, is located in the 5th vertex of the cube. This means that these glasses are wearable devices integrated in the human body, complying with the first dimension of human-computer interaction described (embodiment). In the next section, the AR will be deeply analysed.

1.1.2. Augmented reality

1.1.2.1. Definition and history

One of the most accepted definitions of Augmented Reality (AR henceforth) is offered by Azuma et al., (2001, p. 34): "a system which supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world. […] [Additionally, it has] the following properties: combines real and virtual objects in a real environment; runs interactively, and in real time; and registers (aligns) real and virtual objects with each other."

However, the term Augmented Reality was first introduced several decades ago, in the 1950s by Morton Heilig (Carmigniani et al., 2011). In 1968, Ivan Sutherland developed a head mounted display (HMD), which is now recognized as the first system with such a technology (Scheinerman, 2009) (Figure 6.1). After that, the Videoplace was invented by Myron Krueger in 1975, which was the first area enabling users to engage with virtual items answering to their movements (Carmigniani et al., 2011) (Figure 6.2).

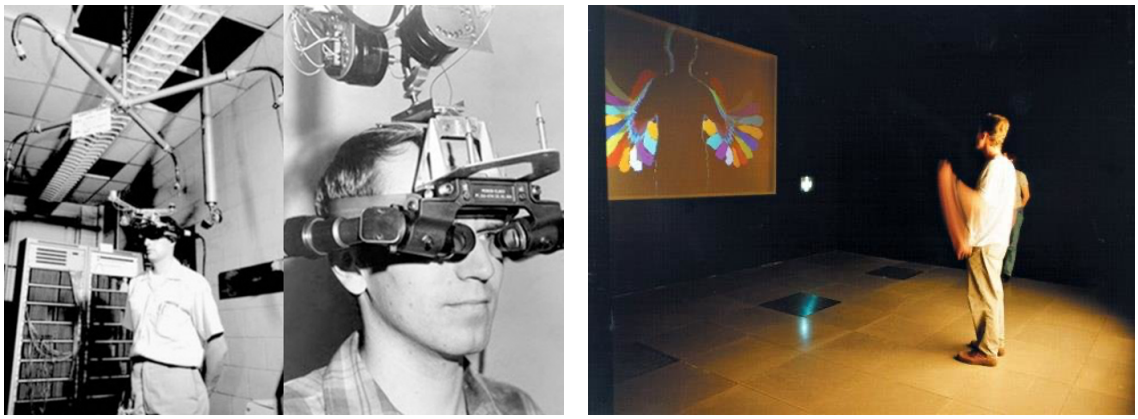


Figure 6. 1: Sutherland's HMD, 1968. 2:Krueger's Videoplace, 1975

In the early 90s, Caudell and Mizell coined the term AR (Arth et al., 2015). These two Boeing researchers who were developing a device for the aircraft assembly line, defined the headset technology as a "used to augment the visual field of the user with information necessary in the performance of the current task" (Caudell & Mizell, 1992, p. 660).

"AR Quake", developed by Bruce Thomas in 2000 at the Wearable Computer Lab, was the first outdoor AR game that utilized portable devices (Figure 7.1). It was an adaptation of a desktop computer game where players collected items, defeated monsters, and accomplished goals. This concept was brought into the real world using AR technology, by wearing a portable computer and a HMD (Piekarski & Thomas, 2002).

Since the creation of AR Quake in 2000, the gaming industry has made significant progress in the development of augmented reality games. In 2003, Siemens introduced their AR-based mobile game "Mozzies", which overlayed mosquitoes in the real world using the phone's camera. This game was awarded as the best video game for cell phones that year (Dannyls, 2019). In 2009, "Invizimals" (Figure 7.2), a popular AR game for PSP was released, which allowed players to capture virtual creatures in the real world using the PSP camera (Dannyls, 2019). Yet, the most important milestone was achieved in 2016: "Pokemon Go" employed AR technology to allow gamers to catch Pokemon in the real world with their phones (Paavilainen et al., 2017) (Figure 7.3). This progress shows the potential of AR technology to improve the gaming experience.

Figure 7. 1:AR Quake, 2000. 2: Invizimals, 2009. 3: Pokemon Go, 2016

1.1.2.2. Classification and characteristics

AR has become relevant due to all the advances that technology has experienced during the last decades and its subsequent cost reductions. These changes differ significantly from the AR landscape of the 1990s when it was still in its early stages (Javornik, 2016).

These days, AR technologies allow the addition of virtual objects, such as text, images, or videos, to a person's real-world surroundings. Smartphones, tablets, wearables, interactive screens, and projectors are some of the smart devices that facilitate the display of these virtual objects. Depending on the device used, the user's experience can have a higher (e.g.: smartphone) or lower (e.g.: try-on screen) mobility level (Javornik, 2016). Additionally, a different embodiment degree takes place depending on the device used (Flavián et al., 2019). Rauschnabel, Felix et al. (2022) offer a classification of AR devices, which range from no embodiment at all (smart mirrors), to a high degree of embodiment (brain interfaces) (Figure 8). This classification takes into account the device used, the enabler, and the display. The device refers to the physical tool used to experience AR, such as a smartphone or a smart mirror. The enabler is the software and applications that enable the experience, such as websites or mobile apps. Finally, the display refers to what the user finally sees, hears, or reads as a result of the combination of the device and enabler. These combined, results in the user's AR experience.

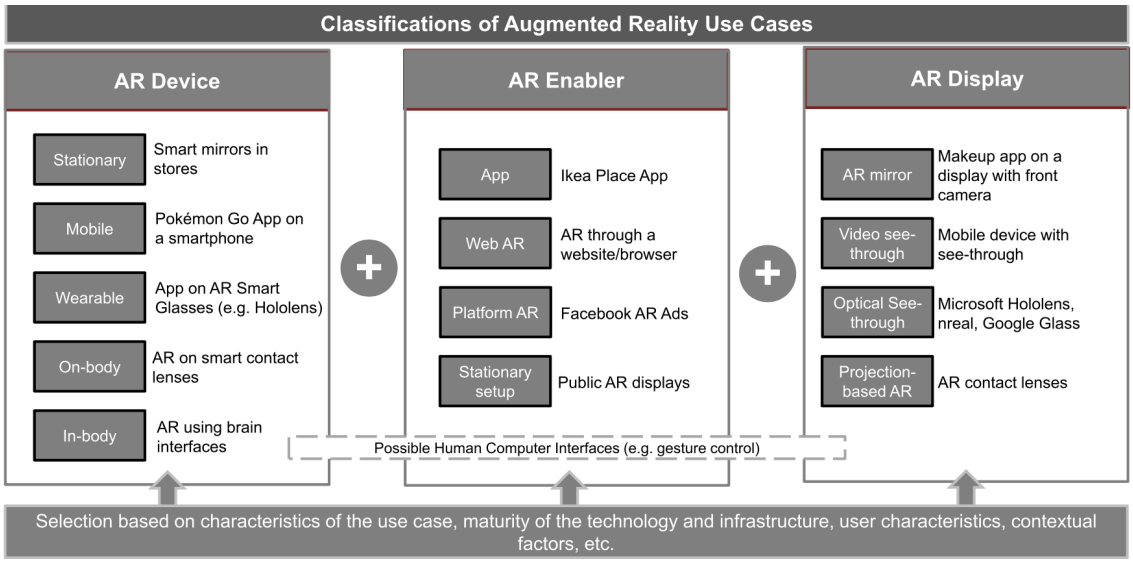


Figure 8. Classification of AR use cases. Rauschnabel et al. (2022)

AR technology has four key characteristics: interactivity, digitality, 3D graphics, and multisensory ability. Craig (2013) affirms that in order to benefit from the AR experience, users need to interact with it, but this degree can vary from just altering the physical viewpoint to controlling and constructing completely different data. The user has to make use of the devices to get the augmentation of the reality that the tool provides. The second characteristic is digitality, although being integrated in the physical world. AR's digital nature allows for easy digital modifications compared to physical modifications, which are more complex (Craig, 2013). Regarding the three-dimensional feature (Rauschnabel, Babin et al. 2022), by introducing 3D graphics and animation, AR creates a visual effect where digital objects seem to coexist and interact within the real-world environment. Finally, the fourth characteristic is its multisensory ability, since AR is able to engage multiple senses, including sight, sound, and touch.

1.1.2.3. AR in marketing

AR offers a wide range of possibilities due to its link to reality. This makes it a powerful tool for a lot of industries, such as medicine (Herron, 2016), education (Haleem et al., 2022), entertainment (Davidavičienė et al., 2019), tourism (Blanco, 2022), supply chain (Higgins, 2019) or social media (Ibáñez-Sánchez et al., 2022). In these examples of AR applications, the technology is the product offered itself, however, the dissertation will focus on the specific context of marketing, where AR becomes the promotional channel.

An increasing number of companies are seeing the potential that AR can generate in their sales or brand image. However, many others are still resisting. Rauschnabel, Babin et al. (2022) carried out in 2020 a survey to German marketing managers about the adoption of AR in this field. According to the survey, more than half of German marketing managers do not use AR in their business because the technology has not yet been established. Moreover, many of them do not know how to make a use of it or do not have the knowledge (Figure 9).

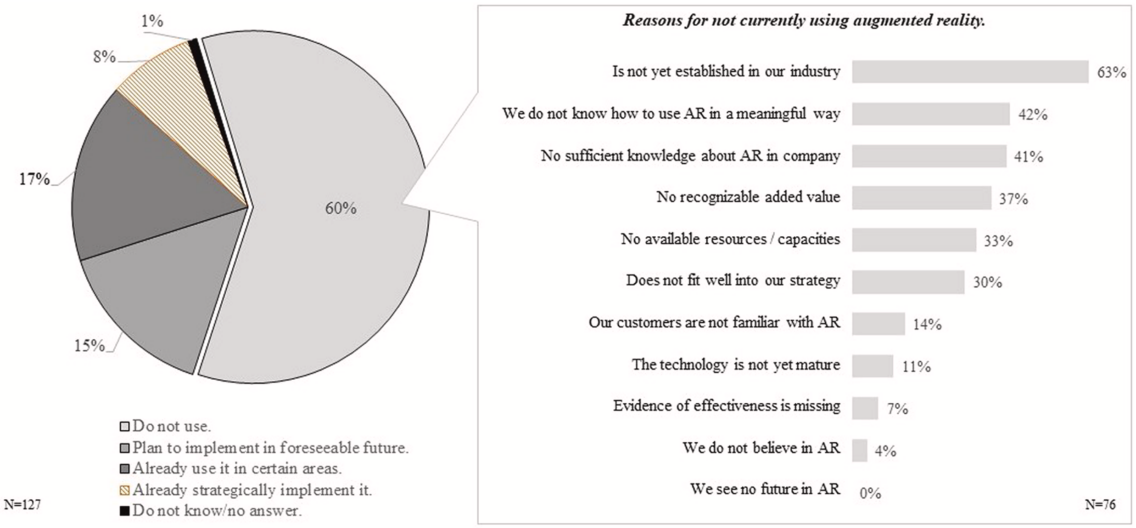


Figure 9. AR marketing usage (Rauschnabel, Babin et al. 2022)

Nevertheless, the survey shows that 40% of managers have a positive outlook and are currently utilizing AR or planning to do it in the short term (Figure 9). As the benefits of AR become more apparent across different sectors, the reasons cited for not using the technology are likely to decrease. As with any technology, increased knowledge and usage will result in more recognition, and this will lead on more tech business developing AR, which means more competition, making it more accessible for businesses of all sizes. As a result, a wider adoption of AR is expected to be seen in the future, as more businesses will begin to recognize its hidden benefits. In sum, it is necessary to explore the potential and possibilities of AR in marketing, so that managers can see its usefulness. The importance of conducting studies, such as the one carried out for this dissertation, is highlighted in order to evaluate the utility of AR and take advantage of its strengths.

In general, what are the advantages and limitations of using AR technology in the marketing field? One of the sectors with the greatest potential to contribute is online retailing. Customers cannot try products offered online. AR helps to fix this issue (Barta et al., 2023a) with, for instance, AR try-on mobile apps. Imagining a product without really knowing how it fits distorts the reality (Heller, 2019). With AR, customers interact virtually with the products, but represented in the physical surroundings, which supports with additional information when they are presented uncertain decisions or when they have to choose between different options, because resemblance between them decreases and consequently negative feelings too (Barta et al., 2023b). This clearly makes the decision-making process easier for consumers, increasing the satisfaction and the chances of future purchase.

Rejeb et al. (2021) also present some of its general pros, highlighting a better experience for customers due to what the previous paragraph explained, an increased brand loyalty, because the value perceived is higher, its complementation with other marketing actions and an upgrade of competitive edge regarding marketing. On the other hand, they also discuss some of its limitations, for example, related to the technology itself, which it is not accessible for every company and the fact that it is more immature than other marketing tools. Moreover, AR can be complicated for some users who lack technological knowledge.

Benefits and limitations of AR have been shown, but to be noteworthy, implementing AR as a new marketing tool cannot be done lightly and Berman et Pollack (2021) establish six steps to follow in order to have more possibilities to succeed. First, figure out the goals wanted to be achieved by AR application (e.g.: raising revenues through more sales or less costs, making a product more appealing, innovating the firm's strategy). Second, determine the most convenient products, channels, and target markets (e.g.: by just implementing it in some of the stores or with the most popular products). The third step is choosing the type of AR device (screens, phone apps) and the fourth consists of designing the application, concerning technological matters and others that affect customers. The step number five is to decide how the AR management will be organized in the company (e.g.: creating a completely new team or externalizing this process). Finally, and after implementation, analysing how well it went, in order to correct errors or see what could be improved.

Now, some real examples of AR implementation in marketing will be shown:

- The fashion industry has adopted an innovative approach to using AR. Some stores have AR screens available which provide customers with the ability to virtually try-on clothes without the need for physically doing it, displaying additional product information, such as colour options, materials, and styling suggestions (Kim, 2015). This not only saves time but also makes the shopping experience more enjoyable, innovative and personalized, which can help build brand loyalty and increase the likelihood of a purchase. Brands such as Topshop, Timberland or Uniqlo have already implemented this technology (Heller et al., 2019) (Figure 10.1).
- Brands in the beauty industry, such as NYX, Maybelline or Dior also took advantage of AR filters and provided a solution to the lack of hygiene that comes with using tester products such as lipsticks or eyeliners in stores. Their apps have filters that apply their makeup products to users (Galpin, 2021). These virtual try-ons make it possible for consumers to try them at home, increasing the easiness and comfort, as after testing they can then buy them online.
- In the furniture and decoration sector, we can find the IKEA App “IKEA Place”. This phone application is able to place items from the Ikea catalogue anywhere in the home that the user focus on with her phone's camera, visualizing how a desk or a couch would look on that spot without the need of buying it before being sure about the decision (Barta et al., 2023). Rauschnabel, Babin et al. (2022) state that, through the application, customers gain motivation and encouragement and, if the result is positive, they are more convinced to buy the product, since buying furniture blindly is a long and complicated purchasing decision (Figure 10.2).

Figure 10. AR marketing examples (1: Topshop VTO screen 2:IKEA Place App)

2.2. Customer experience

Customer experience has become a significant term in the marketing field (Jain et al., 2017). Davidavičienė et al. (2019) describe the customer experience as a "subjective customer feelings about the product (service) used" (p. 38). Verhoef et al. (2009) add that the user responds to the experience multidimensionally, that is physically, affectively, socially, in a cognitive way, or through emotions when interacting with the product or service. At the same time, Lemon and Verhoef (2016) support the definition with an interesting feature, which is the customer journey, claiming that the customer experience does not only encompass the consumption of a product or service. However, they assert that it is a longer process, which entails the pre-consumption (e.g.: previous purchase) and post-consumption (e.g.: loyalty to a brand) as well.

During the past two decades, the customer experience has been significantly altered by the revolution of the digital world. If properly implemented, new technologies allow consumers to interact with products for multiple perspectives (physical, digital), helping them to make more informed decisions and enhancing their satisfaction (Hoyer et al. 2020).

Linking the customer experience with new technologies, Neuhofer et al. (2014) proposed the "experience typology matrix" regarding the level of technological integration in the user's experience. It consists of four levels: firstly, the conventional, in which the company executes all the process and there is not much customer involvement on the action accomplished and technology does not have or barely has a role. Secondly, the technology-assisted, in which the latter helps the consumer somehow, facilitating the good or service supply, through for instance websites. Third, technology-enhanced, where consumers interact with the companies through technologies like social media. Lastly, technology-empowered, experience in which the technology plays a relevant role, not just supporting, and necessarily needs to be there. Then, as the level of technology involvement increases, so does the level of interaction between the customer and the company, facilitating and improving the customer experience. In this way, Flavián et al. (2019) argue that technology development has evolved and the distinction between assisted and enhanced is not needed. Instead, they present the "supported experience" which can be direct, where technologies directly take part in physical surroundings, and indirect, without real integration. According to this experience typology, new technologies can support customer experiences.

To illustrate the concepts, some examples will be provided. The AR apps for furniture and make-up previously mentioned are good examples of direct supported experiences. With AR, users can determine which couch or lipstick suits them best before making a purchase, as they can see how these fit through their electronic devices without physically having those products. As an example of indirect experience, scanning a QR code for a restaurant menu can provide pictures and ingredient details of the dishes. In both cases, users receive additional data, directly or indirectly integrated in the real world, to support their purchase decision, serving as a pre-experience for the customer.

Furthermore, Flavián et al. (2019) divide the empowered experience into related, in which the experience is close to the conventional one but with technology still having a relevant function, and diverted, where the experience deviates considerably from the conventional one due to technology. In this case new technologies are able to empower customer experiences.

An example of related empowered customer experience could be a museum in which an AR avatar of the painter is created, which guides visitors through the museum providing information and explanations of the works, as is the case in the Sorolla Museum in Madrid. Visitors have a similar experience to the conventional one but carried out by AR technology rather than by a human. As for an empowered diverted experience there are to mention the entertainment games, such as the previously mentioned "Pokemon Go", used in contexts like waiting queues. By employing this technology, the fact that the individual is waiting is forgotten, leading to a significant transformation in the queueing experience compared to the conventional one.

2.3. Research context and proposal

1.1.3. AR in the food consumption

This undergraduate dissertation focuses on the application of AR to the food industry. Some of its applications include using AR while grocery shopping, providing information on food products, preparing recipes, and visualizing restaurant menus.

The first example can be found in wayfinding apps, that use markers to display the location of items in a supermarket through the camera of a smartphone when doing groceries. The British app "List & Go" is one if this tools, which additionally allows users to previously select what they want to buy in order to guide them through the supermarket, avoiding not finding the desired products (Wagaine, 2022) (Figure 11.1).

In the same vein, there are apps which overlays additional information to a product when scanning it with the camera, such as discounts or information that does not fit in the packaging. This is the case of "Scan & Save" app launched by a groceries company from the United Kingdom (Wagaine, 2022) (Figure 11.2).

Figure 11. AR for grocery shopping (1: List & Go, 2: Scan & Save)

Moving on to, preparing recipes, we find applications such as "Ibercook Food Service AR", which supplies food for restaurants and hotels. This application helps its customers to better understand their products and recommends them how to make their dishes by means of recipes (Food Retail, 2020) (Figure 12).

Figure 12. AR for receipts (Ibercook Food Service AR)

The last example consists of a way that combines technology with the dining experience. Some restaurants have their menus available through AR apps, which allow customers to see virtual images of dishes in 3D and get additional information about the food, such as the ingredients used in the elaboration and nutritional information. "Menu AR" is one of the options which provides restaurants with a software which permits customers to see the actual size of the dishes, from a 360-degree view and with details about the composition. "Kabaq" is also an AR mobile app that focuses on enhancing the

dining experience by using 3D models to allow users to see the dishes on their table before ordering, allowing them to display their dishes in a more attractive and detailed way (see Figure 13). Since many users may feel insecure about trying new dishes with which they are not familiar with, the ability to visualize them gives them more confidence to try new culinary options, in addition to the great advantage of being able to see all the information about a dish when wanting to make a healthier dietary choice (Raturi, 2018).

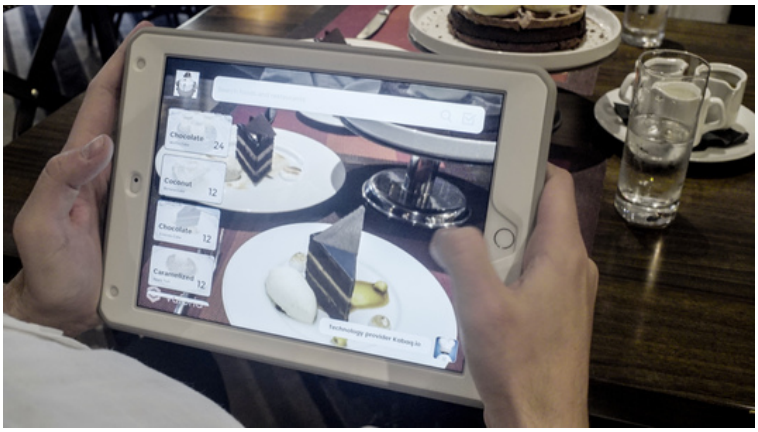


Figure 13. Kabaq App

1.1.4. Impact of AR in healthy food consumption

The main goal of this undergraduate dissertation is to examine whether AR technologies can promote the consumption of healthy food. Carrying a healthy lifestyle can involve many activities such as a good sleeping, hygiene, taking care of mental health, and especially doing exercise and having good eating habits (Divine & Lepisto, 2005). People decide to eat healthy to stay healthy, feel better, live longer, treat or prevent disease, lose or maintain weight, and be fit (Eikenberry & Smith, 2004). Eikenberry & Smith (2004) also conducted a survey which concluded that healthy behaviours imply eating the following types of food: fruits and vegetables, meat, grains, nutritious and low fat, but there are some barriers which difficult this behaviour such as lack of time or money, laziness, or living alone.

According to the World Health Organization (2020), eating healthy is essential for our overall well-being, good mood, productivity, and quality of life, and not doing it can lead to numerous health problems, including obesity, diabetes, heart disease, and cancer. There are plenty of reasons why the barriers mentioned above should be overcome and one easy way of encouraging a healthy consumer behaviour is the influence of the social environment, even Higgs & Thomas (2016) state that the eating standards followed

by the society are a new target to encourage healthier eating. They argue that if somebody's patterns are accepted or identified as consistent, they are likely to be adapted and adopted, as it happens with influencers. Actually, these are one of the reasons why healthy behaviours are extending faster nowadays (Smit et al. 2022).

Because of all its innovative features and the possibilities that it offers, AR may have the potential to positively influence healthy eating habits through a variety of means. For example, AR applications that provide additional information about food products could help consumers make informed decisions about what they eat, motivating them to choose the healthiest products. In addition, AR can be used to make healthy food more visually appealing and accessible and can create interactive and engaging experiences that encourage healthy eating. In conclusion, AR technology can be an effective tool to promote healthy eating habits. Therefore, in this dissertation an empirical study is carried out to contribute to this issue, trying to draw positive conclusions about it which will be shown later.

3. METHODOLOGY

3.1. Research method: questionnaire

The main goal of the empirical study is to analyze if AR can affect the consumers' choices regarding healthy meals, dependent on the attributes that are most valued by consumers when choosing food, their personal traits, and other relevant factors. The data collected from the survey will explore trends and patterns in the responses, which could be used afterwards to inform future research and provide useful information for businesses such as restaurants or delivery apps to promote healthy food choices and improve customer satisfaction.

The research method selected to carry out the data collection of the empirical study is the questionnaire. According to Jiménez et a. (2017), this technique can be classified as quantitative, structured, and direct. Specifically, a self-administered questionnaire using Google Forms was employed. This technique has some drawbacks which may limit its effectiveness: some interviewees may not want to participate or to provide the information needed, there may be a bias when addressing sensitive issues, participants cannot get assistance or clarifications if needed, Internet connection is required, and the profile of the respondents cannot be controlled. Nevertheless, the questionnaire has

numerous advantages that makes it suitable for the desired purpose. This kind of questionnaire permits an easy data analysis, not much effort is expected from the interviewees, the implementation costs are low, and at the same time offers a high number of answers; moreover, questions admit some complexity, and multi-media can be used as a supportive tool (Jiménez et al., 2017).

3.2. Design of the questionnaire

The survey was divided into four different blocks or sections and it contained mainly 5-point Likert scale questions in which participants had to agree or disagree with several statements (the full questionnaire is shown in the Appendix).

The first block consisted of asking the participants about their eating habits and concerns about healthy food consumption (questions 1 and 2 in the Appendix). They were asked how many times per week they consume several products (fruits, vegetables, salted snacks, sweets, soft drinks and fast food) and whether they agreed with some statements dealing with balanced diet, quality products, the five daily meals, their knowledge about healthy eating and their concern about choosing healthy food when going out.

The second block dealt with habits when eating at a restaurant and ordering food with delivery apps (questions 3-5 in the Appendix). The first question asked the participants the frequency in which they use these services. The following two questions aimed at understanding which attributes and situations influence their preferences and choices when choosing a meal at a restaurant or a delivery app: how appetizing a dish sounds in its description or looks in the pictures on the menu, its nutritional and energetic value, the amount of fat or sugar it contains, how healthy it is, the variety of foods and the novelty of the dish. The same was done with the following factors and situations: the amount of hunger, having exercised before eating, the number of people you are with, the ease and speed of preparation, the degree of elaboration and time spent, the time available to eat.

The third block of the questionnaire introduced the term AR (questions 6-8 in the Appendix). A definition of the technology was given with some examples of its use before asking the participants if they knew about it, if they were familiar with it and if they had experience with it. After that, they were asked whether they had ever used it, and if they did, in which context (entertainment, social media, fashion/beauty, education, tourism, hospitality or others).

Fourthly, the Kabaq AR app was shown to the participants before asking them if they knew or had used the tool. At this point, they were asked for the letter of their ID card to randomly assign them to one situation or another, carrying out an experimental treatment (questions 9-10 in the Appendix). Both scenarios consisted of imagining that they were in a restaurant and were offered two starters, two main courses and two desserts, one healthy and the other not in the three cases. After choosing each option, they were inquired about the reason why they made their choices (seemed more appetizing, better presentation, seemed tastier, habit of eating that type of food or not being used to do so, seemed healthier, the amount of fat and calories and considered that it would satiate them) and how much would they pay for the whole menu. The difference between the two situations is that the first one showed videos presenting the food with AR (questions 11-15 in the Appendix) and the second one showed pictures of the dishes (questions 16-24 in the Appendix), being the same menu in both cases, in order to draw possible conclusions about the capacity of each presentation mode.

Lastly, control and sociodemographic questions were asked (questions 25-31 in the Appendix). Specifically, the participants were asked how they had seen the information about the dishes (videos/photos and AR/real), in what situation they had imagined themselves in the restaurant: alone, with friends, with family, with colleagues, or if they didn't imagine themselves with anyone in particular; and at what time: having brunch, lunch or dinner, or if they didn't imagine themselves at a specific time. To collect personal information about the participants, they were asked about their gender, age, educational level, and whether they study or work.

4. ANALYSIS AND RESULTS

4.1. Sample characteristics

4.1.1. Socio-demographic characteristics

The survey was available to participants for one week, from the 7th of May to the 14th of May of 2023. During this period, a total of 178 valid answers were obtained. The Table 1 shows the sample´s socio-demographic characteristics.

Around a 60% of the respondents were women and according to their age, approximately the same percentage was obtained for people between 18 and 26 years old, while more than a fourth were older than 54. Additionally, according to their studies,

three fourths of the participants are studying or already have got a degree. More than three fifths are currently working, and more than a half are students.

Sex	Woman	61.1%	Studies	School /high school	9.6%
	Man	36.6%		Higher/university degree	75.7%
	Other/prefer not to say	2.6%		Masters/doctorate degree	14.7%
Age	18-26	58.2%	What they do	Study	27.5%
	27-44	5.6%		Work	38.8%
	44-53	14.7%		Both	28.1%
	>54	21.5%		None	5.6%

Table 1. Socio-demographic characteristics

4.1.2. Eating habits and dining out

With the first section of the survey, the participants' profile according to their eating habits and behaviours was obtained. As it can be observed in Table 2, more than a half stated that they eat vegetables and fruits more than 5 times per week and around two fifths do it between one and four times per week. According to the less healthy food asked in the survey, between the 50% and 60% of the respondents indicated that they consume soft drinks, sweets and fast food less than once per week and approximately 30% reported the same for salted snacks. Based on these results, we can conclude that slightly more than half of the participants reported engaging in healthy behaviours.

	From 5 times per week to every day	From 1 to 4 times per week	Lower frequency or never
Fruits	53%	40%	7%
Vegetables	58%	41%	1%
Salted snacks	9%	61%	30%
Soft drinks	5%	44%	51%
Sweets	3%	31%	66%
Fast food	0%	40%	60%

Table 2. Frequency of consuming particular food items

Approximately three fifths agreed to a high degree with the fact that they follow a healthy and balanced diet, try to consume quality products and consider that they have knowledge of healthy eating, showing a similar trend to the previous question. A lower percentage, around one fourth, was observed in relation to statements regarding meeting the recommended five meals a day and making healthy choices when going out.

According to the frequencies in which participants go to restaurants and order by delivery (see Table 3), nearly half of them visit restaurants once per week or more frequently, while only a 10% indicated a lower frequency or never doing it. In terms of ordering food by delivery the trend changes considerably, as just a 15% reported doing so once per week or more frequently and half of them stated a lower frequency or never ordering by delivery.

	Once per week or more	Once every 15 days to once every month	Lower frequency or never
Going to restaurants	49%	41%	10%
Ordering by delivery	15%	37%	48%

Table 3. Frequencies of eating at restaurants and ordering delivery food

The Table 4 shows the descriptive data of the attributes and situations that influence respondents when eating out. Regarding the attributes, how appetising the dishes look in the pictures and sound in the descriptions, and the novelty and variety of the food, were the most influencing factors as their averages stand above the middle point (3). The ones influencing the least were the nutritional value and the amount of fat and sugar they contain. As for the situations, the most influential were the amount of hunger, followed by the number of people they are with, while the least considered are having done exercise before eating and the degree of preparation of a dish (Table 4)

	Average	Standard deviation
How the description sounds	3.40	1.22
How it is shown in pictures	3.45	1.24
Nutritional and energetic value	2.29	1.13
Fat and sugar	2.46	1.28
Healthiness degree	2.80	1.16
Variety of food	3.06	1.14
Novelty of the dish	3.20	1.15
Level of hunger	4.03	1.01
Having done exercise	2.77	1.26
Company	3.51	1.16
Easiness of preparation	2.93	1.21
Elaboration degree	2.79	1.13
Time available to eat	3.30	1.09

Table 4. Attributes and situations influencing when dining out

4.1.3. Experience with AR technology

In general, participants showed little knowledge of AR. The average of agreement with each statement were the following: 2.09 for knowing much about AR; 2.26 for being familiar with it and 2.19 for having experience with this technology, with a general average of 2.18 (standard deviation = 1.13). Almost 40% of the whole sample had never used this tool, and only 10% had done it several times.

The most repeated contexts in which respondents made use of this technology were entertainment, accounting for three-quarters, and social media, which accounted for 70% (see Figure 14). Fashion, beauty, education, and tourism were each reported by approximately a fifth of the respondents who had used AR. Finally, most of the respondents (92%) did not know the Kabaq AR app.

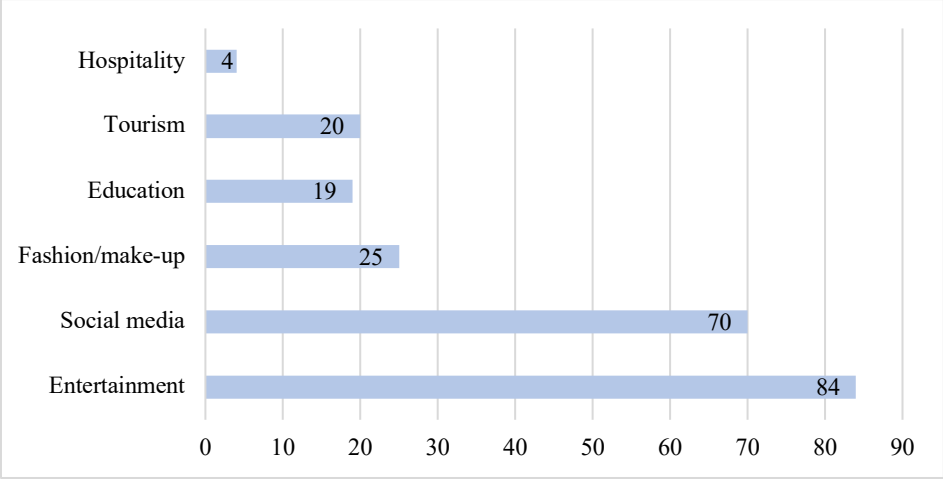


Figure 14. AR uses (number of respondents)

4.2. Effect of presentation mode: AR versus pictures

In this section, the participants' choices of dishes depending on how they were presented (AR or pictures, according to the random assignment), as well as the reasons for their choices and how much they were willing to pay for the selected menu, are analyzed. The Table 5 shows the participants' choices depending on the presentation mode. Considering that the dishes were the same with both methods, we can observe some differences in participants' choices of healthy and unhealthy food.

		Healthy	Unhealthy
Starters	AR	61.5%	38.5%
	PICTURES	75.9%	24.1%
Main courses	AR	54.4%	45.6%
	PICTURES	54%	46%
Dessert	AR	54.9%	45.1%
	PICTURES	64%	36%
MENU	AR	57.1%	42.9%
	PICTURES	69%	31%

Table 5. Chosen dishes

Specifically, participants who saw the information in AR made less healthy choices in the starters and in the deserts; no differences were observed in the main courses. By observing the percentages of the healthy starter and according to the results of the Chi-square test ($\chi2(1) = 4.232$, $p = 0.04$) [1] , it can be concluded that AR was less effective than photos in influencing the decision to choose the healthier starter. However, the difference was not significant in the case of the dessert ($\chi2(1) = 0.015$, $p = 0.902$), meaning that the way of presentation does not influence the choice of the main course. Following the same dynamic, a variable called "healthy menu" was created, which consisted of the menus (starter, main course and dessert) formed by two or more healthy dishes. Again, more healthy menus were selected when using pictures compared to AR, but the difference was not significant ($\chi2(1) = 2.665$, $p = 0.103$).

By examining these effects more in depth, it was observed that the differences mainly occurred due to a gender matter, as male participants chose the unhealthy option more than double with the AR method than with pictures (see Table 6), which is confirmed by the results of the Chi-square test ($\chi^2_{(1)} = 6.478$, $p = 0.011$); no significant difference was observed in the females' choices. Something similar can be found when analysing the menus, as the difference mainly came from the male participants, choosing the healthy option a 30% more with pictures than with AR ($\chi^2_{(1)} = 6250$, $p = 0.012$).

[1] All the statistical tests were carried out with the SPSS software (v26) with the assistance of the student's supervisor.

			Healthy	Unhealthy
Male	Starters	AR	43,8%	56,3%
		PICTURES	75%	25%
	Menu	AR	34.4%	65.6%
		PICTURES	65.6%	34.4%
Female	Starters	AR	69.8%	30.2%
		PICTURES	75.9%	24.1%
	Menu	AR	69.8%	30.2%
		PICTURES	70.4%	29.6%

Table 6. Starter and menus chosen by male and female participants

Now, a short analysis of the reasons for choosing each dish will be presented by comparing the average of the 5-point Likert scale questions of each case (see Table 7). An interesting variable in which the differences between AR's and photos' should be analysed is in the reason of choosing the dish for its presentation, to see if one method can be more effective than the other in this sense, and actually, the difference seems to be significant according to the independent sample T test, which means that participants perceived the main course with a better presentation with the AR method. The rest of the reasons' averages are pretty similar between the methods used and the dishes (starter, main course and dessert). The most emphasised reasons by the participants were "look appetising", "presentation", "look tasty" and "would satiate", and the less "its novelty", "fat" and "calories" in all its forms.

	Starter				Main course				Dessert			
	AR		Pictures		AR		Pictures		AR		Pictures	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Appetizing	3.92	1.06	3.74	1.14	4.09	1.09	3.97	1.12	4.09	1.03	3.98	1.14
Presentation	3.45	1.15	3.17	1.22	3.82*	1.16	3.41*	1.25	3.92	1.11	3.86	1.15
Tasty	3.67	1.16	3.64	1.07	3.99	0.97	3.8	1.09	3.91	1.07	3.83	1.28
Used to it	3.04	1.21	2.70	1.27	2.91	1.21	2.94	1.25	2.35	1.29	2.22	1.22
Novelty	2.26	1.2	2.39	1.15	2.58	1.33	2.55	1.4	3.16	1.57	3.22	1.45
Healthy	2.82	1.44	3.03	1.39	2.86	1.55	2.89	1.6	2.42	1.38	2.69	1.53
Fat	2.52	1.47	2.51	1.33	2.47	1.3	2.57	1.48	2.19	1.35	2.23	1.35
Calories	2.43	1.41	2.45	1.33	2.37	1.25	2.47	1.41	2.19	1.36	2.23	1.39
Satiate	3.15	1.30	3.20	1.13	3.6	1.23	3.62	1.32	3.42	1.28	3.24	1.42

Table 7. Reason for choosing the dish with AR or with pictures

However, the differences increased when comparing the healthy with the unhealthy choices. The significant ones ($p < 0.05$ according to the independent samples T test) are marked with a * in the healthy option of each dish in Table 8. Some of them simply confirm that participants perceived the healthy dish as healthier, as in the reasons "healthy", "fat" and "calories" the healthier options obtained considerably higher averages than the unhealthy ones. However, others were not that obvious. For instance, the healthy main courses and desserts were perceived by participants as more appetizing than the unhealthy ones. The same happened with the reason "being tasty" in the three cases of healthy options. Lastly, in the cases of the main course and dessert, the reasons of "being used to it" and "novelty" showed that participants are more accustomed to eating healthier meals, as the healthy options showed significantly higher averages for "being used to it" and lower for "novelty" than the unhealthy options.

	Starter				Main course				Dessert			
	Healthy		Unhealthy		Healthy		Unhealthy		Healthy		Unhealthy	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Appetizing	3.75	1.13	4.02	1	3.82*	1.19	4.27	0.94	3.79*	1.21	4.38	0.76
Presentation	3.53*	1.13	2.84	1.19	3.78	1.2	3.43	1.22	3.81	1.19	4.01	1.02
Tasty	3.54*	1.09	3.91	1.12	3.71*	1.1	4.12	0.9	3.68*	1.31	4.15	0.89
Used to it	2.95	1.29	2.71	1.14	3.32*	1.18	2.46	1.12	2.45*	1.38	2.05	1.03
Novelty	2.37	1.21	2.23	1.08	2.3*	1.25	2.89	1.14	2.9*	1.51	3.6	1.42
Healthy	3.53*	1.21	1.61	0.82	3.87*	1.2	1.68	1.05	3.21*	1.45	1.6	0.8
Fat	2.95*	1.4	1.55	0.81	3.15*	1.32	1.77	1.06	2.66*	1.45	1.56	0.82
Calories	2.86*	1.39	1.52	0.74	3.02*	1.28	1.7	1.01	2.69*	1.49	1.52	0.77
Satiate	3.09	1.21	3.36	1.23	3.6	1.2	3.63	1.36	3.23	1.4	3.48	1.28

Table 8. Reason for choosing the healthy or unhealthy dish

By analysing Table 9, which shows the main general conclusions obtained from the prices given by the participants to the whole menu, including the starter, the main course and the dessert chosen plus a drink, it can be seen that the AR method and the photos generated different answers.

	12-18€	19-25€	26-31€	>31€	AVERAGE	MODE	MIN	MAX
AR	52%	36%	12%	2%	19.7	15	12.5	50
Pictures	62%	34%	4%	0%	17.8	15	12.5	30

Table 8. Characteristics for the menus' prices

For the percentage of people giving each range of prices to the menus, we can observe a lower percentage for AR than pictures in the lowest price range, while the opposite trend is noticed for higher prices. If we observe the average prices, the AR method averaged almost 20€ while the average of the participants who saw at the dishes with pictures was 2€ lower. The mode was 15€ and the minimum 12.5€ in both cases. However, this maximum price assigned as 50€ for AR and 30€ for the pictures. These results indicate that, in general, the AR method has led to a slightly higher price allocation compared to the pictures.

Additionally, it was observed whether participants were willing to pay more depending on the menu chosen and the method used (see Table 10). According to the first concern, the independent samples T test ($t(176) = -0.019$, $p = 0.985$) showed no significant difference between the average prices assigned to healthy and unhealthy menus, both rounding the 19€. However, it was obtained a different result when examining the differences between the methods used. AR showed a significantly higher average price than pictures ($t(176) = 2.297$, $p = 0.023$). This confirms the fact that people would pay more for a menu represented with AR than with pictures.

		Average	Standard deviation
Menu	Healthy	18.96	4.86
	Unhealthy	18.94	6.31
Method	AR	19.85	6.15
	Pictures	18.01	4.39

Table 9. Prices' characteristics according to menu and method

5. CONCLUSIONS

This undergraduate dissertation explores a lesser-known context of AR that is of great importance to society: promoting healthy eating habits. The aim was to investigate whether AR has the capacity to influence consumers' decisions and guide them towards healthier choices. To achieve this, the research was contextualized by presenting a theoretical framework, before moving to the methodological part conducted in the form of a Google Forms' survey whose results could shed light on this topic in the context of restaurant menus. The main conclusions obtained from it are explained.

First, it was observed that participants who used AR made less healthy choices in two out of three cases compared to those who viewed the images. This suggests that the technology used for presentation may have an impact on less healthy food choices in some categories of food dishes. A highlight of the results was the significant difference in choices of starters. Male participants were found to have a distinctly higher preference for less healthy starters when using AR compared to pictures. This indicates that gender may play an important role in the influence of AR on food decision-making.

Regarding the participants' choice reasons, it was observed that the presentation of the main dish was better perceived with AR compared to pictures, information that could be useful for restaurants, as by using AR customers can perceive the information differently and positively influence their whole experience in the restaurant. However, overall, the rest of the reasons did not show significant differences between the methods used and the different dishes.

In relation to the prices assigned to the menus, participants who used AR chose slightly higher prices compared to those who viewed the images. In addition, it was found that participants were willing to pay more for a menu presented with AR than with images. This suggests that restaurants and food services could potentially make use of AR as a strategy to influence consumers' decisions and increase the perceived value of their menus or the restaurant as a whole, as they may have the feeling of being at an innovative place which make use of new technologies, being willing to pay more even before trying it.

In sum, since AR showed, oppositely as expected, a greater influence on less healthy food choices, the reasons why this happened should be studied and addressed, so that this technology is used in a way which highlights and promotes healthier menu options, enhancing the restaurant’s brand image and meeting the growing demand for healthy food choices. AR could enable the display of additional information on the ingredients used by restaurants, nutritional values or dietary recommendations, which would help and encourage consumers to make more informed choices and encourage the choice of healthier options, as simply displaying the food with AR does not promote these choices.

Some of the dissertation's limitations are that the sample size and the sampling method hinder the generalizability of the results to the whole population. Additionally, the participants' profile analysis showed that they tended more to healthy behaviors than unhealthy ones, which could be the reason for their choices. Finally, the survey was based on imaginary situations, in which real factors are not considered. This may have changed or influenced participants' choices and answers.

From here, several lines of future research are proposed, which could address issues not done so in this dissertation and that may be of interest. First, a qualitative study of real experiences with this tool, such as a focus group, could be conducted. Participants could describe their real experiences and perceptions in a detailed way, allowing for a better understanding of how AR affects and influences consumers and what subjective factors may play a role, something that is not perceived in quantitative studies. This could uncover limitations that do not encourage healthier choices.

Secondly, evaluation of other applications of AR in the context of healthy eating could be carried out, as there are others apart from Kabaq AR in the area of food, such as the ones mentioned in the theoretical framework, possibly showing more positive results regarding this concern.

Finally, just as pictures were compared to AR, it would be interesting to compare different immersive technologies such as VR, providing relevant data about which is more effective and how they can be used to present the dishes in a way which promotes healthy behaviors.

In conclusion, this research has shed light on the potential of AR to influence people's eating behaviors. While its apparent impact on food choices may not be extensive, AR has demonstrated its effectiveness in other areas, such as price allocation. By addressing limitations and conducting further research, all its potential could be discovered, enabling the design and creation of innovative applications which actually succeed in influencing these behaviors, contributing to a healthier society.

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7. APPENDIX

Realidad aumentada y elección de **alimentos**

Hola! Soy Gabriela Esteban, estudiante del grado ADE en inglés de la Universidad de Zaragoza. La siguiente encuesta sirve como herramienta para la recogida de datos para mi Trabajo de Fin de Grado.

Me ayudarías mucho si pudieras dedicar tu tiempo a responder unas preguntas. No te llevará mas de 7 minutos. Es de carácter anónimo y la información solo se utilizará con fines académicos.

¡Muchas gracias por tu colaboración!

* Indica que la pregunta es obligatoria

Hábitos alimenticios

1. Por favor, indica con qué frecuencia comes los siguientes alimentos: *

Marca solo un óvalo por fila.

	A diario	5-6 veces semana	3-4 veces semana	1-2 veces semana	Con menor frecuencia	Nunca
Frutas	◯	◯	◯	◯	◯	◯
Verduras	◯	◯	◯	◯	◯	◯
Snacks salados	◯	◯	◯	◯	◯	◯
Refrescos y bebidas azucaradas	◯	◯	◯	◯	◯	◯
Golosinas y otros dulces	◯	◯	◯	◯	◯	◯
Comida rápida	◯	◯	◯	◯	◯	◯

2. Señala tu grado de acuerdo o desacuerdo con las siguientes afirmaciones en relación a tus **hábitos alimenticios** *

(siendo 1 = totalmente en desacuerdo y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
Me preocupo por seguir una dieta equilibrada y saludable	◯	◯	◯	◯	◯
Le presto atención a la calidad de los alimentos que consumo	◯	◯	◯	◯	◯
Me esfuerzo por cumplir las 5 comidas diarias	◯	◯	◯	◯	◯
Considero que tengo conocimientos sobre la alimentación saludable	◯	◯	◯	◯	◯
Cuando como fuera de casa me preocupo por comer saludablemente	◯	◯	◯	◯	◯

Comer en un restaurante o pedir por delivery

3. ¿Con qué frecuencia sueles comer en restaurantes o pedir en aplicaciones de delivery?:

Selecciona todos los que correspondan.

	Restaurante	Delivery
Varias veces por semana	☐	☐
1 vez a la semana	☐	☐
1 vez cada 15 días	☐	☐
1 vez al mes	☐	☐
Con menor frecuencia	☐	☐
Nunca	☐	☐

4. Indica en qué medida te influyen los siguientes atributos a la hora de elegir comida en un **restaurante o app de delivery**: *

(siendo 1 = no me influye nada, y 5 = me influye mucho)

Marca solo un óvalo por fila.

	1	2	3	4	5
lo apetitoso que suena un plato en su descripción	◯	◯	◯	◯	◯
lo apetitoso que se ve un plato en las fotos de la carta	◯	◯	◯	◯	◯
su valor nutricional y energético	◯	◯	◯	◯	◯
la cantidad de grasa o azúcar que contiene	◯	◯	◯	◯	◯
el grado de saludable	◯	◯	◯	◯	◯
la variedad de alimentos	◯	◯	◯	◯	◯
lo novedoso del plato	◯	◯	◯	◯	◯

5. Indica en qué medida te influyen los siguientes factores a la hora de elegir comida en un **restaurante o app de delivery**: *

(siendo 1 = no me influye nada, y 5 = me influye mucho)

Marca solo un óvalo por fila.

	1	2	3	4	5
la cantidad de hambre que tenga	◯	◯	◯	◯	◯
haber hecho ejercicio antes de comer	◯	◯	◯	◯	◯
la gente con la que estoy (comer solo/ en pareja/ con muchas personas...)	◯	◯	◯	◯	◯
la facilidad y rapidez de preparación	◯	◯	◯	◯	◯
el grado de elaboración y tiempo dedicado	◯	◯	◯	◯	◯
el tiempo del que dispongo para comer	◯	◯	◯	◯	◯

¿Qué es la realidad aumentada?

La Realidad Aumentada (RA) es una tecnología inmersiva que superpone objetos virtuales al mundo real a través de un dispositivo electrónico.

Algunos ejemplos conocidos son los filtros faciales de Instagram, pantallas try-on en tiendas de ropa y juegos de entretenimiento como Pokemon Go.



6. Indica tu grado de acuerdo con las siguientes afirmaciones sobre tu **familiaridad con la Realidad Aumentada** *

(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
Sé mucho sobre la Realidad Aumentada	◯	◯	◯	◯	◯
Estoy familiarizado con la Realidad Aumentada	◯	◯	◯	◯	◯
Ya tengo experiencia con la Realidad Aumentada	◯	◯	◯	◯	◯

7. ¿Has utilizado alguna vez una aplicación de Realidad Aumentada? *

Marca solo un óvalo.

- ◯ Sí, bastantes veces. *Salta a la pregunta 8*
- ◯ Sí, alguna vez en mi vida. *Salta a la pregunta 8*
- ◯ No, nunca. *Salta a la pregunta 9*

REALIDAD AUMENTADA

8. ¿En qué contexto(s) fue? *

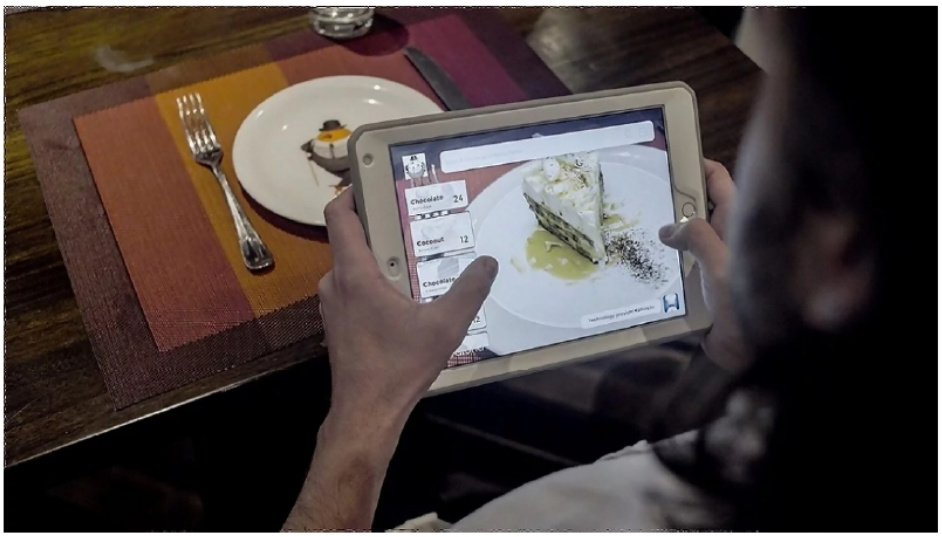
Marca tantos como recuerdes

Selecciona todos los que correspondan.

- [ ] Entretenimiento
- [ ] Redes sociales
- [ ] Moda / belleza
- [ ] Educación
- [ ] Turismo
- [ ] Hostelería
- [ ] Otro: _____

KABAQ AR app

Kabaq AR es una aplicación que utiliza tecnología de realidad aumentada para mostrar imágenes en 3D de platos de comida en el mundo real. Esta tecnología permite ver cómo es el plato antes de pedirlo.



9. ¿Conocías esta herramienta? *

Marca solo un óvalo.

- ◯ No.
- ◯ Sí, pero no la he utilizado nunca.
- ◯ Sí, la he utilizado.

10. Por favor, indica a qué grupo pertenece la letra de tu DNI *

Marca solo un óvalo.

- A - M *Salta a la pregunta 11*
- N - Z *Salta a la pregunta 18*

Situación de consumo

Imagina que estás en un restaurante. El camarero te proporciona una tablet que, gracias a la tecnología de Realidad Aumentada, te permite visualizar los platos como si estuvieran en la mesa a través de la cámara. Puedes observar dos opciones de entrantes, principales y postres, como los que verás clicando en los siguientes videos. Elige el entrante, principal y postre que crees que más te apetecería comer si te encontrases en esta situación.

ENTRANTES

http://youtube.com/watch?v=9szUjjSUiS4

11. ¿Qué entrante elegirías?

Marca solo un óvalo.

- Opción 1. Tomates rellenos
- Opción 2. Salchichas con patatas

12. He elegido este entrante por(que): *

(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
me parecía más apetitoso	◯	◯	◯	◯	◯
me gusta como estaba presentado	◯	◯	◯	◯	◯
me parecía más sabroso	◯	◯	◯	◯	◯
siempre como este tipo de comida	◯	◯	◯	◯	◯
no lo suelo comer en casa	◯	◯	◯	◯	◯
me parecía más saludable	◯	◯	◯	◯	◯
la cantidad de grasa	◯	◯	◯	◯	◯
la cantidad de calorías	◯	◯	◯	◯	◯
considero que me saciaría	◯	◯	◯	◯	◯

PRINCIPALES

http://youtube.com/watch?v=Akmd_GGhwXM

13. ¿Qué principal elegirías?

Marca solo un óvalo.

- Opción 1. Hamburguesa con bacon
- Opción 2. Salmón con patatas al horno

14. He elegido este principal por(que): *

(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
me parecía más apetitoso					
me gusta como estaba presentado					
me parecía más sabroso					
siempre como este tipo de comida					
no lo suelo comer en casa					
me parecía más saludable					
la cantidad de grasa					
la cantidad de calorías					
considero que me saciaría					

POSTRES

http://youtube.com/watch?v=AdPeYuJNmPw

15. ¿Qué postre elegirías?

Marca solo un óvalo.

- Opción 1. Crep con frutas
- Opción 2. Gofre con chocolate y helado

16. He elegido este postre por(que): *
(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
me parecía más apetitoso					
me gusta como estaba presentado					
me parecía más sabroso					
siempre como este tipo de comida					
no lo suelo comer en casa					
me parecía más saludable					
la cantidad de grasa					
la cantidad de calorías					
considero que me saciaría					

17. ¿Cuánto **pagarías por este menú**, teniendo en cuenta que incluye una bebida y no incluye café? *
Indica sólo la cifra en €

Salta a la pregunta 25

Situación de consumo

Imagina que estás en un restaurante y el camarero te proporciona una carta con fotos de dos entrantes, dos principales y dos postres como los que puedes observar a continuación. Elige el entrante, principal y postre que creas que más te apetecería si te encontrases en esta situación.

ENTRANTES

ENTRANTES

OPCIÓN 1

OPCIÓN 2

18. ¿Qué entrante elegirías?

Marca solo un óvalo.

- Opción 1. Tomates rellenos
- Opción 2. Salchichas con patatas

19. He elegido este entrante por(que): *

(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
me parecía más apetitoso	◯	◯	◯	◯	◯
me gusta como estaba presentado	◯	◯	◯	◯	◯
me parecía más sabroso	◯	◯	◯	◯	◯
siempre como este tipo de comida	◯	◯	◯	◯	◯
no lo suelo comer en casa	◯	◯	◯	◯	◯
me parecía más saludable	◯	◯	◯	◯	◯
la cantidad de grasa	◯	◯	◯	◯	◯
la cantidad de calorías	◯	◯	◯	◯	◯
considero que me saciaría	◯	◯	◯	◯	◯

PRINCIPALES

PRINCIPALES

OPCIÓN 1 **OPCIÓN 2**

20. ¿Qué principal elegirías?

Marca solo un óvalo.

- Opción 1. Hamburguesa con bacon
- Opción 2. Salmón con patatas

21. He elegido este principal por(que): *

(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
me parecía más apetitoso					
me gusta como estaba presentado					
me parecía más sabroso					
siempre como este tipo de comida					
no lo suelo comer en casa					
me parecía más saludable					
la cantidad de grasa					
la cantidad de calorías					
considero que me saciaría					

POSTRES

POSTRES

OPCIÓN 1 **OPCIÓN 2**

22. ¿Qué postre elegirías?

Marca solo un óvalo.

- Opción 1. Crep con frutas
- Opción 2. Gofre con chocolate y helado

23. He elegido este postre por(que): *

(siendo 1 = totalmente en desacuerdo, y 5 = totalmente de acuerdo)

Marca solo un óvalo por fila.

	1	2	3	4	5
me parecía más apetitoso					
me gusta como estaba presentado					
me parecía más sabroso					
siempre como este tipo de comida					
no lo suelo comer en casa					
me parecía más saludable					
la cantidad de grasa					
la cantidad de calorías					
considero que me saciaría					

24. ¿Cuánto **pagarías por este menú**, teniendo en cuenta que incluye una bebida y no incluye café? *

Indica sólo la cifra en €

Preguntas de control y socio-demográficas

Para finalizar, necesitamos recoger cierta información de control y de carácter personal

25. La información mostrada sobre los platos del restaurante... *

Marca solo un óvalo.

- ◯ Eran fotografías de los platos reales
- ◯ Eran fotografías de los platos generados por Realidad Aumentada
- ◯ Eran vídeos de los platos reales
- ◯ Eran vídeos de los platos generados por Realidad Aumentada

26. En la situación del restaurante, me he imaginado que...: *

Marca solo un óvalo.

- ◯ Estaba sólo/a
- ◯ Estaba con amigos/as
- ◯ Estaba con mi familia
- ◯ Estaba con compañeros/as de clase o del trabajo
- ◯ No me he imaginado con nadie en concreto

27. En la situación del restaurante, me he imaginado que...: *

Marca solo un óvalo.

- ◯ Estaba almorzando
- ◯ Estaba comiendo
- ◯ Estaba cenando
- ◯ No me he imaginado ningún momento en concreto

28. Sexo

Marca solo un óvalo.

- ◯ Hombre
- ◯ Mujer
- ◯ Otro/prefiero no decirlo

29. Edad

Marca solo un óvalo.

- Menos de 18
- Entre 18 y 26
- Entre 27 y 35
- Entre 36 y 44
- Entre 45 y 53
- Mayor de 54

30. Estudios

Marca solo un óvalo.

- Sin estudios
- ESO
- Bachillerato
- Grado superior/universitario
- Master/doctorado

31. ¿A qué te dedicas?

Marca solo un óvalo.

- Estudio
- Trabajo
- Estudio y trabajo
- Ni estudio ni trabajo