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Augmented reality marketing: A technology-enabled approach to situated customer experience

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ABSTRACT

Recent advances in Augmented Reality (AR) technologies have led to a growing interest in their application for marketing strategy and practice – what we term Augmented Reality Marketing (ARM). However, despite emerging publications on the subject, managers and academics struggle to articulate how ARM delivers experiences that are valuable to customers in a way that is different from other marketing approaches. In this article, we review the emerging literature, and define ARM as a customer-facing interface for the application of digital marketing technologies in physical settings. Rooted in a class of 'situated cognition' theories from social psychology, we identify a unique set of digital affordances which ARM offers beyond extant marketing approaches in traditional media. By drawing on the key conceptual building blocks of situated cognition theory, we develop a framework of ARM experiences to synthesize current research and applications, and to suggest directions for future research.

1. Introduction

Enabled by mobile computing technology, Augmented Reality (AR) is emerging as an experiential interface for digital marketing technologies that seamlessly blend interactive digital content into a person's view of the physical environment (Azuma et al., 2001; Porter and Heppelmann, 2017). From a managerial perspective, the application of AR in marketing—what we term *Augmented Reality Marketing* (ARM)—focuses on creating *digital affordances* for customer experiences, which are the digital cues in a physical environment designed to scaffold (i.e., assist) customer actions and experiences. Such digital affordances engage customers in a contextually and experientially rich manner (Heller et al., 2019a; Poushneh and Vasquez-Parraga, 2017); they thus trigger so-called *situated cognition* where customers rely on and actively interact with a virtually-enhanced (marketing) environment to guide their decision making (Hilken et al., 2017). For example, customers looking to redesign a living room can use the Dulux 'Visualizer' and invite friends and family to give purchase advice by virtually trying out different wall colours (Hilken et al., 2020). Customers can then use the Ikea 'Place' app to project holograms of Ikea furniture into the living room, that helps them see, rather than only imagine, how those pieces of furniture relate with the existing décor (Heller et al., 2019a). In light of growing relevance of digital affordances in marketing, thought-leaders like Michael Porter proclaim that "every company needs an AR strategy" (Porter and Heppelmann, 2017, p. 6) and many firms (e.g., Google, Snapchat) are following suit by deploying ARM as their customer-facing interface for digital customer experiences.

Yet, despite documented ARM deployment across many stages of customers' purchase journeys (Hilken et al., 2018; Javornik, 2016) and its influence on their purchase decisions (Hilken et al., 2017) or brand attitudes (Rauschnabel et al., 2019), broad adoption of ARM remains uncertain (Davis, 2019; Haque, 2015). Part of this uncertainty revolves around sparse conceptualisation of ARM and poor distinction from existing marketing approaches. This led many firms to fail in deploying ARM applications that customers value and embrace. Sparse conceptualization reflects a legacy understanding of AR as a niche media channel (Javornik, 2016), which constrains how managers approach ARM.

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Indeed, recent market surveys show that in the face of slow customer adoption (Gartner, 2018), many firms are increasingly discouraged to (further) invest in AR, believing they lack the knowledge and capabilities to reach and engage their customers at scale through AR (Willersdorf et al., 2019). In particular, managers find it difficult to make the right choices related to user experience through content offerings that will position AR as an everyday technology. This reveals a clear need for a more comprehensive managerial understanding of ARM experiences. In other words, we need to understand how ARM creates and delivers experiences that are valuable to customers in a way that is different from other marketing approaches.

Current research offers limited guidance on this question. Individual studies have argued that ARM's ability to let customers 'situate' their thinking (e.g., by projecting furniture into their living room) offers firms a degree of influence over customers' decisions (Dror and Harnad, 2008; Hilken et al., 2017). Likewise, Heller et al. (2019a) have shown that customers might buy more and pay a premium for products selected using ARM. However, to date, researchers have not integrated such findings within a broad conceptualisation of ARM. This lack of broad conceptualisation reflects a legacy of early research that introduced AR as a niche media channel in marketing (Javornik, 2016), and the applied engineering focus towards AR by the technology giants like Apple, Facebook, Google, and Microsoft. These giants have engaged in a race to make AR ubiquitous across their platforms with investments projected to reach $100 billion by 2024 (GrandViewResearch, 2016). However, with much of the effort towards AR driven by engineering criteria, there is a danger of overinvestment and a "build it and they will come" mentality (Markus and Keil, 1994). While such a market orientation (Kohli et al., 1990) might provide a general principle for the application of AR in marketing, crucially, for marketing managers the successful deployment of AR as a new customer-facing interface hinges on conceptualising ARM along its unique customer experiences.

In this article, we draw on situated cognition theory to conceptualize ARM as a distinct form of digital marketing. While situated cognition theory has not been widely researched in marketing, previous studies have recognized its unique relevance to AR (Hilken et al., 2017). Situated cognition theory posits that customer judgments and behaviour are highly contextual and are driven by cues in the local environment (Schwarz, 2006). Central to this theorizing is the notion of affordances (Greeno, 1994), which in the ARM-context, we define as *digital cues in the physical environment designed to guide the customer's experiences and actions towards a goal*, where the goal can be, for example, informing oneself about a product or service, or making a purchase. We contribute to extant literature by classifying different types of ARM affordances. This classification aims to help managers apply ARM as a customer-facing interface for a suit of digital marketing technologies and to provide an encompassing framework for future research.

To achieve this, we map ARM affordances to the specific principles of situated cognition theory (Smith and Semin, 2016), which reflect a customer's embedded, embodied, adaptive, and shared experiences (Robbins and Aydede, 2009). The embedded and embodied experiences describe interactions with ARM's customer-facing interface, while adaptive and shared experiences enrich those interactions. Using our classification, we review the emerging literature across related disciplines to identify dimensions on which types of ARM experiences can be described within each class of experience. Following these dimensions, we identify current applications, and discuss future research directions for ARM. We conclude the article with implications for theory and practice.

2. Conceptualising augmented reality marketing

In this article, ARM refers to the creation, communication, and distribution of digital affordances in the physical environment with the aim of improving customer experience and decision-making. Affordances, in general, describe those properties of an environment that facilitate interaction with it (Greeno, 1994). In an AR context, digital affordances are achieved through integrating interactive, adaptive, and shareable digital content (e.g., images, information or instructions) into the user's view of the physical environment with the aid of mobile or wearable technology (e.g., smartphones cameras or smart-glasses) (Dunleavy et al., 2009). In the marketing context, the function of these affordances is to scaffold (i.e., assist) customer experience, decision-making, and responses (Hilken et al., 2018). For instance, AR can do this by adding or subtracting information in the customer's perception of the physical environment. For example, digital arrows, lines, and waypoints displayed with an AR application like 'Dent Reality' assist customers in navigating through a supermarket. A digital arrow pointing left becomes an affordance of the supermarket's ARM that scaffolds customers' behaviour to go left, for example, to quickly find a jar of Tikka Masala or to discover that the product is currently on sale. Conversely, removing information by de-saturating colour from a view of other brands of Tikka Masala on a supermarket shelf helps customers locate their favourite brand by reducing information load. The process of scaffolding through ARM facilitates not only actions, but also customer experiences. For instance, when customers project realistic 3D holograms of Ikea furniture into their living room, this improves decision comfort, as customers modify holograms in-real time, move them around the room effortlessly, and interactively share with friends and family around the world (Carrozzi et al., 2019; Heller et al., 2019; Hilken et al., 2017).

Conceptually, the experiences enabled by ARM parallel a class of theories in social psychology called situated cognition. Semin and Smith (2013) describe situated cognition by evoking the environment (what they call embedded cognition) and the customer's actions within that environment (i.e., embodied cognition), stating that situated judgments are inherently malleable (i.e., adaptive) because they rely on cues within the physical and social context (i.e., distributed cognition). In marketing, these principles imply that customer experiences are most compelling when customers evaluate products and services in a personally relevant context (i.e., embed experiences), physically interact with products and services (i.e., embody experiences), experience offerings that adapt to their needs and tastes (i.e., adaptive experiences), and share product or service experiences with other customers (i.e., distribute experiences). Situated customer behaviour that results from these experiences can be measured using traditional metrics like choice, loyalty, or word-of-mouth. However, in the ARM context, these metrics depend on the digital affordances and are influenced on the spot. For example, rather than relying on customers' existing beliefs, 'Dent Reality' can scaffold a customer's choices by displaying personalized offers in real-time and at the point of sale when customers move around a supermarket. These offers can become adaptive with the application of predictive algorithms that anticipate customer behaviour; and they can be distributed when customers leave reviews and ratings in the physical environment via ARM.

Applying a suit of digital marketing technologies via the ARM interface not only aligns with a person's situated way of thinking, but also extends the customer's experiences beyond the range of ordinary perception. For instance, experiences of embedded cognition are extended when the 'W-in-a-box' app increases 'packaging real-estate' using AR animations that engage customers with

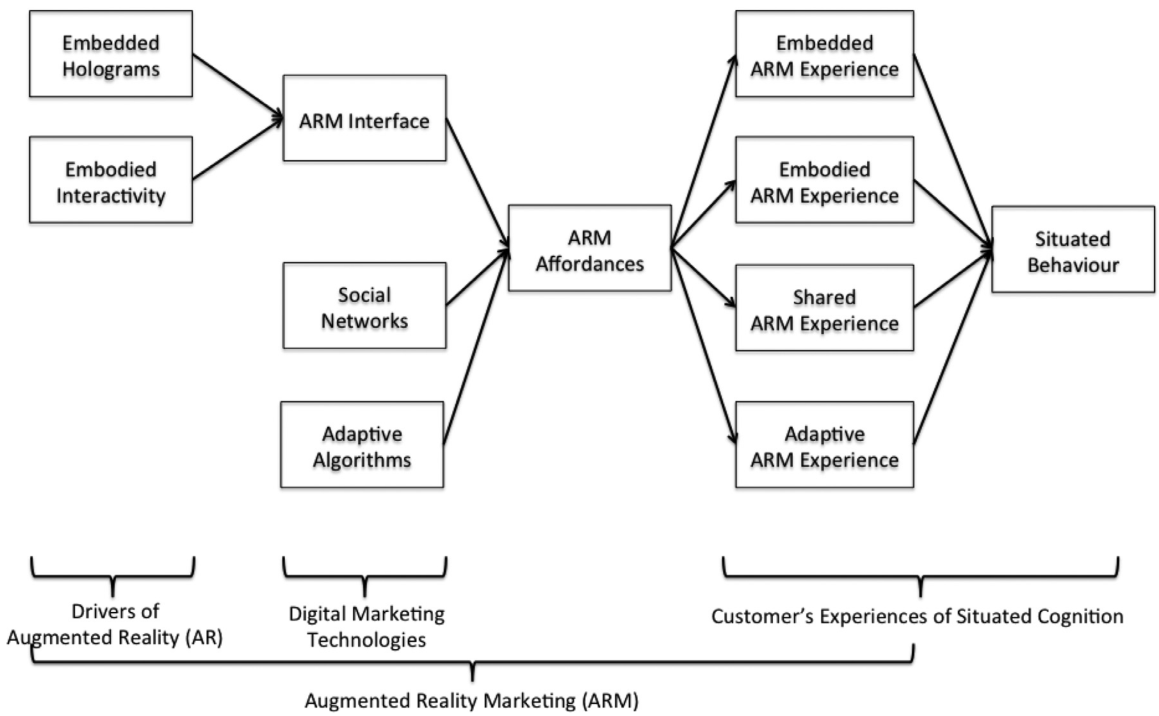

Fig. 1. Framework of Augmented Reality Marketing (ARM) as enabler of situated digital customer experiences.

the environmental benefits of drinking its water from a cardboard box. Embodied experiences may be similarly extended with the 'SketchUp Viewer' that applies novel sensory interactions for architects to control entire AR buildings with hand gestures or voice commands. Adaptive experiences arise when Ikea's 'Place' app selects a colour of an AR chair to automatically match a room's decor. Finally, distributed cognition becomes extended when an application like 'Metaverse' helps customers to distribute AR 'tags' in physical locations effectively co-creating Geocaching experiences for others to follow.

In Fig. 1, we illustrate the conceptual relation between the ARM interface, which embeds and embodies digital content, and the suit of existing digital marketing technologies of computer-mediated social networks and adaptive algorithms that cross the boundary from their current application online into the physical world using the ARM interface. This fusion of digital marketing technologies results in distinct affordances of ARM that engage customers in situated cognition experiences and affect behaviour.

2.1. Classifying embedded arm experiences

ARM is distinct from other forms of digital marketing because it provides so called *embedded* experiences – that is, digital experiences that seamlessly integrate digital content (e.g., product images, information or instructions) into the physical environment (Hilken et al., 2017). An AR device like the Microsoft's 'HoloLens' (Kalantari and Rauschnabel, 2018) uses sensors and computer vision to scan its physical surroundings creating a real-time 3D map, for instance, of a customer's living room. It then projects a realistic image of an Ikea chair in the customer's view of the living room. The realism stems from an accurate relation of the 3D holograms with physical objects in the room. The customer sees in how far the hologram is in proportion to physical objects, how its colour contrasts with those items, and can instantly compares it within the confines of the room. ARM helps customers experience those contextual relations that often are too complex to imagine when described with words, pictures, or video. For many products (e.g., furniture or home appliances) contextual relations determine significant part of their value. However, estimating contextual relations outside their intended use context (e.g., in a store versus in a living room) strains the customer's mental imagery processes. Heller et al. (2019a) find that while shopping using an Amazon's AR app, customers were willing to pay a higher price for products because the uncertainty about contextual relations between a product and its intended use context was reduced.

ARM embeds not only holograms of products, but also contextual information about those products. For instance, embedding a green check mark next to products that match a customer's dietary needs (e.g., a low sugar diet), the 'Dent Reality' app helps customers quickly find suitable breakfast cereals on a supermarket shelf. This brings the power of digital search and sorting to physical contexts, which might help customers deal with larger assortments. Similarly, by letting customers virtually try on different makeup styles, ARM can use a customer's face as the target of embedding. Sephora's in-store virtual mirror helps customers not just see, but also experience how a wide range of makeup products may fit them personally.

Recent studies show the general importance of embedding. For example, Hilken et al. (2017) in their first experiment restrict embedding in the context of an online eyewear retailer that uses AR to help customers virtually try on sunglasses. Their findings suggest that removing embedding breaks the association between ARM and customer value. Heller et al. (2019) observed a similar effect when customers interacted with AR holograms of an Ikea chair. Moreover, they demonstrated that the effect of embedding is mediated by processing fluency of the ARM information. Yet, the literature remains sparse and significant knowledge gaps abound. For instance, it is unclear whether certain types of embedding are more effective than others, and how embedding might be compared across products or decision contexts. In the Hilken et al. (2017) experiment, the ARM information was embed-

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ded using a virtual mirror that allowed customers to see themselves wearing AR sunglasses on a computer screen. In contrast, Heller et al. (2019a) tested embedding of ARM holograms that replicate physical products such as furniture in the customer's living room. Qualitatively, these are different types embedding. One embeds ARM on a customer's body; the other embeds ARM in the customer's environment.

Another dimension of embedding is virtualisation. Embedding ARM experiences can be classified by the degree of virtualisation, that spans i) enhancing the existing physical environment with AR content, ii) digitising actual physical products to replace them with a hologram, and iii) generating entirely novel digital holograms with no counterpart in the physical world. For example, regarding the enhancing of the existing physical environment with AR, an Instagram ARM mirror has the ability to alter a video image of a customer by adding a 'spiky hairdo' or 'hipster moustache' to it. In this case, a subject (i.e., the customer) remains physical while ARM adds a layer of information that is associated with the subject. The same process also applies to objects (e.g., when an AR recipe pops up next to a jar of Tikka Masala on a supermarket shelf). In both cases the physical subject/object remains in view, however its perception is enhanced with an additional layer of ARM information.

Second, the digitising type of virtualisation, which is used by a variety of online retailers, digitally replicates a physical product in AR. For example, Amazon has created digital replicas of physical products sold in their online store. These AR holograms can be displayed in a customer's home using Amazon's mobile app (Heller et al., 2019a). Digitising physical objects represents a greater level of virtualisation compared with enhancing ARM because the physical product is no longer in view; only its AR hologram can be seen. By embedding the hologram in a customer's physical environment, digitising ARM simulates the physical product in that environment. This creates value by helping customers judge the product's relations in its intended use context (e.g., Ikea chair in a customer's living room). A similar form of virtualisation can also be achieved in relation to subjects, where a person becomes a digital avatar. Such ARM avatars are relevant in service and sales contexts where personal interaction can be simulated using ARM (Ballantyne and Nilsson, 2017; Keeling et al., 2013). Accordingly, digitising ARM represents a distinct type of embedding along the virtualisation spectrum.

Third, with regard to generating virtualisation, a recent study by Carrozzi et al. (2019) demonstrated that customers can develop feelings of psychological ownership towards AR holograms which do not have any corresponding physical representation. In this case, ARM holograms were generated to offer an aesthetic or informational function to a customer. While enhancing ARM adds digital information to a physical subject/object, and digitising ARM replicates a physical product in an ARM hologram, the generating ARM represents an even greater level of virtualisation because AR holograms are no longer associated with any physical subject/object but represent stand-alone creations in AR.

Notably, these types of embedding propagate between the levels of virtualisation. For example, a generated ARM experience (e.g., an AR 'Pokémon') can be embedded in relation to the digitised hologram of an Ikea cushion that enhances a physical couch in the Ikea store. Similarly, digitised ARM sunglasses can be embedded in relation to a table, or on the customer's face to show how they look when worn. In Table 1, we summarise current research and applications on embedding ARM experiences along the subject/object and the virtualisation dimensions.

2.2. Research directions for embedded arm experiences

Table 1 suggests knowledge gaps and potential research directions for embedded ARM experiences. From extant studies we know that the enhancing and digitising forms of embedding are essential to ARM. However, little is known about how managers can use different types of embedding to design an ARM strategy. For example, basic questions like "what is the role of enhancing ARM experiences across stages of the customer's purchase journey?" have not been answered. We do not yet know how enhancing experiences should vary across a consideration stage (e.g., where marketers could employ emotional or cognitive ARM appeals), point of sale (e.g., dynamic ARM promotions), and post purchase (e.g., ARM assembly instructions); or how these could be used to achieve divergent marketing objectives such as customer acquisition versus customer loyalty. Current research also considered only brief customer interactions with ARM, so we do not know how embedded ARM experiences should change over time to maintain engagement when customers become used to ARM experiences.

Moreover, extant studies of digitising ARM experiences have been limited to customer interactions with a single ARM hologram at a time. However, cross-selling opportunities based on bundles of ARM holograms offers a natural extension to this line of research. Digitising research has also been restricted to objects (e.g., products sold on Amazon). Yet, digitising subjects for customer service (e.g., ARM avatar of a hotel receptionist) or business-to-business (B2B) contexts (e.g., ARM avatar of a salesperson) opens novel opportunities for research in service automation. Such digitising ARM experiences can also play a significant role during a sales process. For instance, research is needed on how ARM can facilitate construal level between a buyer and a seller during a sales negotiation to achieve a 'visual contract' (e.g., for placing a vending machine in a retail store).

Implications of ARM embedding for the broader marketing strategy are also not well understood. For example, Dent Reality which highlights products that match personalised search criteria can diminish the effect of physical affordances like store layout (Pizzi and Scarpi, 2016) or eye-level shelf position (Murray et al., 2010) potentially affecting how retailers structure their revenue models (Vrechopoulos et al., 2004). Similarly, de-saturating colour from view of products that did not match a selection criterion (e.g., Chylinski et al., 2014), may affect the role of physical packaging displays potentially disrupting aided brand recall in the store (Scholz and Smith, 2016; van Esch et al., 2016). Extending research on embedded ARM experiences across a customer's purchase journey, B2B markets, and marketing strategy in general is needed to develop a deeper understanding of how it can create and deliver value to customers in ways that are different to existing marketing approaches. Examples of research directions for embedded experiences are further summarized in Table 4.

2.3. Classifying embodied arm experiences

Literature suggests that embodiment may be as critical to ARM experiences as embedding is, because many of the positive effects on marketing metrics like customer value (Hilken et al., 2017), word-of-mouth (Heller et al., 2019a), or psychological ownership (Carrozzi et al., 2019) can be disrupted when embodiment is removed. Consequently, embodiment interacts with embedding resulting in a highly situated real-time experience of ARM.

While active inference theories (Friston, 2012, 2018; Gunasti and Ross, 2008) may provide a theoretical background for the role of embodiment in situated cognition (Heller et al., 2019), their application to classifying ARM affordances is not well understood. For instance, active inference assumes that cognition involves deliberate physical actions that help customers fine-tune their perceptions in an environment (Smith and Semin, 2016). Because customers' actions (e.g., moving an AR hologram of an Ikea chair towards a physical desk) are based on mental models

Table 1
Current research and applications of embedded ARM experiences.

Study	Journal	Key findings	Subject/Object dimension	Virtualisation dimension
Research				
Carrozzi et al. (2019)	Journal of Interactive Marketing	The paper highlights that customisation of novel holograms leads to psychological ownership via two different pathways of assimilation and differentiation. Social interaction in AR leads to a dominating assimilation pathway, whereas a personal AR device leads to a differentiation pathway.	Object	Generating
Heller et al. (2019a)	Journal of Retailing	The AR-enabled retail frontline improves decision comfort, motivates positive WOM and facilitates choice of higher value products through easing the processing fluency of mental imagery. The findings also demonstrate boundary conditions of customers' visual processing styles and product contextuality.	Object	Digitising
Hilken et al. (2017)	Journal of the Academy of Marketing Science	The AR-enabled interaction of simulated physical control and environmental embedding positively affects customer value perceptions of the online service experience. Spatial presence functions as a mediator and also predicts decision comfort. Customer value perceptions and decision comfort translate into positive behavioural intentions.	Subject Object	Enhancing Digitising
Huang and Liao (2015)	Electronic Commerce Research	Integrates the technology acceptance model and concepts of experiential value to investigate factors that affect sustainable relationship behaviour toward using augmented reality. Online customers with high cognitive innovativeness put more emphasis on usefulness, aesthetics, and service excellence presented by AR; in contrast, those with low cognitive innovativeness focus on playfulness and ease of use presented by AR.	Subject	Enhancing
Kim and Forsythe (2008)	Journal of Interactive Marketing	Technology anxiety and innovativeness had significant moderating effects on the relationship between attitude and use of virtual try-on technology; however, there was no significant gender difference in the overall adoption process for virtual try-on	Object	Enhancing
Poushneh and Vasquez-Parraga (2017)	Journal of Retailing and Consumer Services	AR significantly shapes UX, by impinging on various characteristics of product quality, and that UX subsequently influences user satisfaction and user's willingness to buy. UX is derived from four user experience characteristics: pragmatic quality, aesthetic quality, hedonic quality by stimulation and hedonic quality by identification	Object	Digitising

Name	Company	Usage scenario	Subject/Object dimension	Virtualisation dimension
Applications				
Snapchat	Snap Inc.	Social messaging application for mobile devices that allows the exchange of stylized photos or videos ("snaps"), as well as text messages ("chats").	Subject	Enhancing
Doodle Your World	Ribena	Adding humorous AR to videos and sharing videos with peers	Subject	Enhancing
Virtual mirror	Mr. Spex	Allows customers to virtually try on sunglasses using their webcam, allowing life comparison of two models and sharing with peers	Subject	Digitising
Converse shoe sampler	Converse	Virtual try-on of shoes	Object	Digitising
LCST Lacoste AR	Lacoste	Virtual try-on of shoes	Object	Digitising
AR American Apparel	American Apparel	Scan signage in-store and receive additional product information such as customer reviews, colour variants, and pricing	Object	Enhancing
TopShop AR Mirror	TopShop	Virtual try-on of products inside of the store	Object	Digitising
Uniqlo Magic Mirror	Uniqlo	Virtual try-on of products inside of the store	Object	Enhancing
Timberland AR Mirror	Timberland	Virtual try-on of products facing outside of the store to make customers stop on the street	Subject	Enhancing
HoloBeam	Valorem Reply	Generates digital avatars of people that then appear as real-life, interactive holograms for communication software such as Microsoft Skype	Subject	Generating

that must integrate digital cues in the perception of the physical environment (e.g., expecting that the AR chair fits under a physical desk), sensory feedback from those actions can confirm or disconfirm the mental model (e.g., discovering the table is too high). This process of using physical actions to fine-tune perception can be observed routinely in physical stores where customers will, for example, pick up, walk around, move, sit, and adjust furniture, to find their preferred Ikea chair. Digital embodiment encourages active inference because it provides physical control over ARM holograms (i.e., the ability to physically move and change their appearance). Hilken et al. (2017) show that embodied control creates a sense of presence, which is a perception that an ARM hologram is part of the physical surroundings. A sense of physical presence can be considered indicative of an integrated mental model that combines digital and physical cues in the customer's perception of the augmented reality. That is, customers who physically act to move, rotate, and resize ARM holograms discover relations between AR holograms and the physical environment, allowing them to better integrate the digital information in their mental model of the environment - making it seem ‘real’.

This process of active inference relies on affordances of i) physical control through action and ii) perception of sensory feedback that results from those actions, which are the two dimensions we can use to classify types of embodied ARM experiences (Heller et al., 2019). First, control in AR typically involves a change in a position or appearance (e.g., colour, shape, or size) of an ARM hologram. Carrozzi et al. (2019) show how control is used to actively customise ARM holograms and, in the process, learn about their properties. Since both control and feedback are expressed using physical senses, we can further classify types of embodied ARM experiences based on involvement of sensory modalities. For example, Microsoft's 'HoloLens' allows customers to control ARM holograms with hand gestures, gaze, or auditory commands. These senses expand the customer's range of controls, where an ARM hologram can be controlled in ways that a corresponding physical product could not be (e.g., using a voice commend to move an Ikea chair; Petit et al., 2019).

Second, involving multiple sensory modalities expands the range of feedback that ARM offers compared to ordinary physical experiences. While visual feedback underlies ARM, vision can be supplemented with auditory (Heller et al., 2019) and/or haptic feedback; and these types of sensory feedback can be congruent with control actions, or not. For example, when a customer 'pushes' an Ikea AR chair towards a desk, the customer expects the chair to arrive at that location. Observing the chair arrive at the desk provides congruent feedback. Observing the chair jump to a different location creates incongruent feedback. Congruence might vary between sensory modalities. For example, physical objects that move through space often make a sound. However in ARM, a marketer designs the sounds that go with actions of AR holograms. So, an Ikea chair seen moving towards a desk might play a congruent sound (e.g., a slight screech when the AR hologram is dragged along a wooden floor) to reinforce the integration within the mental model that generates the feeling of spatial presence of the AR hologram; or it might create an incongruent auditory feedback (e.g., play a happy jingle) to contrast with the expectations of the physical environment and drive customer attention towards the AR hologram. In this way, sensory congruence becomes subject to creative execution in ARM. However, very little is known about creative execution in ARM. For instance, the juxtaposition of incongruent feedback across multiple sensory modalities extends ARM experience beyond ordinary range of perception. Table 2 summarises a classification of embodied ARM experiences in relation to the in/congruence of control and feedback across sensory multiple modalities.

2.4. Research directions for embodied arm experiences

Table 2 shows significant research gaps, which indicates that managers may struggle to optimally calibrate the application of embodied experiences in ARM. There is an apparent bias towards visual aspects of embodiment in ARM research. Multiple sensory interactions have rarely been investigated, and most studies have focused on congruent and familiar types of embodiment. However, since ARM expands sensory feedback and control beyond the range of ordinary experience, it is an open question to what extent these experiences must follow intuitive physics (i.e., be congruent and familiar; Kubricht et al., 2017). For example, when a customer moves an AR hologram of an Ikea chair, does the hologram need to be visible through the path of its movement or can it teleport to speed up the process; and should it remain a chair, or could it causally 'walk' to its designated spot for added amusement?

The range of options available to managers relies on selecting feedback that is congruent or incongruent with the customer's control actions. So far, the literature only considers congruent feedback (e.g., an AR chair moves as it would in a physical environment; Heller et al., 2019). However, introducing instances of unfamiliar feedback may provide an element of surprise to engage customers' attention with ARM activities. At this stage there is no research to suggest the right combination of familiar and unfamiliar instances of feedback; or to what extent psychological processes like narrative transportation might be necessary for customers to successfully integrate unfamiliar sensory feedback during embodied ARM experiences (Escalas, 2006).

Similarly, there is no research on mixing congruent and incongruent feedback to better scaffold customer behaviours, for example during ARM product assembly or for usage instructions. Research is needed on how this can be applied across a mixture of sensory modalities when customers mix physical and digital tasks in AR environments. For example, customers often engage not only with AR, but also with unrelated tasks in the physical environment. Feedback and control modalities might interact across tasks in physical environments, for instance when customers use ARM on the go, in a car, or on a crowded bus. Understanding sensory competition between physical and digital cues is necessary to progress the literature. Accordingly, more research is needed to understand the effect of in/congruent interactions across multisensory coordination of feedback and control when ARM blends digital and physical tasks. Such research will add to our understanding of ways in which embodied ARM experiences create value for customers in ways different from existing marketing approaches. Examples of research directions for embodied experiences are further summarized in Table 4.

2.5. Classifying shared arm experiences

While ARM can engage a single customer in an interaction with AR holograms, it also opens avenues for novel forms of social behaviour. Shared experiences arise within ARM when customers jointly augment a common view of the physical environment with digital content (Hilken et al., 2020). For instance, customers may leave a review 'on' a restaurant, add images of recommended products directly to a friend's living room, or draw lines, arrows and comment bubbles to provide how-to tutorials for servicing a coffee machine. Furthermore, customers can also create entirely new content through shared ARM. For example, 'Spatiate' encourages customers to jointly create and interact with AR art. The two pertinent dimensions for such shared ARM experiences involve the i) synchronicity of the experience and ii) point-of-view (POV) that is virtually enhanced. First, with regards to synchronicity, shared interactions can occur in real-time (e.g., synchronously when customers collaboratively customise an AR car (Carrozzi et al., 2019), or asynchronously when customers use an app like the Yelp 'Monocle' to leave ARM reviews at retail locations for other customers to discover later (Scholz and Smith, 2016).

The second unique aspect of shared ARM experience is the augmentation of another person's POV (Hilken et al., 2020). POV augmentation by customers, service employees, or sales personnel offers a direct form of sensory communication by seeing what the other person sees and directly changing the content of their perception. For example, using the Dulux 'Visualizer' app, customers can asynchronously augment another person's POV by virtually changing the colour of walls in a room from the other person's POV. In doing so, they may not only better understand the decision maker's circumstances, but might also empower or influence the decision-maker's choices more directly through the conveyance of a highly situated recommendation in the form of an AR-enhanced visual (Hilken et al., 2020).

Involving customers in shared ARM experiences also communicates social information. For example, Carrozzi et al. (2019) show that joint ARM interactions are mediated by social identity motives of assimilation and differentiation among customers. Shared ARM experiences may seem 'real' (i.e., generate feelings of presence for ARM content) because they simulate objectivity. Sharing an ARM experience means that presence of an AR hologram is not limited to one's own perception. This makes a shared ARM experience seem objective by allowing a customer to observe its effect on others within a social setting. Moreover, feelings of social presence

Table 2
Current research and applications of embodied ARM experiences.

Research				
Study	Journal	Key findings	Sensory Control	Feedback congruency
Botella et al. (2010)	Behaviour Therapy	AR was effective at treating cockroach phobia. Participants improved significantly in all outcome measures after treatment; furthermore, the treatment gains were maintained after longitudinal measurements.	Touch (screen) control	Visually & acoustically congruent
Carrozzi et al. (2019)	Journal of Interactive Marketing	The paper highlights that customisation of holograms leads to psychological ownership via two different pathways of assimilation and differentiation. Social interaction in AR leads to a dominating assimilation pathway, whereas a personal AR device leads to a differentiation pathway.	Hand-gesture control	Visually congruent
Hopp and Gangadhar-batla (2016)	Journal of Current Issues & Research in Advertising	Increased exposure time to an AR application for a car brand leads to lower brand attitudes and participants with high technology self-efficacy transfer these attitudes to negative brand evaluations.	Touch (screen) control	Visually congruent
Kerawalla et al. (2006)	Virtual Reality	Analysis of teacher–child dialogue in a comparative study between use of an AR virtual mirror interface and more traditional science teaching methods for 10-year-old children, revealed that the children using AR were less engaged than those using traditional resources	Touch (screen) control	Visually congruent
Poncin and Mimoun (2014)	Journal of Retailing and Consumer Services	The use of AR has a positive effect on customer perceptions of store atmospherics, shopping value, and positive emotions. Shopping value and positive emotions also mediate the effect of store atmospherics on satisfaction, which in turn promotes patronage intentions.	Touch (screen) control	Visually congruent
Smink et al. (2019)	Electronic Commerce Research and Applications	Shopping using AR for a 'try before you buy" experience enhances perceived informativeness and enjoyment. Enjoyment leads to affective processing yielding positive brand attitude.	Peripheral (mouse) control	Visually congruent
van Esch et al. (2019)	Journal of Retailing and Consumer Services	Investigates how AR can influence customer's brand attitude based on anthropomorphism theory. A field study suggests that the anthropomorphisation of AR is an effective tactic for retailers as part of their effort to build effective relationships with their customers.	Touch (screen) control	Visually congruent
Applications				
Name	Company & Device	Usage scenario	Sensory Control	Feedback congruency
Aisle 411	Walgreens (Phone/Tablet)	Augmented navigation through the pharmacy store, helping customers to find the product they are looking for	Touch (screen) control	Visually congruent
ByDesign 3D	Stryker (AR Smart Glasses)	Augmented collaboration design platform for the design of operating rooms	Hand-gesture & Voice command control	Visually & acoustically congruent
Google Translate	Google (Phone/Tablet)	Allows instant translation of words and sentences by using the camera of the phone/tablet and overlaying foreign language detected with the language of the consumer's choice	Touch (screen) control	Visually & acoustically congruent
Layar	Layar (Phone/Tablet)	Augmented reality application which makes print media interactive by overlaying it with virtual features. Includes Geo Layers to discover nearby locations	Touch (screen) control	Visually congruent
SketchUp Viewer	Trimble / SketchUp (AR Smart Glasses)	Allows interaction with augmented 3D models of architectural ideas to allow collaboration and visualisation aid during the design phase of architectural models	Hand-gesture & Voice command control	Visually & acoustically congruent
TopShop AR Mirror	TopShop (In-store mirror)	Virtual try-on of products inside of the store	Touch (screen) control	Visually congruent
Uniqlo Magic Mirror	Uniqlo (In-store mirror)	Virtual try-on of products inside of the store	Touch (screen) control	Visually congruent

can be enhanced by persistence of ARM between social settings. For example, Apple's 'ARCore2' saves 3D holograms across devices so they can be displayed asynchronously in time (e.g., later in the same location), or in space (e.g., at the same time but in different locations). This process distributes ARM experiences across individuals, locations, and time, thus creating a sense of independence from an individual customer's perception. Table 3 classifies shared ARM experiences based on whether experiences are shared synchronously or asynchronously, and via first, second, or third person POV.

2.6. Research directions for shared arm experiences

Table 3 suggests that applications of shared ARM experiences typically mix synchronous and asynchronous interactions. However, in the academic literature there is paucity of research about how such experiences should be mixed. While ARM may be shared synchronously in a multiplayer experience (e.g., Snapchat) or asynchronously across time and space (e.g., Yelp), optimal mixing synchronous and asynchronous ARM experiences is not well understood. Synchronous interactions encourage extended engagement due to network effects as more people interact with the same AR content increasing its vale. For example, Facebook's 'Storytime' (an AR video-chat) or Niantic's 'Pokémon Go' AR game derive value because other customers can use them at the same time. Asynchronous interactions in contrast, allow for a larger community of people because not all customers have to be present in the same space and time to interact with the same AR content. It is not certain under what conditions one set of interactions dominates, and how such shared ARM experiences should be integrated.

Table 3
Current research[a] and applications of shared ARM experiences.

Research

Study	Journal	Key findings	Synchronisation	POV
Carrozzi et al., 2019	Journal of Interactive Marketing	The paper highlights that customisation of holograms leads to psychological ownership via two different pathways of assimilation and differentiation. Social interaction in AR leads to a dominating assimilation pathway, whereas a personal AR device leads to a differentiation pathway.	Asynchronized views across space / Synchronized views	Individual POV / Shared POV
Hilken et al. (2019)	Journal of the Academy of Marketing Science	Optimal configurations of social AR in terms of POV sharing formats and communicative acts facilitate socially empowering exchanges of purchase advice amongst customers. Communication motives (related to impression management and persuasion) impose boundary conditions to these effects.	Asynchronized views of a common space	Static / Dynamic POV sharing formats

[a]At the time of submission of this manuscript, we could not identify any other research that utilized shared ARM experiences

Applications

Name	Company	Usage scenario	Synchronisation	POV
Dulux Visualizer	Dulux	Allowing customers to change the colour of walls in their rooms and sharing the results with their peers	Asynchronized across time	Individual's POV
Project Colour App	Home Depot	Allowing customers to change the colour of walls in their rooms and share pictures with your social network	Asynchronized across time	Individual's POV
IKEA AR Catalogue	Ikea	Enables customers to place selected furniture in their own homes using augmented reality, allows taking pictures of the virtual furniture in the room and directly links to the web shop of IKEA	Asynchronized across time and space	Individual's POV
Magnolia Market's AR App	Magnolia Market	Enables customers to place selected furniture in their own homes using augmented reality	Asynchronized across time and space	Individual's POV
HoloRoom	Lowe's	Allows customers to design their kitchen or bathrooms in real-size and change colour, shape and content of their designed rooms in real-time	Asynchronized across time and space	Individual's POV
Ingress	Niantic	A location-based, augmented-reality game around a science fiction story in which players must join one of two forces to compete for territory	Synchronized or Asynchronized depending on the user's location	Individual's POV
Pokémon GO	Niantic / Nintendo	A location-based, augmented-reality game in which players must catch digital creatures who appear on the screen as if they were in the same real-world location as the player	Synchronized or Asynchronized depending on the user's location	Individual's POV
Yihaodian Virtual Stores	Yihaodian	Allows customers to experience virtual grocery aisles on their mobile devices and shop by tapping on the product instead of using web shop	Asynchronized across time	Individual's POV
Ink Hunter	Ink Hunter	Augmented reality application to allow customers to place virtual tattoos on their body to evaluate the look of it and share it with friends	Asynchronized across time	Individual's POV
Snapchat	Snap Inc.	Social messaging application for mobile devices that allows the exchange of stylized photos or videos ("snaps"), as well as text messages ("chats").	Synchronized or Asynchronized depending on the user's location	Individual's POV or Shared View on the same screen
Skype for HoloLens	Microsoft	Allows for shared POV and sharing holograms across a video conference. Users can create and share holograms in real-time	Asynchronized across space	Shared views on different screens

The mix of synchronous and asynchronous ARM experiences also provides a medium for contextual social communication, where experiences (instead of symbols such as language) can be shared, recorded, and modified directly between customers. Little is known about how customers can communicate using directly shared experiences, and how such communications could be applied to marketing metrics such as building brand meaning. Initial research suggests that customers' communication motives related to persuasion or impression management can play an important role in shaping the comfort with using shared AR for exchanging advice (e.g., about purchase decisions) with others (Hilken et al., 2020). Moreover, sharing experiences via different POV formats (Carrozzi et al., 2019; Hilken et al., 2020; Rochlen et al., 2017) has implications for application of empathy in decision-making and new research directions on empathy-based ARM interactions. Developing these lines of research will help distinguish shared ARM experiences from other approaches to marketing. Examples of research directions for shared experiences are further summarized in Table 4.

2.7. Research directions for adaptive arm experiences

Not only can ARM content be interactive between customers (i.e., generate feedback based on direct control actions from customers), but it can also be adaptive meaning that ARM adjusts feedback *without* direct control from a customer (de Ruyter et al., 2018; Scholz and Duffy, 2018). While currently we do not find applications of adaptive algorithms in ARM, the technology is uniquely designed for application of artificial intelligence to marketing. Since ARM generates large amounts of contextual data when mapping the customer's physical environment, it achieves what is called 'contextual awareness' (i.e., automatic classification of objects in the user's environment). Grubert et al. (2016) describe various approaches to contextual awareness in AR and provide ex-

Table 4
Examples of future research directions classified by the underlying dimensions of the ARM framework.

	Embedded experiences			Embodied experiences		
	Enhancing	Digitising	Generating	Control	Feedback	Multi-sensory
Shared (vs individual) experiences:						
Object	*Research Direction*: Effects on CLV from AR enhanced physical products, implications for experience across the customer's purchase journey?	*Research Direction*: Effects of using AR holograms to assist evaluation of physical products sold online, implications for value creation (e.g., cross- and up- selling)?	*Research Direction*: Effects a mix of synchronous vs asynchronous AR generated experiences, implications for brand communications?	*Research Direction*: Effects of sensory control over AR holograms, implications for speed and accuracy of decision-making?	*Research Direction*: Impact of intuitive (vs. cartoon) physics on across congruent vs incongruent AR interactions, implication for customer engagement?	*Research Direction*: Influence of sensory competition between physical and digital cues in dual task AR settings (e.g., walking while accessing AR), implications for attention control?
POV	*Research Direction*: Effects of POV enhancement, implications for sales and employee service support?	*Research Direction*: Effects of AR in education settings, implications for learning by observation (e.g., equipment operation through shared POV)?	*Research Direction*: Effects of shared creativity through AR POV, implications for co-creation?	*Research Direction*: Influence of remote shared control of AR objects via shared POV, implications for after sales service?	*Research Direction*: Effects of vicarious AR experiences, implications for brand meaning and empathy during shared AR experiences?	*Research Direction*: Role of POV research across sensory modalities (e.g., point of hearing vs POV), implications for AR experience?
Adaptive (vs static) experiences:						
Contextual data acquisition	*Research Direction*: Collecting data via AR's mapping of objects in customer's environment, implications for understanding decision contexts, and privacy protection?	*Research Direction*: Simulating product interactions in physical environments, implications for studies of customer behaviour?	*Research Direction*: Generating variations of AR stimuli for personalized experimental designs, implications for product testing?	*Research Direction*: Monitoring interactions with AR holograms by customers, implications for product usage information and testing?	*Research Direction*: Studying application of dynamic AR feedback in experimental designs, implications for customer response testing?	*Research Direction*: Integration of voice, gaze, and haptic interactions, implications for customer experience testing?
Analytics (real-time vs delayed)	*Research Direction*: Models for real-time object recognition in customer's physical surroundings, implications for product search and recommendations; and public policy and regulation of computational asymmetry AR enhanced markets?	*Research Direction*: Modelling dynamic AR content matching based on customer's surroundings, implications for contextual decision-making (e.g., trade-off contrasts, reference points)?	*Research Direction*: Models of targeted behaviour shaping via AR generation, implications for individualized customer behaviour (e.g., influencing foot traffic at store locations using applications like Pokémon Go), and customer sovereignty protection?	*Research Direction*: Predictive models based on AR interactions, implications for AR design, adoption, and usability?	*Research Direction*: Modelling adaptive feedback and decision scaffolding, implications for AR decision-making over time.	*Research Direction*: Integration of image, gaze and voice in data mining models, implications for experience prediction?

amples of how it can be applied to adjust ARM content without a user's direct control. For example, re-arranging a display of products on a supermarket shelf for an individual customer might be physically impractical, yet with ARM it is digitally feasible. Actions such as creating a shortlist of products based on an algorithm's prediction, personalising displays, and introducing real-time recommendations become possible in physical settings using ARM (Zhu et al., 2004). Adaptive ARM experiences potentially amplify these effects by blending a customer's focus on situated cognition with contextually aware computation by the adaptive ARM system.

Adaptive ARM experiences not only sense the environment, but also, through real-time analytics, allow a marketer to scaffold customer behaviour towards a goal. For instance, buying a low sugar breakfast cereal might be scaffolded when ARM de-saturates colour from a view of products that do not match that goal. Recently, the 'Pokémon Go' AR game that engaged users in a chase across local neighbourhoods hunting 'Pokémon' offered brick and mortar retailers lures they could buy to increase foot traffic in their area by spawning 'Pokémon' in those locations (Eurogamer, 2020). Because adaptive ARM experiences select goals without direct control from the customer, they exhibit agency. While current applications focus on ARM goals that align with a customer's objectives to support them (e.g., 'Dent Reality' helps a customer quickly find a jar of Tikka Masala in supermarket), this might not always be the case. For example, 'Dent Reality' might also use price discrimination in a supermarket to maximise the retailer's revenue.

Non-alignment of ARM experiences with the customer's goals should be studied from a policy and regulation perspective. For instance, a brand of high sugar breakfast cereal that is promoted by 'Dent Reality' might lead customers to follow ARM's point of sale guidance and buy the high sugar product, despite their goal to only buy low sugar products, While such instances of ARM must be avoided, there is a danger that unregulated ARM could bias customer's actions against their goals.

Moreover, contextual awareness by an ARM interface can be intrusive for the customer or anyone in the customer's field of view; it thus matters how information about customers and their surroundings is stored, used, and who owns the data. While several studies have mentioned privacy as a limitation to customers' adoption of ARM (Hilken et al., 2017; Rauschnabel et al., 2018), more research is needed to understand implications for customer protection. For example, while the efficacy of educating customers about privacy implications in ARM may be limited, situating privacy notifications (e.g., real-time alerts of privacy intrusions) might be one avenue for future research. Another avenue is studying how customers deal with what can be termed a 'computational asymmetry' when adaptive ARM algorithms processes contextual information in the background without direct customer's knowledge or control. Investigating ways in which customers uncover this asymmetry (e.g., by applying theory of mind to adaptive ARM experiences; Schaafsma et al., 2015), and to what extent this awareness changes customer behaviour, may help policy makers understand trade-offs between customer responsibility and the need for regulation.

Computational asymmetry may arise when adaptive ARM systems become better at scaffolding customer behaviour than the customer him or herself. For example, customers may rely on 'Dent Reality' to navigate a supermarket because they trust it is better at finding products then they are. This encourages offloading of cognition to ARM interfaces; however we do not currently understand to what extent this should be regulated, especially when vulnerable populations (e.g., children or the disabled) are involved. Accordingly, researchers should understand the implications of adaptive ARM experiences before these are widely applied in the market, so that ethical guidelines and policy recommendations can be developed. Examples of research directions for adaptive experiences are further summarized in Table 4.

3. Limitations and conclusion

Although still in the early stages of mainstream adoption, emerging applications of ARM, conceptually suggest a distinct marketing approach that aligns the technology with customers' experience of situated cognition (Hilken, 2018). Unlike attitude-based marketing, where traditional media including print, audio, or video communicate attributes of a product or service in the hope that such impressions shape customer behaviour in a specific decision context, ARM offers digital affordances that affect the customer's perception of the decision context directly. These affordances drive customer experience and actions through their embedding in the environment (i.e., value of the ARM experience is contextual; Heller et al., 2019a) and embodiment through physical interaction (i.e., value is experienced in use; Hilken et al., 2018). Consequently, ARM shifts the focus of marketing from attributes of a product or service to affordances of the situation in which value is experienced through engagement (Heller et al., 2020).

Our classification of the emerging AR literature that supports ARM is limited by the nascent stage of research in the field. This implies that few analytical comparisons are feasible at this stage. Nonetheless, conceptually we propose there is a fundamental difference between ARM and traditional media. This difference hinges on the application of situated cognition in marketing practice. ARM not only maps in real-time the customer's physical environment, but also, through the application of adaptive algorithms, classifies objects in that environment. This allows ARM to adapt digital content in real-time, and to engage with customers in shared contextual experiences (de Ruyter et al., 2020).

In this positioning article, we classified types of ARM affordances according to embedded, embodied, adaptive, and shared experiences. Our classification illustrates how the various types of ARM experiences can be valuable to customers in ways that are different from existing marketing approaches, and highlights opportunities for further research. We note that while the research opportunities are not exhaustive and only serve as a starting point for myriad other potential research topics, they do illustrate how our conceptual framework can guide future research directions based on the interaction of the underlying dimensions of embedded, embodied, shared, and adaptive customer experiences in ARM.

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