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How augmented reality (AR) is transforming the restaurant sector: Investigating the impact of “Le Petit Chef” on customers’ dining experiences

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Abstract

Many businesses across sectors are using extended reality technologies to enhance the consumer experience. In the restaurant industry, digital technologies are gaining growing interest among restaurateurs to improve customers’ dining experiences and thus their overall food well-being. In this research, we conduct an exploratory analysis using a qualitative multi-method approach to examine whether augmented reality (AR) technology contributes positively or otherwise to a customer’s dining experience. We do so through a case study, namely Le Petit Chef AR dining experience. Our findings suggest that AR can influence positively or negatively consumers’ perceptions of their restaurant experiences according to five dimensions, namely sensory dimensions (the five senses’ intensity), the affective dimension (pleasantness), and behavioral, social, and intellectual dimensions. These dimensions can improve the customer’s experience and be managed by restaurateurs to enhance positive attitudes toward AR in the restaurant industry. Furthermore, the results revealed that AR plays an essential role in terms of improving the overall food well-being of consumers and thus can lead to positive post-consumption behaviors. This study also identifies the factors that allow service providers to understand the psychology behind adopting or rejecting technology innovation in the servicescape.

Keywords

AR, dining experience, customer experience, case study, Le Petit Chef, restaurant

Introduction

The integration of digital technologies is increasingly changing both how firms in different sectors function and how customers engage in their relationships with brands. From a managerial perspective, many businesses are considering various digital technologies, depending on the objectives of their businesses. For instance, digital technologies can be used to reduce costs, enhance customers' interactions, provide convenient and immediate access to product and service information, and improve customers' post-purchase service satisfaction (Doorn et al., 2016).

Prior works examined the impact technologies such as self-service technology (SST) and interactive voice response (IVR) have on customer satisfaction (e.g., Othman et al., 2020; Robertson et al., 2016; Boon-itt, 2015; Huang and Rust, 2013). Nevertheless, while the conclusions of these studies show there is an overall positive impact of technology on the satisfaction of customers and their interaction with firms (e.g., Muhammad et al., 2018), other scholars, such as Meuter et al. (2000), examined the sources of customer dissatisfaction with technology. The researchers did so by identifying technologies that lead to the satisfaction of customers as well as technologies that lead to the dissatisfaction of customers, including technology failures and costs, and the lack of human interaction in the service delivery.

Digital technologies can also enhance people's shopping accessibility and provide them with alternative purchasing channels (e.g., Reinartz et al., 2019; Duarte et al., 2018). Both consumers and businesses have experienced rapid increases in the use of digital technology, especially in the retail sector. Examples include checkout-free stores, such as Amazon Go (Cusumano, 2017), and the use of artificial intelligence (AI) and virtual assistants, such as Amazon's Alexa and Google Home (Tristan et al., 2020). Other examples include the integration of extended reality technologies (Batat, 2019a), namely augmented reality (AR) and virtual reality (VR) in physical stores and online to offer more immersive digital

shopping experiences (Peukert et al., 2019). However, these technologies can positively or negatively impact the relationship between customers and brands (Wang, 2020; Larivière et al., 2017). This research examines AR's potential impact on the customer's experience in a highly experiential sector, namely the restaurant industry.

VR is an immersive technology defined as "a real or simulated environment in which a perceiver experiences telepresence" (Steuer, 1992, pp. 76-77). VR can be classified as *tethered*, a computer-based VR, or *untethered*, which integrates smartphone-based VR (Tussyadiah et al., 2018). AR uses digital devices to incorporate additional sensory information, such as sounds, objects, avatars, graphics, and labels into a natural setting. Doing so delivers contextualized perceptions that can improve both a product's visuals or use and provide an enhanced interactive experience for consumers (Wedel et al., 2020, p. 443). Carmigniani et al. (2010) argue that VR and AR's difference is that VR generates a perception of reality entirely based on virtual information, whereas AR enhances the perception of the real world with added computer-generated information.

This article examines the impact AR has on the customer's experience in the foodservice sector. Drawing on the works of Lemon and Verhoef, the customer's experience is defined as "a multidimensional construct focusing on a person's cognitive, emotional, behavioral, sensorial, and social responses to a firm's offerings during the entire purchase journey" (2016, p. 71). AR's impact on the customer's experience has essentially been examined in relation to retail and online shopping via smartphone devices (Nöjd et al., 2020). However, AR affects customers beyond online shopping by merging the digital space and the physical place to create a third *phygital* realm. The phygital realm is a realm in which the characteristics of both real and virtual worlds are combined (Batat, 2019a).

Previous research on how AR affects customers included their physical retail and in-store purchasing behaviors (Fuentes et al., 2017) and AR-enabled virtual try-on technology

(Romano et al., 2020). However, there is little or no research regarding AR's impact on enchanting customers in the physical foodservice space, which is a highly experiential setting. AR technology is expected to become a top priority for the restaurant sector (Foodabletv.com, 2016), not only in terms of food delivery (Hwang et al., 2019) and digitized menus (Peters and Mennecke, 2011), but also in terms of enhancing the overall restaurant experience. AR allows restaurants to virtually display menus, food products, and their customization. As a result, a more immersive food experience can be offered to diners by helping them imagine what offerings will look like before ordering them.

Furthermore, research that examined the adoption and use of digital technologies has emphasized conflicting findings concerning their effects on the customer's experience. It is, therefore, necessary to understand how AR affects the sensory, behavioral, intellectual, affective, and social dimensions of the customer's experience in the physical restaurant space. The role this technology plays in terms of enhancing overall food well-being, which refers to "a positive psychological, physical, emotional, and social relationship with food at both the individual and societal levels" (Block et al., 2011, p. 6), as an outcome of the customer's experiential pleasure of food journey also needs to be examined (Batat et al., 2019). Undoubtedly the integration of extended reality technologies such as AR can provide a customer with a superior and personalized experience that increases the person's sense of immersion by responding to both his or her functional and emotional needs (Tuncer, 2020). However, AR can also hinder customers from enjoying their dining experiences (Margetis et al., 2013).

Therefore, the present study's main objective is to investigate how AR utilized in an actual restaurant setting can affect the customer's experience and his or her food well-being. As digital technology is arriving at diners' tables either by diners themselves (e.g., via their mobile phones and laptops) or by restaurants (e.g., via tablets, QR codes, and apps), its

integration will no doubt change customers' perceptions of their dining experiences and attitudes toward restaurants.

Our research helps advance the existing literature on AR and the customer's experience in the foodservice field and encourages researchers to pursue new studies on the topic. This research can also provide practitioners and foodservice professionals with relevant insights to adapt the integration of digital technologies to consumers' functional and emotional needs to offer them immersive and enchanting experiences. To the best of our knowledge, no prior research has considered the multidimensional perspective alongside AR's integration in a highly experiential and sensorial space, namely a restaurant. In the first section, we present the theoretical background linking AR and the customer's experience. Second, the research methodology, findings, and discussion of the theoretical and managerial implications are introduced. This part is then followed by the research limitations and suggestions for future research.

2. Literature review

2.1. Augmented reality applications: An overview

AR interfaces and usages have been the focus of extensive research in different disciplines ranging from engineering (e.g., Dey et al., 2018; Rankohi and Waugh, 2013) to consumer marketing (e.g., Hackl and Wolfe, 2017; Perid and Steiger, 1998) and food research (e.g., Stelick et al., 2018). A systematic review of 10 years (2005-2014) of the existing literature on AR interfaces revealed nine key domains of AR technology usages, namely remote collaboration, education, entertainment and gaming, industrial applications, interaction, medicine, navigation and driving, perception, and tourism and exploration (Dey et al., 2018). The extensive review's conclusions highlight a limitation in these studies, which is related to the laboratory context in which AR has been examined and the lack of pilot testing.

Although the use of AR technology has increased over the past years, it remains experimental, and its full potential is still unexploited (Rankohi and Waugh, 2013). Typically, AR technologies are famous for their immersive and sensory—mainly visual— aspects used to create artistic and aesthetic experiences (Chevalier and Kiefer, 2020); however, their usages are not limited to these two dimensions because AR includes a variety of technologies that are directedly or indirectly related to immersion. For instance, Wang (2009) presents a list of multiple AR systems, including portable and mobile AR (radio-frequency based tracking technologies such as GPS); infrastructure-dependent technologies (e.g., fiducial markers); and infrastructure-independent tracking technologies (e.g., image-based tracking techniques), among others (Rankohi and Waugh, 2013).

In the consumer marketing field, both scholars and practitioners showed an increased interest in AR technologies to improve customer satisfaction in physical stores (e.g., Hackl and Wolfe, 2017; Perid and Steiger, 1998; Brody and Gottsman, 1999). Research on AR in marketing can be traced back to the end of the 1990s. Early AR studies examined the use of mobile phones as an interaction device with a low level of immersion to augment the consumer’s shopping experience in the store (Perid and Steiger, 1998). In their recent research, Wedel et al. (2020) propose an integrative VR/AR framework in consumer marketing that incorporates the two technologies centered around the concept of customer experience and how the integration of immersive technologies can improve satisfaction throughout the customer journey.

2.2. AR customer experience frameworks

A range of frameworks has been developed to define how extended reality technologies and AR, in particular, affect a consumer’s responses in terms of the person’s experiences. A review of the literature shows that the customer’s experience can be defined according to

three dominant perspectives: (1) a customer journey perspective, (2) a sequential model perspective, and (3) a multidimensional perspective.

Along with a customer journey perspective, the customer's experience is defined by three stages that can be affected by the integration of AR technology: pre-purchase, point of purchase, and post-purchase (e.g., Romano et al., 2020; Herz et al., 2019; Willems et al., 2017; Rese et al., 2017; Verhoef et al., 2007). These studies emphasize both the positive and negative effects AR has on the customer's experience (Wedel et al., 2020; Romano et al., 2020). AR can enhance the experience of customers and provide them with functional and emotional benefits during the three stages of the shopping journey; however, AR can also generate confusion, dissonance, and boredom (Romano et al., 2020). On the one hand, studies show that AR has a positive impact on the customer's experience. For example, AR helps customers bridge online and offline shopping by offering the advantages of both spaces (Javornik, 2016). Customers can also save time when they purchase online. AR can also enhance a consumer's confidence in the decision-making process because the technology offers further information and playfulness by allowing interactions between the consumer and the product (Kang et al., 2020). This situation enhances a consumer's immersion and thus improves the person's overall shopping experience. For example, it has been shown that AR positively affects the online shopping experience because it solves a major issue related to trying on clothes in physical stores—a task customers often perceive negatively (Barnes et al., 2016; Hao Suan Samuel et al., 2015).

Furthermore, AR enhances the experience of customers because it allows them to customize and visualize products (Pallant et al., 2020) by selecting various features such as colors or personalizing products by adding their names to them. Also, prior studies indicated that AR in the context of online shopping could enhance consumers' perceptions of psychological ownership even before making the purchase, thanks to the engaging aspects of

AR, such as product customization, co-creation, easiness and multitasking, time-saving, little effort, and the playfulness of the virtual try-on aspect (e.g., Duarte et al., 2018; Liu et al., 2017; Hilken et al., 2017; Pantano et al., 2017; Jussila et al., 2015). Indeed, AR compensates for the feeling of touch and thus engages the customer in a pleasurable purchase and consumption experience. AR does so because it allows customers to live a physical experience in the store using AR tools in a third realm: phygital. In phygital settings, which combine both the functional and emotional benefits of the digital space and the physical place (Batat, 2019a; 2020b), the customer is more likely to achieve a transaction (Willems et al., 2017).

On the other hand, studies show that AR can also negatively affect the customer's experience through the consumer journey. Although AR makes the online purchase process easy, its integration as an additional stage might negatively affect the shopping experience. Why? Because some shoppers can perceive AR to be cognitively or emotionally demanding in terms of the effort and attentiveness it requires (Dixon et al., 2010). Also, AR integration might be a trend as consumers will first experience it for its novelty but do not adopt it as a relevant technology for their shopping experiences (Ferraro et al., 2017).

To sum up, a recent study by Romano et al. (2020) on the impact AR technology had during the try-on stage of the customer journey showed the following: Before a purchase, AR can expand a consumer's product consideration because it limits the choice set. At the point of purchase, AR can help with product curation and enhance a product's hedonic value, thanks to the technology's playfulness aspect. At the post-purchase stage, the authors state that AR can influence how confident consumers are about their purchases and accentuate cognitive dissonance.

Considering a sequential model perspective, the authors examine the customer's experience by identifying the drivers, characteristics, and outcomes of using technology such

as AR tools to enhance consumption and shopping experiences (Wedel et al., 2020). Notably, the authors identify key drivers that lead customers to adopt AR tools. For instance, consumers' acceptance of AR in their shopping and purchase experiences derive from AR's perceived usefulness and ease of use (Rese et al., 2017). Also, AR adoption can be affected by both internal and external drivers (Batat, 2019a) that can lead consumers to either engage with the technology while shopping or not engage with it. Whereas internal drivers refer to the personal factors related to an individual's behaviors, such as someone's purchasing habits, the frequency of their purchasing, or level of involvement with technology (Puccinelli et al., 2009), external drivers are related to the environment. External drivers can consist of the technological design of products (Jain and Bagdare, 2011).

The willingness of customers to utilize AR is due to both the technology's hedonic and utilitarian characteristics to enhance the shopping experience (Heijden, 2004). To enhance the adoption of AR among consumers, there should be a balance between the two features: playfulness and functionality (Olsson et al., 2013). Prior works show that the technology's features, such as its co-creation aspects, for example, provide customers with certainty about their purchasing decisions. As a result, customers can feel empowered and positive about adopting AR tools (e.g., Pallant et al., 2020; Vahdat et al., 2020; Garaus and Wagner, 2016). Additionally, it is worth noting that the sequential model, developed from the perspective of technology diffusion and adoption (Curran and Meuter, 2005), is a subset of the overall consumer behavior frameworks that include the logic of customer journey developed in marketing.

In line with works that adopted a multidimensional perspective, scholars have defined the customer's experience according to five main dimensions that can be affected by the use of AR technologies, namely, sensory, social, affective, intellectual, and behavioral dimensions (e.g., Wedel et al., 2020; Batat, 2019a). Previous studies argue that, among the five senses,

AR predominately affects three of them: sight, touch, and sound (Wedel et al., 2020, Kang et al., 2020). These senses can positively affect consumers' willingness to get immersed in virtual shopping and consumption experiences (Slater and Wilbur, 1997). Likewise, compared with other digital technologies, a customer's AR experience is likely to be more engaging because it enhances social interactions around virtual products and experiences by integrating avatars or telepresence (Sanchez-Vives and Slater, 2005). For instance, Steinhoff et al. (2018) examined AR's impact on a consumer's social engagement and relationships and the person's willingness to adopt AR tools for shopping and consumption experiences. Regarding the affective dimension of the customer's experience, it has been shown that both positive and negative emotions are related to AR's use (Romano et al., 2020).

When it comes to online shopping, AR can generate positive emotions that lead to the frequency of purchases; however, when a consumer's emotions are negative, this will lead to a decrease in purchase intentions (Martin et al., 2015). The authors reported that factors such as information quality, user interface quality, and security perception could positively or negatively affect consumers' emotions during the online shopping experience (Vakulenko et al., 2018). Notably, prior studies show that AR can positively affect a consumer's learning process (Choi and Choi, 2020; Pantano et al., 2017; Suh and Lee, 2005). These studies argue that AR information improves consumers' learning and purchase intentions in the AR setting.

Moreover, AR's impact is more potent when consumers are experiencing products and services instead of merely searching for information about them (Suh and Lee, 2005). Finally, the integration of AR can affect a consumer's behaviors and attitudes toward brands and products. Research shows that because AR can be used as a creative tool for attracting customers and diffusing awareness about products, there is a substantial relationship between the technology and a customer's engagement and purchase intentions (Romano et al., 2020).

2.3. The psychology of AR dining experience: A well-being perspective

More and more diners of all age ranges use digital technologies such as mobile phones, laptops, and tablets in restaurants. These technologies can positively or negatively impact both foodservice providers and the customer's dining experience (Moser et al., 2016; Breiter and Hoart, 2000). Studies argue that to adapt to the new emerging consumers' functional and emotional needs and the high-tech context, foodservice providers should consider integrating digital technologies to reinvent the restaurant experience (Choi et al., 2014; Wilson, 2007). Thus, restaurants can enhance their customers' dining experiences by utilizing various technologies to provide a sensory immersion. The tools include QR codes, AR and VR, smart plates, and interactive tables. Spence and Piqueras-Fiszman (2013) identified different paths by which restaurants can use digital technologies for multiple purposes. For instance, to enhance food sensory aspects, such as taste and flavor; to offer an entertaining restaurant experience; to deliver information about the food for healthy eating, and enchant diners by offering more memorable social experiences at restaurants. Importantly, eating is a multidimensional and evolving experience (Batat et al., 2019; Batat, 2019b; 2020a) that includes the individual's five senses, the social interactions, and the environment that shapes the restaurant experience. Recent research by Stelick et al. (2018) indicates that extended reality technologies can impact food sensory experiences and thus consumer's food well-being.

In food marketing research, scholars define food well-being from two main perspectives: food well-being as an outcome of food consumption (Block et al., 2011) and as a driving force for pleasurable and healthy food experiences (Batat et al., 2019). The first perspective of food well-being considers the relationship of consumers have with food, which can be affected by five major factors: food socialization, food literacy, food marketing, food availability, and food policy (e.g., Scott and Vallen, 2019; Block et al., 2011). The second

perspective highlights the vital role of food well-being as not only an outcome but also a driving force that allows consumers to live experiential and pleasurable food consumption experiences (Batat et al., 2019; Batat, 2019b). Because food consumption is a symbolic, hedonic, and sociocultural experience (Delormier et al., 2009), considering food well-being as an outcome in terms of healthy eating behaviors is a narrow approach. Indeed, the experiential approach to food as pleasure is strongly tied to the appreciation of symbolic meaning to capture different food well-being pathways (Batat and Addis, 2021). For Batat (2019b), food well-being pleasure should, therefore, constitute an integral part of the food experience by focusing on seven key aspects: aestheticism, socialization, sharing, storytelling, symbolism, memory and nostalgia, and food tasting as a result of stimulating the five senses: touch, smell, taste, sound, sight (Batat et al., 2019).

Prior works have examined how multiple senses (mainly taste, sight, and sound) can either positively or negatively affect a consumer's eating behaviors. However, more recent studies in the food psychology field have investigated the impact of multisensory technologies (e.g., projective virtual reality techniques, audio-haptics renderings, and vibration systems) on the consumer's food sensory experiences (e.g., Velasco et al., 2018; Cornil and Chandon, 2016). The results of these studies show that multisensory technologies can augment people's perceptions of flavors, thus helping them achieve food well-being by sensorially nudging them towards healthy eating and drinking behaviors (Velasco et al., 2018). These studies consider the positive impact technology has on the food consumption field and lead foodservice researchers to assess ways in which to construct a better connection between technology, consumers, service providers, and policymakers. The goal is to ensure that immersive and multisensory technologies can enhance and promote healthy food consumption behaviors and the psychological well-being of individuals (Velasco et al., 2018).

However, although scholars call for research on the impact of innovative technologies in the foodservice field, most existing works have examined extended reality technologies as they relate to physical retail and online shopping (Bonetti et al., 2018) without examining the impact AR has in the hospitality sector, especially the restaurant industry (Wei, 2019). The research related to the impact technologies such as AR have on the restaurant experience was previously uncommon due to AR's newness. However, noticeable advancements in AR research today seem to be assured to affect the experience of diners. AR is also likely reshaping diners' behaviors and attitudes toward restaurants.

Some scholars have examined the concept of food well-being (Block et al., 2011), and others have focused on consumers' food experiences and their relationship to the concept of food well-being (Batat and Addis, 2021; Batat et al., 2019). However, to our knowledge, no research has explored how extended reality technologies, especially AR in a highly experiential context such as a restaurant, can affect the dining experiences of customers and their food well-being. How might both customers and foodservice providers adopt AR? How can it be used to enhance the customer's experience and their food well-being before, during, and after a restaurant visit? This study concentrates on diners' perspectives of the future of AR. The study does so by utilizing a multidimensional approach to the customer's experience. The goal is to provide a framework to examine how AR affects people's dining experiences and overall food well-being.

3. Research setting: "Le Petit Chef" case study

In line with Saunders et al. (2012), the methodology, the framework, and the analytical process are directed by the exploratory nature of our research problem focus. Because this research was designed to examine AR's impact on consumers' dining experience dimensions, an interpretative approach was an appropriate methodology for data collection. Thus, a

qualitative case study (Yin, 2009) using a mixed-method approach (Harrison and Reilly, 2011) was adopted to capture detailed and embedded insights. The approach is helpful when examining a new or an early-stage phenomenon (Davies and Chun, 2002), such as the AR restaurant experience, which is the case in this research.

Furthermore, using a case study is suitable in our approach because it requires both a contextual significance (Miles, 1979) and a holistic depiction of the new phenomenon (Gummesson, 2000). More specifically, we chose to explore one type of augmented reality technology used by some restaurants to enhance the dining experience — “Le Petit Chef.” Le Petit Chef utilizes a 3D video mapping technique developed by the Belgian audio-visual studio Skullmapping, run by Filip Sterckx and Antoon Verbeeck. Skullmapping tells stories with stunning bespoke visuals. The team creates projections on buildings, boxes, shapes, or simply on the ground and adds extra dimensions, including optical illusions and movement onto previously static objects.

According to the company’s founders, “Le Petit Chef” arose from a request from a client who wanted a table mapping for an event. Table mapping is not a new idea, but until now, it was primarily graphic. Skullmapping wanted to do something more human, with a little character walking around guests’ tables and cooking their food. To do so, the company chose Panasonic projectors, which have the specifications and resolution—1920 x 1200—needed. The goal of technology, among other things, is to make the waiting moments in restaurants more pleasant. 3D video mapping is now a technology that has gone viral and has been used in different restaurants worldwide (see <https://www.youtube.com/user/Skullmapping/videos> to observe how this creative technology is used in restaurants).

This context offers an ideal empirical setting to understand how extended reality technologies such as AR are transforming the restaurant experience and how these technologies were perceived by consumers who experienced “Le Petit Chef” in a restaurant.

By creating “Le Petit Chef,” Skullmapping studio demonstrated the interest in video mapping as part of a scenography aimed at entraining and immersing guests in restaurants—thus enhancing people’s dining experiences by bringing AR technology to the table. The video animation, created by using a motion capture process projected onto customers’ tables, presents a “little chef” who cooks in front of diners’ eyes and on their plates. “Le Petit Chef” offers a dining experience at the intersection of different technologies, including holograms, motion capture, 3D video mapping, and augmented reality.

The guests’ table is transformed into a maritime, glacial universe, or other landscape projected over the recipes to tell the stories of the dishes being served. The video projectors help create new customer experiences. A video of the event, which was later posted on YouTube, went viral and received 4.3 million views within its first ten months.

Initially, the mapping was only about the preparation of the main course. Skullmapping then added a starter, a fish dish, and a dessert to cover the whole dining experience. The mapping tells the story of a complete meal that includes a starter, main course, and dessert. Moreover, the storytelling can be adapted to different food cultures and restaurant types (e.g., traditional, ethnic, modern). Also, the company came up with different stories that are customized according to menus. Since then, Skullmapping has been contacted by various high-end hotels and restaurants worldwide, from Russia to Dubai. Thus, the “Le Petit Chef” AR dining experience brought to customers’ tables to show them how their meals are prepared became immersive experiences—ones that can make the waiting moments more enjoyable until the meals are served. Therefore, considering “Le Petit Chef” as a case study and a research context allows us to contextualize our insights and reveal the complexity (Yin, 2013) related to the study of the impact of AR’s adoption in this unique field and how it affects the restaurant experiences of customers. Accordingly, choosing to study the implementation of “Le Petit Chef” in different restaurants from the perspective of the

customers who have lived this AR dining experience allows us to provide a further, common nature of the scheme and dynamics that we examine (Becker et al., 1990).

3.1. Data Collection

Following Harrison and Reilly's (2011) recommendations, we conducted qualitative mixed-method research to collect data from diverse but complementary sources. Primary and secondary data were organized in a chronological two-step process. The first step required collecting secondary data from sources such as tech forums, press releases, websites, food blogs, food and technology magazines, foodservice books, and documentaries to learn more about AR's use in the restaurant sector, especially the video-mapping technology used by Skullmapping in "Le Petit Chef" in different restaurants worldwide. Between September 2018 and December 2019, more than 350 discussions on technology and restaurant forums and blogs were investigated distinctly by the researcher and two external colleagues to produce a 100-page document. The document focused on themes, such as virtual 3D food, 3D printed food, restaurant entertainment, restaurant's digital experience, AR-driven restaurant experiences, the use of digital devices by foodservice employees, restaurant experiences, and food well-being. Secondary data allowed us to capture new emerging trends and how extended reality technologies such as AR and "Le Petit Chef" are transforming the restaurant experience and consumers' perceptions and expectations.

The second step of the data collection process integrated primary data that included interviews with 15 restaurateurs (a restaurant-centric approach) located in different countries (see Table 1). The goal was to understand how the restaurant sector is changing and the impact AR and video mapping are having on the customer's dining experience. To capture the meanings and perceptions from the perspective of guests (a customer-centric approach),

we conducted online phenomenological interviews (Ardley, 2011) with 20 participants who experienced “Le Petit Chef” in one of the restaurants in which AR has been implemented.

[Insert Table 1 about here]

The phenomenological interviews were conducted online and included participants’ narratives. They allowed us to gain in-depth embedded insights about participants’ experiences (Arnould and Wallendorf, 1994). We first interacted with individuals who had experienced the AR dining experience on social media and forums to learn more about their experiences. We then explained the purpose of our study and invited 45 people to participate in the study. The final sample consisted of 20 participants who agreed to share their “Le Petit Chef” dining experiences with us. The sample included 12 women and 8 men from different countries. The participants, on average, were 44 years old. Table 2 provides the characteristics of participants’ profiles. Online interviews followed a phenomenological logic, a hermeneutic approach to qualitative research, and lasted between 90 and 120 minutes. The interviews were recorded with the authorization of each participant.

[Insert Table 2 about here]

Phenomenological interviews allowed us to capture in-depth insights. Such an interview is the most suitable technique for understanding a new phenomenon in the foodservice industry, namely the AR dining experience, through video mapping. Van Manen (2014) stated that phenomenology is the best-suited tool because it is a thoughtful examination of a phenomenon, “Le Petit Chef,” as deliberately experienced by participants from their perspectives embedded within different restaurant settings. Phenomenological interviews aimed to capture participants’ narratives of their AR dining experiences, perceptions, and feelings and build a comprehensive analysis of the “Le Petit Chef” phenomenon. In line with phenomenology, the researcher used an interview guide developed through a literature

review, including a script of core and complementary questions (Lofland and Lofland, 1995) that focused on technology and digital experiences and AR's use in the restaurant sector.

Similarly, the researcher fulfilled a back-and-forth development by incorporating both the overall intrinsic aspects of the examined phenomenon "AR dining experience" and each participant's specific evolving evidence and perceptions. Participants were invited to talk about their use of digital technologies and their perceptions of extended reality technologies. Then, the researcher explored their "Le Petit Chef" dining experiences by asking them questions about how they perceived the experience: what their feelings and reactions were, how the AR technology affected their dining experiences, and their overall well-being as a result. To sum up, the mixed-method approach used in this study refers to an evolving research process that encompasses socially constructed data through interactions with participants, both guests and restaurateurs (Glaser and Strauss, 1967), using various qualitative data sources (primary and secondary). Qualitative techniques were also used to prevent single-method biases, including phenomenological interviews, mixed perspectives (diners and restaurant owners), and informal interviews with researchers in the field.

3.2. Data Analysis

Data were coded manually in line with the phenomenological and hermeneutic research perspective (Thompson, 1997) and by following an iterative "open" and "unfocused" coding process as suggested by Goulding (2000) to detect possible subjects and patterns of significance to explain the phenomenon. Using an iterative analysis alongside a progressive conceptualization, data from both phenomenological interviews with guests and in-depth interviews with restaurateurs were analyzed by two researchers in a back-and-forth between the literature and the field of our study. We also considered the personal and collective analysis stages to generate a common understanding of how the integration of extended

reality technologies (such as AR in the case of “Le Petit Chef”) can affect a guest’s dining experience.

To guarantee the reliability and truthfulness of the results, we considered a triangulation methodological approach using three different data sources (secondary data, interviews with restaurateurs, and phenomenological interviews with customers). We also involved two researchers and colleagues who are experts in extended reality technologies and the foodservice field. These individuals reviewed the interview guide, raw data, and findings. Several interpretations of the data were generated with this approach, reducing the subjective biases related to the researcher’s interpretation (Belk et al., 1989).

Following Thompson’s (1997) guidelines, the data analysis followed three main stages: First, a manual coding model was constructed and discussed among researchers and colleagues in the field. This step led the researcher to polish the topics and deepen the findings by detecting new themes and categories from the three qualitative data sources. Throughout the coding phase, the researcher ensured categories that emerged from the iteration process between the literature and field, including the three data sources, were integrated into the analysis process. Next, codes were gathered into topics, and the connections between them were identified. Last, the final coded themes were reviewed to ensure they echoed the meanings revealed in the dataset.

4. Findings

The findings suggest that AR can affect consumers’ perceptions of their restaurant experiences according to the five dimensions of the customer experience framework: sensory, affective, behavioral, social, and intellectual dimensions (Wedel et al., 2020; Batat, 2019a).

These dimensions can augment the restaurant experience and be managed by restaurant owners to enhance people's attitudes toward using extended reality technologies in the foodservice sector. Furthermore, the results showed that AR plays a significant role when it comes to improving the overall food well-being of consumers and thus can lead to positive post-consumption behaviors. The following section explores and documents each dimension by showing the characteristics and dynamics that emerged and AR's different effects on customers' perceptions of their restaurant experiences.

4.1. AR's effects on a restaurant experience's sensory dimension

The main sensorial aspects we analyzed in this study that could be affected by AR encompass the five elementary senses: sight, sound, smell, taste, and touch (Wedel et al., 2020; Batat, 2019a; Krishna, 2010).

4.1.1. Sight

The results show that AR's visual aspect enhances a restaurant's sensory dimension and thus immerses customers in the dining experience. Customers insisted on the importance of aesthetics and the quality of the resolution of the visual representations as they related to the enjoyment of their restaurant experiences. The respondents stated that the main benefit of AR's use in restaurants is that it enables customers to appreciate a meal's aesthetic attractiveness, rather than just its functional benefit, such as the information provided by a chef or server describing the ingredients and dishes on the menus. The response most shared by customers was that AR should be a way to add experiential value (Batat, 2019a; Mathwick et al., 2001; Holbrook, 1994) by virtually enhancing the aesthetics dimension of the dining experience as well as the meals and menus showcased in the restaurant. As one participant stated:

“I found it interesting that Le Petit Chef was introducing dishes with colors and good quality of the image; it is both entertaining, and it also opens your appetite. I once tried AR in a store for a virtual try-on of shoes, and the quality of the visual was horrible; so, I couldn’t really appreciate the experience.” (P14, online interview)

“I knew about Le Petit Chef AR, and I think they are doing a great job; I did not introduce this technology in my restaurant, but some colleagues are doing it. I believe that the restaurant industry should adapt to the changing environment; however, before introducing this kind of technology, we have to make sure the images are high quality and with food visuals that enhance the guests’ appetite and prepare them to live a great dining experience; otherwise, if the quality of the image is, for example, low resolution, it can harm the dining experience.” (R4, interview)

Our data highlights a constant theme of customers insisting on the technical and perceptual issues related to AR’s use, such as the quality of the visual displays and colors, which can affect one’s immersion in the dining experience. As evidence, “Le Petit Chef” AR generated a positive impact among diners, who enjoyed their dining experiences because they were fully immersed, thanks to the use of high-quality 3D visuals (pixels, colors, etc.) and high-definition resolution. Research has shown that these two key factors can positively enhance people’s positive perceptions of the AR experience (Wedel et al., 2020) and thus their appreciation of the aesthetics quality of the meals being served in a restaurant. This statement is consistent with Li et al.’s (2010) research that emphasizes the importance of the 3D staging of AR settings items, which can positively affect consumers’ attitudes and intentions. As the following quote revealed:

“I think that in restaurants, it is very complicated to introduce these kinds of AR tools. Honestly, diners do not really need AR, as the food experience is multisensorial in nature, so maybe introducing technological devices could be an obstacle. However, what I liked

about Le Petit Chef experience is the way they have perfectly reproduced all the aesthetics of the food we ate in the restaurant. Also, the images were perfect and not pixelized, which is something I really hate about these trendy AR tools. I can talk about it; one day, I experienced AR in a store, and the quality was so bad that it made me feel sick. I was literally sick after trying it for 5 minutes; I wanted to vomit and was having headaches.”
(P4, online interview)

4.1.2. Sound

We found that sounds in the AR dining experience led customers to interact with the virtual character, namely the chef, which can also generate sounds through stereo speakers. This finding is consistent with prior studies that showed that music could generate higher levels of consumer engagement in virtual environments (Bialkova and Van Gisbergen, 2017).

Participants reported that the AR dining experience with sounds helped them engage with the virtual environment and feel involved, thanks to the music and background sounds displayed in the AR experience. One participant noted the following:

“It was fun hearing, in Le Petit Chef, the cute little character talking to us and expressing his joy and fear while preparing the dish. Especially, I liked [it] when he was describing the recipes like saying: this is caviar. I was totally immersed to the point that I forgot I was in a restaurant. I really like the way they worked on sounds and music; it made me feel good and enjoy my dining experience. We also laughed a lot with my friends; it was a real gourmet and entertaining dining experience.” (P20, online interview)

However, implementing sound reproduction in real-time within virtual settings is particularly challenging (LaValle, 2018) because a balance between sounds in the real and virtual environments must be maintained; this must be done to avoid overwhelming

customers with “noise” and thus their experiencing negative perceptions of the AR experience:

“Adding sounds and music in AR dining experiences is a good idea; however, don’t forget that the restaurant is by nature a highly animated place that includes many intersections: among guests and between guests and restaurant staff. So, if AR does not take into account this factor, this would end up in generating real chaos and thus negatively influence the appreciation of the dining experience.” (R12, interview)

“Usually, I don’t like it when restaurants use technologies because it is not needed; the food, the service, and sharing the dining experience with friends is enough. We do not need to talk to other virtual avatars when we go to the restaurant as we are already with friends and families. It could be overwhelming; imagine yourself talking to your friends, and you should also manage the virtual people in AR; it’s madness. What I liked about Le Petit Chef experience is the limited interactions between the virtual character and the guests. They offered the perfect dose and balance.” (R9, interview)

4.1.3. Smell

Although previous studies show that it is challenging to simulate smell in virtual settings due to a lack of technology and ideas (Wedel et al., 2020), our results revealed that the AR used in a restaurant’s physical setting had affected consumers’ perceptions of odors. The AR dining experience has activated guests’ olfactory food memory and thus enhanced the diners’ immersion in the virtual environment. Participants reported that seeing food featured in the 3D video projection through AR helped them anticipate scents and aromas related to the dishes being served. As one participant stated:

“The fact that I was seeing Le Petit Chef creating the meal that was served to me later on, I was also able to not only see the food but also smell it, although it was virtual. I was able to capture the odors of the meal prepared for real.” (P2, online interview)

It should be noted that although technically possible, the AR experience did not simulate the sense of smell. Instead, the experience evoked the *sense* of smell among guests via the content displayed (Batat, 2019a)—namely, via the food preparation shown in the 3D video. Both participants and restaurateurs expressed this idea when commenting that it might be interesting to integrate odors through stories and creative content that appeals to the five senses to create immersive AR experiences:

“I think we should also focus on smell in the AR tools being implemented in the restaurant sector. As you know, smell can enhance the dining experience and thus prepare diners to enjoy the overall food experience. To do this, we need to invest in installations as well as in innovative olfactory technologies.” (R8, interview).

“Le Petit Chef AR experience did not integrate smell. I think it would be great to have this sense displayed in the virtual space, but I’m wondering whether this is compatible with the smell of food already present in the restaurant.” (P12, online interview)

4.1.4. Taste

It was common for our participants to emphasize the impact of AR on their tastes. Guests tended to think that seeing food preparation displayed in the virtual dining experience enabled them to predict each dish’s taste virtually and increased their desire and willingness to taste the food featured in the virtual setting. As one participant reported:

“Seeing the food prepared in the AR animation has increased my appetite and opened my palate. I was really very looking forward to enjoying the real taste of the food that [was]

being virtually displayed; it does not happen for me when I read menus, for example.”

(P10, online interview)

In contrast to previous works that minimized the impact of AR on taste (Wedel et al., 2020 other), our results show that making meals in virtual settings through the projection of 3D video on guests' tables positively affects a customer's perceptions of taste. Because eating is a multisensory food experience (Batat et al., 2019), the meal is not only perceived according to taste and odor but is also affected by visuals generated by AR. AR tools can alter the perception of how foods taste by changing environments from physical to virtual (Stelick et al., 2018).

4.1.5. Touch

The results reveal that respondents did not perceive the benefit of AR technology when it came to enhancing their perceptions of touch. “Le Petit Chef” AR dining experience does not integrate physical interactions with guests because they do not interact with the projected character. Also, they cannot experience touch through connected gloves that give them a sense of contact. However, according to our participants, guests can experience touch through the physical environment in the restaurant when the virtual meal is served in the real environment of the restaurant:

“What is interesting with Le Petit Chef experience is the fact that you can touch and feel the food and the textures because the virtual food is served for real. For example, with your fork, you can touch the food and feel the tenderness of the lobster you just saw in the 3D projection.” (P9, online interview)

As the previous quote indicates, participants did not need to experience touch as part of the AR dining experience because the restaurant allowed them to perceive touch for real when the meal was served. Although current studies emphasize the importance of including

touch sensations through haptics that allows the human body to feel contact with real environmental elements (e.g., Wedel et al., 2020; LaValle, 2018; Tham et al., 2018), our study shows that even if the AR dining experience does not include touch, it is stimulated because it occurs in the real atmosphere—the restaurant in which touch is incorporated through different components not related to AR but related to the physical setting (the restaurant), such as the touch of food, cutlery, and so forth.

4.2 AR's effects on a restaurant experience's social dimension

Participants acknowledge that the integration of AR tools might affect the social dimension of the restaurant experience. One of the main aspects respondents mentioned is the critical role AR tools play in terms of enhancing the social interactions (Scavarelli et al., 2020) among guests and their restaurant staff. The AR dining experience had a positive impact because it was perceived as an ice-breaker activity that facilitated social interactions among customers dining with one another well as their interactions with other customers and staff. As one participant noted:

“I guess what made this experience lovely is the fact that thanks to the cute character projected, we started to interact with people in the restaurant that, without this technology, [we would] most probably never talk to. I guess people in the restaurant and the staff liked the idea that AR has created links between people and made the experience enjoyable.” (P17, online interview)

Likewise, the interaction with the content, especially the storytelling (Santano and Thwaites, 2018) and the character displayed in the 3D video positively affected the extent to which customers enjoyed their physical dining experiences. This is because participants enjoyed the direct effects of the animation from the image and the sound as well as the indirect effects, such as stimulated taste, smell, and touch the experience generated.

Furthermore, our findings show that the use of AR technology in restaurants enhanced customers' perceptions of playfulness and enjoyment because of the technology's device-free aspect: In contrast to technologies that require customers to use their mobile phones, AR/VR headsets, glasses, and other devices, it was not a requirement for "Le Petit Chef" experience. Instead, a high-resolution 3D video projector displayed visuals directly on guests' tables. Because no technological efforts were required of guests, their dining experiences were fully immersive. Participants noted that device-free AR experiences are more immersive than the ones that integrate the use of digital devices such as smartphones or AR/VR glasses:

"What I liked about Le Petit Chef is the fact that to live this AR dining experience, we did not make any efforts, and also, we were not required to use our phones or a VR headset. Headsets are not very practical and can create a negative feeling, especially when you wear glasses like me. Ideally, to enhance the immersion, it would be great to remove all the devices between the users and the virtual world." (P7, online interview)

4.3 AR's effects on a restaurant experience's intellectual dimension

Our respondents identified the intellectual dimension as a key benefit of using AR to enhance the customer's restaurant experience. Engaging in immersive technologies enhances a consumer's knowledge (Suh and Lee, 2005), edutainment (Makarius, 2017), enjoyment, escapism, and playfulness (Kang et al., 2020; Mathwick and Rigdon, 2004). Thus, the edutainment aspect derived from the use of AR allows diners to develop and enhance their food literacy (Batat et al., 2016) and their food cognitive skills (Batat et al., 2019) in a playful and entertaining way. One participant's comment highlights the importance of playfulness and its ability to increase a customer's food literacy and knowledge, which, in turn, led to an immersive experience for the guest:

“Using technologies, especially AR, can sometimes be boring. Le Petit Chef got it all as it is a fun experience, and you can learn about food ingredients and recipes. This was the most engaging and educating AR experience I have ever had. We could even use it to teach people about healthy food behaviors and develop their interest in healthy eating and cooking.” (P1, online interview)

Each AR dining experience initiates an intellectual process through a cognitive and educational emphasis in the virtual 3D animation that constitutes a source of intellectual stimulation for diners. This will encourage diners to develop a food learning mindset through fun and behind-the-scene food recipe encounters (Falk et al., 2012) and thus enhance their food literacy (Batat et al., 2016) as part of the AR dining experience. Likewise, both participants and restaurateurs highlighted the intellectual dimensions by referring to the pedagogical content used in the AR dining experience, which they associate with the production and development of knowledge.

4.4 AR’s effects on the restaurant experience’s affective dimension

An AR experience also integrates an affective dimension that can be explained by hedonism (Kang et al., 2020) and the flow (Csíkszentmihályi, 1988; Batat 2019a), which can increase customers’ affective responses to their interactivity with AR tools (Javornik, 2016). During this flow state, the brand’s value dissolves, the individual’s self-consciousness vanishes, and his or her perception of the temporality becomes distorted (Csíkszentmihályi and LeFevre, 1989). Our results show that diners perceived that AR created an immersive and affective dining experience that positively affected their experiential pleasure of food (EPF) journey. The EPF journey is a multifaceted concept that considers how pleasure contributes to food well-being in the entire process of anticipation, purchase, consumption, and remembrance of food experiences (Batat et al., 2019) and thus improves people’s overall

food well-being (Block et al., 2011). Various participants referred to this point, as illustrated by the following quotes:

“I suppose that this experience made me eat slowly; I did not binge eat and enjoyed my dinner once the food was served. Maybe because I was trying to connect the meal with the AR content and make sense of all this.” (P5, online interview)

“I enjoyed my dinner; the atmosphere was great, the staff smiling, and the other diners were very nice. This AR animation created all this; you feel like it gets people together. I’ll remember it forever; it made me feel so good. I’ll recommend it to others.” (P13, online interview)

Previous studies have indicated there are negative effects related to the use of AR tools. For example, people can experience sadness in the post-virtual reality stage because the “real” world is not as exciting as the simulated world. However, our results revealed diners had positive feelings in the post-AR stage because they were not totally disconnected from the real environment. Instead, they lived the dining experience in between real and virtual settings. In other words, the guests were connected to both environments simultaneously, which is referred to as phygital (physical + digital), the third realm of the customer’s experience (Batat, 2020b). This idea is expressed in the following quote:

“It’s fun. I was very happy and excited before and after the AR dining experience, you know it is like Disneyland; it makes your day, and then once you are done with your dinner, you feel in a good mood, and you want to hug everyone... that was my real post-experience feeling.” (P18, online interview)

Therefore, engaging in immersive extended reality technologies can enhance a consumer’s restaurant experience, delight, and amusement (Kang et al., 2020). In the AR restaurant experience, diners’ perceptions of well-being encompass inherent pleasure and escapism (Mathwick and Rigdon, 2004); the former indicates entertainment that is generated by the use

of AR (Bloch et al., 1986); the latter refers to a state of psychological immersion that allows diners to momentarily escape the real world (Lombard and Ditton, 1997). Despite the potential benefits of AR in improving a diner's well-being and perception of the restaurant experience, there are also disadvantages related to the technology. First, it was mentioned that the entertaining aspect of the AR dining experience could prevail over the perceived quality of the overall food consumption experience. That is, the hedonism of AR immerses diners in an enjoyable restaurant experience (Kang et al., 2020) but can also diminish the purpose of the restaurant experience, the quality of the food and service, as both participants and restaurateurs commented:

“The integration of AR is a good idea, but the first focus should be on AR tools that will enhance and not harm the food and service quality; this is an important factor to create successful restaurant experiences.” (R14, interview)

“It is important that all elements: food, service, and good quality of AR should be gathered to create a positive dining experience. For instance, Le Petit Chef experience integrates all these factors: the food was great, the service was customer oriented, and the technology was without any technical issues or efforts.” (P15, online interview)

Furthermore, the benefit of the AR dining experience may not be enduring for restaurateurs relative to its investment. Scholars note that technological novelty creates enthusiasm for consumers (Pantano, 2014), which is consistent with our results. Our result showed high levels of excitement related to AR's ability to enhance the dining experiences of consumers. However, our findings also highlighted that consumers could perceive an AR dining experience as boring if they repeat it. Why? Because the second time such an experience lacks factors such as the surprise or “wow” effect. Thus, the level of enthusiasm among customers will be lower than it was with the first experience. However, sharing the dining experience with friends, relatives, or siblings who are new to the experience could

encourage diners to repeat the experience. Participants illustrated this point in the following quotes:

“I mean, for me, it [was] like a “wow” effect the first time I did Le Petit Chef, but then if I return to the same restaurant, I would expect a different AR experience. Otherwise, it’s going to be boring to relive the same experience with the same AR content and usage.”

(P11, online interview)

“I can come back to the same restaurant and live the identical AR experience and enjoy it for the second time if I’m with my kids or with friends, who did not experience it.” (P8, online interview)

4.5 AR’s effects on a restaurant experience’s behavioral dimension

This study highlights the impact of AR on consumers’ behavioral responses toward a restaurant’s service, food, and overall experience. In any restaurant selection, the consumer’s decision-making process is based on his or her former restaurant experiences, perceptions, and knowledge about the type of restaurant being considered (Alonso and O’Neill, 2010). Our findings reveal that when AR is used to create immersive dining experiences, particularly in terms of the novelty of the technology used, it can result in diners giving a restaurant greater selection consideration. This theme was illustrated by one participant, who mentioned a prior virtual dining experience:

“I went to a restaurant where they were using iPads to order food and automatic robots to serve the guests. I found it interesting. That’s why I was very curious when I knew about Le Petit Chef; I was interested in experiencing it.” (P16, online interview)

Once diners had experienced the meal’s virtual projection, they were encouraged to select the entire menu displayed in the 3D video. Although their initial choices consisted of one course, diners ultimately ordered all of the courses displayed via AR to try out different ones

(Romano et al., 2020). Diners also reported that AR would help them to change their minds and try new dishes. As one participant noted:

“From my table, I was observing the table next to mine when they had their AR animation; I was intrigued by the visuals of the dishes, so I asked the waiters, and I ordered all of them; they looked yummy...” (P3, online interview)

AR’s use can serve two purposes: (1) proposing alternatives; or (2) guiding customers to select the right products and services that fit their needs (Garaus et al., 2015). Apart from enlarging the diner’s consideration set in terms of trying novel food, conversely, our results show that the AR restaurant experience helped diners limit their food-choice sets (Romano et al., 2020). Participants found that AR was most valuable when they first visited a new restaurant or when they were unfamiliar with the food culture, such as eating Indian food for the first time:

“I think the use of AR can be interesting in the case of ethnic restaurants or when you don’t know the food culture. In this case, using AR can help us to select the right dish and thus avoid disappointment because you were expecting something else...you know what I mean...your face when you see your dish coming over, and you want to say this is not my order!” (P15, online interview)

5. Discussion and implications

The purpose of this study was to gain an understanding of the impact AR has on consumers’ perceptions of the restaurant experience. Particularly, this research examined the customer’s experience along five dimensions—sensorial, behavioral, social, affective, and intellectual—using AR technology. Conducting qualitative, mixed-method research that included various sources of data revealed different ways in which AR can affect the five dimensions of the customer’s experience. It was proposed that AR can enhance a consumer’s immersion in the

restaurant experience and thus have a positive impact on the diner's enjoyment (delight and enchantment), hedonism (food pleasure derived from the experience), and overall food well-being. Similarly, AR can expand the consumer's food choices in a restaurant setting and positively affect one's food sensations. We also determined that AR has an impact on the taste of food and is seen to enhance a consumer's experiential food pleasure.

Conversely, our study identified obstacles or ways AR technology can negatively affect the customer's experience if the technology used is unsophisticated. The same is true if the AR experience is fraught with technical issues, which will detract from a consumer's perception of the overall experience.

Furthermore, the findings show that the perceptions of service providers (restaurateurs) and consumers (diners) were aligned as they both expressed enthusiasm and skepticism toward the use of AR technologies to enhance the restaurant experience. Although both restaurateurs and consumers agreed on the importance of the connection between AR content and the dining experience, including the five senses to enhance the restaurant experience and consumer's food well-being, they also showed their skepticism toward AR's use in restaurants. For restaurateurs, AR should be a mature and technically advanced technology; otherwise, it can generate a negative experience. Moreover, restaurateurs were skeptical because of the cost of the technology and the already highly animated nature of the restaurant experience, which includes many social interactions. Thus, adding AR to the mix could negatively affect the diner's experience. From a consumer perspective, diners expressed their skepticism toward AR due to two main aspects: its novelty and context. Our findings revealed that AR could positively surprise diners if it is their first experience; however during subsequent visits to the restaurant, the diners would expect a new AR experience—a new story and novel content, new themes, and so on. The context was also mentioned as an

essential aspect of integrating AR to enhance the restaurant experience. For instance, in some situations, such as a business diner or a romantic diner, the use of AR could be a distraction.

5.1. Theoretical contributions

This research makes three major theoretical contributions by investigating AR's impact on the customer's experience in the foodservice field. First, it adds value to the existing literature on extended reality technologies and their application in the restaurant sector. Prior works have mainly examined the adoption of AR technology by considering consumers as technology users in the purchase process (Lee and Lee, 2019; Yung and Khoo-Lattimore, 2017) rather than from the customer experience perspective.

This study, to our knowledge, is the first to focus on AR's adoption based on the consumer's perception of its experiential benefits. Five observations were made: AR's use in the restaurant experience is shown to significantly enhance the immersion and engagement of consumers when they feel the technology is efficient and does not require any effort on their part. When this is the case, a consumer is more likely to develop a positive attitude toward the use of AR in restaurants. In terms of extended reality technology research, the importance of technical aspects and avoiding a high cognitive effort on the part of users to engage them in the AR experience (Greenfeld et al., 2018) are two key factors to induce positive feelings and thus favorable attitudes toward AR consumption experiences.

The result of this study is consistent with prior research that emphasized the importance of the functional benefits of technology when it comes to creating immersive and positive experiential and behavioral intentions (e.g., Cuomo et al., 2020; Wedel et al., 2020; Romano et al., 2020; Javornik, 2016). Likewise, the findings show that the AR restaurant experience can increase the satisfaction of customers when the performance is unexpected. Indeed, diners who are enjoying their first AR restaurant experiences expressed positive perceptions

of the lived experience; the experience was better than what they expected. In this sense, our findings enrich the existing body of literature related to customer-service satisfaction, especially the expectation disconfirmation theory (Grimmelikhuijsen and Porumbescu, 2017). Our study shows that the use of AR can generate delight among customers due to positive disconfirmation that occurs when the performance is perceived to be better than what diners expect, which was the case with the Le Petit Chef dining experience.

From a psychological perspective on technology innovations, the current research contributes to the existing literature (e.g., Araujo, 2018; Setia et al., 2013) by advancing our understanding of how a new technological innovation, namely video mapping, which lies at the intersection of different technologies (holograms, 3D, motion capture, and augmented reality) might positively or negatively affect a diner's psychological, social, and experiential dimensions—and thus food well-being. Previous work, though limited, highlights that theories and research grounded in a psychological perspective related to technology adoption can help identify factors that can allow service providers to understand the psychology behind the adoption or rejection of technological innovation. Ultimately, this can help service providers create enchanting AR experiences, which can enhance the cognitive and emotional well-being of both customers and staff in the servicescape.

In line with former works that highlighted the negative impact of the diversity of products on a consumer's decision-making process—one that might possibly lead to confusion and stress (Garaus et al., 2015)—our findings reveal the positive role AR plays in enhancing people's food choices when they are confronted with an extensive assortment of possibilities (e.g., various types of food on menus). Thus, AR can reinforce the self-confidence consumers feel when making choices by reducing the number of them offered (Romano et al., 2020).

Indeed, by visualizing food, consumers may feel more confident about their food choices (e.g., its expected taste and ingredients). Furthermore, this study contributes to previous

works that have highlighted the sensorial impact of AR on three main senses, namely sight, sound, and touch (Wedel et al., 2020). Our research advances the literature on extended reality technologies by showing that AR used in the context of the restaurant experience can also impact two other senses, taste and smell, and thus increase the level of the consumer's immersion and willingness to purchase products and enjoy the experience.

Second, our study contributes to food marketing by advancing the literature on the food experience and the consumer's food well-being (Batat et al., 2019; Block et al., 2011). Our results revealed the positive effect AR has on the food consumption experience. Batat et al. (2019) indicate that to achieve his or her food well-being, the consumer has to go through an experiential journey that encompasses three stages: contemplation (food sensory), connection (food social sharing), and creation (food culture and storytelling). We found that AR in the restaurant experience can enhance consumer's food well-being because this technology is considered a driver for a positive food experience. AR helps consumers achieve their food well-being through these three stages: (1) in the contemplation stage by providing a highly sensorial restaurant experience that involves the five senses; (2) in the connection stage by improving the social interactions among people (the staff, one's dining companions, and other customers), and in different settings including both real and virtual settings; and (3) in the creation stage by improving the immersive dimension of the food experience through the use of storytelling as well as a creative and edutainment content that enhances food literacy (Batat et al., 2016; Block et al., 2011) and the consumer's overall food well-being.

Finally, our results contribute to the growing body of research on merging real and virtual settings and the rising concept of the phygital (physical and digital) customer experience (Batat, 2019a; 2020b). In line with Baudrillard's (1983) notion of hyperreality and Batat's (2019a) concept of phygital, AR plays a critical role in creating a continuum between the physical place and the virtual space. Our results show that phygital as the third realm creates

a new set of hybrid consumption experiences that are not entirely physical nor simply digital but combine the features of both spheres. Phygital, created by the integration of AR, has distinctive characteristics and can either enhance or diminish the customer's experience. Thus, the phygital setting has implications for the way in which restaurants and other businesses engage consumers via AR; phygital does so by combining the two worlds and thus offering consumers more immersive and fulfilling experiences (Batat, 2020b).

5.2. Implications for practice

This study suggests that businesses, especially restaurants, should consider certain aspects when deciding whether or not to implement AR. Instead of focusing on the positive sides of AR, our findings show that AR integration can also negatively affect the customer's experience if it demands effort from the customer or if the technology is not technically mature and efficient. Consequently, it is critical for foodservice professionals to understand both consumers' functional and emotional needs as well as be aware of both the positive and negative aspects of AR. The goal is to avoid any kind of negative experiences generated by the technology, the customer's relationship to technology, and the person's expectations.

The use of AR by restaurants is in its early stages. Thus, restaurants should integrate it by stages, depending on the profile of consumers—that is, whether they are tech-savvy and early adopters or reluctant and technology laggards. Laggards should first be convinced of the value the technology offers regarding the customer's experience, including its behavioral, sensorial, intellectual, social, and affective dimensions. Furthermore, because AR is relatively new, many consumers are more open and eager to accept its integration and share their experiences with it. As suggested by our findings, the integration of AR should focus on creating innovative, consumer-centric experiences with evolving content so as to avoid a *deja-vu* effect. The novelty appeal is not an enduring aspect and can be ephemeral.

Additionally, we found that diners in a restaurant paid more attention to the aesthetics and the story surrounding the food than food or menu items. This could potentially affect their food well-being and result in customers binge eating or over-ordering, which is an aspect foodservice professionals should consider when they select food and menu items being featured via AR. To enhance the customer's experience in the foodservice sector, restaurants might also consider offering customers the ability to co-create and get involved in the AR experience. This could be done, for example, by cooking with the chef or ordering through AR, which engages consumers and gives them confidence about their food choices. Furthermore, including personalized messages or stories about an establishment in the AR content provides an opportunity for new or emerging restaurants to communicate directly about their values and thus create strong connections with their guests. Indeed, because AR encourages flow and immersion, customers can more vividly remember the restaurant experience.

5.3. Limitations and future directions

Like all research, this exploratory research has certain limitations. Because of the qualitative nature of the study, we were able to provide initial insights into the definition of the five dimensions of the customer's experience in the context of AR usage. However, future research should integrate a quantitative approach to the findings and experiments, primarily by examining how AR experiences affect the taste food and testing different situations using larger sample sizes. Our sample size was limited and did not integrate sociodemographic criteria. For instance, the consumer's perceptions of an AR dining experience might be different for male versus female consumers and consumers of different ages and ethnicities.

Furthermore, we recruited participants based on their past AR restaurant experiences, but we did not follow and observe them in the restaurants during their experiences. To address

this limitation, further research can be implemented onsite via an ethnographic approach. This would enrich our findings and capture new dimensions embedded in the context. Future studies extending the current research findings could integrate other types of extended-reality tools within different sectors, such as museums, hotels, events, or even higher education settings. Finally, it could be interesting to conduct a longitudinal study because AR is evolving rapidly and could become obsolete as newer technologies emerge.

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Table 1. Restaurant sample profiles

Restaurant ID	Gender	Age	Location
R1	Female	63	Paris
R2	Female	50	London
R3	Male	45	London
R4	Male	38	Madrid
R5	Female	55	Milan
R6	Male	45	Rome
R7	Male	50	Dubai
R8	Male	52	Paris
R9	Male	47	London
R10	Male	42	Paris
R11	Male	46	Paris
R12	Male	44	Brussel
R13	Male	60	Rome
R14	Female	56	Milan
R15	Male	55	London

Table 2. Participants' profiles

Participant ID	Gender	Age	Occupation	Location
P1	Female	25	Communication	Australia
P2	Female	45	Hospitality	London
P3	Male	60	Marketing	New York City
P4	Female	35	Banking	Paris
P5	Female	40	Administration	Milan
P6	Female	26	Student	San Francisco
P7	Male	65	Digital	Dubai
P8	Male	63	Hospitality	Istanbul
P9	Female	55	Professor	Lausanne
P10	Male	45	Communication	Paris
P11	Female	42	Banking	New Zealand
P12	Male	48	Hospitality	Russia
P13	Male	38	Freelance	Dubai
P14	Female	32	Freelance	Qatar
P15	Female	26	Entertainment	Paris
P16	Male	31	Administration	Russia
P17	Female	27	Student	London
P18	Male	63	Retired	New York City
P19	Female	47	Administration	Budapest
P20	Female	65	Retired	Dubai