The Impact of Virtual Try-On Tools for Beauty Products on Consumer Behavior: A Segmentation Study

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Abstract. We present the characteristics of Virtual try-on tools (VTOs) with an emphasis on digital mirrors used by the beauty industry and review the extant knowledge on the mechanism by which they influence consumer behavior. We utilize a quasi-experimental empirical research design through which 221 self-identified as female participants tested the VTO of a luxury makeup brand and then completed a survey of their socio-demographics, attitudes, and behaviors. Two segments emerge, the hedonic enthusiasts and the utility-focused consumers. Their characteristics are analyzed, and the insights are utilized to draw recommendations for marketers in the beauty industry. This is one of the first studies of how VTOs influence consumer behavior in the beauty industry and the first attempt at segmenting their users.

Keywords: Virtual try-ons · digital mirror · augmented reality · market segmentation · consumer behavior · beauty products

1 Introduction – The Beauty Industry Going Digital

The global beauty industry, comprising a wide range of products under the broad retail categories of makeup, skin care, haircare, and perfume, is a fast growing one. It generated over US$ 400 billion in 2022 [1], grew by 10% in 2023 [2] and is expected to reach almost US$ 600 billion in 2027 [1]. Part of the growth is attributed to prices rising in line with inflation in key markets such as the EU and USA as well as the introduction of technologically advanced and therefore pricey products. Most of it, however, is the result of volume growth. For example, in the skin care category, growth is driven by emerging consumer segments, such as Gen Z, Alpha Generation, and men of all generational groups, as well as product innovations, like the " buzzy ingredients" [2], neuropeptides, which are small protein-like molecules acting as messengers to the cells to produce collagen or triggering skin firming and revitalizing processes [3]. The haircare category is also estimated to have a compound annual growth rate (CAGR) of 5% in the 2023–2028 period due to global trends such as the "skinification of hair, the introduction of

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elaborate routines and specialized products to the hair category, as has been the case in skin care" [2]. Finally, despite the anemic growth of consumer disposable income in the USA [4] and EU [5] consumers are still splurging on beauty products; with some segments such as Gen Zers in China and millennials in the UAE, or makeup in the Asia–Pacific, Middle East and Africa regions emerging as big industry growth drivers [2].

Like many other industries, retail beauty products have found their way to the digital domain. The e-commerce channel achieved a roughly fourfold increase since 2015 [1], helped the industry survive the COVID-19 lockdowns [6], exceeded 20% of the total industry size by 2023 [1] to emerge as "the largest single channel for beauty globally" [2], and has remained the fastest growing one with a 2023–2028 CAGR of 12%. To put the latter point in perspective, the respective figures for travel retail spaces (e.g. airport duty free), specialty beauty shops, and department stores are 9%, 8% and 2% [2]. Part of the channel's growth is a matter of accelerated investment in infrastructure in large markets such as the Middle East and Latin America, increased mobile-device usage, and worldwide improvements in logistics and payment systems. Other contributing factors are the move of established direct-to-consumer brands to e-commerce, the increased sophistication as well as increasing numbers of omnichannel retailers, the explosion of livestreaming and other social selling practices, and the expanding portfolio of online marts like Amazon and its Chinese counterpart, Tmall [1].

This, however, is not an indicator of the online channel cannibalizing the rest. Consumer behavior is both ROPO and reverse ROPO with about half of the consumers in some of the biggest markets like Brazil, Europe, Japan, and the United States exercising the traditional research online purchase offline, about a third in all countries researching only online, and about half researching only offline and purchasing offor online [2, 7]. The majority of consumers in established markets, such as France, Germany, Italy, the United Kingdom, and the United States, visit both online and offline stores to try new brands [1] whilst in emerging markets, such as Vietnam, young females prefer to have their beauty products delivered [8]. The customer journey is clearly, and globally, a phygital one. Customers seamlessly move between digital and physical channels and craft personal omnichannel experiences which form the basis of building relationships with new brands whilst sustaining their relationships with legacy brands. There is a good reason behind the increasing complexity of the retail beauty industry's phygital customer journey: consumers value the convenience of e-commerce [8] but they are not willing to pay more for it, so they shop across price points [1]. Most importantly, they need to try and test products before deciding to purchase [9].

2 Virtual Try-On Tools

Fundamental to the development of the online beauty market is the introduction of Virtual Try-On tools (VTOs) which overcome the problem of consumers' need to try and test products before deciding to purchase. The VTOs utilize Artificial Intelligence (AI) and Augmented Reality (AR) to allow consumers to try various products such as haircoloring and makeup in real-time on themselves using their computer or mobile phone screen. They create an immersive shopping experience for consumers and open

new communication avenues for businesses. Their smart AI analyzes the user's face captured by their smart device camera and then places the selected product right over the area the user has selected. To a great extent, VTOs' immersive reality closely resembles shopping in the physical world. In the case of make-up, for example, it reduces the need to visit a physical store and eliminates being touched or convinced by salesperson's. In other cases, such as with boxed haircoloring, the augmented reality overcomes the limitations of choosing the right product in a physical setting which can only be done by gross approximation – the tiny snippets of how the color looks on light or dark hair found on the side of the box. In general, using VTOs, customers can easily try products from e-shops that can be found anywhere around the globe and make an informed shopping decision. In this sense, this technology helps businesses build customer trust and supports brand loyalty.

Initially, VTOs were introduced in niche retail industries like virtual fitting rooms (VFR) in fashion sector [10]. Early research showed that having a VFR in a website not only increased interest in a specific product but also affected purchase intent and propensity to patronize the e-shop as well as the physical store [10]. This experimental research result supports our assessment, above, that the digital and physical channels are complementary rather than the new one cannibalizing the old ones. During both ROPO and reverse ROPO, consumers use AR technology, alongside product information and user generated content (UGC) in the form of videos, images, and text, as bridges between the digital and the physical world. As recent survey research has demonstrated, users who have become familiar with AR technologies go past the initial interest towards it, which was a reflection of its novelty [11], vividness [11–13], interactivity [11–13] and playfulness, and engage with it to exploit its augmentation potential [13, 14] to meet their utilitarian objectives [6, 14]. Eventually, the use of AR tools increases purchase intent [11, 12, 14]. Thus, the rise of revolutionary interactive technologies such as AR, which merges images of reality with virtually added content to create a uniform user experience, have, not just disrupted [15], but, fundamentally changed the retail industry dynamics regarding how consumers interact with products and businesses online [16], by bridging the sensory gap between eand m-commerce on the one hand and brick-and-mortar channels on the other [17]. Of all the AR technologies used by marketing the VTOs enhance the functionality applications and websites by facilitating consumer decision-making [9], addressing hygiene and safety concerns18 and reducing post-purchase cognitive dissonance, and in this sense contributing to addressing the returns challenges for businesses [19].

2.1 Digital Mirrors

The academic work reflects the realization of the potential of using VTOs by the beauty industry. The digital mirror is the newest VTO tool which is commonly used in the beauty industry to allow consumers to virtually experiment with options of shapes, textures, colors, and shades on their own face, hair or nails. Technically, digital mirrors (also referred to as AR magic mirrors or virtual mirrors), like all VTOs, belong to the self-augmentation category of AR technology [20] (the other two being augmentation of the environment and object augmentation) as they produce the users' altered perceptions of their appearance through the beauty VTOs [49]. They are a more realistic and interactive

version of earlier technologies, such as websites in which consumers could create their avatar on which they could try clothes. In this sense contemporary digital mirrors are an experiential marketing tool [21] which takes the consumer's imagination and engagement ot whole new level of engagement.

In practice, digital mirrors are key e-retailing tools of makeup essentials, like eyeshadow, lipstick, and foundation, but also haircoloring or nail polish, [22]. Since buying makeup depends on maintaining a high level of visual involvement [15], VTOs, such as the digital mirror, substantially enhance the appeal and functionality of corporate digital media and this has led to their extensive adoption by industry players [23].

Sephora™ and Ulta Beauty™ launched their digital mirrors in 2016, known as Virtual Artist and GLAMLab [24]. In 2018, L'Oréal™ incorporated VTO tools into different digital platforms to differentiate itself from competitors [25]. This move resulted in e-sales increasing by 52%, so, in 2021 the personal care giant launched a social VTO in partnership with Facebook [26]. The luxury cosmetics brand Charlotte Tilbury™, one of the first brands to add a VTO on a website [27], implemented the cutting-edge "Magic Mirror Makeup Online Try On" after the COVID-19 pandemic [28]. So, not only new entrants to the beauty market, such as Glossier™ and Rihanna's Fenty Beauty™, but also major international brands, such as Revlon™ and MAC™ have, over the last decade, increasingly been incorporating digital mirrors into their digital platforms for their haircoloring, makeup, and nail polish product lines.

Consumers have been found to appreciate digital mirrors for their convenience, fun, and user-friendliness [22]. The positive emotions they evoke have been found to facilitate product choice and positively impact purchase decisions [9] by cocreating bespoke shopping experiences. So, it comes as no surprise that the global virtual makeup try-on market size is forecasted to grow by a CAGR of 23.3% from 2024 to 2033 [29].

3 Understanding the Impact of VTOs on Consumer Behavior

Academic researchers examined AR-powered applications (apps) like VTOs and digital mirrors through various disciplinary lenses forming an expanding body of literature documenting the development of this cutting-edge e-retail technology [30], its functionality and affordances as a communication medium [20] and its effects on consumer behavior [21, 26, 31] but also on their self-concept [32]. As most of the extant literature has examined a variety of AR technologies, in this section we present their conceptualizations and findings adjusted to the particularities of VTOs, and digital mirrors in particular.

3.1 Characteristics of VTOs

Analyses of AR technologies as media [11, 20, 33] identified the following characteristics of smart device-based VTOs:

1. High ***Interactivity*** between person and machine allowing consumers to actively engage with three-dimensional virtual models of products being used. The high degree of interactivity turns using the app into a fun and pleasurable experience, but also a safe one as the user is in full control of the immersion experience.

2. High ***Vividness*** as the resulting image is as close to actually applying the product and looking at oneself in the mirror as technology can afford. Contemporary digital mirrors produce images which are as vivid as reality but without the mistakes a user can make in application of the products.
3. Diminishing ***Novelty*** as the more widespread the use of VTOs becomes, the more consumers become familiar with them to the final point of taking them for granted and seeking other options to stimulate their imagination.
4. High ***Informativeness*** as they offer useful and totally relevant information about specific products which help consumers make fully informed decisions and thus reduce perceived risk, especially functional risk, and subsequently limit post-purchase cognitive dissonance. Interactivity, vividness, novelty, and informativeness, combined with measures of the functionality of VTOs encapsulated in the concept of ***System Quality*** have been used as the dimensions of the stimulus in S-O-R theory-based empirical research studies [11].
5. ***Hypertextuality*** with many sources linked into creating a phygital experience comprising a blended reality with actual and projected, imaginary elements.
6. Multi-***Modality*** of content representation with textual, visual, and audiovisual components. Hypertextuality and Modality are combined to create the ***Augmentation*** which involves overlaying virtual elements onto the real world, adding a layer of novelty and enjoyment to the shopping process, and delivering further entertainment and immersion
7. One-to-one ***Connectivity*** – that is, a totally personalized experience - with the potential to share the images on other media.
8. Medium to high ***Location specificity*** controlled by the users who can allow targeting using geolocation or limit it to manually choosing the region so that they can see the products they have access to and manually inputting shipping and payment details.
9. Total ***Mobility*** as digital mirror apps on mobile devices can be easily carried and used anywhere.
10. Medium ***Virtuality*** as the virtual elements are immersed in images of reality but do not create a totally virtual experience isolated from reality (i.e. the user's face or hand).
11. High ***Ease of Use*** as their use is simple and straightforward and unlikely to cause consumer frustration, even to novice users. This, of course, is an evolving characteristic; the more technology advances, the easier it becomes to use but also the more adept the consumers become in using it.
12. Limited to no ***Telepresence*** as digital mirrors, unlike other X-realities do not attempt to create a sense of being physically present in a virtual environment. They usually make the consumers' private environments part of the shopping and product use experience. In this sense, they situate the product in the consumer's reality. Thus, it is the product that is being immersed and enmeshed in the consumer's frames of reference which makes the experience feel realistic and enhances both enjoyment and efficiency.

In the context of beauty products, these characteristics of VTOs play a role in delivering engaging and efficient experiences. Informativeness and ease of use boost utilitarian value by offering detailed product information and user-friendly interfaces that help

reduce uncertainty and simplify product choice. For makeup products, this means providing shade details and seamless browsing through various items or combining different products together to create a complete 'look' so they promote not only sales but also cross- and upselling.

Interactivity, augmentation, and telepresence are key factors enhancing the hedonic side of value perception by creating immersive experiences that allow consumers to visualize how different products would appear on their skin tone and facial structure, thus elevating the realism of the VTO experience. It is worth mentioning that out of all these characteristics, augmentation stands out for its ability to provide modality richness by stimulating multiple senses with greater intensity than static pictures or text, thereby creating a deeper sensory experience that feels not only engaging but also realistic and fully personalized. Fundamentally, augmentation ensures the integration of physical reality with virtual content, crafting a unique, authentic user experience.

The self-augmentation VTOs afford has been empirically found to enhance self-brand connections and purchase intentions, especially for narcissistic consumers [34]. This finding suggests that consumers perceive higher experiential value when they see themselves using the product rather than viewing professional models. There is also empirical evidence of the positive effects of informativeness, ease of use, and telepresence on consumers' utilitarian value perception and of telepresence and interactivity on hedonic value perception [33]. During the past decade, there have also been some empirical research results which have demonstrated that the particular combination of the characteristics of VTOs impact on consumer perceptions, including self-perception [32], cognative [21], affective [21] and behavioral [21, 33] responses [21], and behavioral intents such as purchase and patronage [6, 10, 13, 14, 26, 34].

In summary, a 2022 systematic literature review of 53 articles on the use of AR in e-retail [35] concluded that "AR characteristics significantly influence utilitarian, hedonic, perceived risk and experiential value, ultimately resulting in a positive attitude, decision-making assistance and behavioural intentions, wherein customer experience (flow, spatial presence, mental imagery and immersion) plays a mediating role in the process". Augmentation was found to be the most influential in terms of behavioral intentions. The drivers of the behavior were identified to be the perceived value in both the hedonic and utilitarian dimensions whilst perceived risk was, as expected, the most influential negative influence on behavioral intent. The following dimensions of perceived risk were identified: perceived intrusiveness, privacy concern, perceived risk, and control over information access. The results regarding the links between positive attitude, purchase intention, and e-word of mouth (e-WOM) were mixed – a common finding of systematic literature reviews and metanalyses in marketing.

3.2 How VTOs Impact Consumer Behavior

Academic explorations of the mechanism through which VTOs influence consumer behavior in retail and e-retail settings started after 2014 and have mostly applied classic theories such as TAM, "flow", situated cognition theory, and equity theory [19, 35]. Indeed, in our literature review, most empirical studies were based on the Technology Acceptance Model (TAM) [6, 17, 23, 31, 36, 37] and its variants such as the modified e-TAM [17] or the Value-based Adoption Model (VAM) [26] whilst some used the

Stimulus Organism Reponses (S-O-R) model [9, 11, 33, 38] and mixed approaches combining S-O-R logic with elements from multiple theories in new configurations [19] or the Uses and Gratification Theory (U&G) [39]. It is beyond the scope of this chapter to explore the details of the theories or to present a comparative review of them. Instead, we have identified the key constructs that influence consumer behavior in the context of using VTOs and the relationships between them as identified in the relevant empirical literature.

Attitude and Perceived Value

Consumers with positive attitudes towards a new technology like VTOs are more likely to adopt it if they perceive that they derive a certain value from using it. Perceived value in the digital landscape is the result of the consumer's processing the experiential rather than the expected use or consumption component [38] It is a bi-dimensional psychological construct; it can be experienced as hedonic and utilitarian value [9]. Hedonic value is the positive outcome of multisensory perceptions of enjoyment, fun, or socialization derived from an experience, and it is mostly affectively oriented, whereas utilitarian value is associated with cognitive and practical aspects in acquiring useful information or achieving functional benefits from an online service. This is not to imply that these two components of perceived value are independent of each other. They are interrelated influences on the purchase process despite the fact that the consumer can distinguish between (a) the utilitarian value derived from the degree to which VTO app functionality, usefulness, and ease of use balance the perception of transaction and privacy risks involved in using the app and (b) hedonic ones such as fun, socialization, and pleasure [39].

Perceived hedonic value has been empirically found to be a predictor of the intention to continue using VTOs and intention to purchase the tried-on products [11, 33] whilst in other studies, higher perceived utilitarian value was found to be related to purchase decisions [39] and intention [33]. The results are not conclusive as the study samples [39] are heavily biased towards the younger generations and people who have been primed or have prior experience with VTOs. Moreover, it is not yet clear how the context and product dimensions interact with the age of the consumers and their attitude towards technology in general.

Anyway, when the perceived value meets consumer value expectations from the VTO it drives customer satisfaction. Customer satisfaction increases positive attitude towards both the VTO tool and the product, which in turn predicts consumer's behavioral intentions including channel patronage [40]. It has to be stressed that marketers in the beauty sector routinely prioritize the cocreation of experiential value over a traditional transactional approach (Hudson et al., 2018). So, VTOs serve as an online evaluative tool aimed at enhancing the experiential component of search stage of the consumption decision process. The more engaging the experience, the more the consumer consideration set is narrowed, and the more likely the product purchase and repurchase becomes.

Characteristics of VTOs, Attitudes and Perceived Value

Augmentation aims to combine the hedonic and utilitarian dimensions of value to enrich user experiences and produce a positive affective response. It also shapes the brand consumer communication framework through which behavioral intentions [21] and actual

behaviors [9] are formed. The novelty, immersion, enjoyment, and usefulness of VTOs have been found to be related to positive attitudes towards the app itself as well as higher levels of product purchase intention than simple digital product presentations [41]. Similar results have been reported in recent quasi experimental studies [37] which found ease of use, usefulness and enjoyment of using VTOs to be positively associated with attitude towards the app and, indirectly, with behavioral intention.

Moreover, field experiments comparing an AR app and a website offering a unique visual illustration of the product attributes showed that an immersive experience was perceived as having higher hedonic value compared to websites, leading to higher customer satisfaction which in turn translated into positive attitudes. Indeed, AR interactivity and vividness influenced both perceived usefulness and enjoyment which means that it offered consumers higher hedonic and utilitarian value, that is its total perceived value was higher than that of the static images of the website [41]. Even in early AR apps, which were much less vivid and functional than the ones available today, the augmentation effect boosted emotional responses such as excitement, arousal, and pleasure, which consequently enhanced the overall shopping experience, influenced consumer perceptions, and facilitated decision-making. Finally, the greater consumers perceive medium usefulness and enjoyment the more positive their attitude towards VTOs becomes [41]. Augmentation has been found to positively influence hedonic value perception [33], and to generate strong affective responses, and through them significantly influences purchase intention, especially for consumers driven by a hedonic shopping motivation (Watson et al., 2018). Interactivity has also been found to positively affect hedonic value perception [33].

Finally, interactivity and novelty have empirically been found to influence hedonic value perceptions which in turn influence satisfaction and consumer intent to continue using the VTO which is the final step to purchase intention in the decision process [11]. The same study [11] showed that hedonic value perception is not affected by the perceived vividness, informativeness, and system quality of the VTO tool. In another study [33], informativeness has been found to positively affect utilitarian value perception as is ease of use and informativeness.

Despite the growing body of research about the impact of VTOs on consumer value perceptions, attitudes towards them and the products they promote, and behaviors, the factors that may intervene in these relationships are still underexplored. Key issues in need of further investigation are the influence of the consumers' social environment and their personal traits and characteristics, both of which are underexplored [35].

Subjective Norms

Subjective norms can be likened to society's unwritten rules that influence what people think they should or should not do and, in this sense, they measure the social pressure a person feels from important others, such as family, friends, peers, or aspirational groups, to act in a certain way [42]. Understanding consumers' subjective norms helps predict how inclined they would be to use VTOs based on a recommendation from a close friend or preferred beauty influencer. It would also predict the degree to which the social aspect of utilizing VTOs when shopping for beauty products, which requires consumers to share their images or get feedback from their 'purchase pals', would enhance perceived social validation which leads to better choices and increased interest in products [43] or if the

sharing would be perceived as an act of oversharing or non-permitted level of exposure of personal information to the degree that it would stop the consumers form using the VTOs.

When the images they produced are shared on social media, VTOs facilitate seeking peer opinions at the pre-purchase stage which reduces the level of perceived social risk. Positive feedback from peers was found to be associated with higher purchase intention among consumers. Interestingly, participants who received negative feedback from peers but had exposure to a VTO tool reported increased purchase intentions compared to those without VTO exposure. This suggests that social endorsement can influence consumers' purchase intentions, especially when combined with AR experiences [12].

Finally, there is some evidence that, contrary to what most studies have shown, using VTOs may lead to negative emotions such as low self-esteem and they can amplify impulse buying propensity which may result in feelings of guilt (Yim et al., 2017). Fear of being perceived as vain or too materialistic might emerge as a perceived social and psychological risk factor which could discourage some consumers from reusing VTOs in their online shopping for cosmetics. Moreover, VTOs have been found to influence the way consumers perceive themselves. AR mirrors can, under certain circumstances, widen the gap between consumers' ideal appearance and their perception of their actual appearance. They can also affect product-related variety seeking behaviors which can be related to benign aspects of self-evaluations, like consumer confidence in the look the VTO proposes, and even sensitive ones such as mental well-being and self-compassion [32]. Thus, individual differences emerge as an important empirical exploration topic.

Psychological Traits and Sociodemographic Factors

There is some isolated and rather inconclusive evidence regarding the effect of specific personality traits, such as narcissism [34], appearance self-esteem [32], sensation-seeking tendency, and technology anxiety [38] on attitudes towards VTOs and their subsequent effect on consumer behavior.

When using VTOs, consumer characteristics such as age, gender and ethnicity, and traits, such as shopping orientation and product involvement, have been found to indirectly affect purchase intention, satisfaction, and loyalty [9]. In other studies age and gender were found to have no effect on the purchase decision process [12, 39].

The literature we reviewed for this chapter has not directly investigated the influence of socioeconomic status, using proxy measures such as income and education, on consumer value perceptions or attitudes towards the experiential or transactional usefulness of VTOs. More often than not, the samples in empirical studies are biased towards higher educational status [37] and this also restricts the metanalysis potential. In a study of Saudi consumers using AR apps for apparel shopping [36] sociodemographics were found to have some effect on attitudes towards using the technology with women and married people being more likely to hold a positive attitude but age or household size having no effect. Additionally, well-educated females with high incomes showed a stronger inclination towards hedonic value, in their buying intentions [36]. Nevertheless, as with any study utilizing narrowly localized data, caution must be applied, as the findings might not be directly generalizable.

The distinction between utilitarian and hedonic motives could be the determining factor for segmenting consumers using VTOs for beauty products. Women being the

majority of beauty products consumers worldwide, it could be hypothesized that VTOs would appeal to mid-to high-income, educated, working women who are likely to face the demands of busy professional and personal lives and so, would be expected to value convenience and efficiency, over visiting physical stores. It could also be expected that VTOs would also appeal to young tech enthusiasts seeking the entertainment of social sharing of alternative appearances of themselves with like-minded consumers. To test these broadly hypothesized conceptualizations, we conducted an empirical study, key parts of which we present here.

4 An Empirical Investigation of the Impact of VTOs for Beauty Products on Consumer Berhaviour

4.1 Methodology

The empirical study we present here utilized a quasi-experimental cross sectional research design as recommended by earlier research [44]. It departs from the norms of earlier studies in the AR as a marketing tool field by surveying real beauty products consumers who are active on social media after they had experimented with the technology in a real-life, rather than laboratory setting. In this section we present an overview of the study and in the next sections we discuss some of the key findings and their practical implications.

The Participants

With a convenience sample was utilized for the empirical part of our study of the impact of VTOs for beauty products on purchase intentions. Most studies on consumer behavior in the digital domain use student samples [20] despite the well-documented limitations of such samples [34]. Contrary to the many of the studies we reviewed which utilized student samples [9, 12, 17, 19, 21, 23, 32, 34, 38] or student and graduate samples [13, 41] we departed from the norm and approached consumers who were subscribed to beauty-related social media groups, as some earlier studies have done [6, 9, 14, 26, 33]. We sent them in-app instant messages to verify that (a) they identified as female, (b) were over 18 years old, (c) were willing to participate in the study, (d) they were consumers of makeup products, and (e) they were planning to use a mobile phone equipped with a camera to participate in the research in order to control for biases that could be caused by device functionalities and response to AR software.

The VTO Tool

In line with earlier studies [9, 12, 13, 26, 45], we used an existing, and very successful, digital mirror in the luxury makeup segment for the quasi-experimental part of the study. Participants were asked to try an existing VTO tool which is embedded in the website of Charlotte Tilbury™.

Charlotte Tilbury™ is a leading beauty brand founded in 2013 by the renowned British makeup artist Charlotte Tilbury. The brand offers a range of makeup and skincare products that have achieved record-breaking launches. It is an influential brand in the global beauty industry with presence in over 67 countries and flagship stores in major

cities, in addition to its digital presence through its website, social media platforms, and mobile applications. The founder's goal is to create beauty products that the world really needs and wants, focusing on making everyone feel beautiful, safe, and confident. Her aim is to reach women worldwide through an omnichannel business model.

The brand has a strong digital presence and interactive technologies like AR mirrors in stores and an online VTO tool called "Magic Mirror Makeup Online Try On" powered by facial scanning, completely digitalizing consumer experience [28]. Their VTO tool allows consumers to try a wide range of makeup including foundation, blusher, eyeshadow, eyeliner, mascara, lipliner, lipstick, and contouring powder. Users can then save looks to compare them or share them with others, making the shopping experience fun and engaging [27]. Their try-on tool is user-friendly, and a video tutorial on their website provides clear instructions on how to use it appropriately.

Data Collection Procedures

To reduce memory bias, the participants were requested to visit the website via a weblink (https://www.charlottetilbury.com/uk/products/charlottes-virtual-online-makeup-try-on) which took them directly to the VTO tool. They were asked to select a product in which they were interested, then click on it and choose the 'try on option'. After they were done testing the product using the VTO tool, they were instructed to come back and share their experience through an online survey on Google Forms™. This approach echoes the approach of earlier studies which used existing virtual mirrors for fashion accessories [34, 41], cosmetics [31, 37], hair color [19, 26], and make up [9, 19, 32].

Measures and Data Analysis

The survey measured basic socio-demographics (age, income bracket, and education), VTO augmentation [21] perceived value comprising the hedonic and utilitarian dimensions [33], attitude and subjective norms [18], and purchase intention [39]. All scales were based on a five-point Likert-type scale with only the ends defined as strongly agree to strongly disagree [46]. All questions were marked as mandatory to control for non-response errors [47]. The data were analyzed using RStudio integrated development environment (IDE) Desktop version, the most popular R programming tool for statistical computing and graphics, chosen for its capabilities in handling complex models and generating detailed insights from the data.

Ethics

Following research norms, the social groups' administrators were contacted via direct messaging and email requesting approval to share the survey with their subscribers while respecting the group policy and community guidelines. A participation sheet was sent to each administrator to brief self-identified females' respondents on the study's topic, aim, procedures, expectations, and their right to withdraw at any point without repercussion. The survey was sent as a weblink, allowing administrators to publish it or permit the researcher to post it on the corresponding platform. A consent page was included at the beginning of the survey, to obtain a voluntary participation agreement. The page clearly stated that the data collected will be confidential and anonymous to protect respondents' privacy. Additionally, the researcher verified that no harm is caused to any party involved

in the research. The researcher also ensured that all weblinks were safe and functional and tested the brands website using WAVE tool to confirm that the content is accessible to people with disabilities [48]. Participants were also provided with contact information to ask questions or express concerns about the study.

5 Empirical Findings and Recommendations to Industry

A total of 221 usable responses were collected. The majority of respondents were Millennials (52%) and GenZ (43%), educated to bachelor's (52%) and postgraduate (26%) level, and roughly equally split between the lower (45%) and higher (39%) income brackets. The respondents fell neatly into two clusters: the hedonic enthusiasts and utility-focused consumers. We discuss these in the following sections.

5.1 Hedonic Enthusiasts

The findings revealed a group of females who highly value the hedonic aspect of VTOs. They enjoy the shopping experience itself for the excitement and the fun they derive from virtually browsing through products and trying them on. This preference was found in both digital native cohorts (Gen Z and younger Millennial consumers). Their strong appreciation for online engagement aligns with the tech-savvy nature of younger consumers, who reported that they are likely to seamlessly incorporate VTOs into their makeup shopping routine as they see it as the fun part of the purchase process.

Even though this segment includes women from all educational levels it is skewed towards the middle-income (US$1,000-$3,000 personal income per month). What characterizes this segment is that their purchase intentions towards beauty products that they have tried using VTOs are influenced by their peer opinions and social trends more than any other factor.

This segment of beauty shoppers is more likely to enjoy and feel satisfied with apps that offer visually pleasing experiences than any other conventional product presentation method. Engaging digital content emphasizing the recreational dimension of VTOs for beauty products is what effectively captures their interest and boosts the hedonic value perception they seek. Moreover, being digital natives and used to living a blended offline and online life, they are discerning users of technology and they are not easily impressed by digital gimmicks. Thus, their attitude towards both the app and the products it promotes is highly dependent on the quality of the augmentation and the level of enhancement the VTO affords. The technological sophistication of the VTO is also related to the experience of pleasure they derive from it and this is also a factor on which their positive attitude depends.

Catering for the Hedonic Enthusiasts Segment

Increasingly more beauty products manufacturers but also a lot of retailers are realizing the importance of incorporating the entertainment dimension into their marketing communications. For the hedonic enthusiasts segment, however, this is particularly pertinent but not enough. Constantly improving their advanced AR technologies to create realistic

and engaging virtual environments that keep consumers satisfied thus emerges as a necessary and sufficient condition of engaging the hedonic enthusiasts and keeping them engaged and coming back to the digital retail space. Earlier research [33] has demonstrated that the technologically sophisticated dimensions of the VTOs, such as interactivity and telepresence, positively affect users' hedonic value perception. Our work confirms this finding and highlights its importance as it emerges as a beauty products market segmentation criterion.

Moreover, our study revealed that what motivates the hedonic enthusiasts segment to moving from having fun with the VTO to purchasing the products they tried is the opinion of their friends which they seek through sharing their saved images on social media. This means that incorporating customizable light filters in the VTO could not only increase this segment's engagement, as they can see how the makeup they have created would look in different lighting conditions, such as night, sunset, day, etc., but also it would allow them to enhance their photos and thus increase their motivation to share them online. This socializing through sharing makeup looks can potentially result in increasing traffic on the retailer's website.

Another strategy that has been identified as having a significant impact on Gen Z and Millennials' consumer behavior is gamification [49]. Beauty retailers can ride this wave while it lasts by running makeup look contests using their VTOs. Such virtual events can generate not only publicity and social media buzz, which increase traffic to the site and app, but also increase trust in the retailer and the products through usergenerated content (UGC) and positive electronic word of mouth (e-WOM). Gamification and other tactics that encourage social sharing of UGC content increase social media engagement with the brand, enhance the credibility of the VTO tool, and increase social empowerment thus leading to positive transactional outcomes [50, 51].

Hedonic enthusiasts' purchasing behavior was also found to be influenced by social trends. This can be exploited by collaborating with celebrities who not only endorse the use of VTOs but also share their explorations with the app on their own and on corporate social media and interacting with users. The choice of celebrities to partner with requires a systematic exploration of their overall popularity and their following, and engagement levels of hedonic enthusiasts with them. This can add to the appeal of the VTO tool and become a competitive advantage basis for the brand.

VTOs can take a central place in brand communication campaigns aiming at creating shareable experiences that align with the networking lifestyle of the hedonic enthusiasts segment [43]. And what would be more shareable than consumers using the VTO to try on trending makeup looks, or looks created by or for celebrities and influencers? The integration of platforms and technologies in order to make the consumer feel central to the brand communications can only be limited by the marketers' imagination. Given the characteristics of the hedonic enthusiasts, this is key to the full exploitation of the potential of VTOs for the beauty industry.

5.2 Utility-Focused

Our study revealed that is a clearly utility-focused segment consisting primarily of millennials in the highest income bracket (over US$3,000 personal income per month). The

key characteristic of this segment is that they share a pragmatic approach to technology use. They showed an interest in the practical aspects of using VTO tools to buy online beauty products and valued usefulness and convenience more than the fun and playfulness of using apps. This beauty products consumer segment is motivated to use interactive technologies by the functionality they offer by combining accurate visualization with detailed product information. This finding is consistent with those of earlier studies which identified informativeness, ease of use, and telepresence as the factors which positively affected consumers' utilitarian value perception [33].

Attracting and Engaging the Utility Focused Segment
As earlier research has indicated, our research confirms that to attract and convert the utility-focused segment into buyers, app developers must design a user-friendly activation process of the VTOs to make them appealing to a segment of consumers who do not necessarily have specific technical knowledge and therefore may be discouraged form using the app if they have to deal with complicated setup issues during their shopping journey [52]. Similarly, marketers could further enhance this journey with video tutorials on VTO use published on their website or social media platforms [33]. The main goal would be to instruct users step by step on how to smoothly engage with the VTO which would also be communicating messages about the usefulness of the tool and the ways in which it could help them virtually explore product details alongside trying the products on themselves thus facilitating decision-making without the need to visit stores.

Earlier research has also indicated that purchase intention is formed by affective and cognitive responses to the characteristics of AR [53]. Our research findings concur. However, utility-focused consumers are motivated mostly by evaluations of the usefulness of the VTOs based on system interactivity and augmentation quality, and above all product informativeness and reality congruence. Incorporating into the app features such as customer reviews, ratings, and discussion forums where consumers can chat about the VTOs and the products they have tested virtually or bought can increase perceived usefulness of the app. This can make the VTO and, by extension, the products, particularly attractive to utility-focused consumers (Hong & Kim, 2016). Finally, loyalty programs built into the VTO experience or granting exclusive access to new product launches can increase engagement and motivate conversion of utility-focused beauty products consumers.

6 Study Evaluation, and Suggestions for Further Research

While the research has shed light on the impact of VTO tools for beauty products on consumer behavior it is crucial to note the limitations on the generalizability of the findings imposed by sample size and its convenience nature. Although our sample is broader and larger than other studies related to VTO tools it is biased towards Gen Y and Z with the number of Gen X limited to just 5% of the sample. Utilizing panel data could have generated a more diverse sample. Cultural variables were not included in the study and should be examined in the future. Finally, only one VTO was used and, moreover, it was one belonging to a luxury brand. Both these conditions could have potentially biased the results. To control for these, multiple brands should be used as the quasi-experimental design prompts.

Nevertheless, this is one of the earliest studies on VTO characteristics and their effects on consumer behavior. In this sense, this chapter contributes to setting a solid framework for further exploration. Future studies can build upon it by exploring the applicability of other established theoretical frameworks.

Finally, to best of our knowledge this is the first research to consider socio-demographic and behavioral segmentation criteria. In this lies its originality. This first outline of the basic consumer segments of the online beauty retailing can, of course, be expanded and refined by considering a broader range of socio-demographics as well as personality traits and usage patterns. These could better guide the industry in its attempt to improve consumers' online shopping experience.

VTOs are increasingly becoming a subject of high interest in businesses aiming to advance their perceived experiential value and facilitate online sales. For beauty brands, embedding VTOs into their e-commerce platforms and integrating them into their marketing strategies as a key interactive communication tool might be the avenue to their future growth and profitability. The more hedonic and utilitarian consumer needs and tastes are accommodated the more consumers engage with brands and allow them to become parts of their social and personal lives.

Despite the fact that the fragrance sector of the beauty industry is its smallest one, representing an average of 17% of its total 2023 global value (but 27% in Europe), it is the fastest growing one at an annual rate of 14% and one expected to see accelerated growth in the 2023–2028 forecast period [2]. Maybe soon we will have a perfume VTO or we will see combined clothes, accessories, hairstyles and colors, and makeup VTOs. Until then, VTOs will be the spearhead of competitive advantage in the highly competitive makeup segment.

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