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A Helpful Tool or Marketing Gimmick? How Using Augmented Reality Pre-Purchase Shapes Consumer Response to Product Failure

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MANUSCRIPT

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Abstract

Brands increasingly incorporate Augmented Reality (AR) technologies into online shopping experiences. While prior research has primarily explored AR's benefits during the pre-purchase stage of the consumer journey, the current work examines how AR use can negatively shape consumers' attributions and responses in the post-purchase stage. Specifically, we focus on a common post-purchase outcome in online shopping: product failure. Eight studies demonstrate that consumers who used AR pre-purchase (versus other digital displays such as 3D visualization, 360-degree view, or stylized photos) are more likely to attribute the failure to the brand rather than to themselves (e.g., their own misjudgments), inferring that the brand used the technology deceptively to drive purchase. This inferred deception, in turn, decreases consumers' future patronage intentions. Consistent with our theorizing, the effect emerges specifically when the product failure is visual in nature. We further identify three theoretically relevant and managerially controllable moderators that offer insights for marketers considering AR integration: while the inclusion of a commonly used and benign persuasion element (e.g., an "add-to-cart" icon) can heighten inferred deception and amplify the negative effect, providing forewarning messages that increase consumers' self-awareness and offering conspicuous disclosures about the technology's status can reduce inferred deception and mitigate the effect.

Keywords: Augmented Reality, product failure, deception, persuasion knowledge, post-purchase behavior, attribution

Online product return rates have nearly doubled since pre-pandemic levels (Baertlein and McLymore 2023), and now one in three online orders results in a return (PR Newswire 2024). While product returns can be initiated for many reasons, one of the most cited is that the item received fails to meet consumers' visual expectations. For example, the sofa you ordered for your new apartment might look too small when placed in your living room, or the artificial plant you ordered might not "work" with your desk. One survey found that 75% of consumers reported returning an online order due to the perception that the item was "not the right fit" (PowerReviews 2023). This trend has important economic and societal implications, as online returns erode retailers' profits, generate additional carbon emissions, and create billions of pounds of landfill waste (Dickler 2024). To mitigate this trend, brands increasingly provide more immersive tools to reduce consumer uncertainty around online purchases.

Among these tools is the Augmented Reality (AR) feature, a technology that allows consumers to "superimpose computer-generated content onto their real-time physical environments" (Hadi and Park 2024). Typically accessed through smartphone apps (e.g., Amazon shopping app; Perez 2020), the AR feature allows consumers to scan their real-time surroundings (e.g., one's living room), place the virtual content (e.g., a piece of wall art) into the physical space, and experience what the product would look like in their environment (e.g., walking around the living room to place the art on different walls). Major retailers such as Amazon, Target, and Walmart, as well as major consumer brands such as Nike, IKEA, and Sephora, have all incorporated AR features in their shopping apps (Mintel 2025) to "facilitate novel visual experiences" (Szocs et al. 2023, p. 609). The AR market in retail is expected to reach $64.4 billion by 2030, with a forecasted annual growth of more than 20% from 2024 (Globe Newswire 2025).

Emerging research in marketing has primarily explored the impact of using AR during the pre-purchase stage of the consumer decision-making journey, showing that pre-purchase AR use positively influences purchase behavior by increasing mental stimulation, presence, and choice confidence during the decision-making process (Fritz, Hadi, and Stephen 2023; Hilken et al. 2017, Hilken et al. 2022; Kowalczuk, Siepmann, and Adler 2021). The current work builds on this research, but shifts focus to examine how pre-purchase AR use can shape consumers' attributions and behavioral intentions in the *post-purchase* stage, particularly in cases of product failure (i.e., instances in which products do not meet consumers' pre-purchase expectations; Darke, Ashworth, and Main 2010). We find that consumers who use AR pre-purchase, compared to those using other digital product displays (e.g., photos, 360-degree view, or 3D visualization), are more likely to attribute product failure to the brand rather than to themselves (e.g., their own error in judgment), instead inferring that the brand used the technology to deceive them into making a purchase (Darke and Ritchie 2007; Kirmani and Zhu 2007). This inferred deception, in turn, decreases consumers' likelihood of patronizing the brand in the future. Consistent with our deception-based account, we find that this effect emerges specifically for product failures related to visual elements of the product (i.e., what AR technology is assumed to represent), but not for failures related to non-visual cues (e.g., the feel of a product; Peck and Childers 2003).

We further identify three moderators of our effect that are consistent with our theorizing and offer actionable insights for in-app AR design. First, we show that AR app features such as an add-to-cart button (Yang and Huang 2018) can activate persuasion knowledge, making firms' ulterior motives more mentally accessible (Brown and Krishna 2004; Campbell and Kirmani 2000) and thus amplifying the inferred deception following product failure. Second, we find that presenting a forewarning message (Wood and Quinn 2003) during AR use that heightens

consumers' self-awareness in using the AR feature (e.g., "ensure that you are using this feature correctly") can decrease the extent to which consumers attribute the product failure to the brand's deception and thus mitigate the negative effects we predict. Third, we find that conspicuous (vs. covert) disclosures (Stewart and Martin 2004) about the limitations of the AR technology's capabilities will decrease (vs. increase) inferred deception and thus increase (vs. decrease) the likelihood of patronizing the brand.

Theoretically, our findings contribute to extant research on the positive impact of pre-purchase AR use (Fritz, Hadi, and Stephen 2023; Hilken et al. 2022; Kowalczuk, Siepmann, and Adler 2021; Tan, Chandukala, and Reddy 2022) by demonstrating that AR can also negatively shape consumers' post-purchase attributions in the context of product failure, thereby broadening the understanding of how AR use shapes consumer responses in different stages of the consumer journey (Hamilton and Price 2019). Our work also contributes to the literature on consumer inference-making (Haws, Reczek, and Sample 2017; Wu et al. 2017), particularly in the domains of persuasion knowledge (Campbell and Kirmani 2000; Friestad and Wright 1994, 1999) and deception (Darke and Ritchie 2007; Kirmani and Zhu 2007). Traditionally, this stream of research has focused on in-person communication (e.g., interaction with salesperson; Kirmani and Campbell 2004; Main, Dahl, and Darke 2007) or advertisements (Becker, Wiegand, and Reinartz 2019; Darke and Ritchie 2007; Goldfarb and Tucker 2011), exploring when and why persuasion attempts used in these purchase contexts can feel manipulative. More recent work has considered the effects of persuasion knowledge activation in digital contexts (Hmurovic, Lamberton, and Goldsmith 2023; Usman et al. 2024; Watson, Valsesia, and Segal 2024) and how virtual interactions can impact inferred deception (e.g., interaction with a social media influencer; Leung et al. 2022). Adding to this work, we show how AR, an increasingly prevalent

digital product display format, can lead consumers to infer that the brand has ulterior motives and acted deceptively to convert a sale.

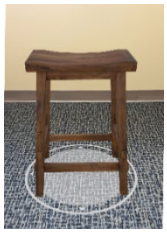
Practically, our research identifies incorporating AR into product displays as a potential liability to the brand for future loyalty post-product failure. We also identify three in-app features that can amplify or mitigate the inferred deception and likelihood of patronizing the brand in the future, thus offering actionable insights for AR app design.

Theoretical Background

Augmented Reality and Attributions of Product Failure

Augmented Reality (AR) is a technology that allows consumers to overlay digital content into physical environments (Hadi and Park 2024). When using AR, consumers can scan their real-time environment via a web app or a smartphone app (e.g., Amazon app; Perez 2020), place the virtual object in their environment, and experience a rendering of what it would look like in that physical environment. AR is not the only way brands display products in digital environments; many brands use photos, 360-degree views, and 3D visualizations to display products during online shopping. AR display is distinct from these other digital display formats, as it allows users to actively integrate their physical surroundings with virtual objects ("real-virtual integration"; Hadi and Park 2024). While displays such as 3D visualization also allow consumers to see what a product looks like from the top, right, left, or bottom (Worldsync 2022), they do not enable consumers to actively place a virtual rendering of the product within their real-time physical surroundings (see Table 1 for example screenshots). This active involvement of consumers in superimposing the virtual object to the real world is a unique feature of AR compared to other digital displays consumers may encounter in online shopping environments.

Table 1: Example Screenshots of 3D Visualization versus AR Feature.

Display type			
3D visualizations or 360-degree view[a]			
Augmented Reality[b]			

Notes:

a- A 360-degree view is created by compiling images taken from multiple angles around a product and thus is, in general, identical to a 3D visualization (Worldsync 2022).

b- Using the AR feature requires consumers to first place the virtual object in their real-time physical surroundings (screenshot 1). They can then move around the object to view it from different angles in their environment (screenshots 2 and 3).

Recent work has documented the positive effects of using AR to superimpose virtual content on real-time surroundings during the product evaluation stage (e.g., deciding which food item to order; Fritz, Hadi, and Stephen 2023). During this stage, AR increases mental simulation (Hilken et al. 2017), the tangibility of the object being viewed (Heller et al. 2019), the authenticity of the experience (Hilken et al. 2022), and choice confidence (Kowalczuk, Siepmann, and Adler 2021), which in turn increases product choice (Fritz, Hadi, and Stephen 2023), especially when product-related uncertainty is high (Tan, Chandukala, and Reddy 2022).

While prior work provides critical insights into how AR influences consumer decisions during the choice-making stage, much less is known about whether and how AR impacts consumers' attributions and behaviors later in the post-purchase phase of the consumer journey. Our research explores the impact of AR use in the context of an important and common post-purchase outcome: product failure, defined as instances in which products do not meet

consumers' pre-purchase expectations (Darke, Ashworth, and Main 2010). Past work finds that product/service failures directly impact customer satisfaction (Oliver and DeSarbo 1988; Smith, Bolton, and Wagner 1990) and drives important post-purchase outcomes, such as trust (Longoni, Cian, and Kyung 2023) or purchase intentions (Khamitov, Grégoire, and Suri 2019). A key question in this literature is how consumers form attributions about who is to blame (e.g., themselves, the retailer, etc.) for the failure (Dunn and Dahl 2012; Folkes 1984; Weiner 2000), and, more recently, how these attributions occur for failures in non-traditional contexts (Khamitov, Grégoire, and Suri 2019). For example, Longoni, Cian, and Kyung (2023) show how consumers understand and respond to human-driven versus algorithm-driven public service failures.

We propose that using AR pre-purchase can shape consumer attributions of a future product failure, such that those who use AR pre-purchase, compared to those who have used other digital displays, are more likely to attribute the failure to the brand versus to other causes, such as their own misjudgment. We propose that this occurs because of the distinct characteristic of AR. Specifically, unlike more "passive" displays such as photos, 360-degree view, or 3D visualization, which require less interaction from the consumer (e.g., simply clicking or dragging one's finger on a screen), AR instead requires that consumers actively integrate virtual objects with their physical surroundings. For example, Amazon's in-app AR feature requires consumers to first place the virtual object in their real-time physical surroundings using the app and then move the object around their physical environment to view it from different angles. This interaction requires more consumer engagement than other aforementioned digital display formats, which simply involve viewing a product on a screen.

We propose that this heightened involvement required in using AR subsequently affects consumers' attributions of product failure. That is, due to greater consumer involvement compared to other, more passive digital displays, we suggest that consumers who use AR will be more likely to believe that they did their "due diligence" and thus believe that any negative outcome that follows is not within their responsibility. Supporting this conjecture, prior research documents that when consumers exert effort, it often leads to a belief that they are owed a positive outcome (De Witt Huberts et al. 2014; Feather 1992). For example, consumers who invest significant effort in a firm (through past purchases) are likelier to believe they will win a prize in a random drawing (Reczek, Haws, and Summers 2014). In our context, we propose that using AR will lead consumers to believe that they put in their best efforts to fully predict what the product would look like in their environment before purchase. Thus, any negative outcome that may follow is attributed less to their own error in judgment and more to the brand's actions. We discuss the content of these brand-focused attributions in the next section.

Using Augmented Reality Increases Inferred Deception Following Product Failure

If consumers who use AR pre-purchase are more likely to blame the brand (rather than their own misjudgments) for product failure, what specific brand-focused inferences are they making? We propose that one inference consumers may make is that the brand used AR technology in a deceptive way to persuade them into making a purchase. According to the Persuasion Knowledge Model (PKM; Friestad and Wright 1994), consumers develop lay theories, that is, "cultural folk knowledge" (Friestad and Wright 1994) about how persuasion operates, from personal experiences and cultural narratives like media coverage (Haws, Reczek, and Sample 2017). We posit that, compared to other digital product displays, AR is more likely to activate persuasion knowledge because both consumers' personal experiences and cultural

discussions (e.g., in the popular press) could have reinforced the notion that this technology is as much a persuasion tactic as a tool offering unbiased utility. For example, AR's origins are often framed as a marketing gimmick ("How AR is Shifting from Marketing Gimmick to E-Commerce Upgrade"; Streets 2018) or a tool of persuasion, with some experts suggesting that the feature began as a marketing tactic and only evolved into something more useful for consumers over time (see also Javornik 2016).

To explore this conjecture, we ran a pilot study (n = 100; see Web Appendix A for details) and examined whether AR, compared to other digital product displays, is in fact more likely to activate persuasion knowledge. Participants rated four common digital product displays (photos/pictures, videos, 3D visualization/360-degree view[1], and AR) on the extent to which they think each option is being offered to inform consumers or to actively persuade consumers (1 = to inform/help, 7 = to persuade). As expected, AR ($M = 5.19$) was most strongly associated with persuasion, with participants more likely to think the feature was offered to persuade them (rather than to inform or help), compared to pictures/photos ($M = 3.92$, $p < .001$), videos ($M = 4.35$, $p = .006$), or 3D visualization/360-degree view ($M = 4.41$, $p < .001$). The finding provides initial evidence that AR is more likely to activate persuasion knowledge than other digital displays.

Prior research shows that when persuasion knowledge is activated, consumers are more likely to perceive marketers as having self-serving motives (Campbell and Kirmani 2000) and engaging in deception (Darke and Ritchie 2007; Kirmani and Zhu 2007). While not all persuasion tactics are viewed as deceptive (Isaac and Grayson 2017), inferences of deception arise when consumers feel that a marketer sets false beliefs through persuasion (Held and

[1] Note that, as illustrated in Table 1, a 360-degree view is largely identical to a 3D visualization, except that the former may lack depth cues (e.g., shadows; Worldsync 2022).

Germelmann 2018; Levine and Duncan 2021). In the context of AR, we expect that following product failure, consumers who used AR (vs. other digital displays) pre-purchase are more likely to infer that the brand manipulated them into making a purchase by setting a false belief about what the product would look like in their physical surroundings in a manner that increases persuasion (e.g., making the fit of the product look more desirable than it does in reality). This inference of deception will, in turn, decrease consumers' future patronage intentions for the brand, a prediction consistent with prior work showing that consumers view the source of deception more negatively (Campbell and Kirmani 2000; Darke and Ritchie 2007). Formally:

> **H1:** After experiencing product failure, consumers who used AR pre-purchase will be less likely to patronize the brand in the future than those who use other digital displays.

> **H2:** The effect described in H1 is driven by (a) increased attributions that the brand is responsible for the product failure and (b) a greater likelihood that consumers infer that the brand engaged in deception.

Importantly, we hypothesize that the effects predicted in H1 and H2 are specific to product failures that involve some visual component of the product (e.g., the way the product fits into a physical space). While AR displays provide helpful visual cues to consumers pre-purchase, these technologies are not expected to provide insights into non-visual cues (e.g., the feel of a product; Peck and Childers 2003). As such, when product failure stems from non-visual attributes such as haptic qualities, AR is unlikely to elicit the same inferences of deception that we predict in H2. Note that this moderation via product failure type provides indirect support for

the role of inferred deception, as it demonstrates that the decrease in patronage intentions is not simply due to general disappointment over experiencing product failure after using AR. If that were the case, we would expect to observe the negative post-purchase response regardless of the source of product failure. Instead, we predict that AR decreases patronage intentions following product failure only when the failure occurs in the domain where consumers are more likely to infer that AR was used to intentionally mislead them (i.e., the visual domain).

H3: The effects predicted in H1 and H2 will occur for visual (vs. non-visual) sources of product failure.

Moderating the Decreased Patronage Intentions Following Use of Augmented Reality in Product Failure Context

We further demonstrate how theoretically relevant and managerially controllable features of the digital display environment can impact consumers' inferences and, thus, responses to product failure following pre-purchase AR use. First, past research finds that consumers are more likely to use persuasion knowledge when the ulterior motives of the marketer are highly accessible (Brown and Krishna 2004; Campbell and Kirmani 2000). For example, persuasion knowledge is more likely to be activated when a salesperson flatters a consumer right before making a purchase (Campbell and Kirmani 2000). A common feature in AR apps offered by several prominent retailers (e.g., Target, Amazon, IKEA) is the presence of an add-to-cart button (Yang and Huang 2018) that is integrated into the AR experience (see Web Appendix B for real-world examples). While marketers incorporate this element into an in-app design to reduce friction in consumer decision-making (Unal and Park 2023), we propose that the presence of

such an element (that can be viewed as soliciting purchases) during AR use can instead make ulterior motives of the firm more cognitively accessible to consumers, thus amplifying the inferred deception following product failure. We therefore predict:

H4: Including an add-to-cart button in an in-app AR experience will amplify the effects predicted in H1 and H2.

Next, we propose that by drawing consumers' attention to their role in accurately using the AR feature (e.g., by warning them in the app to "make sure you are using the feature correctly"), they will be less likely to blame the brand for future product failure. Research on the theory of self-awareness (Duval and Wicklund 1973) finds that the "tendency to perceive oneself as being causally responsible for events is increased by directing attention toward the self" (Fenigstein and Levine 1984, p. 231). Pham et al. (2010) apply this theory to the marketing domain, finding that raising consumers' self-awareness (e.g., through the presence of mirrors) increases satisfaction with the provider after product failure by increasing attributions of the failure to consumers themselves. Similarly, we expect that a forewarning message (Wood and Quinn 2003) that heightens consumers' self-awareness about their role in ensuring their correct usage of AR will mitigate inferences of deception, thus reducing its negative impact on patronage likelihood. Formally put:

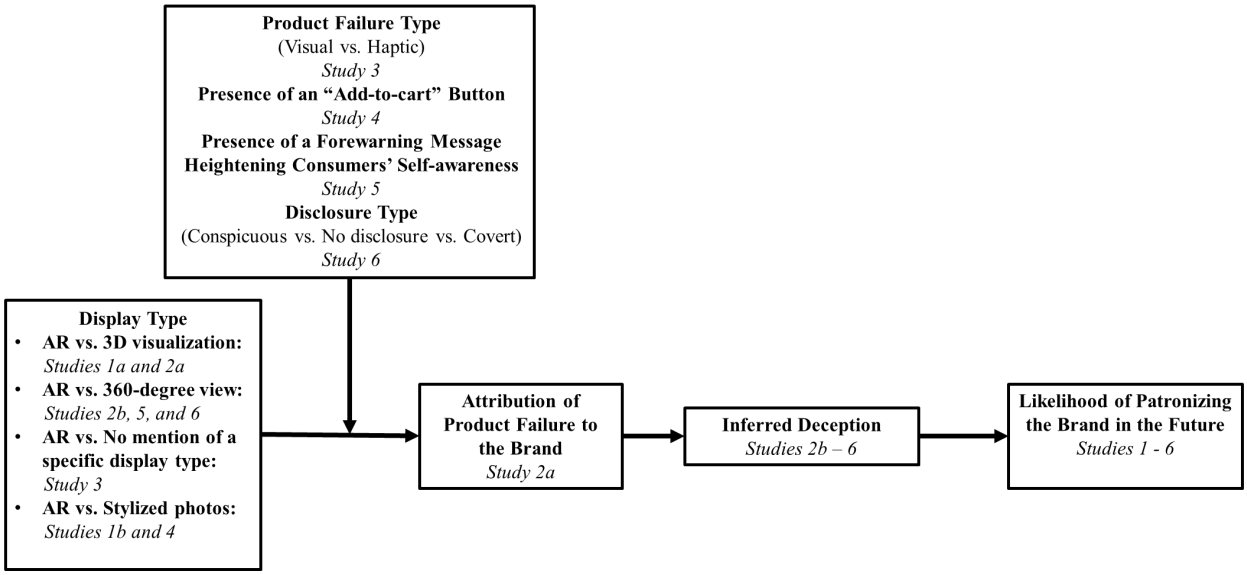
H5: Providing a forewarning message designed to increase consumers' self-awareness during AR use will mitigate the effects predicted in H1 and H2.

Finally, we propose that inferences of deception may also be influenced by the brand's disclosures about the status of its AR technology. In the marketplace context, disclosures aim to make complete information known (e.g., notifying consumers that an ad image was modified; Schirmer et al. 2018). Like most new technologies, AR has its limitations[2], however, most online retail stores (e.g., Amazon, Target, or IKEA) with integrated AR features do not warn of the technology's potential limitations. It is possible that brands may believe that, even if they were to provide one, a more covert disclosure may be preferable, as a more clear and conspicuous disclosure (Stewart and Martin 2004) may draw consumer attention to the potential weakness of the technology, and thus decrease the likelihood of purchase. In contrast, we propose and demonstrate that a more covert disclosure (e.g., a disclosure presented with small text) will seem like an attempt to hide potentially damaging information to convert a sale, thus implying ulterior motives on the part of the brand. Consistent with this prediction, Herbst et al. (2012) show that more covert, fast-paced (vs. normal-paced) disclosures can decrease purchase intentions toward brands because they seem like a tactic to hide information. We thus predict that compared to providing no disclosure, providing a conspicuous (vs. covert) disclosure will attenuate (vs. amplify) the negative effects we predict. See Figure 1 for our full conceptual model.

H6: Providing a conspicuous (vs. covert) disclosure during consumers' AR use will attenuate (vs. amplify) the effects predicted in H1 and H2.

[2] In a pilot study, we found that among consumers who had used AR before a purchase, 45.5% (70/154) had experienced subsequent product failure (see Web Appendix C for study details). This finding suggests that despite providing consumers with additional visual information, AR technology does not fully eliminate the incidence of "product fit" related product failure. Our research explores the inferences consumers make about why this failure happened and the consequences of these inferences on future patronage of the brand.

Figure 1: Conceptual Model.



Overview of Studies

Eight studies demonstrate that using AR (vs. other digital product displays) pre-purchase negatively impacts consumer response to product failure. To test the generalizability of our findings, we compare AR to a range of digital displays, including 3D visualization (Studies 1a and 2a), 360-degree view (Studies 2b, 5-6), stylized photos (Studies 1b and 4), and a "true" control condition with no specified display type (Study 3). Using AR and 3D visual representation of a real product participants received in the study, Study 1a demonstrates that using AR (vs. 3D) pre-purchase decreases future patronage intentions following product failure. Using a different control condition and product category, Study 1b shows that the effect is robust above and beyond contextual size cues. Studies 2a and 2b demonstrate that the effect is driven by increased attributions of product failure to the brand and the subsequent inference that the brand acted deceptively, using both scaled items (Study 2a) and coded open-response protocols (Study 2b). Study 3 explores an important boundary condition, demonstrating that the effect does not extend to non-visual (e.g., haptic) sources of product failure. The remaining studies identify

moderators of this effect, offering insights into brands' in-app AR design. Study 4 tests H4, demonstrating that the presence of a benign persuasion element (an add-to-cart button) during AR use can increase inferred deception following product failure and thus amplify the decrease in patronage intentions. Study 5 tests H5, showing that forewarning messages that heighten consumers' self-awareness can mitigate the negative effects. Finally, Study 6 tests H6, showing that conspicuous disclosures about AR's limitations similarly reduce the inferred deception and thus help mitigate the decreased patronage intentions.

Study 1a

Study 1a tests H1 in the context of real product failure. The study was conducted in a university lab, where participants viewed a focal product through either an AR or 3D display before experiencing product failure.

Design and Procedure

Two hundred and ninety-two undergraduates (M_{age} = 20.4, 63.4% male, 36.6% female) participated in the study for course credit. Participants were randomly assigned to either AR or 3D display conditions. We chose a 3D visualization as the comparison condition because, like AR displays, it allows consumers to view a product from multiple angles (top, bottom, left, etc.), providing a realistic product representation. However, unlike AR, it does not enable consumers to superimpose a virtual visualization of the product onto their physical surroundings.

Upon entering the lab, participants learned that the university lab partnered with a wall décor brand that was seeking student feedback on a new feature it plans to provide. Participants saw an image of the brand's website, which featured two pieces of framed wall art, and were asked to click on the wall art they would like to receive at the end of the study[3] (see Figure 2,

[3] We used the Qualtrics heatmap feature to allow participants to click on the website image.

Panel A). Participants then read: “This brand website is testing out a new function, where they let you view the wall art in a 3D display (vs. Augmented Reality).” The page featured a QR code for participants to scan with their phones. By scanning the code, participants could “open” a 3D visualization of their chosen wall art on their phones. In both conditions, participants could view the product from multiple angles, but only in the AR condition could they superimpose it onto their physical surroundings (see Figure 2, Panel B for example screenshots). In both conditions, they spent some time viewing the product in the respective format.

After viewing the product, participants were told that they would receive the wall art of their choice upon exiting the lab. They then spent another 15 minutes participating in other studies before leaving the lab. On their way out, participants were led to a breakout room where they ostensibly should receive the wall art they chose; however, participants received a small, printed image of the wall art instead of a larger frame-sized version that would be expected. This product failure was designed to mimic a common type of failure observed in the marketplace (i.e., discrepancies in product size/measurement; PowerReviews 2023). Consistent with this intention, a post-test using the same sample pool as the main study (n = 180 undergraduates) confirmed that participants perceived this experience as product failure (see details in Web Appendix D).

Upon exiting the breakout room, participants completed a “satisfaction survey” to help inform the lab about whether it should continue to partner with the brand. Specifically, participants read the following: “The [name of the university where the study was conducted] lab might consult with this brand to conduct another study in the fall semester. Your response will be used to inform us (and the brand) to decide whether we want to partner with this brand in the

future." They were then asked: "How likely are you to revisit this brand in the future?" and responded using a slider scale ranging from -50 ("not likely at all") to 50 ("very likely").

Figure 2 Panel A: Two Framed Wall Art Displayed on The Brand Website.

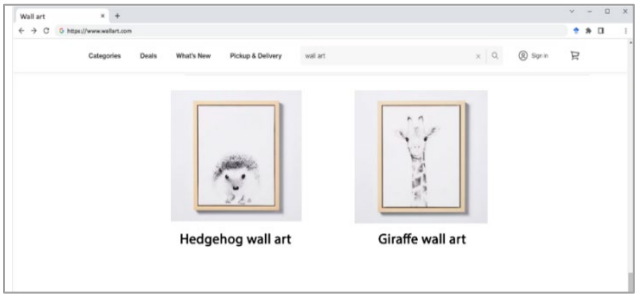


Figure 2 Panel B: Example Screenshots of a Wall Art Viewed in 3D (Left) or AR (Right) Format.

Results and Discussion

A one-way ANOVA with the type of display (AR vs. 3D) as the independent variable and likelihood to patronize the brand in the future as the dependent variable revealed that, consistent with our theorizing, those who used AR (vs. 3D) to view the wall art were significantly less likely to patronize the brand in the future (M_{AR} = 3.75 vs. M_{3D} = 10.18; $F(1, 290) = 4.56$, $p = .033$, $\eta^2_p = .015$). Thus, while participants in both conditions experienced product failure, the type of display they used to view the product earlier in the study influenced future patronage intentions. One potential limitation of this study is that the AR condition may be providing more size-related information (e.g., other real-world objects that serve as size cues) than the

comparison condition. Study 1b addresses this concern in two ways: First, we provide explicit product size information in both conditions, such that both the AR and the comparison condition receive specific dimensions of the product. Second, both displays include a real-world object (i.e., a water bottle) that can serve as a size cue.

Study 1b

Design and Procedure

The study was pre-registered (https://aspredicted.org/5k52-4fnm.pdf). A total of 200 participants (M_{age} = 39.1; 44.8% male, 52.7% female, 2.5% non-binary) were recruited from Connect in exchange for monetary compensation and were assigned to either stylized photo or AR conditions. For robustness, we chose a different product category (an artificial plant) and a different control condition (stylized photos). Notably, we chose this comparison condition due to (a) its prevalence in online retail environments and (b) its ecological validity, as it realistically allows for the inclusion of a size cue.

All participants imagined looking for an artificial plant to decorate their living room on a brand website, and that "they found a plant that they like on this website." Participants in both conditions were further given specific information about the size of the plant: "The overall dimensions of the product are: 33 Inches (H) X 22 Inches (W) X 23 Inches (D)." Afterwards, they learned that the brand offered "Augmented Reality feature to view the plant" (vs. "stylized photos of the plant"), and that they "decide to test out AR feature" (vs. "decide to look at some photos"). Importantly, in the AR condition only, participants read "You walk in your living room to test the feature. You then pointed your camera to the living room floor to place the stool virtually in your living room," a manipulation designed to highlight the greater degree of consumer involvement afforded by AR. Participants then viewed two screenshots of the plant

viewed in AR format (vs. stylized photos; see Table 2). The authors obtained these screenshots by using an existing e-commerce app (that provides both AR and stylized photos) to view the product in the corresponding format.[4] To further address concerns about differences in the presence of size cues across conditions, all conditions included a water bottle positioned next to the plant, which served as a size cue to help convey the relative scale of the focal product. All participants read that they spend a few minutes "to see whether or not the plant you are considering buying would fit your living room." They then read that they decided to order it, but then, a few days later, when they received the plant, they "realized that it was not the right fit and decided to return the product" (i.e., the product was different from prior expectations; Darke, Ashworth, and Main 2010). Participants then indicated their likelihood to patronize the brand in the future ("Based on your experiences with this brand, how likely are you to visit this brand to look for a different product?") on a seven-point scale (1 = extremely unlikely, 7 = extremely likely).

Table 2: Screenshots Presented in Study 1b.

Stylized Photos		Augmented Reality	
			

Results and Discussion

[4] For this study and all subsequent studies that show participants screengrabs of a product viewed through either AR or the comparison display format, we captured the screengrabs by actually viewing the product through an existing e-commerce app that offers both AR and the comparison display type being tested.

A one-way ANOVA with the type of display as the independent variable and likelihood to patronize the brand in the future as the dependent variable revealed that, consistent with the finding of Study 1a, the likelihood of patronizing the brand in the future was significantly lower in the AR (M_{AR} = 3.16) than the stylized photo condition (M_{photo} = 4.20; $F(1, 199) = 16.76$, $p < .001$, $\eta^2_p = .078$). That is, even when both (a) specific product dimensions and (b) a cue providing relative size information were provided in both display types, consumer response to product failure was significantly more negative in the AR (vs. photo) condition, suggesting that the effects we observe occur above and beyond differences in presence of product size information across display types. Having established preliminary support for H1 in Studies 1a and 1b, we next demonstrate the robustness of the effect across different experimental settings and explore the underlying mechanism in Studies 2a and 2b.

Studies 2a and 2b

Study 2a tests hypotheses 2a and 2b, exploring our prediction that those who used AR (vs. 3D display) are more likely to attribute the failure to the brand (H2a) and, specifically, are more likely to infer that the brand was being deceptive (H2b). Using a different measure of deception (i.e., open-ended responses), a different product category, and a different control condition, Study 2b provides further support for the role of inferred deception.

Study 2a Design and Procedure

This study was pre-registered (https://aspredicted.org/2s4x-sj2n.pdf). A total of 304 participants (M_{age} = 38.5; 52.3% male, 46.4% female, 1.3% other) were recruited from Connect in exchange for monetary compensation and assigned to either an AR or 3D display condition. Participants imagined searching for a chair for their room on a brand's website and, as in previous studies, learned that the brand offered an "Augmented Reality" (vs. "3D display")

feature. Participants were then shown an image of the brand's chair along with a QR code, and were instructed to scan the code to view the chair through AR (vs. 3D display).[5] Upon scanning the code, participants could either see a 3D visualization of the chair (in the 3D display condition) or an image of the chair with an AR icon (in the AR condition) appearing on their screen. Once participants in the AR condition clicked the AR icon, they could "launch" the chair in Augmented Reality (see Table 3 for example screenshots). As in Study 1a, participants in both conditions could view the chair from multiple angles; however, only those in the AR condition could place and view the chair within their real-time surroundings. Participants were encouraged to spend some time viewing the product in the respective format. Afterwards, participants read the same product failure scenario used in Study 1b.

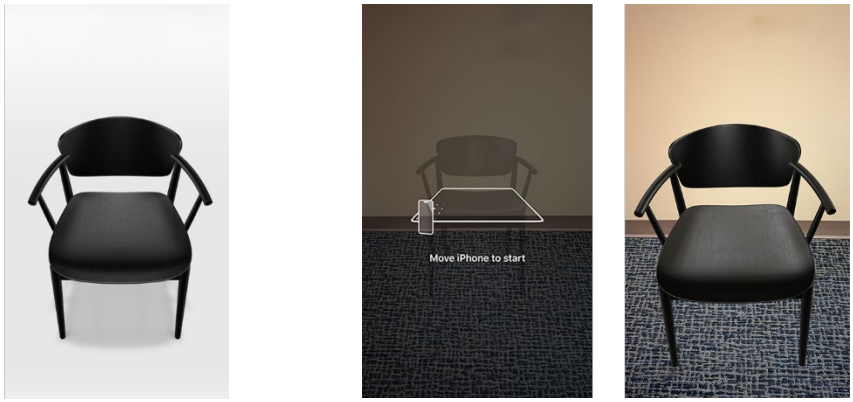
Participants indicated their likelihood to patronize the brand in the future on the same item used in Study 1b. They then indicated their attributions of the product failure and inferred deception (the order of the measures was randomized) on seven-point scales. Attribution of the product failure was measured using two items (r = .87) adapted from Russell (1982): "Now you will read two statements about your impressions or opinions of why this outcome in the scenario happened: (a) Is the cause something you are responsible for or something the brand is responsible for? (1 = you are more responsible, 7 = the brand is more responsible); (b) Is the cause something about you or something about the brand? (1 = something about you, 7 = something about the brand). Inferred deception (α = .95) was measured using the following items: "To what extent do you think this brand used deceptive tactics to get you to buy a product?"; "To what extent do you think this brand intentionally tricked you into making a bad purchase?" and "To what extent do you think this brand manipulated you into buying its

[5] We created both the 3D and AR display using the open-source framework developed by Google. To host and deliver the product visualizations, we used GitHub Pages.

product?" (1 = not at all, 7 = very much so). Lastly, and as pre-registered, we asked participants if they were able to actually view the product in the respective display format ("Were you able to view the chair using the brand's AR (vs. 3D display) feature?" 1 = yes, 2 = no) to account for potential technical issues or user errors. Consistent with our pre-registration, we excluded participants who indicated no to this question (n = 25, or 8.2% of the sample), leaving 279 participants (M_{age} = 38.6; 52.3% male, 47.0% female, .7% other). However, we note that the inclusion of these responses does not change the significance of any reported results.

Table 3: Example of Participants' Perspective of a Chair Viewed in 3D (Left) or AR (Right) Format.

3D display	Augmented Reality



Study 2a Results and Discussion

Likelihood to patronize the brand. As pre-registered, we ran a one-way ANOVA with display type as the independent variable and likelihood to patronize the brand as the dependent variable. Consistent with H1 and previous studies, there was a significant decrease in likelihood to patronize the brand when participants used AR (M_{AR} = 3.81) versus a 3D display (M_{3D} = 4.45) to view the product ($F(1, 277) = 9.32$, $p = .002$, $\eta^2_p = .033$).

Attributions of product failure. The same one-way ANOVA with attributions of product failure as the dependent variable demonstrated, as expected, that participants in the AR (vs. 3D

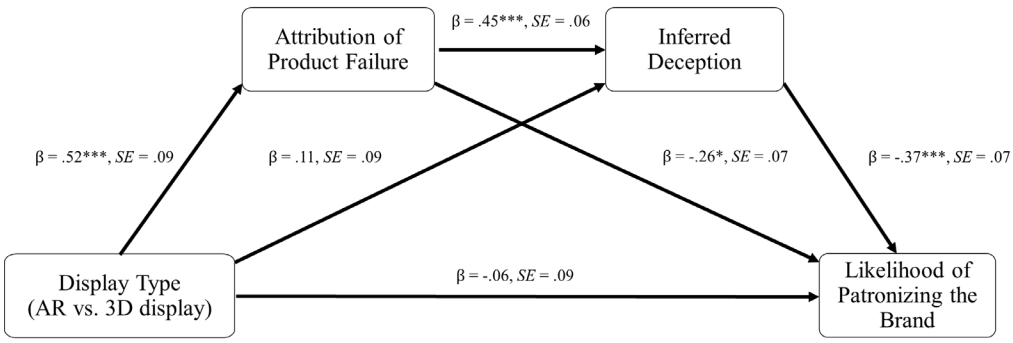
display) condition were significantly more likely to attribute the failure to something about the brand versus themselves (M_{AR} = 4.71 vs. M_{3D} = 3.68; $F(1, 277) = 31.85$, $p < .001$, $\eta^2_p = .103$).

Inferred deception. The same one-way ANOVA with inferred deception as the dependent variable demonstrated that participants were more likely to infer that the brand was deceptive in the AR (M_{AR} = 3.18) versus 3D display condition (M_{3D} = 2.49; $F(1, 277) = 13.64$, $p < .001$, $\eta^2_p = .047$).

Serial mediation. Consistent with pre-registration, we ran a serial mediation using PROCESS model 6 (Hayes 2017) where the independent variable was the display type, the dependent variable was patronage intentions, the first mediator was the attribution of the product failure, and the second mediator was inferred deception. The result revealed a significant indirect effect of the serial model (indirect effect = -.09, SE = .03, 95% CI [-.15, -.04]; Figure 3).

Discussion. Study 2a provides support for H2a and H2b, demonstrating that using AR may increase the likelihood that consumers attribute the product failure to the brand, and specifically, to the brand being deceptive. We further conducted a follow-up study (reported in Web Appendix E) using a more controlled design. Specifically, while this study is strong in ecological validity as it allows participants to interact with a real AR or 3D interface on their own smartphones, we lack control over the participants' exact use of the displays in their home environments. Therefore, in the follow-up study reported in Web Appendix E, we manipulated pre-purchase AR versus 3D display use via a scenario, along with screengrabs of a product viewed through the respective display formats. The results from this more controlled design replicated the findings of Study 2a. Study 2b uses open-ended responses to demonstrate that participants spontaneously infer deception more in the AR condition.

Figure 3: Serial Mediation in Study 2a.



Notes: * $p < .01$, ** $p < .05$, *** $p < .001$.

Study 2b Design and Procedure

A total of 277 undergraduates (M_{age} = 20.68, 61.0% male, 38.6% female, .4% prefer not to say) participated in the study in exchange for course credit and were assigned to either AR or 360-degree condition. To further test the robustness of our effect, we chose a different comparison (360-degree view) condition and a product category (a side table) than those used in previous studies. In the 360-degree [AR] condition, the brand described the feature as allowing customers "to preview the product [in your own room virtually] to see how it looks before you make a purchase," and that customers "can move around the table [virtually in your room] to see how it would actually look." The description in the AR condition thus highlighted the greater customer involvement enabled by AR (i.e., moving the table virtually within their own space). All participants then read the same description of the product failure experience as in Studies 1b and 2a.

We measured the likelihood of patronizing the brand on the same item used in Studies 1b and 2a. Participants then completed an open-response thought listing task adapted from prior persuasion knowledge research (Costello, Walker, and Reczek 2023). Specifically, they were asked: "You indicated that you are [participants' response to the patronage intention measure was automatically populated (e.g., "extremely unlikely")] to revisit this brand. In the box below, please describe (in your own words) why you indicated as such." Participants responded using an

open-ended text box. We coded these responses to assess whether participants spontaneously mentioned feeling deceived by the brand, without being prompted.

Study 2b Results and Discussion

Likelihood to patronize the brand. A one-way ANOVA with display type as the independent variable and patronage intention as the dependent variable again found that there was a significant decrease in likelihood of patronizing the brand in the AR (M_{AR} = 3.42) compared to the 360-degree condition ($M_{360\text{-degree}}$ = 4.01; $F(1, 275) = 9.19$, $p = .003$, $\eta^2_p = .032$).

Inferences of deception coded from open-ended responses. We recruited three independent coders (i.e., research assistants for the behavioral lab), blind to the study hypothesis, to code the open-ended responses. Specifically, we asked them to rate each response provided by the participants on "the extent to which the writer mentions feeling tricked and deceived by the brand (1 = not at all, 5 = very much so)." Because the agreement between the coders was high (α = .87), we averaged the scores to create an index of the inferred deception. A one-way ANOVA with this index of inferred deception as the dependent variable revealed a significant difference across the display type, such that participants were more likely to mention that they felt deceived by the brand in the AR (M_{AR} = 1.96) compared to 360-degree condition ($M_{360\text{-degree}}$ = 1.51; $F(1, 275) = 12.38$, $p < .001$, $\eta^2_p = .043$).

Mediation. A mediation analysis (PROCESS model 4; Hayes 2017) where the independent variable was the display type, the mediator was mentions of inferred deception, and the dependent variable was the likelihood to patronize the brand revealed a significant and negative indirect effect through inferred deception (indirect effect = -.19, SE = .06; 95% CI [-.308, -.087]).

Discussion. Taken together, the results of Studies 2a and 2b replicate the findings of Studies 1a and 1b, providing further support for H1. Importantly, these studies also provide support for our proposed mechanism (H2) using both scaled items (Study 2a) and open-ended responses (Study 2b). In Study 3, we test H3, exploring the type of product failure as a boundary condition.

Study 3

Study 3 examines an important boundary condition and provides additional support for the role of inferred deception in driving the observed effect. Specifically, we propose that negative responses to product failure following pre-purchase AR use should emerge only when the failure is visual, a domain where consumers can more plausibly infer that AR was used to intentionally mislead them. In contrast, the effect should not extend to non-visual failures involving other sensory experiences like haptic touch (Peck and Childers 2003), given that AR is a technology designed specifically to provide visual sensory cues.

Design and Procedure

A total of 605 participants (M_{age} = 38.5; 46.6% male, 51.25% female, 1.7% non-binary) were recruited from Connect in exchange for monetary compensation in a 2 (display type: AR vs. control) X 2 (product failure: visual vs. haptic) between-subjects design. All participants imagined looking for a stool for their living room and read that they found one they liked after browsing a few options on a brand website. In the AR condition, participants read that the brand offers an Augmented Reality feature and that they "walked into your living room to test out the AR feature and view the product," a manipulation similar to that used in Study 1b that highlights greater consumer involvement afforded by AR. In the control condition, participants were told they simply "view the product," with no mention of a specific display type. This "true" control

condition allowed us to test whether the observed effect is robust to contexts where the comparison digital display is not specified.

All participants then read that they purchased the stool, and when they received it a few days later, it turned out to be "not what you expected." Importantly, the reason why the product did not match their prior expectations was manipulated across the visual versus haptic failure conditions. In the visual failure condition, participants read that "its size does not fit your living room," a product failure description like those used in prior studies. In the haptic failure condition, however, participants read that "its cushion feels a bit too firm." Participants then indicated their likelihood to patronize the brand and inferred deception using the same items used in Study 2a (α = .96).

Results and Discussion

Likelihood to patronize the brand. A two-way ANOVA with display type and product failure domain as the independent variables and likelihood to patronize the brand as the dependent variable revealed a non-significant main effect of the display type ($F(1, 601) = 1.51$; $p = .220$; $\eta^2_p = .003$) and a significant main effect of product failure domain ($F(1, 601) = 33.75$; $p < .001$; $\eta^2_p = .053$), such that participants in the visual (vs. haptic) product failure condition were significantly less likely to patronize the brand ($M_{visual} = 3.34$ vs. $M_{haptic} = 4.15$). Importantly, there was a significant interaction ($F(1, 601) = 26.43$; $p < .001$; $\eta^2_p = .042$; see Figure 4, Panel A). Simple effects revealed that, when product failure occurred in the visual domain, we replicated the negative effect of using AR pre-purchase, such that the likelihood of patronizing the brand was significantly lower in the AR ($M_{visual\text{-}failure\text{-}AR}$: 2.89) than in the control condition ($M_{visual\text{-}failure\text{-}control}$: 3.78; $p = .006$; $\eta^2_p = .013$). However, when product failure occurred in the haptic (i.e., non-visual) domain, the effect reversed: Likelihood of patronizing the brand was

higher in the AR ($M_{\text{haptic-failure-AR}}$: 4.42) versus control condition ($M_{\text{haptic-failure-control:}}$ 3.87; p = .006; η^2_p = .013).

Inferred deception. A two-way ANOVA with display type and product failure domain as the independent variables and index of inferred deception as the dependent variable revealed a significant main effect of the display type ($F(1, 601) = 11.49$; $p < .001$; $\eta^2_p = .019$), such that inferred deception was higher in the AR ($M_{\text{AR}} = 3.64$) versus the control condition ($M_{\text{control}} = 3.20$). There was also a significant main effect of product failure domain ($F(1, 601) = 70.81$; $p < .001$; $\eta^2_p = .105$), such that participants in the visual (vs. haptic) product failure condition felt greater deception ($M_{\text{visual}} = 3.96$ vs. $M_{\text{haptic}} = 2.88$). Importantly, there was a significant interaction ($F(1, 601) = 18.02$; $p < .001$; $\eta^2_p = .029$; see Figure 4, Panel B). Simple effects reveal that, when product failure occurred in the visual domain, we replicated the prior findings, such that inferred deception was significantly greater in the AR ($M_{\text{visual-failure-AR}}$: 4.45) than in the control condition ($M_{\text{visual-failure-control}}$: 3.47; $p < .001$; $\eta^2_p = .046$). However, when the product failure occurred in the haptic (i.e., non-visual) domain, there was no significant difference in inferred deception across the AR ($M_{\text{haptic-failure-AR}}$: 2.82) versus the control condition ($M_{\text{haptic-failure-control:}}$ 2.93; p = .544; η^2_p = .001).

Figure 4 Panel A: Likelihood of Patronizing the Brand (Study 3).

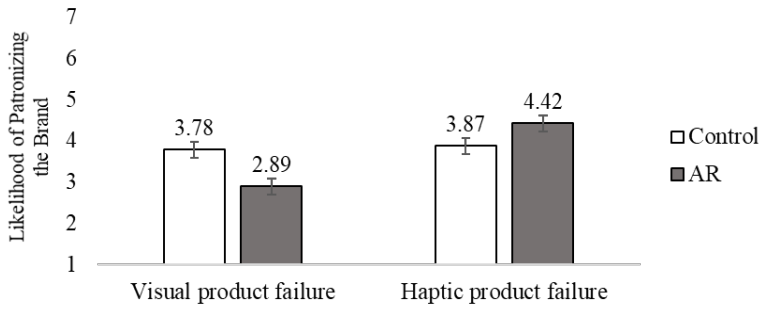
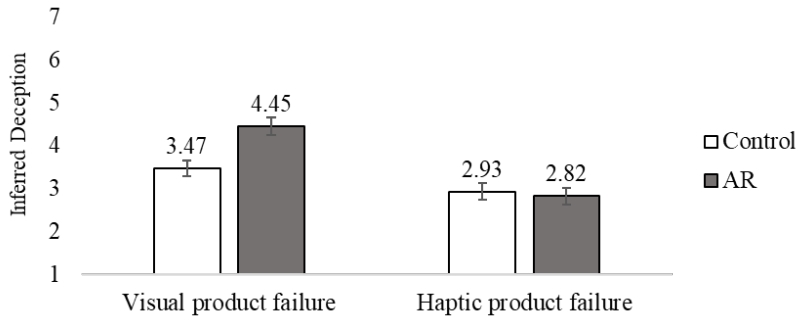


Figure 4 Panel B: Inferred Deception (Study 3).



Moderated mediation. We ran a moderated mediation analysis using PROCESS model 7 (Hayes 2017) where the display type was the independent variable, likelihood to patronize the brand was the dependent variable, mediator was the index of feeling deceived, and the moderator was the domain of product failure. The result revealed a significant index of moderated mediation (index = -.29, SE = .07; 95% CI [-.44, -.15]): When the product failure happened in the visual domain, we see a significant mediating role of inferred deception in driving the effect of display type on patronage intentions (indirect effect = -.26, SE = .05; 95% CI [-.37, -.16]). However, when the product failure occurred in the non-visual (i.e., haptic) domain, we no longer see heightened deception driving the observed effect (indirect effect = .03, SE = .05; 95% CI [-.06, .12]).

Discussion. The results of Study 3 provide support for H3, demonstrating an important boundary condition for the proposed effect. The decrease in patronage intentions following AR use occurs only when the product failure is in the visual (vs. non-visual) domain. Note that, consistent with prior research showing positive affective consequences of using AR pre-purchase (e.g., Fritz, Hadi, and Stephen 2023), when the product failure occurred in a non-visual domain, participants in the AR condition were significantly more forgiving of the brand for the failure, even reporting higher patronage intentions compared to those in the control condition. Having explored when and why the negative effect of using AR pre-purchase can occur in the context of

product failure, Studies 4, 5, and 6 examine managerially controllable moderators that can amplify or attenuate the effect.

Study 4

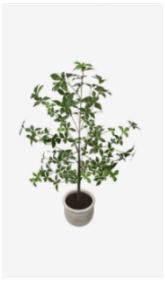
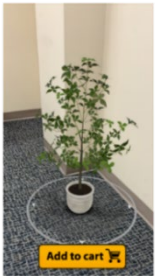
Study 4 tests H4, exploring whether including an "add-to-cart" button in an in-app AR design increases inferred deception post-failure, as this seemingly benign element can make the firm's ulterior motives more accessible. We test this prediction in a 2 (display type: AR vs. stylized photos) x 2 (add-to-cart icon: present vs. absent) between-subjects experiment.

Design and Procedure

The study was pre-registered (https://aspredicted.org/DSX_S3S). A total of 402 participants (M_{age} = 39.87, 44.3% male, 53.5% female, 2.0% non-binary, .2% prefer not to disclose) were recruited on Connect in exchange for monetary compensation. As in Study 1b, we used "stylized photos" as the control condition for the current study. Note that comparing AR with this control condition provides a more conservative testing of our effect because consumers may expect higher deception with stylized photos because of the ease with which this display type can be manipulated (Schirmer et al. 2018). The procedure was identical to that in Study 1b. Participants imagined looking for an artificial plant and viewed two images of the artificial plant through stylized photos versus AR. Only in the add-to-cart present conditions, participants saw screenshots with a prominent add-to-cart icon included in the image (see Table 3). All participants then read the same product failure scenario used in prior studies (i.e., returning the plant because it was not the right fit). Likelihood to patronize the brand in the future and inferred deception (α = .93) were measured using the same items used in Studies 2a and 3.

Table 3: Screenshots Participants Viewed in Each Condition in Study 4.

	Stylized Photo	Augmented Reality

Add-to-cart icon absent				
Add-to-cart icon present				

Result and Discussion

Likelihood to patronize the brand. As pre-registered, we ran a two-way ANOVA with display type and the presence of an add-to-cart icon as independent variables and likelihood to patronize the brand as the dependent variable. The result revealed a non-significant main effect of the presence of the icon ($F(1, 398) = 2.34$, $p = .127$, $\eta^2_p = .006$) but a significant main effect of display type ($F(1, 398) = 50.03$, $p < .001$, $\eta^2_p = .112$), such that likelihood to patronize the brand was lower in the AR versus stylized photos condition ($M_{AR} = 3.22$ vs. $M_{photos} = 4.44$). Importantly, there was a significant interaction ($F(1, 398) = 5.59$, $p = .019$, $\eta^2_p = .014$; see Figure 5, Panel A). Simple effects show that when the brand does not provide a prominent add-to-cart icon, we replicated the observed negative effect of using AR pre-purchase, such that likelihood of patronizing the brand was lower in the AR versus stylized photos condition ($M_{AR} = 3.55$ vs. $M_{photo} = 4.37$; $p < .001$, $\eta^2_p = .027$). However, in support of H5, this effect was amplified when the display included the add-to-cart icon. Patronage intentions were significantly lower in the AR (vs. stylized photo) condition ($M_{AR} = 2.88$ vs. $M_{photo} = 4.51$; $p < .001$), with the effect size being over three times larger than when the add-to-card icon was absent ($\eta^2_p = .101$).

Inferred deception. As pre-registered, we ran the same two-way ANOVA with inferred deception as the dependent variable. The result revealed a significant main effect of the presence of the add-to-cart icon, such that participants were significantly more likely to infer deception in the presence (vs. absence) of the icon (M_{icon_absent} = 3.07 vs. $M_{icon\_present}$ = 3.71; $F(1, 398) = 18.59$, $p < .001$, $\eta^2_p = .045$). There was also a significant main effect of display type ($F(1, 398) = 62.87$, $p < .001$, $\eta^2_p = .136$), such that participants inferred greater deception in the AR versus the stylized photos condition (M_{AR} = 3.98 vs. M_{photo} = 2.80). Importantly, there was a significant interaction ($F(1, 398) = 10.99$, $p < .001$, $\eta^2_p = .027$; see Figure 5, Panel B). Simple effects show that, consistent with prior findings, participants inferred greater deception by the brand in the AR versus stylized photos condition when there was no add-to-cart icon (M_{AR} = 3.41 vs. M_{photo} = 2.72; $p = .001$, $\eta^2_p = .026$). Notably, these inferences were even more pronounced when the brand displayed the add-to-cart icon on the screen. Those in the AR (vs. stylized photos) condition were more likely to infer deception (M_{AR} = 4.54 vs. M_{photo} = 2.87; $p < .001$), with the effect size being more than five times larger than when the icon was absent ($\eta^2_p = .137$).

Figure 5 Panel A: Likelihood of Patronizing the Brand (Study 4).

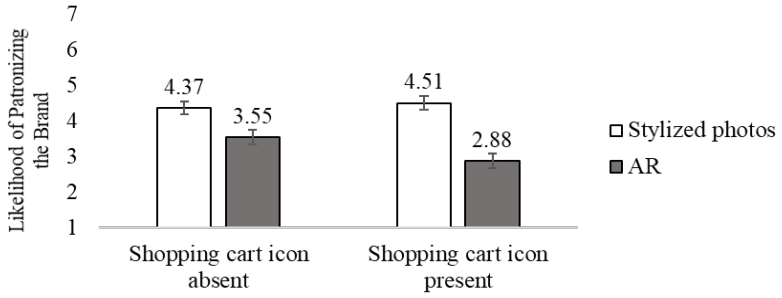
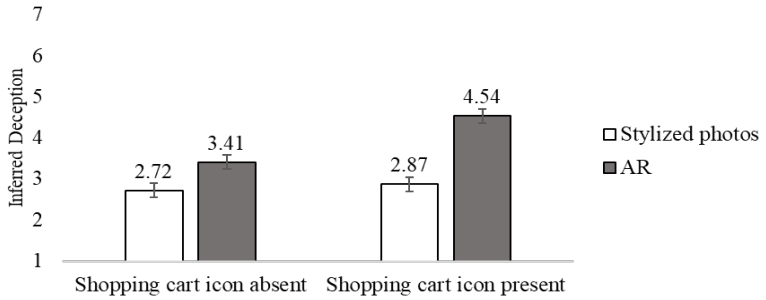


Figure 5 Panel B: Inferred Deception (Study 4).



Moderated mediation. As pre-registered, we ran a moderated mediation with PROCESS model 7 (Hayes 2017) with display type as the independent variable, likelihood to patronize the brand as the dependent variable, inferred deception as the mediator, and the presence of the add-to-cart icon as the moderator. The result revealed a significant index of moderated mediation (index = -.28, SE = .09; 95% CI [-.45, -.10]): Replicating the previous findings, when there was no add-to-cart icon, inferred deception significantly mediated the decrease in patronage intentions (indirect effect = -.19; 95% CI [-.31, -.08]). Notably, when the brand provided an add-to-cart icon, we see that the inferred deception exerts greater power in driving the decreased patronage intentions, with the indirect effect of deception being more than two times greater than when the icon was absent (indirect effect = -.46; 95% CI [-.62, -.32]).

Discussion. The results of Study 4 support H4 and demonstrate that brands stand to be cautious about integrating certain persuasion elements into consumers' in-app AR experience. While many prominent online retailers (e.g., Amazon, Target, IKEA) display persuasion elements like an "add-to-cart" button in their AR apps, presumably to streamline consumers' experience, we demonstrate that such features may backfire when consumers experience product failure after using AR, as it may make ulterior brand motives more accessible.

Study 5

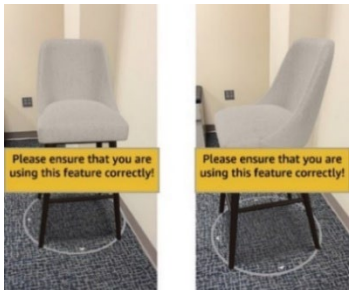
In Study 5, we test H5, exploring whether directing attention to the self (Duval and Wickland 1973; Fenigstein and Levine 1984) via a forewarning message about the customers'

role when using AR can shift attributions away from the brand, mitigating the effect we predict in H1 and H2. We test this in a 2 (display type: AR vs. 360-degree) X 2 (forewarning message: absent vs. present) between-subjects design.

Design and Procedure

The study was pre-registered (https://aspredicted.org/Y8L_DQ9). A total of 403 participants (M_{age} = 39.22; 49.6% male, 48.4% female, .7% non-binary, .2% other, 1.0% prefer not to say) were recruited on Connect. All participants imagined they were looking for a bar stool for their kitchen and saw a screenshot of a brand's website and were asked to click "bar stool" on the website to simulate what they would do on an actual website (see Web Appendix F for stimuli used in the study). They then saw a screenshot of a bar stool from the brand that accompanied either an "AR" or a "360-degree" icon and read that they had decided to view the product using the feature. As in prior studies, only in the AR conditions did participants read additional statements highlighting greater consumer involvement ("you walk into your kitchen to test the feature. You then pointed your camera to the kitchen floor to place the stool virtually in your kitchen"). In the forewarning message absent conditions, participants saw two screenshots of the stool in the corresponding display format (see Table 4); in the forewarning message present conditions, participants saw the same screenshots accompanied by the following message: "Please ensure that you are using this feature correctly!" The forewarning message was crafted to increase self-focus (Pham et al. 2010) and make it salient to participants the possibility that they could be the ones who are incorrectly using the feature. All participants read the same product failure scenario described in prior studies. They then indicated the likelihood of patronizing the brand and inferred deception (α = .93) using the same items as in prior studies.

Table 4: Screenshots Participants Viewed in Each Condition in Study 5.

	360-degree view	Augmented Reality
Forewarning message **absent**		
Forewarning message **present**		

Result and Discussion

Likelihood to patronize the brand. As pre-registered, we ran a two-way ANOVA with the display type and the presence of forewarning messages as independent variables and likelihood to patronize the brand as the dependent variable. The result revealed a non-significant main effect of presence of forewarning message ($F(1, 399) = .063$, $p = .802$, $\eta^2_p < .001$) but a significant main effect of display type ($F(1, 399) = 8.42$, $p = .004$, $\eta^2_p = .021$), such that likelihood of patronizing the brand was overall lower in the AR versus 360-degree condition ($M_{AR} = 3.70$ vs. $M_{360\text{-degree}} = 4.21$). Importantly, there was a significant interaction ($F(1, 399) = 14.03$, $p < .001$, $\eta^2_p = .034$; see Figure 6, Panel A): Simple effects show that, when there was no forewarning message (i.e., conditions identical to the prior studies), we replicated the negative effect of using AR on the likelihood of patronizing the brand ($M_{message\_absent\_AR} = 3.39$ vs. $M_{message\_absent\_360} = 4.57$; $p < .001$, $\eta^2_p = .053$). However, in support of H5, when the brand offered a forewarning message that increases consumers' self-awareness of using the feature correctly,

the effect was eliminated ($M_{message\_present\_AR}$ = 4.01 vs. $M_{message\_present\_360}$ = 3.86; p = .553, η^2_p = .001).

Inferred deception. As pre-registered, we ran the same two-way ANOVA with the index of inferred deception as the dependent variable. The result revealed a non-significant main effect of presence of a forewarning message (F(1, 399) = .2.89, p = .09, η^2_p = .007), but a significant main effect of display type (F(1, 399) = 4.77, p = .030, η^2_p = .012), such that inferred deception was overall higher in the AR versus 360-degree conditions (M_{AR} = 3.16 vs. $M_{360\text{-degree}}$ = 2.83). Importantly, and as predicted, there was a significant interaction (F(1, 399) = 4.47, p = .035, η^2_p = .011; see Figure 6, Panel B). Simple effects show that when there was no forewarning message, we replicated the previous finding that participants infer greater brand deception following product failure in the AR versus 360-degree condition ($M_{message\_absent\_AR}$ = 3.46 vs. $M_{message\_absent\_360}$ = 2.80; p = .002, η^2_p = .023). However, in the presence of a forewarning message that increases self-awareness, there was no significant difference in inferred deception between the AR versus 360-degree conditions ($M_{message\_present\_AR}$ = 2.87 vs. $M_{message\_present\_360}$ = 2.86; p = .961, η^2_p < .001). These results thus demonstrate that the proposed forewarning message does not indiscriminately increase consumers' positive responses across all digital display types. Rather, the message specifically attenuates the increased inferred brand deception that typically arises from consumers attributing product failure to the brand following AR use.

Figure 6 Panel A: Likelihood of Patronizing the Brand (Study 5).

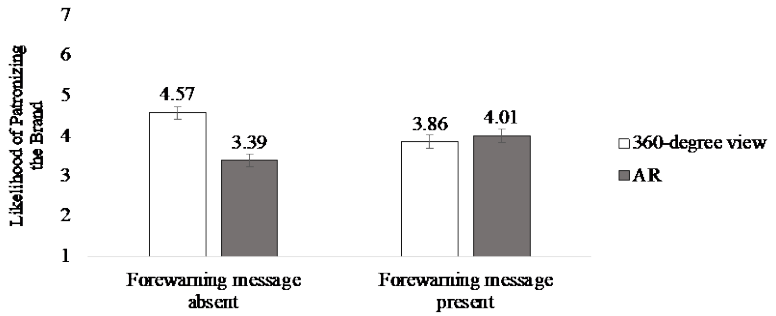
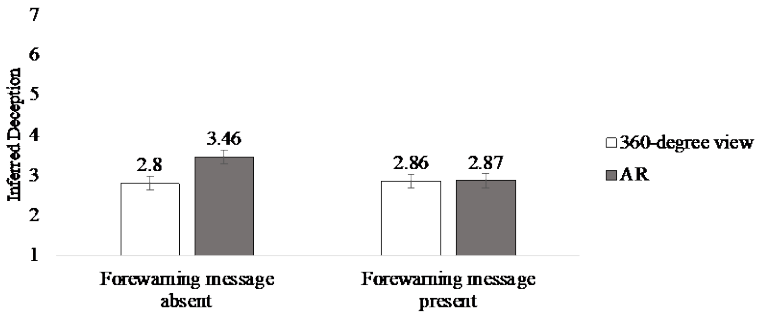


Figure 6 Panel B: Inferred Deception (Study 5).



Moderated mediation. As pre-registered, we ran a moderated mediation analysis using PROCESS model 7 (Hayes 2017) with display type as the independent variable, likelihood to patronize the brand as the dependent variable, inferred deception as the mediator, and presence of forewarning message as the moderator. The result revealed a significant index of moderated mediation (index = -.20, SE = .09; 95% CI [-.41, -.02]). When there was no forewarning message, we replicated the prior findings, showing a significant indirect effect of inferred deception (indirect effect = -.19, SE = .07; 95%CI [-.33, -.05]). However, when the forewarning message was present, the indirect effect of inferred deception was no longer significant (indirect effect = .02; SE = .07; 95% CI [-.11, .16]).

Discussion. The results of Study 5 provide support for H5 and demonstrate one intervention that brands can use to reduce the negative effect of using AR pre-purchase on responses to product failure: a forewarning message that increases self-awareness. When consumers' own role in using the feature correctly was made salient, using AR pre-purchase did not significantly decrease the likelihood of patronizing the brand nor increase inferred deception post-failure.

Study 6

In Study 6, we test H6, exploring how a disclosure around potential limitations of the AR feature should be presented to consumers. While the intuition may be not to include a disclosure

or to use an inconspicuous disclosure to make the AR technology's limitations less salient, we predict there are benefits to making AR disclosures visually conspicuous, a practice currently uncommon in the marketplace. The study tests the effectiveness of providing a conspicuous disclosure during pre-purchase AR use via a 3-cell (disclosure type: no disclosure vs. conspicuous disclosure vs. covert disclosure) between-subjects design, where all participants imagined using AR.

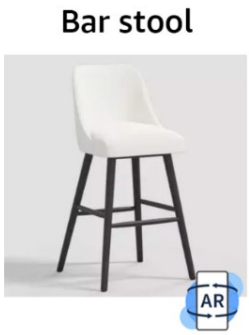
Design and Procedure

A total of 300 Connect participants (M_{age} = 39.37; 44.6% male, 53.7% female, 1.7% other) participated in the study in exchange for monetary compensation. Similar to Study 5, all participants imagined that they were looking for a bar stool for their kitchen on a brand website, clicked the "bar stool" category on it, and moved on to see an image of a stool from the brand that accompanied an "AR" icon (i.e., identical to the AR conditions in Study 5).

While no additional information was provided in the no disclosure condition, participants in both conspicuous and covert disclosure conditions read the following disclosure provided by the brand: "Caution: Please note that our Augmented Reality feature is still in its testing stage!" The only difference between the two disclosure conditions was how visually prominent the disclosure was (see Table 5). In the conspicuous (vs. covert) disclosure condition, the caution was written in a large (vs. small) font and in a vivid black (vs. light grey) color. All participants then read the same product failure scenario used in prior studies and indicated their likelihood of patronizing the brand and inferred deception (α = .96) on the same measures used in prior studies.

Table 5: Screenshots Participants Viewed in Each Condition in Study 6.

Conspicuous disclosure	Control (no disclosure)	Covert disclosure



Result and Discussion

Likelihood to patronize the brand. A one-way ANOVA with disclosure type as the independent variable and likelihood to patronize the brand as the dependent variable revealed a significant main effect of disclosure type ($F(2, 297) = 20.46$, $p < .001$; $\eta^2_p = .12$; see Figure 7, Panel A). Bonferroni-corrected pairwise comparisons demonstrate that participants were more likely to patronize the brand in the future when they received a conspicuous disclosure ($M_{conspicuous} = 4.49$) versus when they did not receive a disclosure ($M_{no\text{-}disclosure} = 3.54$, $p < .001$) or received a covert disclosure ($M_{covert} = 2.89$, $p < .001$). Importantly, the patronage intention in the covert disclosure condition was significantly lower than when there was no disclosure ($p = .028$), signaling that providing a disclosure that is not visually prominent can backfire more than not providing a disclosure.

Inferred deception. The same one-way ANOVA with inferred deception as the dependent variable revealed a significant main effect of disclosure type ($F(2, 297) = 44.36$, $p < .001$; $\eta^2_p = .23$; see Figure 7, Panel B). Bonferroni-corrected pairwise comparisons demonstrate that the inferred deception was lower when participants received a conspicuous disclosure ($M_{conspicuous} = 2.24$) compared to when they did not receive a disclosure ($M_{no\text{-}disclosure} = 3.69$, $p < .001$) or

received a covert disclosure (M_{covert} = 4.47, p < .001). Notably, the inferred deception when participants received a covert disclosure was significantly greater than when there was no disclosure (p = .004).

Figure 7 Panel A: Likelihood of Patronizing the Brand (Study 6).

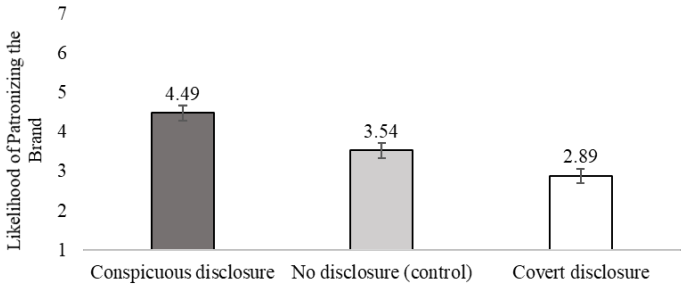
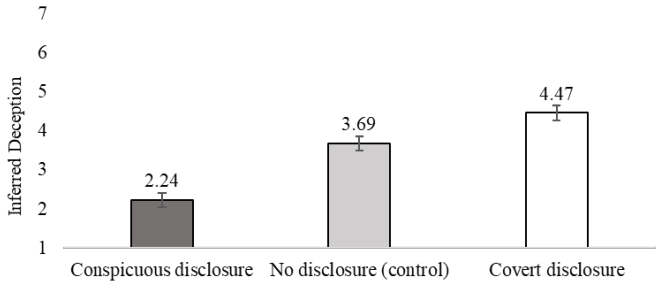


Figure 7 Panel B: Inferred Deception (Study 6).

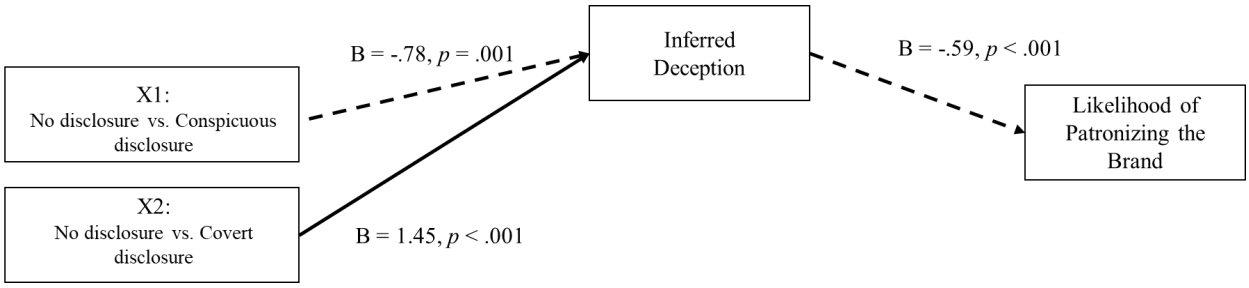


Mediating role of inferred deception. We ran a multi-categorical mediation analysis using PROCESS model 4 (Hayes 2017) where the independent variable is the disclosure type (0: no disclosure, 1: covert disclosure, 2: conspicuous disclosure, mcx=1 for indicator coding), the proposed mediator was inferred deception, and the dependent variable is patronage intentions. The result provided evidence of the role of decreasing (vs. increasing) inferred deception in driving the increased (vs. decreased) patronage intention in the conspicuous (vs. covert) disclosure condition compared to the control. When comparing no-disclosure and covert disclosure conditions, we see an overall *negative* indirect effect (indirect effect = -.46, SE = .15; 95% CI [-.75, -.16]), such that covert disclosure *increases* inferred deception compared to the no-

disclosure condition, which leads to a relative *decrease* in patronage intentions. In contrast, when comparing the no-disclosure and conspicuous disclosure, we see an overall *positive* indirect effect (indirect effect = .86, SE = .16; 95% CI [.57, 1.18]), such that conspicuous disclosure *decreases* inferred deception compared to the control condition, thereby producing a positive effect. Figure 8 illustrates the observed relationship.

Discussion. The findings of Study 6 provide support for H6 and offer a practical insight for marketers. Providing a disclosure about the potential limitations of AR pre-purchase can help mitigate the activation of deception following product failure and mitigate the subsequent decrease in patronage intention, but only when the disclosure is conspicuous. This study also suggests that providing a covert disclosure may backfire, as this approach may be viewed as manipulative, thereby further encouraging inferences of deception by consumers.

Figure 8: Relative Indirect Effect of Disclosure Type on Patronage Intentions (Study 6).



Notes: The dashed line indicates negative relationships, and the solid line indicates positive relationships between the two variables.

General Discussion

The current research explores when and why integrating AR into the pre-purchase stage can negatively impact consumers' future support of a brand when product failure occurs. Specifically, we demonstrate that using AR pre-purchase, compared to using other digital displays (e.g., photos, 360-degree view, or 3D visual representation), significantly decreases

consumers' likelihood of patronizing the brand post-failure. This is because consumers who used AR (vs. other digital displays) pre-purchase are more likely to attribute the failure to the brand, inferring that the digital display was used to deceive them into making a purchase. Importantly, this effect occurs specifically for failures in the visual (vs. non-visual) domain, where AR technology is more likely to elicit inferences of deception.

We further demonstrate three moderators of the effect that can inform marketers on how to design in-app AR experiences for consumers. First, we demonstrate that the common marketplace practice of including a shopping cart icon with an "add-to-cart" prompt during AR experience increases the size of the negative effect we observe. Second, these negative effects can be attenuated by providing consumers with a forewarning message that increases self-awareness and by offering conspicuous disclosures about the technology's potential limitations.

Theoretical Contributions

The current work contributes to prior work exploring consumer responses to AR by examining how the impact of pre-purchase AR use extends to consumer-brand relationships in the post-purchase stage. As more online retail stores incorporate such technology-driven displays (Hoffman et al. 2022; Szocs et al. 2023), emerging work in marketing has begun to explore how using these displays shapes consumers' decision-making journey (Fritz, Hadi, and Stephen 2023; Heller et al. 2019; Hilken et al. 2017; Hilken et al. 2022; Tan, Chandukala, and Reddy 2022). Notably, this stream of work has (1) focused on how AR impacts customer experiences during the decision-making process, and (2) demonstrated positive consequences, such as an increase in psychological ownership (Carrozzi et al. 2019; Fritz, Hadi, and Stephen 2023) or perceived authenticity of the experience (Hilken et al. 2022). To the best of our knowledge, the current work is the first to examine how AR can negatively shape consumers' attributions of and

responses to post-purchase outcomes. In doing so, we build on prior work highlighting the relevance of consumer and firm effort (De Witt Huberts et al. 2014; Feather 1992; Reczek, Haws, Summers 2014; Wu et al. 2017). Specifically, we posit that this effect occurs because AR requires greater customer involvement, which fosters a sense of due diligence among consumers, similar to the effect of other effortful marketplace behaviors such as a greater number of purchases (Reczek, Haws, Summers 2014), leading them to believe that they are owed a positive outcome. Thus, when experiencing a negative purchase outcome (i.e., product failure), consumers who used AR pre-purchase are less likely to attribute the product failure to themselves, instead inferring that the brand is at fault.

Our research further extends the literature on persuasion knowledge by highlighting how technological tools can heighten consumers' inferred deception. While much of the existing research has centered on in-person communication, such as interactions with salespeople (Campbell and Kirmani 2000; Kirmani and Campbell 2004; Main, Dahl, and Darke 2007) or through traditional advertisements ((Becker, Wiegand, and Reinartz 2019; Darke and Ritchie 2007; Goldfarb and Tucker 2011), we build on the work by examining persuasion attempts in digital contexts. Recent studies have shifted focus toward how virtual interactions, such as those involving social media influencers (Leung et al. 2022) or AI (Watson, Valsesia, and Segal 2024), affect perceptions of deception. Our findings contribute to this research by identifying a novel factor in online purchase contexts that can impact inferred deception: the use of AR. Specifically, we demonstrate that pre-purchase AR use (vs. other types of digital displays) can significantly increase inferred deception following product failure and thus decrease the likelihood of patronizing the brand in the future.

Finally, we contribute to the literature on product failure by identifying the role of technology-driven display (AR in particular) in shaping consumer attributions of failure. In their comprehensive review of service failures and brand transgression, Khamitov, Grégoire, and Suri (2019) highlight the importance of understanding consumer responses to product/service failures (or what they refer to as "initial negative events") that occur in non-traditional contexts such as technology-mediated interfaces. Recent work has begun to address this question by focusing on the emerging role of algorithm as product/service providers, for example exploring how product failure caused by algorithm (vs. human provider) affect brand attitudes (Srinivasan and Sarial-Abi 2021), or how algorithm-driven public service failures impact consumer responses (Longoni, Cian, and Kyung 2023). We add to this body of work by demonstrating how the use of AR technology pre-purchase can shape consumers' attributions of subsequent product failure.

Practical Implications

The current work identifies three moderators of the effect, offering actionable insights for marketers seeking to incorporate AR into online shopping experiences. First, we find that brands should be cautious in including seemingly benign persuasion elements such as a shopping cart icon with an "add-to-cart" button in their in-app AR design. Study 4 shows that including an add-to-cart button in the AR feature may provide consumers with additional evidence that AR is primarily a persuasion tool, thus amplifying the inferred deception following product failure. While online retailers such as Amazon or Target have integrated these elements into their in-app AR design, we identify a potential downside of this common practice.

The current research also provides two ways marketers can mitigate the inferences of deception following product failure. First, Study 5 demonstrates that providing a forewarning message that increases consumers' self-awareness (e.g., "please ensure that you are using this

feature correctly") during AR use can effectively mitigate inferences of deception. We further demonstrate that incorporating a conspicuous disclosure about the AR technology's limitations can help mitigate inferred deception following product failure compared to providing no disclosure or a visually covert disclosure, the latter of which may increase consumers' negative responses by increasing inferred deception. While most online retailers that incorporate AR features do not provide disclosures (and thus may intuit that a covert disclosure that does not make the technology's limitation salient is preferable), we suggest that providing a visually prominent disclosure can help alleviate inferences of deception that may follow a potential product failure.

Limitations and Future Research

In our studies, we explored a variety of products, including artificial plants (Studies 1b and 4), wall art (Study 1a), chairs (Study 2a), bar stools (Studies 3, 5, and 6), and side tables (Study 2b). We chose products among the home décor and furnishing category because this is the category in which the AR feature is predominantly used in the current marketplace, with about 70% of consumers reporting that they have used the feature for these product categories (Mintel 2025). However, it is worth exploring whether the negative effect of using AR on consumer response to future product failure extends to different product categories (e.g., experiential products). For example, would consumers be less likely to revisit a restaurant if a disappointing dish was viewed through an AR menu rather than a photo menu? The food industry is another emerging category in which AR is likely to be integrated (Fritz, Hadi, and Stephen 2023). It would therefore be worth investigating whether the observed effect holds in more experiential purchase contexts.

Another limitation of our work is that it focuses on decision contexts in which consumers use AR to examine a product's appearance in their real-time surroundings. Thus, we focus on the context in which consumers use an outward-facing camera to superimpose virtual content on their physical environment (Hadi and Park 2024). Another notable application of AR involves consumers using inward-facing cameras to superimpose virtual content (e.g., a makeup product) on themselves (e.g., their face; Hadi and Park 2024). Often referred to as a "virtual try-on," these applications allow consumers to virtually place objects such as clothing or accessories on their face or body. Future work could profitably explore whether consumers react more negatively to the brand post-failure when they superimpose the content on themselves versus on their real-time environment. It is also possible that the observed negative effect of using AR explored in the current paper is attenuated for virtual try-ons, as consumers might be more likely to attribute the failure to themselves (e.g., "Perhaps I gained some weight since ordering") rather than to the brand. While we focus on consumers' use of AR in real-time physical surroundings, as this is a more predominant form of how AR is used in the current online shopping context (Mintel 2025), examining whether the same effect holds when consumers are using AR on themselves would be an intriguing avenue for future research. More broadly, future research could explore how different forms of AR technology, including those that project virtual objects onto the physical world versus onto the self, shape consumer perceptions and inferences in both similar and distinct ways.

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MARKETING SCIENCE INSTITUTE

FINAL WORKING PAPER

Web Appendix

A Helpful Tool or Marketing Gimmick? How Using Augmented Reality Pre-Purchase Shapes Consumer Response to Product Failure

Web Appendix A: Pilot study exploring consumer beliefs about AR and persuasion

In this pilot study, we explore the extent to which different digital display types activate persuasion knowledge. Participants rated four common digital display options ("pictures/photos," "videos," "3D visualization or 360-degree view," and "Augmented Reality feature") on the extent to which they believe brands offer these options to actively persuade consumers to buy their product versus to inform or help consumers make a decision.

Design and Procedure

A total of 100 participants (M_{age} = 38.6; 49.0% female, 50.0% male, 1.0% other) were recruited from Connect in exchange for monetary compensation. All participants were told that they would be asked about their online shopping experiences. On the next page, participants read the following: "Online stores often let shoppers view products in different ways. For example, major online retailers such as Amazon and Target offer the following options for customers to view their products: Pictures/photos, videos, 3D/360-degree view, and Augmented Reality. We would like to hear your thoughts on these display options. Specifically, we would like to know why you think companies provide these different ways to view products."

We then assessed the extent to which each display option elicits persuasion knowledge by asking the following question for each of the four display options: "I think the primary reason that companies provide (a) pictures/photos; (b) videos; (c) 3D visualization or 360-degree view; (d) Augmented Reality (AR) app for viewing a product is…1 = to inform/help consumers make a decision, 4 = neither to inform nor to persuade, 7 = to persuade consumers to buy the product." Afterwards, participants indicated their age and gender to complete the study.

Results and Discussion

A repeated-measures ANOVA revealed that the extent to which different display options activate persuasion knowledge varies significantly by display type ($F(3, 297) = 9.87$, $p < .001$; $\eta^2_p = .091$). Bonferroni-corrected pairwise comparisons revealed that participants were more likely to perceive AR ($M = 5.19$, $SD = 2.10$) as being offered by brands to persuade them (rather than to inform or help) compared to pictures/photos ($M = 3.92$, $SD = 2.35$; $p < .001$), videos ($M = 4.35$, $SD = 2.29$; $p = .006$), or 3D visualization/360-degree view ($M = 4.41$, $SD = 2.33$; $p < .001$). No significant differences were found among other display types in the extent to which they were viewed as being offered as a persuasion tactic (see Table 1 for details). This result thus provides evidence that among different digital display types, AR is most strongly associated with the activation of persuasion knowledge.

Web Appendix Table 1: Result of Bonferroni-Corrected Pairwise Comparisons.

Display type	**Comparison**	**Mean Difference**	**Standard Error**	**Significance**	**95% CI for Difference** Lower Bound	Upper Bound
Pictures/photos	Videos	-.430	.192	.164	-.947	.087
	3D visualization/ 360-degree view	-.490	.271	.439	-1.219	.239
	Augmented Reality (AR)	-1.270***	.276	< .001	-2.012	-.528
Videos	Pictures/photos	.430	.192	.164	-.087	.947
	3D visualization/ 360-degree view	-.060	.266	1.000	-.776	.656
	Augmented Reality (AR)	-.840***	.246	.006	-1.504	-.176
3D visualization/ 360-degree view	Pictures/photos	.490	.271	.439	-.239	1.219
	Videos	.060	.266	1.000	-.656	.776
	Augmented Reality (AR)	-.780***	.150	< .001	-1.184	-.376
Augmented Reality (AR)	Pictures/photos	1.270***	.276	< .001	.528	2.012
	Videos	.840**	.246	.006	.176	1.504

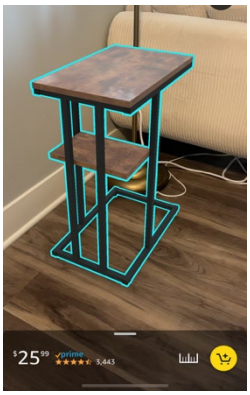
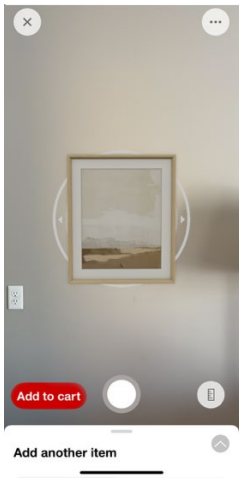
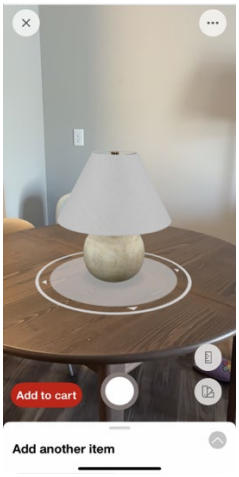
3D visualization/ 360-degree view	.780***	.150	< .001	.376	1.184

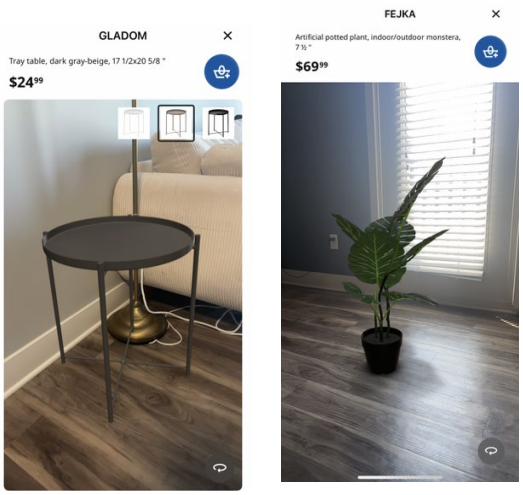
Notes: * $p < .01$, ** $p < .05$, *** $p < .001$.

Web Appendix B: Real-world examples of add-to-cart button integration in in-app AR design

A common feature in AR apps offered by several prominent retailers is the integration of a salient "add-to-cart" button (often displayed as a text prompt that says "add to cart" or a prominent shopping cart icon) within the in-app AR experience. Table 2 presents actual screenshots from major retailers that present this design element during in-app AR use.

Web Appendix Table 2: Example Screenshots of "Add-to-Cart" Prompts in Real-World AR Apps.

Retailer	Screenshots of a shopping cart icon displayed during in-app AR experience		Description
Amazon			On Amazon shopping app, an add-to-cart icon (yellow) automatically appears when using the AR feature. Note that when exiting the AR feature, Amazon sends another reminder to put the item in the cart (second screenshot).
Target			On Target app, "add to cart" button (red) automatically appears when using the AR feature.

IKEA		On IKEA, an add-to-cart icon (blue) automatically appears when using the AR feature.

Web Appendix C: Pilot study looking at experiences of AR use and product failure

This pilot study examines whether consumers have experienced product failure following pre-purchase Augmented Reality (AR) use.

Design and Procedure

A total of 331 undergraduates (M_{age} = 20.2; 47.4% male, 52.3% female, .3% prefer not to answer) participated in the study in exchange for course credit. We first described what an Augmented Reality (AR) feature is: "More brands are offering Augmented Reality (AR) function to consumers. AR allows consumers to overlay real-world environments with 3D virtual objects. You would probably have seen this feature offered by brands such as Amazon, Nike, Target, and IKEA. For example, Amazon offers "View in Your Room" option, which lets you view products in your home." All participants then were asked whether they have used AR feature before ("Have you ever used AR feature from any brand before when shopping online?" 1 = yes, 2 = no). If participants indicated "no," they were redirected to the end of the survey. Only participants who responded "yes" were directed to the follow-up question assessing whether they had experienced product failure following AR use during the pre-purchase stage. As noted in the main paper (and consistent with prior literature), we define product failure as instances in which a product does not meet a consumer's pre-purchase expectation. Accordingly, participants were asked: "Have you ever experienced a situation where a product you ordered online after previewing it through any AR feature was different from what you actually received in real life? (1 = yes, 2 = no)."

Results and Discussion

We first examined the percentage of participants who had previously used AR when shopping online: About half of the participants (46.5%, 154 out of 331 participants) indicated

having used AR before. We then looked at, among these participants, how many had experienced product failure following AR use. Similarly, approximately half (45.5%, 70 out of 154 participants) reported that the product they received differed from what they expected based on the AR experience. This finding thus suggests that, despite offering more immersive visual information, AR technology does not fully eliminate product-fit related failures. Our research explores the inferences consumers make about these failures and how such inferences influence their future patronage intentions.

Web Appendix D: Post-test of Study 1a

In Study 1a reported in the main paper, participants (undergraduates) were told that at the end of the study they would actually receive the wall art that they chose as part of the study. After viewing their chosen wall art via an AR or a 3D display during the study, participants, at the end of the study, were led to a breakout room where they received a small, printed image of a piece of wall art instead of a frame-sized version. In this post-test, we aimed to confirm that participants actually viewed this outcome as a product failure.

Design and Procedure

We recruited participants from the same pool as the sample used in the main study. A total of 180 undergraduates (51.7% male, 48.3% female) participated in the study in exchange for course credit. As in Study 1a, participants were told that the lab was partnering with a wall décor brand seeking student feedback on a new feature. They viewed the same brand website image used in Study 1a and were asked to choose between two framed wall art options (featuring either a hedgehog or a giraffe) by clicking on their preferred design (i.e., following the same procedure as in Study 1a). Once participants clicked on their preferred wall art in the website image, they moved onto the next page, which displayed the following description: "You chose the [*either "hedgehog" or "giraffe" was populated depending on participants' choice*] wall art. Now imagine that what you actually receive is a small, printed image of a [*either "hedgehog" or "giraffe"*]." The description was designed to mirror what participants in Study 1a experienced. We then assessed the extent to which participants perceive this experience as a product failure using the following measure adapted from the definition of product failure by Darke, Ashworth, and Main (2010): "In this scenario, how much did the wall art you end up receiving match your prior expectations of it? 1 = did not match at all, 7 = matched perfectly."

Result and Discussion

We ran a one-sample t-test to examine whether participants perceived the outcome described in the study as a product failure. As expected, participants responded that the wall art they received did not match their prior expectations ($M = 2.11$, $SD = 1.02$), with the mean rating significantly lower than the midpoint of the scale ($t(179) = -25.00$, $p < .001$, *Cohen's d* = 1.02). Notably, 92.2% of participants rated the experience below the scale midpoint, indicating that the vast majority viewed what happened in Study 1a as product failure.

Web Appendix E: Follow-up of Study 2a reported in the main paper

We conducted a follow-up study of Study 2a (reported in the main paper) to examine whether descriptions of pre-purchase AR use (i.e., a more conservative and controlled manipulation) are sufficient to elicit a similar psychological response to that produced via actual AR use.

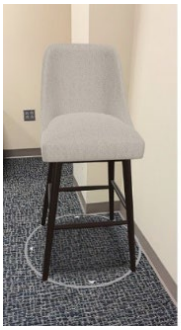
Design and Procedure

A total of 401 participants (M_{age} = 37.9; 53.9% male, 45.4% female, .7% other) were recruited from Connect in exchange for monetary compensation and assigned to either AR or 3D display condition. All participants first read that they were looking for a bar stool for their kitchen on a brand website. They were told that the brand offers "Augmented Reality" (vs. "3D display") feature, and that they decided to try this out.

On the next page, participants in the AR (vs. 3D display) condition viewed two screenshots of the stool viewed in AR (vs. 3D display) format (see Table 3). As in Study 1b (reported in the main paper), the authors obtained these screenshots by using an existing e-commerce app (that provides both AR and 3D features) to view the product in the corresponding format. In the AR condition only, participants read "You walk in your kitchen to test out the feature. You then pointed your camera to the kitchen floor to place the stool virtually in your kitchen," a manipulation designed to highlight greater degree of consumer involvement afforded by AR. In both conditions, participants read that they "spend a few minutes rotating and moving the stool to see if it would fit in your kitchen." All participants then read that they decided to order it, but then, a few days later, when they received the stool, they "realized that it was not the right fit and decided to return the product."

Participants indicated their likelihood to patronize the brand in the future on a seven-point scale ("Based on your experiences with this brand, how likely are you to revisit this brand to look for a different product?"; 1 = extremely unlikely, 7 = extremely likely), the same item used in Studies 1b and 2a reported in the main paper. They then indicated their attributions of the product failure and inferred deception (the order of the measures was randomized) on seven-point scales. We used the same measure of attributions of the product failure (r = .89) and inferred deception (α = .92) as in Study 2a.

Web Appendix Table 3: Screenshots Presented in Each Condition in this Follow-up Study

Augmented Reality		3D display	
			

Result and Discussion

Likelihood to patronize the brand. A one-way ANOVA with display type as the independent variable and likelihood to patronize the brand as the dependent variable replicated the previous finding (reported in the main paper), such that there was a significant decrease in likelihood to patronize the brand in the AR (M_{AR} = 2.98) versus 3D display condition (M_{3D} = 3.49; $F(1, 401) = 9.60$, $p = .002$, $\eta^2_p = .024$). The result thus demonstrate that descriptions and screenshots of pre-purchase AR use elicit a similar psychological response to that produced via actual AR use.

Attributions of product failure. A one-way ANOVA with display type as the independent variable and attributions of product failure as the dependent variable demonstrated that,

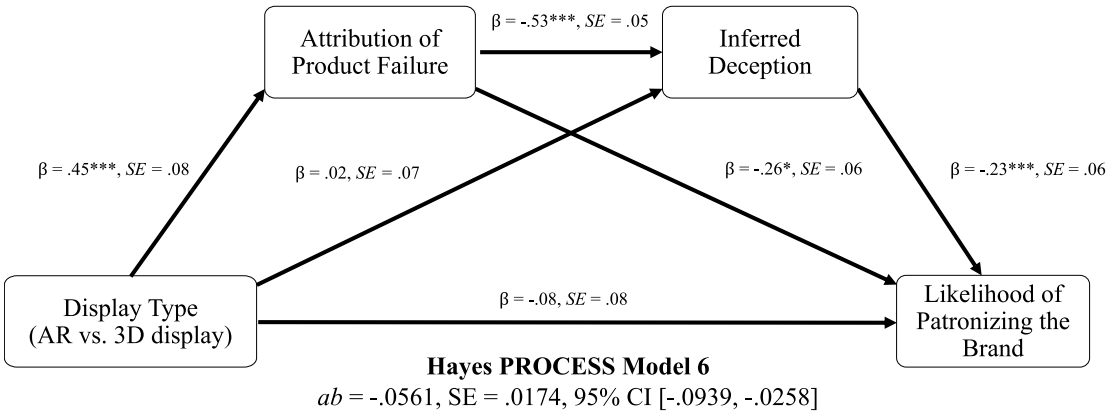
consistent with the finding of main study, that participants in the AR (vs. 3D display) condition were significantly more likely to attribute the failure to something about the brand versus themselves (M_{AR} = 4.49 vs. M_{3D} = 3.59; $F(1, 401) = 32.89$, $p < .001$, $\eta^2_p = .076$).

Inferred deception. A one-way ANOVA with display type as the independent variable and inferred deception as the dependent variable demonstrated, as expected, that participants were more likely to infer that the brand was deceptive in the AR (M_{AR} = 3.68) versus 3D display condition (M_{3D} = 3.17; $F(1, 401) = 9.65$, $p = .002$, $\eta^2_p = .024$).

Serial mediation. We ran a serial mediation using PROCESS model 6 (Hayes 2017) where the independent variable was the display type, the dependent variable was patronage intentions, the first mediator was the attribution of the product failure, and the second mediator was inferred deception. The result revealed a significant indirect effect of the serial model (effect = -.06, SE = .02, 95% CI [-.09, -.03]; see Figure 1) and was similar to that obtained in the main study.

Discussion. The current study thus successfully replicates the results of Study 2a reported in the main paper (thereby providing support for hypotheses 2a and 2b) using descriptions of AR use.

Web Appendix Figure 1: Serial Mediation.



Notes: * $p < .01$, ** $p < .05$, *** $p < .001$.

Web Appendix F: Stimuli used in Study 5

Study 5 reported in the main paper used a 2 (display type: AR vs. 360-degree) X 2 (forewarning message: absent vs. present) between-subjects design. In all conditions, participants first saw a screenshot of a brand's website (Figure 2, Panel A) and were told that they were looking for a bar stool. Participants were asked to click on the "Bar stool" category in the website image, which simulates what they would do on an actual brand website. Figure 2 panel B displays what it looks like when a participant clicks on the bar stool category.

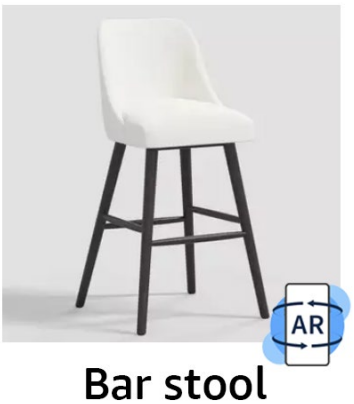
Web Appendix Figure 2 Panel A: Website Image Displayed to Participants.

Web Appendix Figure 2 Panel B: Example Screengrab Simulating What It Looks Like When a Participant Clicks on "Bar Stool" Icon.

Participants then moved onto the next page, where they saw a screenshot of a bar stool from the brand that accompanied either "AR" or "360-degree" icon, which again simulates what actual brands do to convey the existence of these features. Figure 3 below demonstrates the screenshot participants viewed in AR and 360-degree conditions, respectively.

Web Appendix Figure 3: Screenshots Viewed in Study 5.

Augmented Reality condition



360-degree display condition

Participants then moved onto the next page and, as described in Study 5 of the main paper, saw screenshots corresponding to their conditions. The descriptions and screenshots participants viewed in each condition are reported in the main paper.