

# Can augmented reality replace physical trial for the online purchase of experience goods?

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## Abstract

### • Objectives

This research aims to understand whether, during an online purchase, a virtual trial in augmented reality is likely to replace a physical trial, helping to make a decision to buy or not. We focus on experience goods, i.e. goods that need to be used to be fully evaluated.

### • Methodology

We first conducted a qualitative study (17 semi-structured interviews with consumers), followed by a quantitative study to build a typology (N= 349).

### • Results

The first study highlights a lack of confidence in augmented reality. The second study draws up a typology of three consumer profiles - pro-online, pro-offline and pragmatists – and shows that only the first profile requires a virtual trial in AR to make a decision.

### • Managerial implications

This research shows that, for experience goods, augmented reality cannot satisfy all consumer profiles. Brands are therefore encouraged to combine several alternatives to physical trial, to reach their entire target audience.

### • Originality

The originality of this work is twofold. Firstly, studying the usefulness of augmented reality trial for the specific category of experience goods. Secondly, using a mixed-methods approach.

• **Keywords:** virtual trial, physical trial, purchasing process, augmented reality, experience goods, purchase decision, e-commerce.

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Over the last decade, online commerce has grown significantly (it now represents almost 13% of retail trade<sup>1</sup>), which has changed the distribution dynamics for many categories of goods and services (Mandal et al., 2021). Online sales offer many advantages, insofar as they make it possible to present entire product ranges, as well as to cover an entire territory without needing physical points of sale. However, for certain categories of goods, fully online distribution remains difficult, as it deprives consumers of the opportunity to try out.

This is particularly true for experience goods (Darby and Karni, 1973; Nelson, 1970), which can only be evaluated through actual use, usually by touch. They are opposed to search goods, for which access to a detailed description makes it possible to assess quality. Clothing, furniture, cosmetics and cars are considered to be experience goods (Weathers et al., 2007). For this category of goods, consumers often seek to touch the product, to visualise it on themselves or in their own environment (for example, an armchair in their living room). For retailers, the challenge is to enable consumers to make a decision that will satisfy them, even though they cannot physically interact with the product. There are a number of solutions available to them: displaying products on the website in 3D or augmented reality, sending samples, but also sending the product with the possibility of long-term returns, such as “100-day trial” or “try at home” mechanisms.

Augmented reality is particularly relevant to the home goods sector (the third largest in terms of e-commerce market share). Augmented reality makes it possible to visualise an object in its physical environment, and therefore to check if it is suitable for the interior. It appeared for the first time in the furniture sector: in 2014, Ikea offered to virtualise furniture by scanning its

catalogue with a smartphone. Nowadays, this technology is relatively widespread: in 2023, in France, the penetration rate of augmented reality, all applications combined, was 48%<sup>2</sup> (a figure that is predicted to rise to 52% by 2027). Yet there is a paradox: despite its promise, particularly as a means of offering product trials, few retailers are yet offering augmented reality on their retail websites.

Several authors have looked at the uses of augmented reality in marketing and identified several benefits (Flavián et al., 2019), such as the fact that it is appealing (Rauschnabel et al., 2019) or that it increases behavioural intentions (Whang, 2021). Most of this research focuses on goods directly related to the human body (glasses, make-up, jewellery) and on how augmented reality influences the purchase of products online. This work aims to shed further light on the different user profiles of augmented reality, in order to understand whether it can be beneficial and useful for everyone. We will therefore answer the following question: *to what extent does the use of an augmented reality tool lead to make an online purchase decision?*

To answer this question, we first conducted a series of interviews with consumers, including the use of an augmented reality trial tool. These interviews show a lack of confidence in the tool, which limits the intentions of those interviewed to use it. However, this lack of confidence varies according to the profile of the individual. In order to better understand this result, we then set up a quantitative study aimed at constructing a typology of augmented reality user profiles. We identified three profiles, which enabled us to formulate recommendations for distributors selling experience goods online. We encourage them to propose a range of solutions to compensate for the lack of trials and not to focus solely

1/ Source : FEVAD report, 2022.

2/ Source : Statista AR & VR report, avril 2023.

on augmented reality, which cannot satisfy all consumer profiles.

## Literature review

### Trial in the purchasing process

Marketing literature has focused on trial within the purchasing process, attempting to link it to one of the five stages defined by Engel et al (1968): recognition of a need, information search, pre-purchase evaluation, decision and post-purchase evaluation. To date, several visions coexist concerning the definition of the trial and its place in this process. Trial can be considered as “exploratory” and linked to information search phase (i.e. the second phase of the purchasing process) if we consider that consumers, when they buy a new product, generally do not know its quality. Trial would then be a means of acquiring information and forming an opinion (Goering, 1985).

The information gathered during this second phase enables the consumer to narrow down the range of choices in order to form a consideration set, i.e. a set of brands or products considered acceptable and from which the final choice will be made (Chandon and Strazzieri, 1986). It is acknowledged that the consideration set is easier to form in an in-store context than on the Internet: online, the large amount of information available makes the task more difficult (Punj and Moore, 2009). In other words, if we consider that trial takes place during the second phase of the purchasing process, it would be a tool for forming the consideration set. That’s why it can be considered as “exploratory”, in the sense that it enables to explore the offer available.

Another approach is to see the trial as “confirmatory”, i.e. as a means of confirming or refuting consumer expectations (Olson and Dover, 1979). In this second situation, the information collected generates expectations

about the product, and the trial makes it possible to judge whether these expectations have been met. Here, trial would be more closely linked to pre-purchase evaluation (third phase of the purchasing process) and its role would be to validate a choice from a set of considerations already formed. This research focuses on this second option: we want to understand whether augmented reality can be used to confirm a decision during an online purchase, without the need to go to the shop.

In addition, it seems coherent to consider that the trial experience is, more broadly, part of the overall consumer experience. The experience is based on a combination of stimuli, judged to be more or less satisfactory by the consumer (Roederer, 2012). Trial meets the criteria of this definition as it combines hedonic-sensory stimuli along with praxeological, temporal and rhetorical dimensions. Trial can therefore provide consumers with more or less satisfaction during the purchasing process.

### Trial and experience goods

We are focusing here on experience goods (Darby and Karni, 1973; Nelson, 1970), i.e. products that are difficult to evaluate in the pre-purchase phase without making direct use of them (such as cosmetics, clothing or furniture, for example). For these products, it is difficult to totally exclude physical trials in physical retail environments (Mandal et al., 2021). Indeed, trial makes it possible to gather several types of information. Firstly, it enables sensory elements to be apprehended directly (touch, sight, hearing, particularly in the case of household equipment). This information is more or less necessary depending on the individual’s level of need for touch (Peck and Childers, 2003): some people can make a decision on the basis of visual information alone, while others need to touch the product. The need for touch is part of the process of acquiring information

via the senses and enables people to judge the quality of a product. In this context, individuals with a high need for touch will have more confidence in a product with which they have been able to interact, whereas for those with a low need for touch, the impossibility of trying it is less of a problem. In addition, trying out a product gives a more tangible view than simply seeing it (Laroche et al., 2001). Tangibility has a direct impact on consumer decisions, insofar as a tangible product is recognised as being easier to evaluate than an intangible one (Laroche et al., 2010). Conversely, in the case of low tangibility, consumers perceive a higher level of risk, likely to dissuade them from buying the product. We also know that the risk associated with buying online determines

the acceptability of this distribution method, depending on the buyer's profile (Bèzes, 2012). The tangibility offered in-store therefore simplifies the decision-making process for consumers.

### Augmented reality: an alternative to in-store trials?

We analysed the websites of the main players in furniture distribution in France, to identify the variety of alternatives to physical trial in this industry. The list of retailers studied is based on the study "Furniture Distribution" (Xerfi, June 2020) as well as on an online watch conducted by the authors during the year 2022. All websites were analysed in 2022. Second-hand retailers, specialist retailers (kitchens, bedding) and DIY

Table 1: List of the different alternatives to physical product trial

Solution	Description	Examples of brands
Virtual trial in augmented reality	Visualizing furniture in augmented reality in your own home, usually via the smartphone camera	Ikea, Bo Concept, Made.com
Virtual tour of the store	The website offers a virtual tour of the store: customers can move around the rooms by moving their computer mouse, rotating furniture, or zooming in.	La Redoute
Samples	Sending samples of materials (fabrics, wood, tiles, etc.) to the customer's home, prior to purchase (usually free of charge).	Bo Concept, Camif, Made.com, MYCS
Pictures of the product at other consumers' home	The product page includes pictures of the product taken by consumers and posted on social networks (usually Instagram). The product is also presented in real interiors.	Maisons du Monde, Made.com*, Tikamoon, Miliboo, But
3D visualisation	A three-dimensional representation of the product in volume. Consumers can move the product, simulate its use (e.g., opening drawers or a door) and personalise it according to their tastes (e.g. choosing a colour).	Cinna, Tikamoon
Video appointments	Individual one-hour appointment with an advisor who will show the consumer the products he or she is interested in.	La Redoute
Trial period at home	Consumers can return furniture free of charge and without having to justify the reason, after a period defined by the brand. This means they can see the furniture at home and have time to confirm their purchase or not.	MYCS, Tikamoon

\*Made.com closed its doors at the end of 2022.

retailers are excluded from the scope. Table 1 summarizes the various tools implemented (non-exhaustive list).

As we can see, some solutions are more often offered by retailers than others. Decorating advice services seem to be relatively common, as is the sending of samples. On the other hand, virtual shop visits, customisable configurators (allowing consumers to view in 3D an object that they have customised to their own tastes) and augmented reality displays are less common, probably because of the resources required to implement them. After setting out this overview, we

wanted to understand how consumers react to augmented reality. As it enables them to visualise the product in their own home, it seems to be the closest thing to a ‘real’ trial. Augmented reality consists of superimposing digital information on a real environment (Azuma, 1997). Many authors have focused on virtual trials in recent years (Kumar, 2022). Table 2 provides a summary of the main research carried out on this topic.

The table 2 highlights two important points. On the one hand, most of the research carried out on augmented reality trials for experience goods concerns products related

Table 2: Summary of the main research published on augmented reality in marketing

Reference	Experience good	Channel	Stage of the purchasing process	Variables tested
Javornik (2016)	Chair, glasses	Online	Alternatives evaluation	Affective responses, cognitive responses, behavioural intentions
Pantano et al., (2017)	Glasses	Online	Purchase	Attitude, behavioural intention
Poushneh and Vasquez Parraga (2017)	Glasses	Online	Purchase	Purchase intention, satisfaction
Yim et al. (2017)	Glasses, jewelry	Online	Purchase	Attitude towards augmented reality, purchase intention
Beck and Crié (2018)	Clothes	Online & offline	Alternatives evaluation, purchase	Intention to visit (online / offline), purchase intention
Merle et al. (2018)	Lipstick	Omnica-nal	Alternatives evaluation, purchase	Purchase intention, efficiency of the decision
Smink et al., (2019)make-up, furniture	Lipstick	Online	Purchase	Attitude towards the brand, purchase intention
Park and Yoo (2020)	Lipstick	Online	Alternatives evaluation, purchase	Mental imagery, behavioural intention
Beck (2022)	Glasses	Offline	Alternatives evaluation, purchase	Curiosity, behavioural intention
Tan et al. (2022)	Make-up	Online	Purchase	Sales
This study	Furniture	Online	Alternatives evaluation	Profile of augmented reality users, affinity with augmented reality by profile

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### Box 1: Methodology of the qualitative study

We chose to first carry out an exploratory qualitative study, using semi-structured interviews. We selected the Made.com and Maisons du Monde websites, as both of them offer a wide variety of devices, including an augmented reality tool. The (convenience) sample consisted of 17 people (6 men and 11 women) aged between 20 and 65, who had made at least one purchase of goods related to home furnishings in the last 12 months. Appendix 1 provides the detailed profile of the respondents. 13 people browsed the Made.com site and 4 the Maisons du Monde one. For both brands, the interview took place in three stages. We first asked the respondents to recall their most recent home furnishings purchase (stage 1). Then, we asked them to search for a chest of drawers on the site for their home (stage 2) as if they really wanted to buy it. The third phase consisted of having them try out augmented reality for the piece of furniture they had found. Then, they were invited to express their feelings about the tool and to describe its role in their decision-making. The interviews were conducted face-to-face and lasted between 33 and 40 minutes. We entirely transcribed them before coding them manually in a grid (using the method of a first reading to identify the main themes, followed by a second reading to identify the sub-themes).

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to the human body (glasses, cosmetics). On the other hand, these research focus on the impact of augmented reality on the purchasing process (through various variables) but not on the characteristics of the people who use this technology. In the present article, we seek to identify whether augmented reality visualisation can, just like a physical trial, help all consumers to make a purchasing decision for experience goods. Box 1 presents the methodology for the first stage of our research.

### Trial as a decision-making aid

We wanted to understand to what extent respondents feel that augmented reality can help them making decisions. The results show that opinions about this tool are mixed. They also suggest that there are several respondent profiles, which could explain the differences observed.

#### Perception of the different tools used to visualize products

Before delving into the augmented reality visualization tool, we observe that consumers appreciate online features and information differently. All respondents value seeing products in real interiors of other customers, considering it one of the most useful elements for evaluating and projecting the product

in their own space (*“Seeing the products in customers’ homes helps with projection,”* Camille, 33 years old; *“There are a lot of product visuals; seeing it in people’s homes is not useless like photos, that’s where we project ourselves the best,”* Arnaud, 28 years old). This is especially appreciated by those who find it challenging to trust brand photos (*“I don’t trust photos of wood [furniture],”* Adrien, 33 years old). Detailed photos and zooms to see the product more closely are generally appreciated, especially by those with a strong affinity for the product category. These images help them assess the quality, colour, and texture of the product (*“I like having zooms and details of the products; we can really see the quality,”* Pauline B., 30 years old).

Focusing specifically on the perception of augmented reality, respondents did not particularly appreciate it. However, they attribute this to the technology’s lack of precision and believe that when it becomes more efficient, augmented reality can be useful for them (*“In theory, it’s great, but it’s not optimal,”* Pauline B., 30 years old; *“We need to advance in technology for better sizing, shadows, and textures. Maybe under those conditions, it will be beneficial, but not now,”* Noë, 20 years old).



In detail, several sources of dissatisfaction are mentioned. First, they found the tool difficult to use (*“I struggled to use the augmented reality app; I don’t find it intuitive,”* Valérie, 56 years old). They also mention a lack of confidence in the tool (*“I don’t trust the tool; it doesn’t allow me to project the product in my home,”* Pauline L., 27 years old). This lack of confidence makes them doubt the realism of the representation, about two aspects: colour and size. Firstly, they are unsure about the projected size of the furniture (*“I had trouble figuring out if it was the actual size,”* Victoire, 26 years old; *“I’m not sure the size is 100% accurate. It seemed huge to me. So, I would still need to use my tape measure to see if it’s right or not,”* Pierre, 31 years old). Finally, they question the fidelity of the shown colour (*“The colour was very dark, not true to the photos,”* Astrid, 27 years old).

In order to understand the reasons for this lack of confidence, shared by the majority of respondents, we questioned the criteria for trust in augmented reality. The literature shows that trust in augmented reality relies on several factors (De Ruyter et al., 2020): the credibility of the visual elements presented, the creativity of the content, and the alignment between the content offered and the information sought by the consumer. In this case, the verbatims suggest that the lack of confidence emerges from a lack of credibility.

The interest of augmented reality, according to the respondents, lies in the ability to assess the fit with their interior (*“It brings something you don’t have when you go to the store, which is seeing the product at home, in your environment, with your decor. It’s really added value for this reason because even in-store, you have to imagine it,”* Pierre, 31 years old; *“The potential interest is to confirm if it’s harmonious in the room, in terms of colours and shape compared to other furniture,”* Hervé, 54 years old).

The respondents consider that while augmented reality helps with decision-making, it is not decisive (*“It helps with envisioning, but it’s not essential,”* Camille, 33 years old; *“It’s a plus, but I could have made my decision without it,”* Astrid, 27 years old). However, the tool is seen as complementary to other devices (*“It’s the last missing tool because we already have all the textures and information on the website,”* Arnaud, 28 years old). The utility may depend on the product category, price level, and therefore, risk level, or the luxury level (*“I think this kind of tool is relevant for some products and completely gadget for others,”* Paul, 30 years old; *“It almost undermines the beautiful object that doesn’t look good in the 3D rendering,”* Adrien, 33 years old).

In summary, although virtual trial in augmented reality appears to date as the only solution to project the product at home, it is rather disappointing for respondents. It is interesting to note that, despite an unsatisfactory technology, respondents consider augmented reality as a relevant complementary tool (although it is not a substitute for physical trial). They manage to distance themselves from the tool’s limitations and to judge the usefulness of augmented reality technology more generally. This provides insights into its potential benefits, if the technology becomes more efficient. It seems that augmented reality visualization (for experience goods) could enhance the purchasing process and reduce the risk for some people, especially concerning size and proportions. However, it is not enough to form a reassuring decision for consumers.

In detail, individuals do not all seem to have the same opinion regarding the usefulness of this technology for decision-making. Trust in the technology, online purchasing habits, relationship with the product and the individual’s ability to project and visualise the product seem to have an impact on this perception of usefulness. We then

re-analysed the interviews to identify the different profiles of the respondents and their personal characteristics.

### Several profiles of buyers

The data collected enable us to identify three buyer profiles: pro-online, pro-offline and pragmatists. Among the 17 respondents, we found similarities in the behaviour of certain individuals.

**Pro-online shoppers** are used to buying online and are curious about technology, or at least about new features offered by brands (augmented reality, 3D visualisation, etc.). They can buy any product category online without fear (*“I buy everything online, it doesn’t scare me at all”*, Hortense, 28 years old; *“No, I don’t feel the need [to go into a shop]”*, Noë, 20 years old). These people generally have a “full online” experience, researching, evaluating, and buying the product online. There are a number of reasons for this: a desire to save time (*“I ordered it online, it saves me time”*, Pauline B., 30 years old), a search for the best value for money (*“I looked at the carpets I liked on the Internet and found one that offered good value for money”*, Astrid, 27 years old), or the opportunity to compare a large number of products (*“I did a keyword search on Google”*, Noë, 20 years old).

Pro-online shoppers do not express any risk before their online purchase; they are fairly confident. This is probably due to the fact that they can easily assess the attributes of the product online, thanks to the pictures (*“I’ve never seen it in real life but I’ve seen it displayed so much on Instagram that I knew what it was going to look like”*, Adèle, 28 years old) and the descriptions (*“I trusted the description on the site”*, Marie, 27 years old; *“It’s well described, it’s got what you need”*, Noë, 20 years old). They don’t mind not trying out an experience product such as a sofa or armchair in a physical outlet (*“Buying a piece of furniture online doesn’t*

*seem any more complicated or easier than any other item”*, Paul, 30 years old). However, we noticed that quality and comfort are attributes that are difficult to assess online, even for them (*“It’s not comfortable, the quality isn’t great”*, Marie, 28 years old; *“My sofa is pilling, I’m a bit disappointed with the texture and the mechanism of the sofa bed isn’t great, perhaps I could have seen these aspects in shop”*, Astrid, 27 years old).

**Pro-offline shoppers**, on the other hand, have difficulty trusting commercial sources, particularly information provided by brands on the internet (*“I did several searches online, several times to see the photo because I thought it might be rubbish”*, Hervé, 54 years old). They rarely buy online. Instead, they adopt a cross-channel approach and are very often webroomers. Most of the time, they look for information online (*“I started searching on the Internet, I looked at websites selling several brands, then to get more information I went to the brands’ own websites”*, Arnaud, 28 years old) before going to the store to validate the product and buy it (*“As a general rule, I don’t buy without seeing the product in person”*, Adrien, 33 years old; *“I decided to go to the store afterwards to see the chest of drawers in person”* Arnaud, 28 years old). When they visit the shop, they already know what they want and seek to validate certain product attributes to reassure themselves (*“The shop is a confirmation phase, I know I want to buy the product because I like it, but I just want to be sure of my purchase”*, Adrien, 33 years old).

Due to their lack of trust in online platforms, the pro-offline individuals have a strong need for reassurance during the pre-purchase phase (*“I needed to be reassured,”* Arnaud, 28 years old; *“I questioned the quality of the carpet,”* Colombe, 26 years old). Two main perceived risks associated with online purchases are identified in this profile:



The risk of mismatch with their interior (“*I’m afraid it won’t fit with my interior,*” Colombe, 26 years old).

Financial risk (“*As it is a significant purchase and a bulky product, I needed reassurance,*” Arnaud, 28 years old; “*I didn’t dare to order online without being sure of what it would look like. The price was a barrier,*” Colombe, 26 years old).

In contrast to the pro-online individuals, they are very distrustful of the Internet and do not like evaluating product attributes based on commercial sources (“*I don’t trust brand photos on the internet in perfect interiors,*” Adrien, 33 years old). They feel the need to touch and try the product to validate their choice. If a trial is not possible, they seek to reduce the risk through various means:

Seeking input from personal sources such as friends or trusted individuals (“*Not tested, but I bought it because I had positive feedback from people I trust,*” Adrien, 33 years old).

Referring to the brand’s image and reputation. If a brand has excellent reviews and is well known, the need to test the product may be lower (“*If I hadn’t seen it in person, I would have still bought it. I trust the retailer,*” Adrien, 33 years old).

Checking for guarantees such as free returns (“*I have 100 nights to return it,*” Adrien, 33 years old).

Finally, **the pragmatists** are individuals whose attitude varies depending on the product. The more involving the purchase, the more they want guidance from retailers and real support during their pre-purchase phase (“*The saleswoman quickly gave me all the information I wanted,*” Valérie, 56 years old; “*For an involving purchase, I think it’s important to have a salesperson, it was reassuring, and he guided and advised us well,*” Victoire, 26 years old). For products seen as less involving and easier to evaluate, such as research products, online purchases

are possible. However, for experience goods, it will be impossible (“*I wanted an armchair, I went to the store,*” Elvire, 65 years old). Pragmatists perceive two risks during online purchases: financial risk and performance risk (“*Things I buy online are not high-value purchases [financial risk]. I’m afraid of the quality and afraid of being disappointed for an expensive purchase [performance risk],*” Camille, 33 years old). Pragmatists also appreciate having samples available to evaluate the product, especially when the desired version is not available in stores or if they want to buy online (“*If samples are offered, it can help reassure me,*” Camille, 33 years old).

These three profiles react differently to the absence of a physical trial and to virtual trials in augmented reality. For pragmatists, it’s impossible to buy a piece of furniture without going to the shop (“*I need to touch the product,*” Elvire, 65). Despite all the tools provided to visualise the product, for this target group, it is difficult to transcribe their pre-purchase in-store evaluation to an online setting. It is especially true for experience goods (“*Does this kind of tool help me? I’m not sure,*” Paul, 30). On the other hand, all of the pro-online users are satisfied with their experience, which they find even superior to the one they have in-store (“*I won’t need to go to the shop because you can see all the information really well [note: in augmented reality],*” Hortense, 28). Lastly, pro-offline customers would never consider making a purchase after trying out augmented reality (“*I hate the technology, the product is not credible,*” Adrien, 33).

Thus, differences emerge from one profile to another and suggest different reactions to augmented reality product trials. This echoes the literature, which suggests that certain individual variables may lead to different responses to augmented reality (Gatter et al., 2022; Kowalczyk et al., 2021). A priori, it does not enable all consumers to make a purchase

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### Box 2: Methodology of the quantitative study

The interviews suggest that virtual trial in augmented reality may be perceived differently depending on the profile of the consumers. We wanted to confirm this through a quantitative study designed to identify a typology of respondents. To do so, we set up an online questionnaire, distributed on the Prolific platform. The questionnaire included questions relating to the individual himself (general attitude towards e-commerce, need for touch, perceived risk for the product category, expertise in the product category, affinity with e-commerce, need for social interaction) as well as questions relating specifically to the visualisation of products in augmented reality (techno-familiarity, ease of use of the technology, usefulness, mental imagery, information completeness, intention to use, experience with augmented reality, trust in the technology, accuracy of the technology, perceived control). In order to ensure the reliability of the responses, the first question asked respondents whether they had used an augmented reality tool when purchasing household goods in the last 12 months. Only those who answered in the affirmative were able to continue with the rest of the questionnaire. All the other questions were scales taken from the literature, translated into French when needed (see appendix 2). All are measured in 7 points. The final sample consisted of 349 respondents (women = 50%, average age = 56).

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decision. Given the differences between the profiles, we now assume that their appeal for augmented reality will also be different. To confirm this intuition, a quantitative study is required. Box 2 presents the methodology for this second data collection.

### Typology

We first checked the reliability of the scales used (Appendix 3) and then carried out a cluster analysis (Ward's method with chi-square measurement) (Hair, 2019). Based on the results of study 1, we chose three clusters. We used the following individual variables to identify the clusters: need for touch, perceived risk, affinity with e-commerce, expertise in the product category, general attitude towards e-commerce, need for social interaction, general trust in augmented reality and familiarity with augmented reality. We then conducted an ANOVA to confirm the differences between the three groups of respondents (independent variable = cluster membership, dependent variables = the eight variables mentioned) ( $p < 0.001$  for all variables). The first cluster is made up of 106 people, the second of 74 people and the third of 169 people. Each cluster comprises over 10% of the sample, as expected (Hair, 2019). We then tested the stability of the clusters by sorting the observations in a different order and

classifying them again. The clusters remain stable. There was no significant difference ( $p > 0.1$ ) between the clusters in terms of socio-demographic variables (age, gender, income level, level of education).<sup>3</sup>

However, their buyer profile varies. The first cluster (N=106) is made up of people with a generally low affinity with e-commerce, a high need for touch and who also perceive a generally high level of risk (compared with the sample average). They also have a strong need for social interaction when shopping. Finally, their level of familiarity with augmented reality and their confidence in this technology are lower than the average for the sample. This group could correspond to the pro-offline shoppers identified in the interviews.

The second cluster (N=74) corresponds more to the pro-online group. It is made up of people with a very strong affinity with e-commerce and a high level of familiarity and trust in augmented reality. Their need for touch, their general level of perceived risk and their need for social interaction when shopping are lower than the sample average.

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3/ After this initial analysis, we carried out a non-hierarchical classification (dynamic clustering) which confirmed the results (in terms of the size of the groups and the trends observed for each of them).

Table 3: Clusters characteristics

Variable	Sample Mean	Cluster 1	Cluster 2	Cluster 3
Affinity with e-commerce	4,29	2,69	5,64	4,69
Perceived risk	3,35	4,23	213	3,32
Need for touch	4,37	5,30	2,98	4,39
Expertise in the product category	4,71	4,21	5,22	4,80
General attitude towards e-commerce	3,04	4,16	1,80	2,89
Trust in AR	4,92	4,36	5,80	4,88
Techno familiarity	4,99	4,71	5,52	4,94
Need for social interactions	2,81	3,24	2,52	2,67

Finally, the third cluster (N=169) is made up of people who combine a strong affinity with e-commerce with a high level of need for touch and perceived risk. They tend to trust augmented reality and their need for social interaction when shopping is in line with the sample average. We can therefore assume that these people have no negative preconceptions about online shopping or the use of augmented reality technology, but that their level of perceived risk and their need for touch may lead them to prefer the shop in certain cases. This would therefore correspond to the pragmatists. In short, we find here the three groups identified during the interviews. Table 3 details the characteristics of each cluster.

We then conducted a new ANOVA to identify more specifically how each cluster reacted to augmented reality. The results were significantly different from one cluster to another ( $p < 0.001$ ). We find the same trend here, namely that cluster 3 is the one corresponding to the sample average (the pragmatists), cluster 1 is the one for which the values are on average lower than those of the sample (the pro-offline) and cluster 2 is the one for which the values are on average higher than those of the sample (the pro-online). The pro-online group is very enthusiastic about augmented reality. They

enjoyed their augmented reality experience, finding the device accurate, useful and easy to use. When it comes to the product they are viewing, they feel that augmented reality provides comprehensive information and gives them a strong sense of perceived control. Finally, augmented reality stimulates their mental imagery. They therefore intend to use it again in the future. The pro-offline users are more reserved: they find it less useful, less precise and seem to have more difficulty in imagining the object (mental imagery). They also felt that the information was less complete than the pro-online users and found augmented reality less easy to use. Finally, they have lower desire to use it again in the future. Finally, pragmatists consider the tool to be fairly accurate, easy to use and useful. On the other hand, they consider the information to be incomplete and their intention to use augmented reality in the future is somewhere between pro-offline and pro-online. Table 4 details how each cluster rates augmented reality.

These results confirm what emerged from the interviews: there are three profiles of augmented reality users, who appreciate this technology to a greater or lesser extent, because it is more or less able to offer them what they need when shopping. These three profiles are summarised in Figure 1.

Table 4: Assessment of augmented reality by cluster

Variable	Sample Mean	Cluster 1	Cluster 2	Cluster 3
AR accuracy	5.29	4.96	5.85	5.24
Information completeness	5.00	4.51	5.71	4.99
Experience with AR	5.18	4.73	5.91	5.13
Mental imagery	4.94	4.62	5.40	4.94
Intention to use	4.94	4.46	5.77	4.89
Perceived control	5.20	4.84	5.95	5.10
Easiness of use	5.35	4.97	6.07	5.28
Utility	5.29	4.80	5.84	5.22

Figure 1: Typology of buyers

<p><b>Profile 1 : The pro-online</b></p> <ul style="list-style-type: none"> <li>– Strong affinity with e-commerce.</li> <li>– Used to buying online for all product categories.</li> <li>– Full online purchase process.</li> <li>– Low perception of risk, low need for touch, low need for social interaction when shopping.</li> <li>– Purchase without trial possible for any type of good.</li> </ul>	<p><b>Profile 2 : The pro-offline</b></p> <ul style="list-style-type: none"> <li>– Low confidence in online shopping and websites in general.</li> <li>– Offline purchase process most of the time.</li> <li>– Strong perception of risk when making purchases.</li> <li>– Strong need for touch and try products before buying them.</li> <li>– Strong need for social interaction when shopping</li> </ul>	<p><b>Profile 3 : The pragmatists</b></p> <ul style="list-style-type: none"> <li>– Confidence in e-commerce.</li> <li>– Variation of purchasing channel according to the product category.</li> <li>– Purchase without trial possible for some type of goods but not for experience goods.</li> <li>– Social interaction appreciated but not essential.</li> </ul>
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## Discussion, limitations, and avenues for research

The aim of this research was to understand the extent to which the use of an augmented reality tool can help consumers make decisions when shopping online.

Our results show that augmented reality is not, a priori, a relevant tool to replace physical trial for all consumers. For most of them, it does not trigger a purchase, whereas a physical trial does. The people we interviewed see it as an additional tool that is sometimes useful, but not enough to make a decision. In detail, we can see that augmented reality produces different effects depending on the profile of the person using this technology. We have identified three profiles. For some (the

pro-offline), augmented reality will be of no interest because they have little attraction for online commerce and a strong attraction for physical commerce. This is explained by their strong need to touch products and their desire for social interaction during their shopping (Peck and Childers, 2003). Augmented reality is therefore not likely to compensate for the lack of physical experience for these people. Pro-online shoppers, on the other hand, have a strong affinity for e-commerce and augmented reality, coupled with a lower need for touch and social interaction. These individuals trust augmented reality and see it as an additional source of information. However, this category of shopper is used to making online purchasing decisions even without this assistance. Augmented

reality will therefore not radically change their purchasing process. A third category of people, the pragmatists, will judge the relevance of the tool differently from one purchase to the other (and from one product category to the other). In other words, augmented reality will be a useful addition in some cases, but in others it will be useless. We have not identified a profile for which augmented reality would be perceived as the perfect tool. These findings complement the existing literature in several ways. Firstly, we focus on another category of goods, which enriches our understanding of the usefulness of augmented reality for the online purchase of experience goods (Darby and Karni, 1973; Nelson, 1970). In addition, we shed new light on consumer profiles. Indeed, much research has focused on the usefulness of augmented reality for decision-making in general (Beck, 2022; Beck and Crié, 2018; Hilken et al., 2022; Merle et al., 2018; Park and Yoo, 2020; Smink et al., 2019; Tan et al., 2022), without necessarily taking into account the differences between consumers. We show here that augmented reality will indeed help some consumers, but not all of them.

These results are also interesting from a managerial point of view. In the case of our sample, the pro-online group, which is very much in favour of e-commerce and augmented reality, represents the smallest group. For the other two groups, augmented reality will not suffice at all (pro-offline) or not systematically (pragmatists). We need to identify the weight of this group in a representative sample of the population in order to better identify what proportion of consumers perceive augmented reality as useful. This means that augmented reality cannot convert pro-offline consumers, who prefer shops, and does not provide substantial added value for pro-online consumers, who do not need it to project themselves. However, it can be used to recruit pragmatists, even for experience goods. In the end, augmented reality has the same limitations as other

digital tools, in that it can only satisfy certain groups of consumers.

These results allow us to formulate recommendations for online retailers in the experience goods sector. Firstly, segmentation should be carried out on the basis of the variables identified, in order to determine which segment the customers of a given company belong to. Depending on the company's targeting strategy, there are several possible scenarios. If the distributor is looking to target the "pro-offline", it will be necessary to develop a strategy for sending products or samples, so that they can see the products directly and touch them. If the distributor is only looking to target pro-online customers, it must attach particular importance to showing products on the site, specifically by showing photos taken by other customers. If they are looking to target pragmatists, augmented reality can play a role alongside other decision-making tools. However, potential customers will need to be reassured about the reliability of augmented reality, particularly in terms of product size and colour, for example with reviews from customers who have ordered with the help of augmented reality. Finally, if the retailer is looking to target all segments, it would seem appropriate to combine several, or even all, of the alternative solutions to physical testing that exist today (sampling, photos *in situ*, etc.).

Although this work focuses on online distribution, its conclusions confirm that omnichannel distribution remains the most appropriate model. Since augmented reality cannot satisfy all consumer profiles, complementarity between physical and online channels seems to be the best option in the end, so that each profile can benefit from a satisfactory experience.

Of course, this study has limitations. Firstly, we did not take into account the history of the relationship between the respondents and the brand, even though this is likely to influence



the appreciation of the system. Secondly, we note that the technology is not always effective in its current state, which has consequences for our respondents' appreciation of augmented reality. Furthermore, we are only studying one type of furniture here. Further research could study other furniture, but also other products belonging to the category of experience goods (clothing, glasses, make-up, etc.). For example, augmented reality seems useful for evaluating the volume of a piece of furniture in a room. This problem does not arise with a pair of glasses, but they will have to satisfy other criteria, such as harmony with the shape of a face. It would also be interesting to study augmented reality in combination with other tools (such as samples), for each profile. This would make it possible to identify the optimum device for each of the three consumer groups.

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## Appendices

### Appendix 1: Respondents profile, study 1

First name	Gender	Age	Frequency of online purchase	Cluster	Brand
Valérie	F	56 y.o.	Occasionally	Pragmatist	Made.com
Camille	F	33 y.o.	High	Pragmatist	Made.com
Elvire	F	65 y.o.	Low	Pragmatist	Made.com
Arnaud	H	28 y.o.	Low	Pro-offline	Made.com
Pauline L.	F	27 y.o.	High	Pragmatist	Made.com
Colombe	F	26 y.o.	Low	Pro-offline	Made.com
Victoire	F	26 y.o.	Low	Pragmatist	Made.com
Hortense	F	28 y.o.	High	Pro-online	Made.com
Adrien	H	33 y.o.	Occasionally	Pro-offline	Made.com
Astrid	F	27 y.o.	High	Pro-online	Made.com
Adèle	F	28 y.o.	High	Pro-online	Made.com
Pauline B.	F	30 y.o.	Occasionally	Pro-online	Made.com
Marie	F	27 y.o.	High	Pro-online	Made.com
Noë	H	20 y.o.	High	Pro-online	Maisons du Monde
Pierre	H	31 y.o.	High	Pro-online	Maisons du Monde
Hervé	H	54 y.o.	Low	Pro-offline	Maisons du Monde
Paul	H	30 y.o.	Occasionally	Pragmatist	Maisons du Monde

## Appendix 2: Scales used in study 2 (typology)

Scale	Items	Source
Affinity with e-commerce	<ol style="list-style-type: none"> <li>1. I won't buy furniture on the Internet because I don't trust it.</li> <li>2. I won't buy furniture on the Internet because I prefer to go to the stores.</li> <li>3. I won't buy furniture on the Internet because I need to touch and see the product.</li> </ol>	Veg-Sala Nathalie & Geerts Angy (2015)
Need for touch	<ol style="list-style-type: none"> <li>1. I place more trust in products that can be touched before purchase.</li> <li>2. I feel more comfortable purchasing a product after physically examining it.</li> <li>3. If I can't touch a product in the store, I am reluctant to purchase the product.</li> <li>4. I feel more confident making a purchase after touching a product.</li> <li>5. The only way to make sure a product is worth buying is to actually touch it.</li> <li>6. There are many products that I would only buy if I could handle them before purchase.</li> </ol>	Peck Joann & Childers Terry L. (2003)
Techno familiarity	<ol style="list-style-type: none"> <li>1. You consider that you have a very bad / very good level of knowledge on these technologies.</li> <li>2. You consider yourself to be very little informed / very well informed about these technologies.</li> <li>3. You consider yourself to be very unfamiliar / very familiar with these technologies.</li> </ol>	Goudey Alain & Bonnin Gaël (2016)
Perceived risk	<ol style="list-style-type: none"> <li>1. In general, buying furniture seems risky to me</li> <li>2. Buying furniture can be a bad idea.</li> <li>3. Buying furniture is an act with an uncertain outcome.</li> <li>4. Buying furniture makes me anxious.</li> <li>5. The idea of buying a piece of furniture could make me anxious.</li> </ol>	Thelen Shawn T., Yoo Boon-ghae, & Magnini Vincent P (2011)
Ease of use	<ol style="list-style-type: none"> <li>1. It is easy to learn how to use augmented reality.</li> <li>2. It is easy to use augmented reality to find the information needed.</li> <li>3. It is easy for me to become skillful at using augmented reality.</li> <li>4. It is easy to use augmented reality for my shopping.</li> <li>5. Overall, I find augmented reality easy to use.</li> </ol>	Ayeh Julian K., Au Norman & Law Rob (2013)
Utility	<ol style="list-style-type: none"> <li>1. Augmented reality improved my shopping.</li> <li>2. Augmented reality helped me shop more efficiently.</li> <li>3. Augmented reality made my shopping easier.</li> <li>4. Augmented reality made it easier for me to make a decision while I was shopping.</li> <li>5. Overall, I find augmented reality useful for shopping.</li> </ol>	Ayeh Julian K., Au Norman & Law Rob (2013)
Expertise in the product category	<ol style="list-style-type: none"> <li>1. How much do you know about furniture and decoration items?</li> <li>2. How much do you know about furniture and decoration items compared to your friends?</li> <li>3. How much do you know about the important things to consider when buying furniture and decoration items?</li> <li>4. How much do you know about these products compared to your friends?</li> </ol>	Coulter Robin A., Price Linda L., Feick Lawrence, et al. (2005)

Scale	Items	Source
Mental imagery	<ol style="list-style-type: none"> <li>1. The mental images that came to mind when I used augmented reality formed a series of events in my mind, which I was a part of.</li> <li>2. I imagined that the furniture / decoration items I saw in augmented reality were actually in my home.</li> <li>3. I fantasized about using this furniture/decoration item.</li> <li>4. I could easily construct a story about myself and the furniture/ decoration item based on my imagination.</li> <li>5. While browsing the product presentation, many images came to mind.</li> <li>6. The mental images that came to mind were very clear and specific.</li> <li>7. The images that came to mind acted as a source of information about the products.</li> <li>8. It was easy for me to imagine using the furniture/decoration item.</li> </ol>	Lee Jung Eun & Shin Eonyou (2020)
Information completeness	<ol style="list-style-type: none"> <li>1. How much information did you feel you have about the item you tried/saw in augmented reality? None at all / very much.</li> <li>2. How knowledgeable do you feel you are about the item you tried/ saw in augmented reality? not knowledgeable at all / extremely knowledgeable.</li> <li>3. To what extent do you feel you had enough information to make a sound decision about the item you tried / saw in augmented reality? not at all / very much.</li> </ol>	Tormala Zakary L. & Petty Richard E. (2007)
Intention to use	<ol style="list-style-type: none"> <li>1. I intend to increase my use of augmented reality in the future.</li> <li>2. I intend to use augmented reality in the future.</li> <li>3. I will always try to use augmented reality</li> <li>4. I plan to use augmented reality frequently</li> </ol>	Singh Nidhi & Sinha Neena (2020)
Experience with AR	<ol style="list-style-type: none"> <li>1. I was satisfied with the overall Augmented reality experience.</li> <li>2. I was content with the overall Augmented reality experience.</li> <li>3. I was delighted with the overall augmented reality experience.</li> </ol>	Sung Eunyoung C. (2021)
General attitude towards e-commerce	How much do you enjoy buying furniture and home decor online?	Ad hoc
Trust in AR	<ol style="list-style-type: none"> <li>1. Overall, I have confidence in augmented reality.</li> <li>2. Augmented reality is reliable.</li> <li>3. Augmented reality is trustworthy</li> </ol>	Leroux Erick & Pupion Pierre-Charles (2022)
AR accuracy	<ol style="list-style-type: none"> <li>1. The information offered by the augmented reality tool were helpful for me to evaluate the product.</li> <li>2. The information offered by the augmented reality tool were helpful in familiarising me with the product.</li> <li>3. The information offered by the augmented reality tool were helpful for me to understand how the product would function.</li> </ol>	Flaviàn Carlos, Gurrea Raquel & Orùs Carlos (2016)
Perceived control	<ol style="list-style-type: none"> <li>1. I felt in total control of what I was doing.</li> <li>2. I felt like I could control what I was doing.</li> <li>3. I had a feeling of total control.</li> <li>4. I felt in total control of my action.</li> </ol>	Guo Yi M. & Poole Marshall S. (2009)
Need for social interactions	<ol style="list-style-type: none"> <li>1. I like to shop where people know me.</li> <li>2. While shopping on the Internet, I miss the experience of interacting with people.</li> <li>3. I like to browse stores for the social experience.</li> </ol>	Liu Xia, Burns Alvin C. & Hou Yingjian (2013)

## Appendix 3: Scales reliability, study 2 (typology)

Scale	Cronbach $\alpha$
Affinity with e-commerce	0.856
Need for Touch	0.905
Techno familiarity	0.873
Perceived risk	0.835
Ease of use	0.921
Utility	0.925
Expertise in the product category	0.868
Mental Imagery	0.877
Information completeness	0.852
Intention to use	0.884
Experience with AR	0.899
General attitude towards e-commerce	Non applicable
Trust in AR	0.906
AR Accuracy	0.759
Perceived control	0.909
Need for social interactions	0.743

## Appendix 4: Mean comparison between clusters (Bonferroni)

Variable	Cluster	Clusters	Mean difference	Sig.
Affinity with e-commerce	1	2	-2,950	<.001
		3	-2,000	<.001
	2	1	2,950	<.001
		3	,950	<.001
	3	1	2,000	<.001
		2	-,950	<.001
Utility	1	2	-1,040	<.001
		3	-,424	<.001
	2	1	1,040	<.001
		3	,615	<.001
	3	1	,424	<.001
		2	-,615	<.001

Variable	Cluster	Clusters	Mean difference	Sig.
Perceived risk	1	2	2,096	<.001
		3	,903	<.001
	2	1	-2,096	<.001
		3	-1,193	<.001
	3	1	-,903	<.001
		2	1,193	<.001
Ease of use	1	2	-1,096	<.001
		3	-,302	0.019
	2	1	1,096	<.001
		3	,794	<.001
	3	1	,302	0.019
		2	-,794	<.001
Need for Touch	1	2	2,317	<.001
		3	,914	<.001
	2	1	-2,317	<.001
		3	-1,403	<.001
	3	1	-,914	<.001
		2	1,403	<.001
Mental imagery	1	2	-,779	<.001
		3	-,324	<.001
	2	1	,779	<.001
		3	,454	<.001
	3	1	,324	<.001
		2	-,454	<.001
Intention to use	1	2	-1,309	0.016
		3	-,425	<.001
	2	1	1,309	<.001
		3	,883	<.001
	3	1	,425	<.001
		2	-,883	<.001
Perceived control	1	2	-1,103	<.001
		3	-0,257	0.081
	2	1	1,103	<.001
		3	,846	<.001
	3	1	0,257	0.081
		2	-,846	<.001
Expertise in the product category	1	2	-1,010	<.001
		3	-,592	<.001
	2	1	1,010	<.001
		3	,418	<.001
	3	1	,592	<.001
		2	-,418	<.001



Variable	Cluster	Clusters	Mean difference	Sig.
General attitude towards e-commerce	1	2	2,368	<.001
		3	1,276	<.001
	2	1	-2,368	<.001
		3	-1,091	<.001
	3	1	-1,276	<.001
		2	1,091	<.001
Trust in AR	1	2	-1,441	<.001
		3	-,524	<.001
	2	1	1,441	<.001
		3	,916	<.001
	3	1	,524	<.001
		2	-,916	<.001
Techno familiarity	1	2	-,808	<.001
		3	-0,234	0.22
	2	1	,808	<.001
		3	,573	<.001
	3	1	0,234	0.22
		2	-,573	<.001
Information completeness	1	2	-1,200	<.001
		3	-,478	<.001
	2	1	1,200	<.001
		3	,722	<.001
	3	1	,478	<.001
		2	-,722	<.001
Experience with AR	1	2	-1,183	<.001
		3	-,402	<.001
	2	1	1,183	<.001
		3	,780	<.001
	3	1	,402	<.001
		2	-,780	<.001
AR accuracy	1	2	-,890	<.001
		3	-,281	0.018
	2	1	,890	<.001
		3	,609	<.001
	3	1	,281	0.018
		2	-,609	<.001
Need for social interactions	1	2	,718	<.001
		3	,572	<.001
	2	1	-,718	<.001
		3	-0,145	1
	3	1	-,572	<.001
		2	0,145	1