



Holistic augmented reality brand equity (HARBE) model: building customer-based brand equity through augmented reality

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Revised: 31 January 2025 / Accepted: 8 February 2025 / Published online: 29 March 2025
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Abstract

Although some recent research presents various uses of augmented reality (AR) in brand contexts, no overarching model exists to explicate its effects, justify its usage, or specify how it contributes to brand management objectives, such as customer-based brand equity. To determine if AR actually can support brand equity, the current article adapts an existing customer-based brand equity pyramid into a three-stage framework of AR and AR features (cf. 2D communication tools) as brand experiences, consumers' perceptions and evaluations of AR as mechanisms, and brand equity (salience, meaning, response, and relation) as consequences. A secondary data analysis of 398 effects, extracted from 74 journal papers, published between 2010 and 2024, reveals three key insights. For brand managers, the findings detail the direct effects of AR on brand equity. For marketing managers, they describe consumer behaviours in response to AR. For AR creators, they demonstrate ways to develop purposeful AR experiences. The newly proposed Holistic AR Brand Equity (HARBE) model details the direct effects of AR features and mechanisms on each type of brand equity, which also enables managers to make rapid, evidence-based decisions about leveraging AR to enhance brand strength.

Keywords Augmented reality · Brand · Brand management · Brand-management objectives · Customer-based brand equity

Introduction

Artificial intelligence, the metaverse, and extended reality are not just buzzwords but also critical topics for various research domains. Augmented reality (AR) technology offers a particularly notable form of extended reality, due to its ability to expand reality virtually, instead of replacing it, as is the goal of virtual reality. Specifically, AR enhances a recorded user environment by mapping virtual, three-dimensional (3D) elements onto it (Milgram et al. 1994) and thus

providing time- and place-independent user experiences (Azuma 1997; Bonetti et al. 2019; Brengman et al. 2019). It is easily accessible through different hardware devices (e.g., smartphones, tablets, smart glasses); the cost of AR glasses remains high, but users can readily access web- or app-based applications (Qiao et al. 2019). Reflecting these unique and appealing properties, various research disciplines investigate AR technology, including in brand-related domains.

A quick survey of Google Scholar, searching for brand management research that investigates AR, reveals a notable increase in the number of publications, from approximately 10,400 in 2020 to 14,300 in 2022 to 17,500 in 2024 (as of January 22, 2025). Most of these studies feature empirical investigations of consumers' perception of AR features, such as interactivity (e.g., Barhorst et al. 2023; Scholz and Duffy 2018; Yim et al. 2017), immersion (e.g., Bonetti et al. 2019; He et al. 2018; Kowalczyk et al. 2021), personalisation (e.g., Lin and Chen 2017; Scholz and Duffy 2018; Smink et al. 2020), and informativeness (e.g., Huertas and Gonzalo 2020; Kowalczyk et al. 2021; Nugroho and Wang 2023). Compared with two-dimensional (2D) digital communication methods, AR provides expanded opportunities for users to experience these unique features (e.g., Alimamy and Gnoth

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2022; Barhorst et al. 2023; Smink et al. 2019). However, brand and marketing managers still struggle with determining the most effective brand communication methods; in addition to AR, they might consider a range of conventional and digital communication tools (e.g., websites, digital ads, social media marketing, print, out-of-home).

Regardless of the channel used, ensuring that customers have appealing, appropriate experiences with their products, services, and related marketing efforts helps brands establish their strength and desired associations (i.e., thoughts, feelings, images, beliefs, perceptions, and opinions) among consumers (Keller 2001). If they adopt AR, brands likely use it at different stages of the customer journey to support their strategic marketing objectives, as predicted by recent models like the BICK FOUR model (Rauschnabel et al. 2022a) and 4C framework (Rauschnabel et al. 2024a). Studies that undertake some empirical tests of conceptualisations related to AR, such as the SOR model (Jiang and Lyu 2024; Xu et al. 2024) or AISAS model (Sharma et al. 2023), also emphasise consumer behaviour or the customer journey. In parallel with such research evidence that AR is a powerful experiential marketing tool, current brand management practices suggest its positive effects and its potential to function as a “game changer” (Tasner 2024). Recent predictions indicate that by 2028, there will be 3.1 billion users of AR software, which will earn global annual revenues of 15.6 billion EUR (Statista 2023). Already, AR appears to have developed beyond its initial status as a totally new technology and reached a mature state, integrated into business practice, since it disappeared from the Gartner’s Hype Cycle (Herdina 2020). Such research- and practice-based insights concur in their indications of the vast potential of AR for brand management.

Its implications for brand management are especially notable because, compared with short-term marketing activities, brand management aims to create long-term value, in the form of brand images, customer loyalty, and recognisable brand elements. Brand managers therefore must identify suitable tools for achieving strategic, long-term objectives, including defining the brand personality, creating recognition and overall brand value, and strengthening brand relations (Cid et al. 2022). From this perspective, brand management decisions provide bases for other marketing actions. For example, efforts to increase brand equity can enhance the economic market value of the brand (Biel 1992) and thus predict the overall success of the company. For brand managers seeking to determine which brand experiences contribute to brand equity, the results from AR research are compelling: It appears to increase customers’ brand satisfaction (e.g., Poncin and Mimoun 2014; Kowalczyk et al. 2021), positive attitudes towards the brand/product (e.g., Brito et al. 2017; Xu et al. 2019; Yang et al. 2020), purchase intentions (e.g., Arghashi 2022; Barhorst et al. 2023;

Smink et al. 2019), and positive overall brand evaluations (e.g., Haumer et al. 2020; Pina and Dias 2020; Wu and Dong 2021). However, no existing conceptual approach merges all these findings to address how increasingly popular AR technology can facilitate brand managers’ efforts to build equity and manage the brand in practice. In addition to the implications for practice, evidence related to the brand-building potential of AR methods would be valuable for researchers, educators, and students. To establish such valuable insights, we propose and attempt to answer two broad research questions: First, does AR influence brand equity, and second, if so, through which mechanisms?

In deriving answers to these questions, we propose a simplified model that can be implemented in practice. In line with implementation science—which aims to apply evidence-based research to professional practice to address challenges (Nilsen 2015)—we consider such a model critical for three main reasons. First, due to the time pressures they face, most brand managers need simple, evidence-based, generalisable models that can support fast but good decisions. Second, establishing a conceptual, overall view of how AR affects brand equity provides basic information about whether to rely on AR as a tool to communicate and create brand equity. Third, decades of research into users’ perceptions and evaluations of AR features have provided a wealth of results, from which we can identify patterns linked to key brand variables, such as brand equity.

Our efforts along these lines adopt the structure that Jaakkola (2020) recommends for conceptual model studies. That is, as we have done in this current section, we begin by defining the research problem and questions. We provide theoretical and background information next, which provides a foundation for the conceptual framework that we derive (Step 1), containing variables that reflect the experience (AR vs. 2D communication tools, AR features), the mechanism (perception and evaluation), and the brand consequences (dimensions of the brand equity pyramid, Keller 2001). The data for our analysis come from extant empirical studies that address AR in brand or consumer contexts (Step 2), which reveal 389 effects. Next, we provide a theoretical synthesis that produces various results (Step 3), including the identification of three decision patterns at different levels. They can help brand managers decide quickly between AR or 2D communication, depending on the brand equity objective; marketing managers anticipate how customers will feel and behave in response to an AR brand experience; and AR creators explore which AR feature is likely to produce which objective. On the basis of these patterns, we introduce a holistic augmented reality brand equity (HARBE) model that makes it easy for managers to identify how they can use AR to achieve brand equity on different dimensions. Finally, we outline some implications of the model for both practitioners and researchers (Steps 4 and 5).



With this strategic approach to the research gap, the current study does not provide a classical research-to-science theory. The proposed model integrates an existing framework and model, to establish an implementation model for brand practice. In Nilsen's (2015) classification of theoretical approaches—descriptive approaches involving processes or guidelines, understanding approaches that detail influences on outputs, or evaluation frameworks—our model represents the descriptive category and its subcategory of implementation theory. Through the development, adaption, or modification of implementation theories, researchers can “prioritize aspects considered to be most critical to analyse issues related to the how and why of implementation, thus improving the relevance and appropriateness to the particular circumstances at hand” (Nilsen 2015, pp. 7–8). Those critical aspects can include the relations among determinants. In this sense, the current research contributes by reducing the main effects and deriving a practical model from a brand management perspective, such that it shows how to develop customer-based brand equity from the bottom up.

Theoretical background and conceptual framework

Customer-based brand equity

Creating a brand can differentiate offerings from competitors'; it also implies the creation of imaginary value (Kapferer 2004). In turn, Park and Srinivasan (1994) define brand equity as the added value that results from assigning the brand to a product; Kotler et al. (2022) categorise this added value as emotional or monetary. Emotional value is manifest in the ways consumers think about, feel towards, and act on the brand; monetary value refers to prices, market share, or profitability due to the brand (Kotler et al. 2022). Other studies instead define three perspectives: financial, employee, and customer (King and Grace 2009). In line with Kotler et al. (2022), the financial perspective pertains to the brand's monetary value, which might be measured by its stock price, cash flow, or market value (Myers 2003). Such objective assessments make brand value comparable. Employee-centric brand equity instead refers to perceptions and evaluations of the brand by employees; it acknowledges the unique impact of brand familiarity on employees' attitudes and behaviours in work environments and organisational cultures (King and Grace 2009). Finally, the third perspective makes the consumer central to brand evaluations, because they purchase the branded products or services (Keller 2016). On the one hand, customer equity reflects the “aggregate[ed] customer lifetime values across customers” to the brand (Rust et al. 2001, p. 4); on the other hand,

customer-based brand equity (which we refer to as brand equity) measures the brand's perceived value to consumers. Aaker (1991, p. 15) defines it as “a set of brand assets and liabilities linked to a brand..., that add to or subtract from the value provided by a product or service to a firm and/or to that firm's customers.” Thus, changing the assets or liabilities in a set can affect brand equity to varying degrees. Yoo et al. (2000, p. 196) instead define brand equity as “the difference in consumer choice between the focal branded product and an unbranded product given the same level of product features,” such that they recognise more benefits than are available from competing products or services.

Related research also distinguishes different components of brand equity, spanning quality, associations, loyalty, awareness, image, personality, attitude, trust, satisfaction, esteem, and attachment (Shariq 2018), and defines it according to legal instruments, logos, company, shorthand, risk reducer, identity system, image, value system, personality, relationship, adding value, and evolving identity with a strategic management focus (Cid et al. 2022). Web Appendix A offers a comparison of established brand equity models. Among them, perhaps the most influential are those from Keller and Aaker.

Aaker (1991) first proposed a customer perspective for a brand equity model, which included brand loyalty, awareness, perceived quality, associations, and other proprietary brand assets as dimensions of brand equity (especially the brand name and symbol), which then influence customers' perceptions of brand value. Later, Aaker (1996) introduced some subcategories for the five dimensions, updated some of the proprietary assets, and added internal leadership to the brand quality dimension and differentiation from competitors (value, personality, and organisation) to brand associations. Despite its influence, this approach contains some mutually dependent variables, and empirical measures of some dimensions are difficult.

For Keller (1993), the main dimension of brand equity is brand knowledge, which comprises awareness and image. Awareness implies recognition of a brand; its image is reflected by the uniqueness, strength, favourability, and types of brand associations. In turn, Keller also proposed a resonance model, extended by brand responses and relationships (Keller 2001), which usually is depicted as a pyramid. The base of the pyramid is brand *salience*. On this level, brand management efforts are devoted to creating awareness of the brand (e.g., name, logo, other symbols). Salience gives customers a fundamental idea of the category of needs that the brand addresses. If the customer is aware of and can remember and recall the brand, brand salience exists. Next, brand *meaning* consists of brand performance and imagery. Brand performance is a functional observation, such that it reflects customers' knowledge about the brand's product features, services, style, price, and so forth. Brand



imagery instead reflects customers' imagined observations, which take the form of their picture of the brand, store perception, sense of brand personality, and usage associations. Both imagery and performance can differentiate the brand from competitors. The third level of brand equity refers to the consumer *response*, again divided into two categories. First, consumers' rational judgements lead to their attitudes, choice, trust, satisfaction, and purchase. Second, consumers' feelings and emotional responses include excitement and security, affective reactions, or intense brand use. Both responses target brand management objectives, such as positive consumer reactions and brand attitudes. Finally, the top of the pyramid is customer–brand *resonance*, related to the brand management objective of a loyal, engaged relationship. Brand relations might take the form of customer participation in a brand community, brand connection or love, and a willingness to spend money or resources for the brand. Across these different levels, Keller's theoretical model is useful for brand managers in various ways; it also establishes a means to conduct comparisons of overall brand equities or of brand equity dimensions within each level.

Keller (2016) also extended this brand equity model to a brand value chain model, which includes multiple actors that can moderate value creation processes. It seeks to predict financial impacts. However, because the 2001 model prioritises dependencies within rational (performance/judgement) and emotional (imagery/feelings) routes, or cross-over effects (Keller 2016), for the current study, we embrace Keller's (2001) approach and definition of brand equity, which resonates with four requirements linked to our research questions. First, compared with other brand equity approaches, Keller's pyramid suggests a route to strengthen existing brands as well as build new brands, so it provides a strong basis for model extensions (Kuhn et al. 2008; Yousaf et al. 2017). Second, the model offers unique guidance pertaining to how to build a brand across multiple, differentiated levels. Third, Keller's pyramid is sector- and industry-independent and adaptable to any brand. Fourth, it constitutes a general approach, such that managers can apply it to support strategic brand-related decisions and ensure consistency across them. Such strategic decisions refer to which tools and technologies to use for brand communications with customers. Brand managers nearly always struggle to identify and choose the most effective, cost-efficient tool from the many available, and many brands remain hesitant to use relatively newer technologies such as extended reality or the metaverse, despite their vast potential value as additional brand touchpoints for creating customer impressions.

Augmented reality

Augmented reality applications appear on multiple platforms, including mobile devices (phones, tablets, laptops),

sensors (e.g., magic mirrors), smart glasses, and glass extensions (Milgram et al. 1994). Web-based AR experiences usually do not even require a special application installation; they can be accessed through a URL or other trigger (e.g., QR code, image, GPS data). In most cases, consumers use the cameras on their own devices to scan the natural environment, and then the AR software expands it with virtual elements on the screen. Thus, AR enables the projection of and user interaction with virtual 3D elements, such as models, text, videos, and animations (Bregman et al. 2019), in real space and real-time (Azuma 1997). Users in turn can achieve an immersive experience without leaving their current environment (Bonetti et al. 2019).

A technical classification based on the type of device would define AR as mixed reality, on a reality–virtuality continuum (Milgram et al. 1994). Rauschnabel et al. (2022b) define extended reality as any representation of a new form of reality that is interchangeable with other extended reality states. In this definition, AR and virtual reality are subordinate to the broader category of extended reality, and their classification depends on the type of presence that users perceive (local or telepresence) and their sense of whether the experience occurs in real space or replaces it. Kumar et al. (2024) instead list main attributes of AR to define it: portability, personalisation, reality congruence, assortment, contextualisation, shareability, interactivity, and informativeness.

The unique and compelling characteristics of AR have made it a popular tool for various purposes in the engineering, military, education, and medicine fields (e.g., Azuma 1997; Gargrish et al. 2021; Peters 2018). For management, it also is proving valuable for internal company training. With regard to marketing in particular, AR positively affects consumer-perceived enjoyment (e.g., McLean and Wilson 2019; Nikhashemi et al. 2021; Yim et al. 2017), usefulness (e.g., Kowalczyk et al. 2021; McLean and Wilson 2019; Yim et al. 2017), and imagination (e.g., Barhorst et al. 2023; He et al. 2018; Park and Yoo 2020). However, considerations of its specific, strategic uses during brand communication to customers have not appeared in prior research.

Using AR for brand management

Brand communication can be internal, such as employee training, and external, such as consumer marketing. When targeted at customers, it can evoke both short-term brand perceptions and long-term brand evaluations. Accordingly, we postulate that AR as a communication tool can support marketing campaigns, as when the movie *Dune: Part Two* was promoted with AR filters added to Snapchat (Erl 2024). Alternatively, AR can contribute to long-term product communication efforts, as exemplified by the IKEA app, released



in 2017, that helps consumers arrange furniture virtually in their homes before buying it (IKEA 2017).

Prior brand management research involving AR primarily deals with user behaviour, whether referring to consumers or employees, after interacting with AR applications. Such studies analyse levels of acceptance (e.g., Goebert and Greenhalgh 2020; Pantano et al. 2017; tom Dieck and Jung 2015), flow experience (e.g., Gupta and Nair 2021; Hsiao et al. 2020; Lee et al. 2018), consumer satisfaction (e.g., Lin and Chen 2017; Poushneh and Vasquesz-Parraga, 2017; Rhee and Lee 2021), and brand experience (e.g., Kumar et al. 2023; Liao 2015; Poushneh and Vasquesz-Parraga, 2017).

Another, relatively less prevalent approach takes the perspective of the brand or company, that is, the sender of the AR communication. Specifically, seven conceptual papers describe the use of AR for marketing purposes. Scholz and Smith (2016) propose a framework (ENTANGLE) of immersive customer experiences within AR, designed to engage the customer after the AR experience. Chandra and Kumar (2018) apply the technology–organisation–environment (TOE) contexts defined by Tornatzky and Fleischer (1990) to AR. When they investigate the use of AR in six phases of a customer journey from a management (provider) perspective, Rauschnabel et al. (2022a) link marketing performance measures (awareness, exploration, planning, purchase, usage, and loyalty) to the BICK FOUR framework of marketing objectives (branding, inspiring, convincing, and keeping). Similarly, Sharma et al. (2023) apply the AISAS (awareness, interest, search, action, and sharing) model to new technologies (including AR) and thereby demonstrate that the stages in the nonlinear decision journey have interactive effects and are influenced by consumers' age. Kumar et al. (2024) use two frameworks, SEAD (sensory, efficiency, assessment, and discovery benefits) and SALES (status, achievement, lifestyle, economy, and safety), to consider AR. They both list detailed attributes, benefits, and values of AR, and they reveal the interconnectedness and relative importance of those factors. With the stimuli–organism–response (SOR) framework, Xu et al. (2024) show how AR can enhance an ecommerce consumer experience. Finally, Rauschnabel et al. (2024a) offer a 4C (consumer, content, context, and computing device) framework to identify various levels of consumer engagement. Web Appendix B lists these previous approaches, which together show that conceptual publications have focused predominantly on AR uses that target short-term management objectives; practitioners still struggle to implement the technology as a marketing tool (Rauschnabel et al. 2022a).

When it comes to brand equity, which we include in this study as a long-term management objective, we find no conceptual research pertaining to AR. Just five empirical studies address questions of AR and brand equity (Haumer et al.

2020; Javornik et al. 2021; Jiang and Lyu 2024; Kim et al. 2021; Wu and Dong 2021), each of which examines specific AR characteristics and one or a selected few brand equity dimensions. Furthermore, these studies provide results specific to particular use cases, without establishing a general model for researchers or brand management purposes. In summary, current literature does not provide resources or recommendations for brand managers regarding whether and how to use AR to achieve long-term brand management objectives.

Conceptual framework

Starting with a classical framework of antecedents, processes, and consequences (Kumar 2021; Lavoye et al. 2021; MacInnis and Jaworski 1989), we adjusted it in our conceptual framework, to refer to experience, mechanisms, and consequences (Rauschnabel et al. 2024b), as Figure 1 illustrates. The experience variables pertain to what happens when brand managers use AR versus 2D communication tools in different set ups, as well as the effects of specific AR features (design elements) that AR creators can select. The centre of the framework includes the mechanism variables, which refer to consumers' evaluations of the AR technology, spanning both AR perception and AR evaluation. Finally, the consequence of our proposed framework reflects Keller's (2001) brand equity pyramid, from bottom (salience) to top (relation). The arrows across variable levels indicate the directions of the effects identified in prior research, along with the underlying research question. Using this framework as an analytical scheme, we seek to structure the data that we collect.

Method

Data collection

We undertook a secondary data collection, with the recognition that many empirical studies already have investigated AR in brand contexts and consumers' related evaluations. Using SCOPUS as the search engine, we searched peer-reviewed publications that included the keywords "augmented reality," "brand," "management," and "marketing." The initial search revealed a significant increase in worldwide search requests for AR in 2010, so we set the search period to January 2010–January 2024. Furthermore, we limited the subject area to business, management, accounting, and social science research, which aligns with our brand management focus. We required the publications to be written in English and excluded conference papers, book chapters, and editorials. The SCOPUS search result produced 1,570 articles (as of January 31, 2024). We checked their key



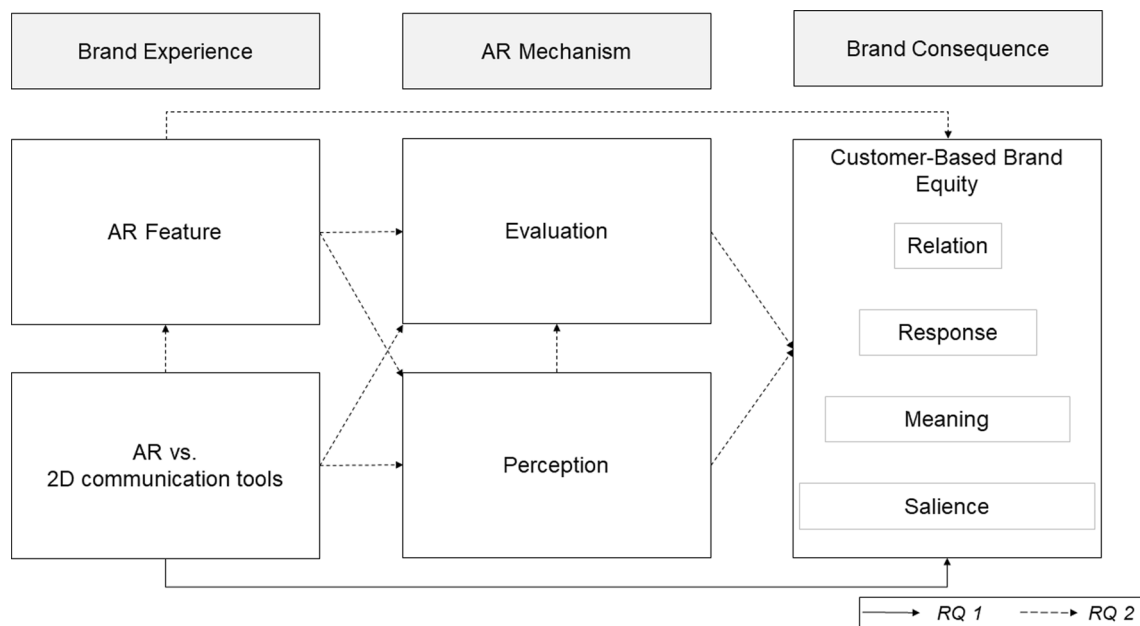


Fig. 1 Classical Conceptual Framework Adapted to AR and Levels of Brand Equity

characteristics to eliminate duplicates, papers not in English, or divergent research fields (e.g., education, engineering); doing so reduced the set to 327 papers. With a snowballing method, we checked the reference lists of these papers to identify any additional sources. Finally, we excluded any papers that never referred to brand equity, leaving 79 relevant studies for our data set. It includes 23 studies dealing with questions of AR versus 2D communication tools and 71 that investigate different AR features (i.e., some studies do both).

Data analysis

We extracted the main findings from these 79 papers and applied them to the structure of our conceptual framework. Specifically, we created a separate row for each effect of AR versus 2D communication tools and of each AR feature on the AR mechanism and brand consequence. This process revealed 398 effects ($n = 82$ for AR vs. 2D communication tools; $n = 316$ for AR features). The complete data set is available on request. To be included in the data analyses, we required significant positive effects from the independent to dependent variables (e.g., positive effects of AR on brand evaluations), because such effects represent evidence-based, statistically supported impacts. For the purposes of this study, “significant positive effects” refer to support for hypothesised effects (relations). In our attempt to highlight the possible relationship between AR technology and brand management objectives, we follow studies in various research areas that consider significant,

positive relations between two variables to establish an analysis of disaggregated data, such as for prognostic purposes (Swindle et al. 2005) or economic relations (Yang and Martinez-Zarzoso 2014).

After exploring all the positive effects in these articles, we created several categories of variables, to establish a contextual structure for AR (feature, perception, evaluation) and brand (salience, performance, imagery, judgements, feelings, relationship) variables that appear in prior research. We conducted a manual text categorisation to simplify the data synthesis (Lacity and Janson 1994), such that we selected variables that match an overall category (e.g., response, interactivity, and modality as part of the interactive category). In this step, we reduced 89 identified variables at the AR feature level to 19 categories (interactive, navigate, informative, immersive, augmented, vivid, privacy concerned, easy to use, qualitative, aesthetic, personalised, dynamic, innovative, shareable, markerless, responsive, anthropomorphic, and contextual). We also condensed the 81 variables at the AR perception level into 12 categories (enjoy, educational, novel, secured, useful, authentic, engaged, irritated, imagined, flow, curious, and close). For the AR evaluation level, we reduced the 41 identified variables into nine categories (attitude towards AR, adoption, congruence, duration time with technology, satisfaction, experience, benefit, trust, help in the decision-making process, and rejection). After these categorisations, we reassigned the 398 effects to the corresponding categories, as listed in Web Appendix C.



Finally, we summarised the extracted effects in our framework, in line with “The currently recommended method of data extraction in systematic reviews [which] is for two researchers to independently extract data and come to consensus over discrepancies through discussion or in consultation with a third party (double data extraction)” (Buscemi et al. 2006, p. 697). The cutoff value ($n \geq 2$) is a quality standard that ensures the validity of our results (Buscemi et al. 2006; Mathes et al. 2017): If at least two independent authors of two independent studies observe the same effect, we consider it a notable effect.

Results

Patterns of AR and brand variables

The data analysis indicates three main patterns that reflect the needs of different participants in brand management decision-making processes: (1) Brand management (AR usage vs. 2D communication tools), (2) Marketing (customers’ feelings and behaviour in response to the AR experience), and (3) Creatives (detailed view of AR features for app creation). Even as we distinguish them, we highlight that all three patterns align with our conceptual framework and reflect experience, mechanism, and consequence elements. In the figures in which we depict these patterns, arrows indicate at least two independent and identical effects from one variable to another; highlighted arrows signal research

dependency and at least five independent, identical research results.

Brand management level

Figure 2 illustrates the pattern that emerges from the effects of AR versus 2D communication tools on customer experience, according to prior research. For brand managers and consultants, this patterns reveals if and when AR is beneficial for build brand equity. The left-hand side pertains to the decision to use AR or not (RQ1). The right-hand side depicts the effects on the brand equity dimensions. We highlight three key findings within this pattern. First, two studies indicate the more positive direct effect of 2D communication tools (e.g., digital signage, mobile websites) on brand judgement, compared with AR tools (Jäger and Weber 2020; Kowalczyk et al. 2021). Second, the pattern reveals notable effects of AR usage on brand relationships (Brito et al. 2017; Haumer et al. 2020; Huang and Liu 2021; Poncin and Mimoun 2014; Rauschnabel et al. 2024a; Sharma et al. 2023) and brand response judgements (Brito et al. 2017; Haumer et al. 2020; Huang and Liu 2021; Kowalczyk et al. 2021; Poncin and Mimoun 2014; Tan et al. 2021; Tsai et al. 2020; Yang et al. 2020). This collection of effects indicates that using AR is sufficient to enhance both relationships and judgements. Third, the pattern indicates a lack of effects from the uses of either AR or 2D communication tools to brand meaning performance.

Arguably, the first two findings are contradictory. To explain this outcome, we note that studies of the AR versus

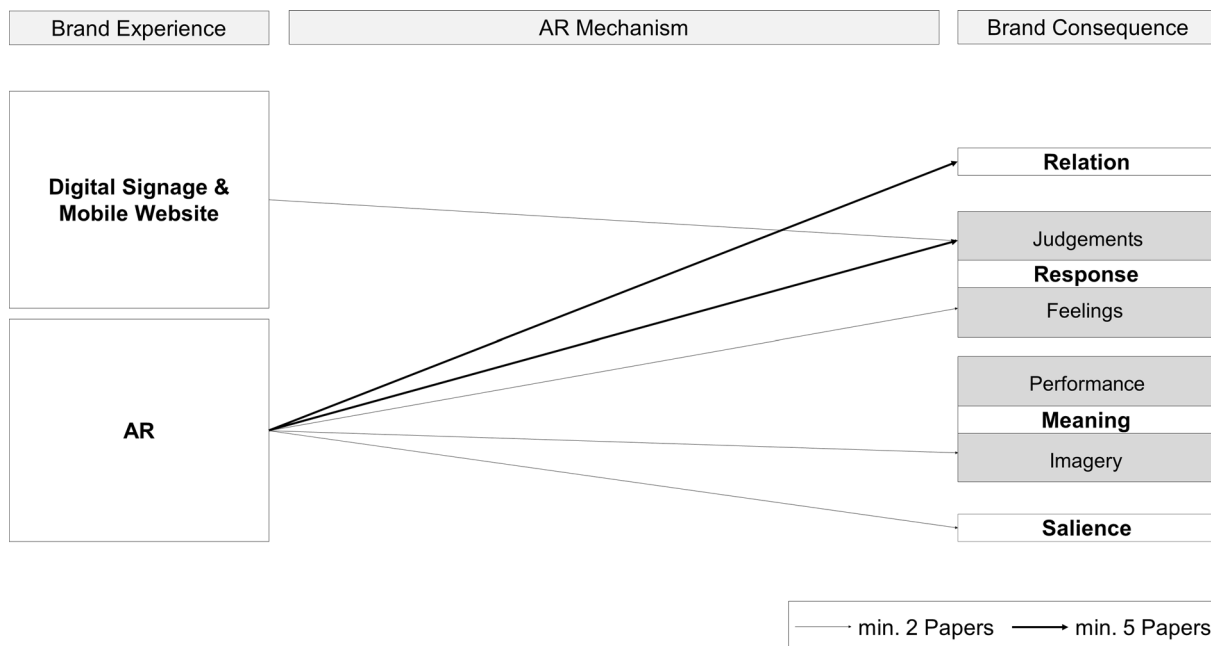


Fig. 2 Brand Management Perspective on the Impact of AR and Non-AR Usage on Brand Equity



2D communication tools debate are less common than research that focuses in detail on AR, possibly because “Journal editors and referees may be more likely to publish results that are statistically significant, that confirm some prior belief or, conversely, that are surprising” (Andrews and Kasy 2019, p. 2766). This concern is well known; more papers are published when they offer statistically significant, positive results (e.g., Brodeur et al. 2023; Chan et al. 2004; Sutton 2009). Therefore, our findings actually establish the intensity of relevant research, and in comparisons of AR versus 2D communication tools, results that favour AR are likely to be over-represented. To establish a neutral view on AR, it is important to consider other media. Furthermore, the direct positive effects of AR and 2D communication tools (digital signage or mobile websites) on brand judgement indicate that brand management decisions should reflect the specific the use case, because both tools can support this objective.

Marketing level

The pattern of AR mechanisms on brand consequences in Fig. 3 reveals consumer behaviours in response to AR. For marketers, it indicates how consumers perceive and evaluate AR technology and how these views affect brand equity. On the left, the experience pertains to AR usage. Consumers primarily focus on feelings about and judgements of the brand experience (Brakus et al. 2009; Ebrahim et al. 2016), as indicated by the AR mechanism. The AR perceptions and evaluations reflect how they process the effects of AR usage

(left) on brand equity (right). Here, we derive four main findings. First, nine of the 12 AR perception variables, and six out of nine AR evaluation variables, appear in at least two independent publications, written by different authors. Second, seven out of the eight AR perceptions (i.e., useful, flow, enjoy, imagined, authentic, educational, and irritated) affect brand judgements. The most evident effect is from imagination induced by AR on brand judgements (Barhorst et al. 2023; Park and Yoo 2020; Rauschnabel et al. 2019; Scholz and Duffy 2018; Sihi 2018); such imagination also is positively influenced by customers’ enjoyment (Gatter et al. 2022; Rauschnabel et al. 2019; Scholz and Duffy 2018). Third, we find few studies of the effects on brand salience or performance. Although Xu et al. (2024), Feng and Xie (2019), and Liao (2015) research customers’ switching behaviour, brand recall, and brand awareness, none of the effects were explored by another, independent author. Fourth, irritation with using AR leads to rejection of the technology, with negative impacts on consumers’ brand judgements (Feng and Xie 2019; van Esch et al. 2019).

Creation level

Developers and technology engineers are interested in technological attributes (Mast and Hawes 1986); they thus might gain insights from the pattern in Fig. 4, which represents the effects of identified AR features (left) on brand equity (right) (RQ2), from an app-creation perspective. Three findings emerge. First, many of these publications refer to same six (out of 19) AR features, without considering AR

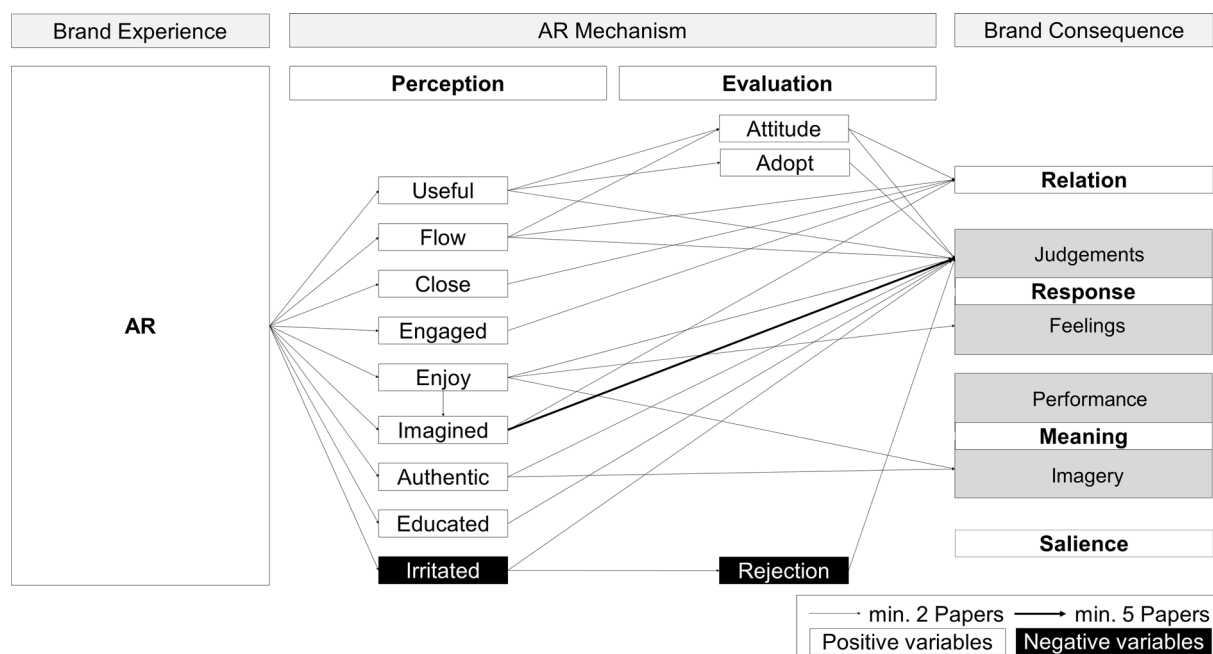


Fig. 3 Marketing Management Perspective on the Influence of AR Perception and Evaluation on Brand Equity



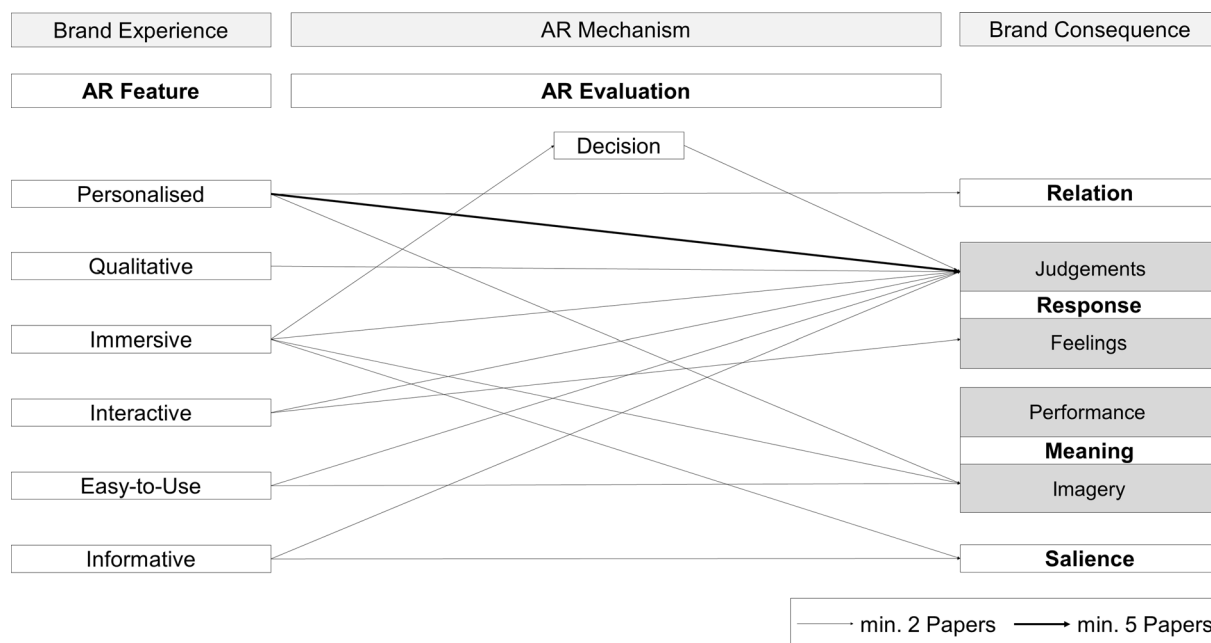


Fig. 4 AR Creation Perspective on the Impact of AR Features

perceptions; only one of ten AR evaluation variables has been researched more than once. Second, the researched AR features (i.e., qualitative system and service, interactive, immersive, easy-to-use, personalised, and informative) exhibit direct effects on brand judgements, especially if the AR is personalised (Alimamy and Gnoth 2022; Baek et al. 2018; Hsiao et al. 2020; Javornik et al. 2021; Phua and Kim 2018; Sihi 2018). Notably, these most researched AR variables appear well-founded in established theories. For example, the AR ease-of-use feature and usefulness perception are part of the technology acceptance model (Davis 1989) and its extensions (Venkatesh et al. 2003). Furthermore, the flow model (Csikszentmihalyi 1975), satisfaction theory (Oliver 1980), the user experience model (Norman 1998), and the customer experience model (Schmitt 1999) are distinct from researching the mechanism. Third, we find little research into the effect of AR features on brand performance. Although Bonetti et al. (2019) identify positive effects of immersive, personalised AR on brand performance quality, no second study affirms their findings.

HARBE model

To clarify how AR might support the achievement of brand equity objectives (RQ2), we establish a model and theoretical frame for predicting the effects between the established theory (Keller's brand equity) and a new item (AR technology) (Jaakkola 2020). Figure 5 illustrates our proposed Holistic AR Brand Equity (HARBE) model, which comprises all total and direct effects from AR to

brand equity, across all three patterns. To develop this new model, we used the five-step NESTA technique (Rasolofoarison and Russell 2023).

1. Narrate: We define the key message, that is, how AR directly affects the development of brand equity.
2. Extract: We select key elements and define their relations and directions. All dimensions of brand equity and the three AR dimensions are key, because they reflect direct effects.
3. Transpose: We select different shapes and colours as design elements and symmetry and closure as gestalt principles. The use of familiar structures supports greater cognitive understanding of our research results (Milligan 1979).
4. Structure: We position the key elements of brand equity at the centre of the model, reflecting the equivalence of the subcategories. Furthermore, we highlight the three AR dimensions to help users identify the corresponding variables. The arrows around the AR dimensions signal the direction of the effects.
5. Assess: We check whether the visual graphic fits our key message.

Applying these steps repeatedly, we adapted the model several times. The final version of the HARBE model shows which AR dimensions positively affect brand equity levels and demonstrates that AR can support the development of brand equity, from bottom to top.



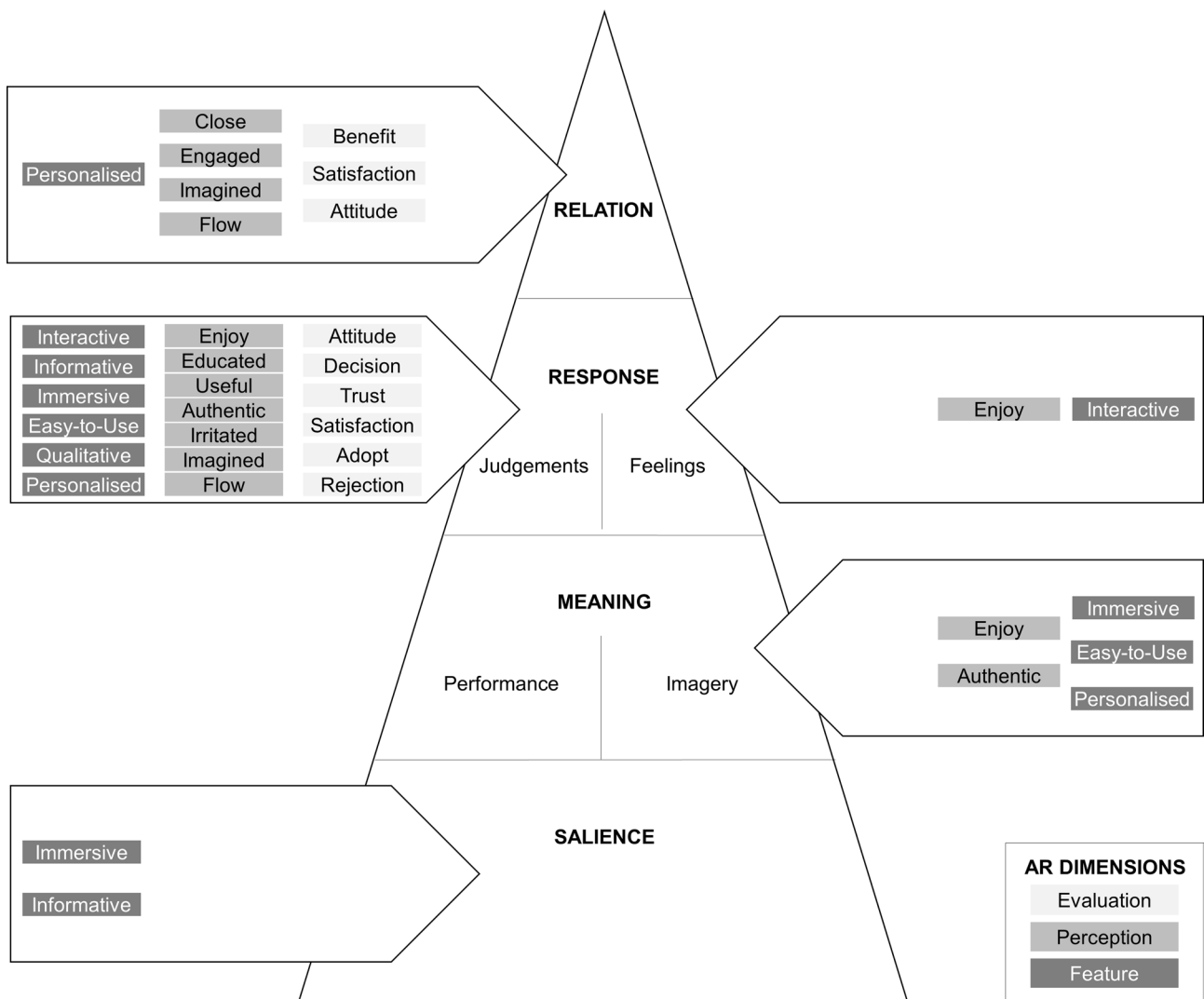


Fig. 5 HARBE Model

At the bottom of the model, the brand achieves salience. The AR features of informativeness and immersion have direct impacts on customers’ awareness and switching behaviours (Bonetti et al. 2019; Sihi 2018; Xu et al. 2024), which are classified at this level. Increased customer awareness stems partly from curiosity, which in turn implies a knowledge gap (Loewenstein 1994), “defined as the difference between two quantities: what a person knows and what he or she would like to know. Curiosity arises when people become aware of the existence of a knowledge gap” (Menon and Soman 2002, p. 3). Information about the product or brand can close this gap and address customers’ question about who the brand is (Keller 2001). In addition, immersion is a core AR feature, and AR advertisements generate attention from customers, who may be unfamiliar with the technology (Yang et al.

2020). Thus, customers appear curious to engage in an AR brand experience and learn what immersion is.

The second level, meaning, pertains to performance and imagery. The effects of AR on brand imagery have been researched thoroughly in terms of the AR features of personalisation, immersion, and ease of use (Huertas and Gonzalo 2020; Javornik et al. 2021; Kazmi et al. 2021) and the AR perceptions of enjoyment and authenticity (Gupta and Nair 2021; Javornik et al. 2021; Pantano and Servidio 2012; Sihi 2018; Sung 2021). Brand imagery includes brand variables, such as aesthetics, imagination, shop perceptions, and brand experience. In Keller’s (2001) view, meaning can be reached through unique brand associations. For example, AR integrates customers into the brand experience by allowing them to try products virtually, such as by mapping elements onto customers’ bodies or homes, which is both highly personal



and immersive. In combination, the AR brand experience evokes individual imagination about the brand in each customer's mind (Rauschnabel et al. 2019). These ideas create meaning for the brand (Pallant et al., 2021). In contrast with imagery, performance has not been studied in two independent studies; perhaps AR does not affect brand performance.

On the third level, customers' responses include both judgements and feelings. Judgement is the most researched dimension of brand equity, and all AR dimensions have direct effects on it. In addition, the AR features ease of use, personalisation, interactivity, immersion, quality, and informativeness directly affect satisfaction, trust, brand attitude, purchase (intentions), and liking (e.g., Cuomo et al. 2020; Kowalczyk et al. 2021; Pantano and Servidio 2012; Tsai et al. 2020). On the AR perception level, imagination, usefulness, enjoyment, education, and flow directly affect satisfaction, trust, brand attitudes, and purchase intentions (e.g., Barhorst et al. 2023; Gatter et al. 2022; Phua and Kim 2018; Sung 2021). In the AR evaluation dimension, we find direct effects from satisfaction, AR attitude, adoption, and decision on purchase (intentions), brand attitudes, satisfaction, and brand adoption (e.g., Hsiao et al. 2020; Lacka 2020; Lin and Chen 2017; Rhee and Lee 2021; Sengupta and Cao 2022). Brand equity-level judgements in our model also map the effects of customers' sense of irritation with AR on brand judgements, particularly attitude (Feng and Xie 2019; van Esch et al. 2019). Irritation in this context reflects psychological stress or a negative emotional dissonance; customers' irritation negatively influences both attitudes towards the technology and brand judgements. A similar effect chain has been demonstrated for digital advertisements (Sharma et al. 2022); it appears to apply to AR brand communication tool. The data underlying our HARBE model identify positive effects of customers' rejection of AR technology on brand judgements as well, especially attitude (Bonetti et al. 2019; Smink et al. 2020).

In contrast with judgements, customers' feelings towards a brand appear to depend on AR interactions and perceived enjoyment. Brand equity feelings reflect customer-to-customer relations, positive emotions, and prestige (Javornik et al. 2021; Scholz and Duffy 2018; Xu et al. 2024). The correlation between an interactive experience through technology and perceived enjoyment has been widely researched, such as in gamification or co-creation marketing contexts (e.g., Kaur et al. 2023; Nobre and Ferreira 2017). In line with Lee et al. (2006), who use virtual models as interactive stimuli on a website, we find that an interactive, joyful, AR brand experience leads to brand responses.

At the top of the HARBE model, we come to the customer-brand relationship. Personalisation of the AR exerts a direct, evidence-based influence on brand love, advocacy, and brand connections (Alimamy and Gnoth 2022; Bonetti et al. 2019; Huang 2019; Huang and Liu 2021; Javornik

et al. 2021). As Coelho and Henseler (2012) indicate, the direct positive effect of technological customisation (or personalisation) on customer brand loyalty is an indication of a strong brand relationship. In general, customisation involves highly personalised marketing output, such that a brand or marketer uses customer information to adapt the promotion, product or service, price, and communication, which should encourage interactions between customer and marketer (Vesonen 2007). With AR technology, customisation is facilitated, because it is possible to scan the customer's environment or body in real-time and then add brand elements, immediately and without requiring additional data, such as from customer relationship management systems. Therefore, it offers a high level of customisation, even at the first brand contact.

For the AR perception dimension, the variables closeness, flow, imagination, and engagement positively affect the brand relationship, manifested as a willingness to pay more, brand engagement, loyalty, love, physical connection, and recommendations (e.g., Arghashi and Yüksel 2022; Barhorst et al. 2023; Huang and Liu 2021; Javornik 2016; Lee et al. 2018; Nikhashemi et al. 2021; Rauschnabel et al. 2024b; Scholz and Duffy 2018; Sung 2021). Highlighting two of these effects, Ali et al. (2021) consider the transfer of any technological engagement to the brand, and Shin et al. (2018) argue that perceived closeness to the human environment (other humans or objects) positively affects the perceived relationship to a brand that is digitally integrated into that environment. Therefore, AR users feel connected to the brand, due to their perception of physical and emotional closeness, induced by the AR technology.

Turning to AR evaluations, we find that a positive AR attitude, satisfied users, and AR-generated benefits positively influence customers' engagement, brand connection, love, recommendations, and willingness to pay (Arghashi and Yüksel 2022; Goebert and Greenhalgh 2020; He et al. 2018; Khan and Fatma 2024; Lee et al. 2018; Rhee and Lee 2021; Scholz and Duffy 2018; tom Dieck et al., 2018). The link from satisfaction and a positive attitude towards AR technology to a loyal relationship also is predicted by the notion of technology-based vertical brand extensions, which "extend[] an existing brand to a product that typically requires different levels of technology. Upward (downward) brand extension refers to extending an existing brand to a product whose technological dimension is generally seen as more (less) advanced" (He and Li 2010, p. 1368). He and Li (2010) propose that better fit between the brand and the technological brand extension brand leads to stronger brand loyalty. At the highest level of brand equity, it thus seems that AR is no longer a standalone dimension with unique effects on the brand evaluation. For customers, the technology is part of the brand. As implied by Veloutsou (2015), a positive evaluation of the (AR) experience is a positive



evaluation of the brand, and those positive evaluations result in a relationship.

Discussion

Theoretical Implications

The novel approach we take in this article uncovers three main implications, with theoretical relevance for both research and education. First, it contributes to the necessary conceptual effort to advance brand management research (Heller et al. 2023) by providing fundamental, conceptual knowledge about the use of AR for long-term-oriented brand management. Therefore, this article provides a foundational source for education on AR and brand management, with insights for students, researchers, and lecturers in management, marketing, communication, design, or computer science fields. Second, our proposed experience–mechanism–consequence framework is scientifically useful; it provides a general structure for analysing data about AR in brand management, with the potential for applications to other technologies too (e.g., virtual reality, metaverse, artificial intelligence), as well as other models of consequences (e.g., Aaker 1991, 1996; Yoo et al. 2000). Integrating this framework into academic syllabi can help students and novice researchers devise ways to depict effect chains when researching the effects of technologies. Third, the HARBE model in particular reveals research gaps (brand performance) and effects that have been researched multiple times (e.g., all three AR dimensions on brand judgement). Thus, these patterns can guide researchers, especially novices, as they seek research gaps and work to position their own research.

Practical implications

When it comes to brand managers and AR designers or consultants, our study offers another set of four practical implications. In bridging scientific research and brand management practice, the patterns and models that we derive can give brands a deep understanding of AR experiences, even if they have little previous experience with AR technology. Thus, the results can help encourage and increase knowledge transfers about AR in brand management within a company, especially during onboarding processes for new colleagues or when introducing a new brand.

Furthermore, the customised frameworks for brand communication patterns give brand managers or consultants immediate, evidence-based answers regarding whether they should use AR or another tool. These patterns suggest the clear advantage of AR when it comes to customer–brand relationships, as well as its relative advantage for brand

feelings, imagery, and salience, for which different AR feature support distinct brand equity objectives. Referring to these patterns should help advance discussions of brand communication activities and efforts to define requirements for internal creation or external advertising agency pitch briefings. Finally, AR creators can adjust their existing applications according to these patterns, to increase the chances of successful AR designs for a particular objective.

In a related sense, the HARBE model supports simplified decision-making. It identifies the significant positive, direct effects of using AR on each dimension of brand management objectives. Specifically, it details the opportunities and barriers of using AR to determine the need for help from specialists, calculate budgets, and define brand communication objectives. In addition, the HARBE model could reduce technology inhibitions. A brand manager who struggles to use AR might apply this model to identify which brand management objective can be best supported by specific AR functions. The model immediately reveals which parameters influence the success of brand equity objectives and thus provides a basis for rapid, evidence-based decisions.

Finally, it offers adaptable AR design elements. The goal of the applied conceptual model was to simplify available data pertaining to AR effects on brand management objectives, so it identifies design elements (AR features) that can be adapted to further or future technologies that may arise from AR. The effects of the general design elements on customers' brand evaluation remain valid.

Limitations and further research

A notable limitation of this article results from our method for analysing the positive effects, such as on perception, evaluation, and each level of brand equity. For these assessments, we only present data relevant to our research question about whether and how AR affects brand equity; we do not integrate non-significant or negative significant results. With regard to the potential for confirmation bias, our analysis includes some supported hypotheses with contextual negative effects (e.g., irritation with using AR positively affects rejection of the AR technology, which significantly and positively affects consumer judgements of the brand). In addition, our research does not deal with the strength of the effects. Another limitation refers to the communication tools; previous research has compared AR with websites or digital signage in particular, without addressing other channels, like advertising, sponsorships, or other formats. The double data extraction method could impose another limitation: Our analysis only includes variables for which at least two independent studies identified the same effect. This selection criterion helps ensure the validity of our results, but the data come from heterogeneous studies. For our HARBE model, which depicts the effects on an abstract



level, the details of the individual studies were not necessary. Still, this method establishes the efforts linked to the technology, not the costs.

Both the limitations and the contributions of the proposed model suggest ideas for continued research. First, the underlying framework for the model previously has been established as valuable in research that seeks to illustrate effect chains. Conceptual research could address the influences of AR features on brand evaluation, using and adapting the classic conceptual framework we used. Second, the three derived patterns indicate significant positive effects from AR to brand judgements, which result from specific variables in a brand management context (i.e., purchase intentions, attitude, liking, and satisfaction), where they have been researched intensively. To diversify insights into the effects of AR on brand equity and obtain a broader view, continued research should investigate variables such as willingness to spend time/energy with the brand, customer ambassadors (brand relationship), image perception and associations (imagery), and brand knowledge (performance). Our study highlights gaps in sufficient evidence to draw conclusions, particularly regarding performance. Third, the frequently analysed variables resonate with established models of acceptance, satisfaction, and flow. Some publications suggest the potential relevance of other theoretical perspectives, such as anthropomorphism (van Esch et al. 2019) or means-end chain theory (Kumar et al. 2024). Even more theoretical diversity would be helpful for researching technology in a brand context, to expand both the data and the questions being investigated. More data can help researchers gain greater depth, such as with meta-analyses (Lipsey and Wilson 2001). In line with data diversity, conceptual works might consider significant positive, insignificant, and significant negative effects. Fourth, we excluded moderating effects, such as demographics (e.g., age, culture) or personality traits (e.g., familiarity with the technology), that are worth investigating.

Conclusion

Previous research has not conceptualised or explaining the implications of technology at a brand management level (Heller et al. 2023). Unlike consumer-focused (e.g., 4C, Rauschnabel et al. 2024a; SOR, Xu et al. 2024) or marketing-oriented (e.g., BICK FOUR, Rauschnabel et al. 2022a) models, we investigate AR technology in light of the overall brand management objective, brand equity, on a higher abstraction level. The results of our secondary data analysis confirm the appropriateness of adapting the experience–mechanism–consequence conceptual framework to AR research. They also reveal three patterns, at different levels of the brand decision-making processes (brand manager,

marketing manager, app creator), which lead to the proposed HARBE model, an implantation theory.

These findings and conclusions reflect the original objective of this research, namely, to simplify complex results about AR in an implementation model that can support brand management efforts. We do not offer a new theoretical model for deriving a definition; rather, the HARBE model combines existing frameworks and models for AR and brand equity, which enhances its practical use value. In particular, our novel HARBE model details how AR enhances brand equity in four ways: (1) Its use in brand communications has a positive effect on all levels of brand equity; (2) It affects brand salience, meaning, customer responses, and relationships, such that AR is a useful communication tool for achieving short-term brand awareness and long-term customer–brand relationships; (3) It increases positive brand equity by providing appealing features to customers (interactivity, personalisation, immersiveness, ease of use, informativeness); and (4) It transforms positive perceptions (e.g., flow, enjoyment, usefulness) and evaluations (e.g., satisfaction, trust, attitude) into positive brand evaluations.

The results also offer valuable insights for researchers, especially in revealing the research gap pertaining to the effects of AR on the brand’s meaning-level performance. Furthermore, AR does not emerge as superior to other communication tools, suggesting the need for comparative research involving AR and other media, to establish evidence-based recommendations for decision-making.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1057/s41262-025-00381-4>.

Funding Open Access funding enabled and organized by Projekt DEAL. Jörg Henseler gratefully acknowledges financial support from FCT Fundação para a Ciência e a Tecnologia (Portugal), national funding through the research grant Information Management Research Center—MagIC/NOVA IMS (UIDB/04152/2020).

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there are no conflicts of interest.

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Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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