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Understanding the diffusion of virtual reality glasses: The role of media, fashion and technology

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ABSTRACT

Facebook, Google and many other established players' future will encompass a new media format—Virtual Reality (VR)—that require novel devices such as VR glasses. While market forecasts are promising, recent diffusion rates indicate that consumer acceptance is still limited. By incorporating existing and proposing new benefits and risks through the lenses of media, technology, and fashion research, the authors develop and test a comprehensive framework to study consumer reactions to wearable VR glasses. Results of an empirical consumer study on virtual reality acceptance indicate various novel and interesting findings. For example, health and privacy risks diminish adoption rates, whereas—contrary to other technologies—psychological or physical risks—do not. Likewise, fashionable designs and wearable comfort—two novel constructs investigated in this research—matter in addition to established utilitarian and hedonic constructs. Finally, this study includes a novel perspective on media technologies by showing that VR-adoption intention is highest when consumers expect to experience both a strong sense of virtual embodiment (the sensation of being another person) and virtual presence (the sensation of being at another place), while the presence of only one of these conditions may even have a negative effect.

1. Introduction

In order to understand new technologies, previous research has mostly incorporated theories from management information system and computer science, such as the technology acceptance model (TAM; Davis, 1989). While these studies have substantially enhanced our understanding why people use computers and other information technology (King and He, 2006; Wang and Sun, 2016), recent developments suggest that novel frameworks are required (Kalantari 2017). Examples of such developments are wearable technologies (e.g. virtual reality devices), faster and cheaper computing power, more immersive media (e.g., augmented reality, virtual reality, mixed reality), large app ecosystems, and so forth. These technological developments allow users to satisfy a variety of needs that traditional media and technology acceptance theories do not incorporate (e.g. Rauschnabel, 2018).

In recent years, leading companies such as Samsung, Facebook and Google have introduced and promoted affordable digital VR technologies within consumer markets. Typically, these are wearable head-mounted devices (cf. VR glasses) including else devices that use the displays of regular smartphones. In this research, we argue that extant theories do not capture the specific characteristics of these technologies fully and new frameworks are required for three reasons: First, technology acceptance theories focus mostly on the benefits (e.g., how useful a technology is) but neglect consumers' critical assessment of potential risks (e.g., Davis, 1989; King and He, 2006; Venkatesh et al., 2012). Examples of these theories include the technology acceptance model (TAM, Davis, 1989) and its extensions (e.g., TAM2, c.f. Venkatesh and Davis, 2000), The unified theory of acceptance and use of technology (UTAUT, Venkatesh et al., 2003) and its extension to consumer technology (Venkatesh et al., 2012), or the innovation diffusion theory (Rogers and Shoemaker, 1971). Especially with newer advancements, consumers become more skeptical whether the benefits of a technology outweigh its potential threats, such as to their privacy, health, or psychological well-being. Second, VR devices' main benefit is an immersive media environment, thus, the perception of being physically present in a non-physical world. This is a core difference to other technologies, such as smartphones. Established technology acceptance theories have mostly developed independently from media technologies (King and He, 2006; Kalantari 2017), and thus, would ignore a core distinction to extent technologies. Third, VR glasses are not just used, they are also worn (Rauschnabel, 2018). Traditional technology and media frameworks have been developed for stationary or mobile

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devices and thus, factors such as wearable comfort did not play a relevance (Venkatesh et al., 2012). As a conclusion, this research argues that a decision-making framework for VR devices requires the integration of benefits, risks, and media specific factors.

Prior research has not addressed this issue and thus, very little is known about consumers' reactions to VR glasses. As discussed, established frameworks do not fully capture the unique characteristics of VR glasses, and prior research lacks of comprehensive frameworks. For example, scholars from numerous disciplinary perspectives, such as marketing (Barnes, 2016; Barnes et al., 2015), tourism (Gibson and O'Rawe, 2018), medicine (Hayhurst, 2018) and education (Freina and Ott, 2015) have emphasized specific aspects of VR glasses, but the literature remains fragmented. In addition, these studies have typically investigated the media component of VR, i.e. the underlying processes of context specific VR media applications, but not of VR as a whole. As a conclusion, we echo the calls for more generalizable research on wearables (e.g., Kalantari, 2017) and on VR in particular (e.g., Pejsa et al., 2017) and develop a VR framework by integrating benefits and risks through the lens of media, fashion, and technology.

In addition to the theoretical relevance, understanding consumer responses to VR glasses is also highly relevant from a business standpoint. While numerous research and consulting institutions have highlighted the potential for VR consumer applications (Haque, 2015; Forbes Agency Council, 2017), actual adoption figures remain disappointing. A recent survey conducted by ContextWorld (2016) concluded that one-quarter of the population has still never heard about VR, and only about 10% of consumers say they have heard “lots about it” (ContextWorld, 2016, p. 5). In this study, we echo these conclusions and show that only about 1% of the surveyed respondents own a VR device, with 10% of respondents having actual usage experience. This is surprising, since major players such asFacebook, Samsung and others have put considerable effort into promoting the technology. Nevertheless, as Adscend Media CEO Fehzan Ali says: “I am of the opinion that virtual reality is the future, just not necessarily in its current form. As with all new significant innovations, it can take time for mass product-market fit to occur, and at the point it does, adoption occurs at a rapid pace” (Forbes Agency Council, 2017: p. 1). Thus, companies may benefit from insights into consumers' reactions to AR, and particularly from those illuminating drivers of VR adoption.

By combining three perspectives—media, fashion and technology—we develop a theoretical framework to answer the following research questions:

(1) What benefits and risks drive consumers' reactions to VR devices?
(2) How do VR-specific factors, such as virtual presence, virtual embodiment and their interplay, affect user adoption?

The remainder of the manuscript unfolds as follows: First, we define the core terms and review related research. Next, we propose a theoretical model grounded in three research streams: media, fashion, and technology. This model is then tested within a sample of 611 German consumers and analyzed using structural equation modeling (SEM). The results identify multiple benefits and risks associated with VR glasses, and indicate which of them shape consumer reactions (see Table 1). Based on these results, we discuss how these findings contribute to the discourse around technology acceptance, wearable technologies and the VR discipline as a whole, and additionally provide recommendations for technology executives and app developers.

2. Theoretical foundation

2.1. Virtual reality and virtual reality glasses (VR glasses)

Based on prior research (e.g., Craig et al., 2009; Slater et al., 2010; Serino et al., 2016), we define *virtual reality* (VR) as a form of immersive digital media that generates a three-dimensional, virtual imaginary and interactive media environment that the user processes or perceives much as he/she perceives the real world. This allows a user to process virtual visual stimuli and navigate realistically within a virtual environment; for example, applications often enable a user to look around or navigate through a virtual environment. Common examples include a user being able—independently of his “real world” spatial presence—to perceive himself as being at another place (e.g., a tourist destination), while being able to observe this location realistically, nearly as if he were there in fact (e.g., by moving his head to look around). Users can also take on the role of persons physically different from themselves (virtual embodiment), and by doing so, experience a life as another individual (Slater et al., 2010; Serino et al., 2016).

Virtual-reality applications can be used with screen-based technologies (e.g., by playing Second Life on a computer). Recently, wearable VR glasses have been introduced to consumer markets. We propose the following definition for *VR glasses* (common synonyms include virtual-reality goggles, virtual-reality headsets, head-mounted VR displays, and HMVRD):

> Virtual Reality glasses are wearable devices that allow individuals to use immersive virtual-reality applications, enabling these individuals to experience and interact with simulated environments through a first-person perspective.

Typical VR devices are glasses-like headsets with own computing power and displays. Other approaches use ordinary smartphones that are attached to holders (e.g., self-made cardboard holders). A related but distinct concept is augmented reality (AR; and augmented reality smart glasses (ARSGs) as devices), which is often discussed synonymously. However, in contrast to VR, users of AR are not closed off from reality (Rese et al., 2017; Scholz and Smith, 2016). Rather, AR augments the perception of the real world by overlaying virtual elements on top of it (Craig et al., 2009). Today, almost all major players in the field, including Google, Apple, Facebook, Amazon, Microsoft, Sony and Samsung, have established distinct AR and VR groups and units. Recently, Goldman Sachs predicted that by 2025, the market for AR and VR will grow to $80 billion, reaching a size comparable to that of today's PC market. The Forbes Agency Council (2017) is in line with this view.

2.2. Related research on virtual reality

To date, many different applications for VR have been created, including 360-degree video apps, games, education apps, and applications in tourism (Craig et al., 2009). Prior research studied the antecedents and consequences of VR in many contexts. However, this research has typically investigated the applications themselves, with the device itself playing a less important role. For example, Huang et al. (2016) studied VR in the context of Second Life and based their model predominantly on the TAM (Davis, 1989). Other studies have focused on the outcomes and benefits of VR in the fields of healthcare (Hayhurst, 2018), education and learning (Jou and Wang, 2013; Freina and Ott, 2015; Didehbani et al., 2016), or even sports (Plante et al., 2003). However, in-depth findings on how users react to VR devices as a whole remain scarce (Kalantari, 2017). We argue that this is a substantial gap in the literature, since consumers' general reaction to VR devices determines their future adoption or resistance behavior. However, there is extant research on other wearable devices that we will review in the following sections.

2.3. Acceptance of wearable technologies

Understanding how people react to innovations, in particular new technologies, has been the focus of numerous studies within multiple disciplines. Although it has been subject to some criticism, the technology-acceptance model (TAM) and its extensions, including TAM2, UTAUT, and UTAUT2 have received considerable attention in the

Table 1
How consumers perceive virtual reality glasses: Factors, prior research and contribution.
Constructs related to Virtual Reality.

Factor and proposed direction	Definition	Example	Summary of prior research	This study
Media				
Virtual presence (+)	The subjective sense of being in a particular virtual environment even when one is physically situated in another.	While using VR glasses in their home, individuals feel as if they are on the moon, or in a fantasy land.	Under-researched in general	No effect/positive driver of attitudes in combination with virtual embodiment
Virtual embodiment (+)	The virtual representation of a participant's body with a virtual body different from their own.	While using VR glasses, the user feels that he/she is a different person/character, such as a Neanderthal man, a knight, or Michael Jackson.	Under-researched in general	Main effect negative/positive driver of attitudes in combination with virtual presence
Fashion				
Fashionability (+)	A user's overall evaluation of the design of the device.	A device has a modern and fashionable design.	Under-researched for wearables	Matters, but only directly on intention
Wearable comfort (+)	An overall evaluation of how comfortable the device is while being worn.	The device is light and does not feel bulky.	Under-researched for wearables	Driver of attitude
Technology				
Utilitarian benefits (+)	A user's evaluation regarding the potential of VR technology to make his/her life more efficient.	Device helps a user perform certain tasks, such as in planning a trip.	Well-established construct for wearables and other technologies	Driver of attitude
Hedonic benefits (+)	The extent to which a person believes that using a VR device is pleasant and enjoyable.	A user perceives playing a VR game to be enjoyable.	Well-established construct for wearables and many other technologies	Driver of attitude
Data privacy risk (−)	The degree of perceived risk that the user's personal data can be accessed by the manufacturer, app developers, or third parties.	A firm tracks a user's usage data and sells it to advertising companies that send spam emails.	Well-established construct in the technology literature, but wearables research has resulted primarily in non-significant findings	Driver of attitude
Health risk (−)	The perceived negative impact on a user's health through using the device, such as damage to one's eyes.	A user expects that VR glasses will damage their eyesight.	Under-researched for wearables	Not significant
Psychological risk (−)	The perceived risk that using VR glasses may have a negative impact on a user's psyche.	A user expects psychological damage from realistically interacting in fake worlds.	Under-researched in general	Not significant
Physical risk (−)	The extent to which a person believes that using VR glasses can expose them to any physical threat, such as hitting furniture due to being closed off to the physical environment.	A user is afraid that he/she could hurt him/herself by running against a wall because he/she cannot see the real world while using VR glasses.	Under-researched in general	Not significant

academic context (Kalantari, 2017; King and He, 2006; Wang and Sun, 2016). Broadly speaking, these models argue that several aspects of the technology, such as perceived usefulness (often also termed "functional benefits," "utilitarian benefits," or "performance expectancies") and ease of use, determine consumers' adoption and use of a specific technology. However, with regard to wearables, scholars quickly realized that technology factors alone were not sufficient to explain consumer reactions (Kalantari, 2017; Chuah et al., 2016; Kim and Shin, 2015, Rauschnabel, 2018).

The term "wearable technologies" (synonyms include "smart wearable technologies," "wearables," and "fashnology") is used to cover a variety of devices that are physically attached to a user's body (Kalantari, 2017). Typically, wearables imitate the design of more conventional fashion accessories or clothing. For example, smartwatches typically share similarities with regular watches, while smart glasses (e.g., ARSGs like Google Glass, or VR glasses such as Oculus Rift) are worn like regular glasses. Other wearables include smart T-shirts or fitness trackers (Kalantari, 2017).

Therefore, Rauschnabel et al. (2016) have proposed the term "fashnology" as a concept highlighting the necessity of supplementing technology-acceptance theories with fashion-related factors. This, however, does not imply that users would use the term 'fashion' in everyday language when talking about their wearables. This term only suggests that users' behavior is also driven by similar factors that people include in their decision making when thinking about traditional fashion items (e.g. a hat or a shirt). This is also in line with Kalantari's (2017) literature review of prior research on the adoption of wearable technologies. She presents a comprehensive list of factors associated either with the "wearable aspect" (e.g., visibility, design) or the "technological aspect" (e.g., enjoyment, ease of use). Adapa and colleagues (2018) built on this "fashnology view" and developed a fashnology acceptance model based on qualitative research on Google Glass and a Sony smartwatch. They provide numerous quotes in which consumers discuss the design and the weight of devices as being crucial factors. Research on smartwatches, for example, has shown that consumers tend to perceive them as a technology and/or fashion gadget, and rate the devices as being comparatively more useful and/or visible based on this determination (Chuah et al., 2016). Recently, Dehghani (2018) conducted an analysis of social media postings about smartwatches and concluded that "fashnology emerged to be a very relevant dimension" (p. 10). Rauschnabel et al. (2016) argue that the mental categorization of ARSGs as a fashion accessory or technology determines the relative strength of technology- and fashion-related drivers. Likewise, Jung et al. (2016) show that smartwatches' shapes are important characteristics in influencing consumer reactions. Choi and Kim (2016) propose and test a model that shows that fashion-related constructs play an important role in understanding consumers' reactions to smartwatches, which they argue is particularly relevant due to smartwatches' luxurious image. Likewise, Kuru and Erbuğ (2013) study drivers of on-body phones. The authors provide a list of various relevant factors, some of which are more related to technology (e.g., interactivity) and others to the fashion aspect (e.g., pleasing aesthetics, wearability, expressiveness).

Only a few studies specifically incorporate risk factors. Technology research in general often incorporates broad, general risk factors, such as whether use of a technology is perceived as being risky or not. Other studies conclude that risk dimensions are context and technology specific (tom Dieck and Jung, 2015). For example, Featherman and Pavlou (2003) find performance, financial, crime, psychological, social and privacy risks to be relevant for online services, in addition to an overall risk perception. Luo et al. (2010) employ a comparable approach for mobile banking, and find similar relevant dimensions. More closely related to the context of the present research is a recent study by Yang et al. (2016), who study smart wearable technologies in general; here, the findings show that perceptions of performance and financial risk decrease the perceived value of a wearable device. Rauschnabel (2018) study the privacy risks associated with AR technology, and show that people do not care about their own privacy, but about other people's. While prior research has shown that risk factors matter in technology use and risk dimensions vary between different technologies, information on perceptions of risk associated with VR technologies remains scarce. In this study, we theorize and test the importance of physical risks associated with being closed off from reality, psychological risks associated with experiencing non-existing objects and environments, health risks such as potential harm to the eyes, and privacy risks.

2.4. Research gap and intended contribution

Prior research identifies numerous factors related to the adoption of wearable devices on which this study can build. However, unanswered questions remain. In particular, the present research intends to address and fill the following research gaps:

- Research on VR glasses is scarce, and since prior research indicates that no single model applies to wearables in general (Kalantari, 2017), research specifically on this device is needed to better understand this promising technology. This study proposes and tests a comprehensive model of benefits and risks related to the device itself, but also to VR as a medium.
- This study combines theories and frameworks from media (Huang et al., 2016; de la Pena et al.; 2010), fashion (e.g. Beaudoin et al., 1998; Jegethesan et al., 2012), and technology (e.g., Venkatesh et al., 2012) to explain consumer reactions to VR. This model can guide future research on numerous wearable technologies.
- Prior research has argued that VR allows users to virtually "be another person" or "be at another place." However, these two factors—and in particular their interplay—have never been investigated on a broad level. This study makes a first attempt to study the importance of these general VR factors in shaping consumer reactions.
- With regards to finding ways to market VR devices and apps in this early stage of the product lifecycle, managers may be particularly interested in factors that shape consumer reactions, especially within a broad potential customer group in which a majority has never before used a VR device. Therefore, this study complements prior research by using a broad sample of consumers and identifies factors that managers can address.

3. Hypotheses

3.1. Overview: A theoretical framework for VR glasses

Before discussing each hypothesis in detail, we provide an overview of the research framework, as illustrated in Fig. 1. The model draws on the assumption that three categories of constructs determine consumer reactions. The first category *media* factors related *to the VR experience itself*, in particular, the two dimensions that allow users to escape into other bodies and explore other places. The second category *fashion* comprises factors that are related *to the wearable component of VR glasses* and encompass design and comfort aspects. Finally, the third category of factors conceptualizes VR glasses as a *technology* that, as proposed in numerous frameworks, address a variety of benefits but can also be associated with risks. In the subsequent sections, we will provide hypotheses about specific constructs. Table 1 also provides an overview of the constructs and their definitions, along with a summary of their presence in prior research.

The core dependent variables of the models are attitudinal and intentional constructs. As the attitudinal construct, we apply "attitude toward using VR glasses," defined as a person's overall evaluation of the

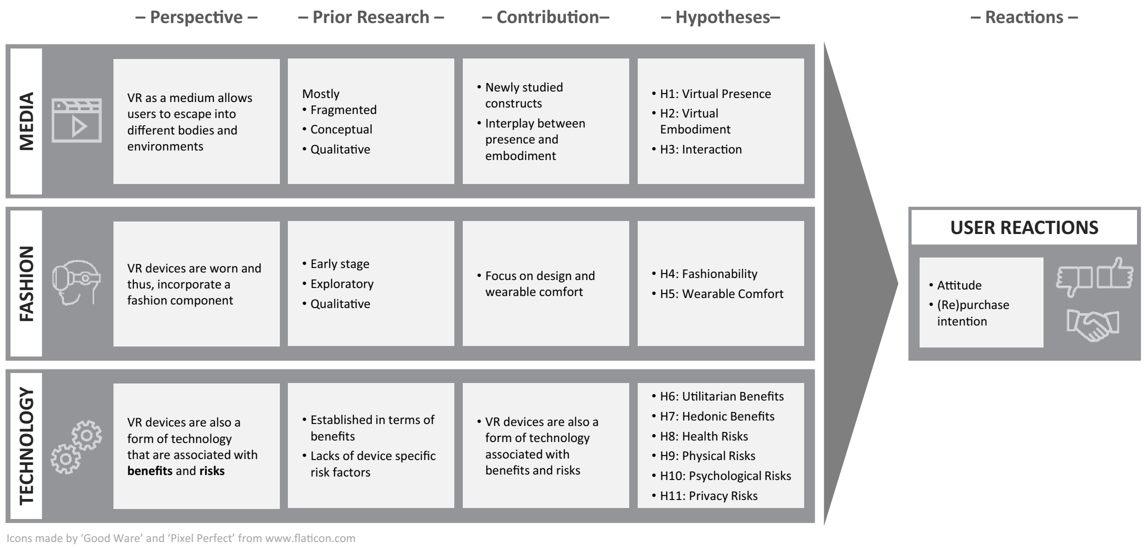

Fig. 1. Model overview: Research streams related to virtual reality devices. A Virtual Reality (VR) acceptance framework.

favorability of using VR glasses. As an intentional construct, we apply "intention to (re)purchase VR glasses." Among owners of devices, this is defined as the degree to which they would purchase the device again; among non-owners, it is defined as the degree to which they intend to buy VR glasses in the future.

3.2. Media: factors related to the virtual reality experience of VR glasses

Many humans have a general need to experience novel things, visit places, experience emotions or characters. For example, people travel to other places, learn about other cultures, dress as different characters on carnival, play in role games, or consume immersive media (Agarwal and Karahanna, 2000).

There is consensus in media research that people use certain media to satisfy their craving to experience fantasy and emotions (e.g., Zeng, 2011; Lucas and Sherry, 2004). Oftentimes, people use media to escape from reality (e.g. Haridakis and Hanson 2009) or because they can do things they cannot do in real-life, such as driving race cars or flying (Lucas and Sherry 2004). Armstrong and Hagel (2000) discuss examples of online communities that allow users to experience fantasy like worlds, such as engaging in football games using the name and character of a famous football player, or to be a "medieval baron at the Red Dragon Inn" (p. 88). The literature provides numerous examples of media specific gratifications that can explain the reaction toward specific apps (see, for example Sundar and Limperos (2013)). The virtual-reality experience offers users the opportunity to look around and interact with an artificial world (Burdea and Coffet, 2003). In this regard, the immersive virtual environment may be a representation of the real world aimed at creating a lifelike experience, or may seek to establish a fantastic and extraordinary sci-fi world (Agarwal and Karahanna, 2000). Thus, we theorize that two broad factors essentially determine the virtual-reality illusion experience: *virtual presence* (being at another place) and *virtual embodiment* (being another person).

Fundamentally, virtual reality allows individuals to experience a virtual presence in a fictitious place. Early papers in the field include studies by Held and Durlach (1992), Sheridan (1992), and Slater and Wilbur (1997), all of which introduce and assess the concept of presence in virtual environments—that is, the sensation of being in a place depicted by the virtual-reality system although one is not physically there. In line with Sheridan (1992) and Witmer and Singer (1998), we define virtual presence as a user's subjective sense of being present in a particular virtual environment even when the users is physically located in another. In many sectors, including business, medicine, education and tourism, virtual-presence concepts that provide individuals with the perception of presence within a virtual environment are already being adopted (Huang et al., 2016). de la Pena et al. (2010) highlight the profound new potential of immersive journalism that delivers first-person experiences of news stories. Through the creation of an artificial environment, individuals are enabled to experience an alternative reality. The sensation of being in a place depicted by the virtual-reality system although one is not physically there marks the fundamental purpose of virtual reality—the fascination of using the technology. Bowman and McMahan (2007) conclude that virtual presence provides users with a unique experience evoking strong, positive reactions. Thereby VR glasses allows users to feel present in the created environment which elicits emotional reactions (Riva et al. 2007). The prospect of such an experience may be a salient factor driving individual attitudes toward VR glasses.

H1. Virtual presence has a positive effect on attitude toward using of VR glasses.

Modern VR technologies allow individuals to experience exceptional perceptions, including the illusion that external objects are part of their bodies (cf. the rubber-hand phenomenon, Botvinick and Cohen, 1998), out-of-body experiences (Ehrsson, 2007; Lenggenhager et al. 2007) and virtual-embodiment experiences, in which they are given the illusion that a virtual body has become their own (Petkova and Ehrsson, 2008; Slater et al. 2010; Serino et al., 2016). So-called virtual embodiment can be defined as the virtual representation of a participant's body through a virtual body different from their own (Banakou et al., 2016). Studies show that VR glasses allow participants to experience the feeling of having another body which may alter the participants' reactions and behavior (Yee and Bailenson, 2007; Maister et al., 2015), even including a reduction in implicit racial bias (Peck et al., 2013; Maister et al., 2013; Banakou et al., 2016). Being able to experience a digital self-representation thereby not on lead to behavioral changes on the user side but has been found to be a key motivation for using VR technology (Yee et al., 2009). The perspective of virtual embodiment, or the chance to experience being in a virtual body different from one's own, may therefore be a strong driver for the use of VR glasses, and may subsequently positively affect an individual's attitude toward using VR glasses. We hypothesize:

H2. Virtual embodiment has a positive effect on attitude toward using of VR glasses.

While virtual presence and virtual embodiment may separately be salient drivers, the combination of the two phenomena may be an even more prominent driver in individual attitudes toward the use of VR glasses. That is, the prospect of being another person in another place may be the salient factor attracting individuals to use VR glasses. Avatars are one commonly studied phenomenon in this context, defined as "online manifestations of self in a virtual world… designed to enhance interaction in a virtual space" (Peterson, 2005: 30). Avatars allow users to perceive their virtual presences as being real, provide a high level of identification with the character depicted, allow users to do fantastic things in the virtual worlds, and facilitate social and psychological connections with others (Biocca et al., 2003; Bulu, 2012; You et al., 2017). It may therefore be the interaction of virtual presence and virtual embodiment that drives individuals' attitudes toward using VR glasses:

H3. The combination of virtual presence and virtual embodiment - the prospect of being another person in another place - has a positive effect on attitude toward using of VR glasses.

3.3. Fashion: Factors related to wearability of VR glasses

Prior research has argued that when people evaluate wearable technologies, they also incorporate fashion-related factors. The term "fashnology" (e.g., Rauschnabel et al., 2016; Kalantari, 2017; Adapa et al., 2018) has been proposed to describe this phenomenon. Fashion researchers (e.g., Beaudoin et al., 1998; Beaudoin et al., 1998; Watson and Yan, 2013) have identified numerous factors to explain why people chose particular apparel. Summarizing these frameworks identifies three broad categories of factors:

- The first category of factors covers the virtual appearance of fashion products, which we term "perceived fashionability". Fashion scholars have investigated and conceptualized this broad factor in terms of design or colors (Summers et al., 2006), attractiveness (Beaudoin et al., 1993), image (Watson and Yan, 2013), style (Beaudoin et al., 1993), or how it matches one's self-presentation goals (Lee and Burns, 1993; Watson and Yan, 2013).
- The second category investigates the haptic aspects of apparel, which reflects the extent to which people experience wearing clothing items as comfortable (Watson and Yan, 2013; Jegethesan et al., 2012).
- The third group of variables refers to the functional quality of clothing products and is studied in terms of overall quality (Beaudoin et al., 1993; Watson and Yan, 2013), durability (Summers et al., 2006), appropriateness for particular occasions (Easey, 2009) or through price cues (Lee and Burns, 1993; Watson and Yan, 2013). For example, people may choose a raincoat to avoid getting wet during rain, and people evaluate a raincoat to what extent they expect to obtain this goal.

Following Knight and Baber (2005), we argue that two fashion-related factors are particularly relevant: the design (*perceived fashionability*, i.e. "what it looks like") and the degree to which it is comfortable or not ("what it feels like"). We study the third category of factors (functional quality) by building on prior research on media technology (as discussed later).

Perceived fashionability, i.e. the design component, of a technology has been found to be a relevant determinant of consumer behavior in many ways (Homburg et al., 2015). Prior TAM research has shown that image (the extent to which an individual expects that using a device will enhance his/her status among others) also drives usage (e.g., Venkatesh and Bala, 2008). Consumer researchers (e.g., Holman, 1980; Tunca and Fueller, 2009; Bierhoff, 1989) have argued that ownership of wearable accessories strongly influences a person's physical appearance (e.g., clothing or jewelry). In a different context, Belk (1978: 39) states that "[i]n virtually all cultures, visible products and services are the bases for inferences about the status, personality and disposition of the owner or consumer of these goods." AlthoughVR glasses are not typically worn in public, and thus may not be directly visible to others (ContextWorld, 2016), the design component may still play an important role, as research has shown for other types of wearable devices (e.g., Knight and Baber, 2005). For example, VR users could post photos of themselves wearing the devices on social media or present them decoratively at home so that they become visible to visiting friends. Thus:

H4. Perceived fashionability has a positive effect on attitude toward usage.

In addition to the perceived fashionability, the haptic aspect plays a salient role. We define the term *wearable comfort* to mean consumers' overall subjective assessment of the physical feeling from wearing VR glasses (c.f., Knight and Baber, 2005). In line with prior research, we propose that using VR glasses with a high level of wearable comfort "feels good," leading to greater usage enjoyment. Kuru and Erbuğ (2013) identify a construct called "wearability" that is determined by specific characteristics of the device, such as its ease of carrying or its fit with human anatomy. Eisenmann et al. (2014) and tom Dieck et al. (2016), who conducted qualitative research on Google Glass, report that users discussed the weight of the devices. In the context of ARSGs, Rauschnabel (2018) argues that wearable comfort is influenced by the physical characteristics of the device itself, manifesting in the weight, bulkiness, operating temperature, physical pressure while wearing, and so forth. Since positive (vs. negative) wearable comfort is good (vs. bad), we propose that greater wearable comfort means that consumers will have a more (vs. less) positive attitude toward using the focal device.

H5. Wearable comfort has a positive effect on attitude toward using of VR glasses.

3.4. Technology: Factors related to technological aspects of VR glasses

Numerous previous technology- and media-related studies have focused on *utilitarian and hedonic benefits* (Kalantari 2017), thus, the general functional and emotional benefits individuals receive from using a certain tool or device. Utilitarian benefits refer to the functional value from use. That is, how useful the device itself is in helping to accomplish certain daily tasks (Davis, 1989; King and He, 2006). In H6 we propose that a person who perceives a high utilitarian benefit in VR glasses thus perceives them as beneficial in helping perform certain tasks better, easier or faster. In contrast, H7 focuses on the hedonic benefits, and thus reflects the amount of pleasure (e.g., fun or enjoyment) a person expects from using a device (Venkatesh et al., 2012). This can derive from the use of specific apps (e.g., games), but potentially also just from enjoyment of the use of the devices in general. Since both constructs have been validated numerous times (for a review, see King and He, 2006), we refer to these studies and replicatively hypothesize:

H6. Utilitarian benefits have a positive effect on attitude toward using of VR glasses.

H7. Hedonic benefits have a positive effect on attitude toward using of VR glasses.

Although most acceptance and use models focus on the benefits of a technology (King and He, 2006), consumers typically also consider risk factors when making decisions (Yang et al., 2016). Conceptually, risk factors are negatively related to benefits, and thus can coexist with benefits (Cocosila et al., 2007). In other words, a consumer can weigh perceived benefits (as hypothesized in H1 through H7) against risks (as hypothesized in H8 through H11).

It is important to note that although scholars have identified numerous technology-related risks in the past (e.g., Luo et al., 2010), specific risks occur only for certain technologies. For example, technologies that do not collect any personal data (e.g., a traditional calculator) are not likely to be associated with privacy risks. In this study, we build on the findings from Luo et al. (2010) and theorize four different risk factors: *health risks* from the actual use of the device; *physical risks* from being closed off from reality while physically in a space; *psychological risks* associated with interacting in artificial virtual worlds and *privacy risks*, since personal data can be collected, stored and used by app developers and/or hackers.

Being exposed to electronic visual devices, especially those that have active wireless connections, is often associated in public perceptions with health risks, such as damage to the eyesight or electromagnetic pollution (Cocosila et al., 2007; Luo et al., 2010). While the actual research on whether this is true for humans has produced fragmented and inconsistent findings, the topic has led to controversy among consumers (Cocosila et al., 2007; Arning et al., 2014). Most salient is the potential threat to one's eyes. For example, Rauschnabel et al. (2016) discuss the role of ARSG usage on users' eyes and conclude that there is little research on the impact of this risk on consumers' decision-making processes. Popular media has discussed potential negative outcomes associated with usage VR, including eye strain, fatigue, dizziness and motion sickness (Mukamal, 2017; Chester, 2017). Chester (2017: 1) concludes that eye experts caution that "that vision problems are set to rise as VR headsets become mainstream." While research does not provide causal inferences on whether this represents an actual threat, it is likely that consumers may incorporate health risks as a potential risk that negatively impacts their attitude toward using of VR glasses. Thus:

H8. Health risks are negatively related to attitude toward using of VR glasses.

Being closed off from reality allows users to immerse themselves in fictitious worlds in which they can be another person or visit novel places (Craig et al., 2009). While immersed, people are typically focused on these virtual tasks, and are effectively blind to the physical world around them (Slater et al. 2010; Serino et al., 2016). With VR, this is exacerbated by the fact the user has no ability to see the real world. People may hit furniture or walk into walls while using the glasses, or by gesturing with their hands, they can break physical belongings or even injure themselves. Immersive technology typically makes people ignore the reality around them, leading to (perceived) physical risks.

H9. Physical risks are negatively related to attitude toward using of VR glasses.

Being exposed to virtual worlds may further relate to psychological problems. Research offers evidence that VR can be a useful means of affecting a user's psychological states. Rizzo et al. (2015) show that therapists can use VR to treat post-traumatic stress disorder among people exposed to war or terrorism. Therefore, a "wrong" use could analogously lead to negative impacts on one's psychological wellbeing. Other effects less directly related to the virtual-world aspect are also possible. For example, poor purchase decisions in general, but also with regard to a specific technology, can negatively impact a user's peace of mind and well-being. Potential psychological consequences related to media use have been the subject of contentious discussions regarding the use of the internet and other media (e.g., Chester, 2017), as well as of applications such as mobile banking (Luo et al., 2010). With regard to VR specifically, we found anecdotal evidence in social media from a user who reported weird, hallucination-like consequences from using VR. One user reported that he wanted to put a VR controller on a table that did not exist in the real world:

"[Someone] tried to put their controllers on a table… that wasn't actually there. So, the controllers just fell. They just dropped them, and we were like, 'Ohhhhh don't do that.'"

(http://www.smh.com.au/technology/innovation/seven-stories-of-injury-and-other-vr-hazards-20160205-gmmk6r.html).

We propose that perceived psychological risks are negatively related to potential users' attitudes toward the use of VR glasses. In other words, people who expect that using VR glasses will make them feel psychologically bad are less likely to have a positive attitude toward using VR glasses. Thus:

H10. Psychological risks are negatively related to attitude toward using of VR glasses.

The development of new technologies can pose tremendous threats to a user's level of perceived privacy (Collier, 1995; Mason, 1986). We define privacy risk as the individual's perception of the risk that he or she could lose control over his/her personal information due to the use of a given technology (Malhotra et al., 2004). In the context of VR, we contend that potential privacy risks relate to app developers who may track user behavior, to analogous worries focused on the manufacturer of the devices or their operating systems, and also to illegal attacks by hackers who may steal personal user information. This could include data about app usage, as people with access to this information could draw conclusions about users' personal interests. To the best of the authors' knowledge, privacy concerns have not yet been studied in the context of VR. However, we propose that privacy concerns do matter, since they affect the perceived trustworthiness of a given technology. Privacy risks thus create a psychological risk barrier that involves feelings of uncertainty and vulnerability (Ackerman, 2004; Connolly and Bannister, 2007; Lewis and Weigert, 1985; Barney and Hansen, 1994). Since these feelings are by definition negative, a high degree of perceived privacy risk should lead to more negative attitudes toward using a technology—in this case, VR glasses. Thus:

H11. Privacy risks are negatively related to attitude toward using of VR glasses.

3.5. Overall evaluation of VR glasses

Theories in human decision making argue the role of attitude as an antecedent to behavior (Fishbein and Ajzen, 1975). Adopted to the focus on technology, technology-acceptance research (King and He, 2006; Davis, 1989) showed that users with a positive attitude toward using a technology are more likely to use it. Thus, we hypothesize a widely replicated finding that attitude toward use drives consumption intentions.

H12a. Attitude toward use has a positive effect on (re)purchase intention.

Therefore, attitude toward use serves as a mediator in the relationships between the exogenous variables and (re)purchase intention. Thus, we hypothesize:

H12b. Attitude toward using of VR glasses serves as a mediator in the relationships between the effects hypothesized in H1 through H10 and (re)purchase intention.

3.6. Control variables

We further argue that the proposed three categories of factors hypothesized above may not be complete. In particular, additional factors

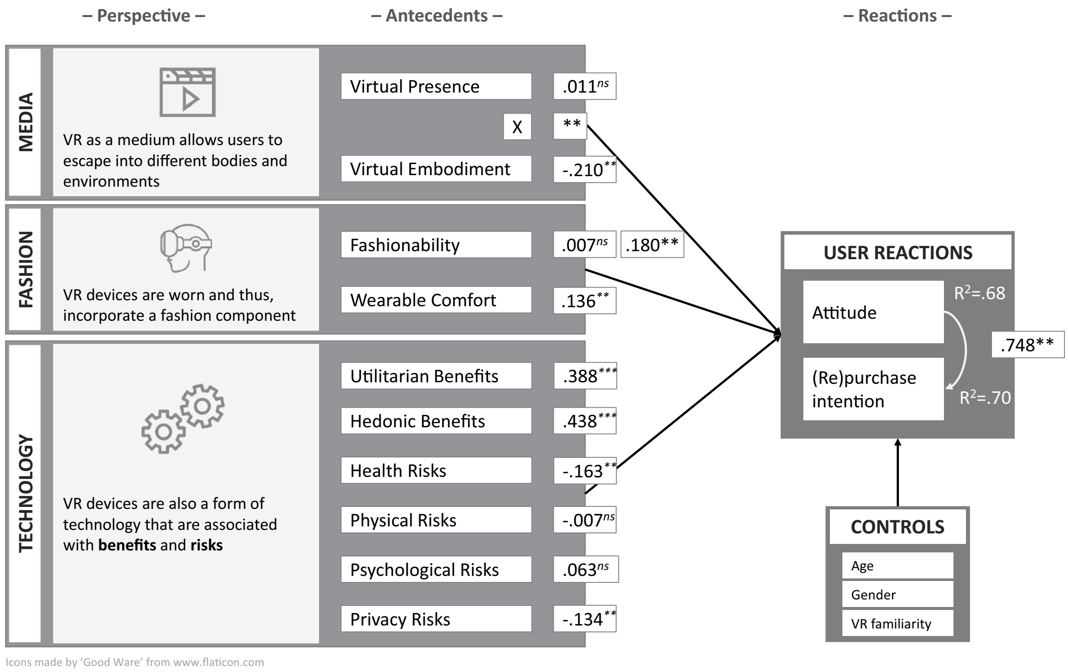

Fig. 2. Survey results: Drivers and barriers to the adoption of virtual reality glasses.
Results of the Virtual Reality (VR) consumer survey.

that go beyond the scope of this research (e.g. characteristics of the user and his/her prior experience with AR) may be relevant. To account for this, we included three control variables in the model. The first two are age and gender, as they are common control variables in technology research. In addition, different levels of knowledge about VR glasses may impact users' reactions, for example, because very innovative consumers have a better knowledge about VR technologies than less innovative consumers. Thus, we chose the degree of familiarity with VR glasses as a third control variable. We modeled direct effects from all three control variables on the two endogenous variables.

4. Methodology and research design

4.1. Data collection and sample

With the help of an online panel of a professional market-research firm, we surveyed 611 German consumers with different (socio-) demographic backgrounds. We used quotas on age, gender and area of residence (urban vs. rural) taken from official German statistics. Respondents received financial compensation for participation. Appendix 1 presents the sample. We specifically included all consumers, whether they know/own VR technology or not, in order to establish a non-fragmented perspective on consumers' actual attitudes and behavior toward VR glasses. Notably, 13.3% of the respondents had never heard of VR glasses, 76% had heard of the technology (but never tried it), 8.7% had tried VR devices and 1.4% owned their own devices.

These numbers are similar to common market-research studies (e.g., ContextWorld, 2016: 5). Since we expected these results prior to the data collection, we added a brief description (see Appendix 1) that included two photos of VR devices to ensure that respondents had a minimum level of knowledge about the subject. In doing so, we followed traditional practices in related research in which a majority of consumers lack actual usage experience with an emerging technology (e.g., Stock et al., 2016). While surveying actual users may increase the measurement of obtained benefits, and by doing so increase internal validity, very little is known about the mass of consumers who are not (yet) users of a technology. Therefore, this study provides a realistic description of existing market mechanisms.

4.2. Measurement model

When possible, we adopted scales from the literature and adapted them to the present context (see Appendix 3) using seven-point scales ranging from 1 (totally disagree) to 7 (totally agree). Items were marginally reworded for users and non-users. For example, "I would buy VR glasses" for non-owners and "I would buy VR glasses again" for owners. Detailed wording is available upon request. To further validate the reflective scales, we conducted a confirmatory factor analysis. Fit measures were satisfactory on both a global and a construct level. Appendix 3 lists all detailed measurement items, including sources, Cronbach's alphas, composite reliability (CR) and average variance extracted (AVE). The respective recommended thresholds of 0.7, 0.7, and 0.5 were exceeded. Appendix 2 provides a correlation matrix, descriptive statistics.

4.3. Discriminant validity and common method bias

A comparison of the correlations between the constructs (see Appendix 3) and the square root of the AVE of each construct does not indicate any concerns with regard to discriminant validity (Fornell and Larcker 1981). Since we rely only on self-reported measures, common method variance (CMV) could be a threat to the results (Podsakoff et al., 2003). To assess the magnitude of CMV, we applied a series of procedures such as the Harman single-factor test and a marker variable procedure. None of these procedures indicated any concerns.

5. Results

In the second step, we modeled the proposed relationships between the constructs in a structural equation (SEM) model using Mplus 7.1. We followed the recommendation in the methodology literature (e.g. Hair et al., 2006) and applied covariance-based SEM due to the characteristics of this research (e.g. focus on explanation rather prediction, theory-driven research rather exploratory research, reflective scales only and sufficient sample size). All fit measures were in line with the recommendations of the literature (χ^2 = 1129; df = 371, p < .001; CFI = 0.954; TLI = 0.943; RMSEA = 0.058; SRMR = 0.055). We now focus on the hypothesized effects (see Fig. 2):

5.1. Hypotheses testing

5.1.1. Direct effects

In the following, we discuss the effects presented in Fig. 2 in more detail.

Among the studied media factors, virtual presence (β = 0.011; p = .87) does not reach the level of significance, undermining H1. Virtual embodiment (virtually being another person)—contrary to H2—showed a significant negative effect (β = −0.210; p < .001). The results of the interaction hypotheses (H3) are detailed later.

An inspection of the fashion related factors indicates that fashionability does not relate significantly to attitude (β = 0.007; p = .90). However, post hoc analyses indicate that perceived fashionability does in fact play a crucial role in directly influencing the second reaction construct, namely (re)purchase intention (β = 0.180; p < .001), indication partial support of H4. The second fashion-related construct, wearable comfort (β = 0.136; p = .008) reaches significance, supporting H5.

Finally, among the studied technology factors, utilitarian (β = 0.388; p < .001) and hedonic benefits (β = 0.438; p < .001) both show significance, supporting H6 and H7.

Among the risk factors, health risk (β = −0.163; p < .001) and privacy risk (β = −0.134; p = .001) show significant effects, supporting H8 and H9. Physical risk (β = −0.007; p = .87) and psychological risk (β = 0.063; p = .16) did not reach significant levels, leading us to reject H10 and H11.

As discussed, we controlled for VR experience, age and gender. Results indicate significant effects for VR experience (β = 0.132; p < .001), and age (β = −0.073; p = .012), but not gender (β = −0.015; p = .59). All variables combined explain 68% (p < .001) of the variation in attitude.

Finally, we examined the direct effects on purchase intentions. H10a appears valid, as attitude (β = 0.748; p < .001) directly relates to (re) purchase intention. Among the control variables, VR experience (β = 0.084; p = .003) and gender (β = −0.058; p = .03), but not age (β = 0.010; p = .73), are significant. These variables together explain 70% (p < .001) of the variation in purchase intention.

5.1.2. Indirect effects

We also assessed the model's indirect and overall effects on purchase intention, since attitude toward using serves as a mediator in the proposed model (see Fig. 2). Following Hayes (2013), we examined the 95% bias-corrected bootstrap confidence intervals (CI) of the indirect effects. Mediation is established when the 95% CI does not include zero (represented with a ✓ in Table 2). In addition, the strength of the total effects offers insights into the relative importance of each of those factors in shaping purchase intentions. Since mediation cannot be established for all constructs, H10b receives only partial support.

Table 2
Mediating effects.
Drivers and Mediators for the adoption of VR.

Variable	Indirect β CI low	β (indirect)	Indirect β CI high	Mediation?
Fashionability	−0.10	0.01	0.10	×
Wearable comfort	0.05	0.14	0.22	✓
Utilitarian	0.27	0.42	0.60	✓
Hedonic benefits	0.25	0.38	0.51	✓
Health risk	−0.13	−0.07	−0.06	✓
Physical risk	−0.07	−0.01	0.05	×
Psychological risk	−0.01	0.05	0.11	×
Data-privacy risk	−0.14	−0.10	−0.05	✓
Virtual presence	−0.10	0.01	0.13	×
Virtual embodiment	−0.26	−0.17	−0.10	✓

Note: only unstandardized coefficients presented (ML, Mplus).

Table 3
Interaction effects of VR-specific factors and robustness tests.
Virtual Presence and Virtual Embodiment.

Effect	β	p
Model 1 (as hypothesized)		
Virtual presence → Attitude toward using VR glasses	0.082	0.232
Virtual embodiment → Attitude toward using VR glasses	−0.240	< 0.001
Virtual presence X Virtual embodiment → Attitude toward using VR glasses	0.077	0.002
Moderation established?	✓	
Alternative model 1		
Virtual presence → (Re)purchase intention	0.082	0.232
Virtual embodiment → (Re)purchase intention	−0.240	< 0.001
Virtual presence X Virtual embodiment → (Re)purchase intention	0.077	0.002
Moderation established?	✓	
Alternative Model 2		
Virtual presence → Attitude toward using VR glasses	0.082	0.234
Virtual embodiment → Attitude toward using VR glasses	−0.244	< 0.001
Virtual presence X Virtual embodiment → Attitude toward using VR glasses	0.070	0.004
Virtual presence → (Re)purchase intention	0.041	0.346
Virtual embodiment → (Re)purchase intention	0.045	0.272
Virtual presence X Virtual embodiment → (Re)purchase intention	0.083	< 0.001
Moderation established?	✓	

Note: Standardized effects, LMS interaction probing approach.

5.1.3. Interaction effect

H3 hypothesizes that a positive interaction takes place between virtual presence and embodiment. We modeled the interaction of these two latent constructs in Mplus using the LMS approach, and integrated this interaction term in the overall model. In support of H3, the results show a significant positive interaction (β = 0.077; p = .002); this indicates that the combination of virtual presence and virtual embodiment—the sense of being another person in another place—has a positive effect on attitude toward using VR glasses.

To further assess the robustness of his novel conclusion, we ran two alternative models, the results of which are presented along with the original model in Table 3. In alternative model 1, we modeled a direct effect of virtual presence, virtual embodiment and their interaction on (re)purchase intention and included this in the overall model (Fig. 2). The interaction was again significant (β = 0.090; p < .001), indicating that this finding also holds for a different consumer-reaction variable. In alternative model 2, we modeled virtual presence, virtual embodiment and their interaction on attitude and on (re)purchase intention. Results indicate that both interaction effects hold (on attitude: β = 0.070; p = .004; on purchase intention: β = 0.083; p < .001), as shown in Table 3, indicating that the effects hold even when the model controls for additional relationships. Thus, the interaction appears to be robust across different user reactions.

5.2. Robustness tests and post hoc analyses

To assess the stability of the findings, we conducted a series of robustness tests. We reanalyzed the model both without and with selected control variables. Replications using alternative SEM estimators, specifications, and methods (e.g., as in Table 3) did not alter the conclusions. These additional results are available from the authors upon request. Finally, one may expect experience to determine the magnitude of the exogenous variables in the model. To assess this, we modeled these 10 direct effects from experience in the proposed model. Findings replicated the conclusions presented above. While the distribution of experienced vs. non-experienced users in this sample is similar to that reported in other market-research studies (e.g., ContextWorld, 2016), assessing group differences in effect sizes is not possible, since the sample size of 62 experienced users was substantially below the sample requirements to do so. However, when eliminating these 62 experienced users from the dataset, responses from the remaining respondents indicate similar results. Since all robustness tests support the findings presented above, conclusions appear to be stable and robust.

6. Discussion

6.1. Summary of the findings

The objective of this research was to propose and empirically test a comprehensive framework for the study of consumer reactions to VR glasses. By doing so, this research provides insights into mechanisms that explain how consumers react to this new form of immersive media technology. In particular, this study identifies a set of potential benefits and risks associated with VR glasses and shows which of them influence consumers.

Results (see also Appendix 3) indicate that consumers have a moderately positive attitude toward using VR glasses (M = 3.70), while (re)purchase intention remains comparatively lower (M = 2.58). Furthermore, findings indicate that consumers perceive the following benefits from the use of VR glasses: First, they tend to see the opportunity to explore new places (presence; M = 5.21) and to gain access to entertainment (hedonic benefits; M = 5.06) as core benefits associated with VR glasses. Respondents saw less value in VR glasses with regard to utilitarian benefits (M = 3.49) and embodiment (M = 3.95), and tend to attribute relatively low importance to the fashion component of VR glasses, particularly in terms of wearable comfort (M = 3.07) and perceived fashionability (M = 2.14). Among the risk factors, privacy risks (M = 4.09) are viewed as most prominent, followed by physical risks (M = 3.89), health risks (M = 3.61) and psychological risks (M = 3.30).

SEM-results show that not all of these factors are equally important in explaining the variation in consumer reactions. Consumers tend to react positively to VR glasses if they associate them with hedonic benefits. This supports the relevance of hedonic applications such as 360-degree videos or games (Craig et al., 2009). However, utilitarian benefits are almost equally important. To be precise, today most consumers do not see a functional value in the technology; yet those who do, react much more positively to the devices. Likewise, consumers who rate wearing VR glasses more as 'comfortable' also tend to react more positively. Evaluation of the fashionability, however, plays a different role, since perceived fashionability seems to matter in purchase decisions but not in the process of attitude formation. In other words, a good design may trigger adoption independently of attitude.

Results lead to surprising conclusions about the two VR-specific factors, embodiment and virtual presence. Contrary to our hypotheses, their effects were not as hypothesized, and the main effect of virtual embodiment was even negative. However, their interaction was positive and significant, indicating that the existence of only one of the two factors is not sufficient to shape a favorable attitude (and indeed may even have a negative effect). This out-of-body experience drives attitudes only when it is combined with an out-of-place experience, thus enabling an entirely new holistic virtual experience (Blascovich and Bailenson, 2011; Kilteni et al., 2012).

The present findings suggest that neither perceived *physical risk* nor *psychological risk* significantly impact people's attitudes toward VR glasses. However, people do fear *health risks* associated with the actual use of the device. The risk of potential eyesight problems has a negative effect on people's attitudes toward VR glasses. Notably, *privacy risks* were also found to have a significantly negative effect on people's attitudes. A perceived lack of security in the technology and the fear of personal information being improperly accessed or misused appears to create a barrier that prevents people from using VR glasses. This is an interesting finding, since research on a closely related technology, wearable AR devices, has concluded that privacy does not matter to consumers in this context (Rauschnabel et al., 2018; Kalantari, 2017).

Results are in line with prior research on wearables and support the "fashnology" concept in broad strokes (Kalantari, 2017; Jung et al., 2016; Chuah et al., 2016; Rauschnabel et al., 2016), indicating that fashion-related factors (*here:* wearable comfort and perceived fashionability) do matter. However, the results further indicate that consumers do not find the design of today's VR devices convincing.

6.2. Theoretical contribution

As noted, little previous research has been done on VR, although forecasts indicate that the technology is likely to experience rapid future growth within consumer markets (ContextWorld, 2016). The present study provides three major theoretical contributions to this contemporary area:

- The first major theoretical contribution addresses the VR discipline as a whole (Craig et al., 2009). While most prior research has studied VR applications in specific contexts (e.g., Jung et al., 2016), this is—to the best of the authors' knowledge—the first study to assess VR devices in general. It provides researchers interested in understanding VR and its diffusion into consumer markets with a better understanding of why people may adopt VR glasses. Future research in this emerging discipline can build on the present findings; we will discuss avenues for further research below. For example, a novel approach is to study virtual presence and virtual embodiment, as well as their interplay.
- The second contribution is to the literature on consumer adoption of new technologies in general (King and He, 2006). This study provides a novel framework with a specific focus on VR technologies. However, the general idea of identifying relevant factors derived from three perspectives—media, fashion and technology—is also applicable to other wearable devices. This likely outperforms the pure application of existing frameworks. For example, unified frameworks for the study of consumer reactions to technology in general (e.g., Davis, 1989; King and He, 2006; Venkatesh et al., 2012) typically do not incorporate wearable-specific fashion constructs or media specific variables. This study shows that these factors matter. We argue that our framework can also be inspirational to the study of other wearable technologies. For example, ARSGs—wearable, glasses-like devices that use Augmented Reality—are a related form of device. However, whereas the media factors studied here are unique to VR, others (e.g. altering one's environment by integrating virtual object, see Rauschnabel, 2018) may be relevant. Likewise, studies assessing wearables that are worn continuously (and not, as VR glasses, only for specific purposes) could benefit from additional wearable constructs, such as the design fit with one's clothing style. Thus, the innovative approach of this study by incorporating *media*, *technology* and *fashion* can serve as a starting point for the study other wearable devices.
- This leads to the third theoretical contribution. While initial studies have explored the fashion aspects and shown that wearables are indeed processed psychologically like fashion accessories (e.g., Rauschnabel et al., 2016; Chuah et al., 2016), other studies have extended this research with more nuanced findings, as in the case of the qualitative research by Adapa et al. (2018). This study is the first to assess the importance of wearable comfort empirically.

Taken as a whole, the three major theoretical contributions of this study provide evidence that novel technologies require novel frameworks. In other words, applying existing general technology-acceptance frameworks to innovative technologies without substantial adjustment and extension could lead to false or incomplete conclusions. Even when new technologies appear similar to existing ones (e.g., wearable AR devices and wearable VR devices), the underlying mechanisms affecting drivers of and barriers to use may differ substantially.

6.3. Managerial contributions

Multiple recommendations for VR manufacturers and app developers can be derived from this research. We discuss some of the particularly important ones below.

Since VR glasses represent a form of “fashnology”, manufacturers need to develop devices that both look good and feel good. In a similar context, Haque (2015) argues that glasses-like technologies should represent “coolness” and “freedom” that liberates consumers from established norms and ideas. Therefore, simple or plain designs for VR Glasses may not be the only way to move forward. Manufacturers should consider more provocative and unusual designs. Since a majority of consumers do not yet have actual user experience with the technology, this provides manufacturers with the opportunity to develop ‘de facto standards’. This means that a manufacturer of VR Glasses that comes out early with a very novel design that differs from the few previously existing VR devices may successfully create widespread expectations regarding what a VR device “typically” looks like. While specific recommendations regarding what a “cool” design for VR devices may entail are beyond the scope of this study and we do not know how VR technologies will change within the next years (Forbes Agency Council, 2017), promising avenues for manufacturers could include collaborations with designers, brands, fashion manufacturers, celebrities or artists.

Second, most VR manufacturers promote the technology's hedonic benefits. For example, 360-degree videos and games are among the most commonly produced apps. However, this study shows that utilitarian benefits are also important. Promotion of apps that could make a user's life more efficient should complement approaches that focus on entertainment. Indeed, utilitarian and hedonic benefits are positively correlated in this study ($r = 0.62, p < .001$), indicating that people can perceive VR glasses as being both useful and enjoyable. Working with developer teams on apps with utilitarian benefit, and highlighting this in public communications, is therefore highly recommended.

Third, manufacturers should develop strategies to reduce risk factors, particularly with regard to users' health and privacy. Medical research by independent third parties is necessary in order to establish actual health impacts. If health risks cannot be determined objectively, having third-party labels may be a way of reducing the magnitude of this risk perception within the public. With regards to privacy concerns, companies may be able to reduce the issue's saliency by ensuring a transparent use of data, publishing guidelines and behavior restrictions for apps, and giving users more control over the way their data are used.

As VR becomes increasingly common in various sectors such as fashion, automotive, entertainment and tourism, companies developing VR applications should bear in mind that virtual presence and virtual embodiment are only able to attract potential users when combined. While neither virtual possibility affects attitudes toward using VR glasses when implemented separately (and their appearance separately can even have a negative effect), the prospect of experiencing both phenomena together (that is, the sensation of having a different body in a virtual place) is a salient positive driver of consumer attitudes toward the use of VR glasses. Companies in the sector should therefore take care to incorporate both VR experiences in combination when conceptualizing and developing VR apps.

6.4. Limitations and future research

The present study is subject to several limitations. While the sample of German consumers provides a general overview regarding the mechanisms being studied, the inability to obtain more detailed insights into other markets or specific sub-samples (e.g., only those who already own such devices) remains a limitation. More research is needed in order to improve our understanding of how the identified mechanisms differ between users, or how they change once an individual is exposed to VR for the first time. As the present research focused on the characteristics of the VR glasses themselves, consumer characteristics play only a minor role (as control variables). However, personality, demographics motivations, cultural background, peer-characteristics and other individual-difference variables could enhance our understanding of VR glasses by providing additional lenses through which to examine this promising topic. Uses and Gratification Theory (Sundar and Limperos, 2013) or personality theories (e.g., McCrae and Costa Jr, 1999) could be useful starting points for future endeavors. One interesting finding from this research involves the interaction of virtual presence and embodiment—that is, the perceptions of “who one is” and “where one is.” Future research could explore additional dimensions such as “when one is” (time travel). This research conceptualized the exogenous variables as independent from each other. Future studies should deepen our understanding how these variables related to each other. For example, do media factors (i.e. virtual presence) enhance other benefits that we classified as technology factors (e.g. hedonic factors)?[1]

More research is also needed to identify the mechanisms that explain the presence or absence of the consumption drivers and barriers studied here. For example, future studies could seek to determine which design characteristics constitute a “good” design, or which strategies are effective in reducing risks.

7. General conclusions on virtual reality

Without doubt, VR is an emerging topic, and is currently in an early stage of the product lifecycle. This study provides early insights into how consumers react to this innovative and novel media technology. We hope our findings inspire other researchers to investigate this promising field further and apply the idea of investigating future wearable technologies through the lens of media, fashion and technology.

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[1] We thank a reviewer for this suggestion!

Appendix

Appendix 1. Sample demographics. Sample of the VR survey

Age in years (M = 50.3, SD = 17.4 years)	
18–29	17.8%
30–39	11.6%
40–49	18.0%
50–59	18.2%
60–69	13.9%
70 and older	20.5%
Gender	
Male	47%
Female	53%
Experience with/ownership of VR glasses	
No, I have never heard of it	13.3%
No, but I have heard of VR before	76.6%
No, but I have experienced VR before	8.7%
Yes, I own the following device (__)	1.4%
Education	
Primary – /Lower secondary school education without vocational education	1.8%
Primary – /Lower secondary school education with vocational education	19.6%
Secondary school certificate without A-level-completion	27.3%
A-level-certificate without higher/university degree/diploma	26.7%
Higher degree/university diploma	23.9%
n/a	0.7%
Job/occupation	
I work full-time	36.0%
I work part-time	16.7%
I am currently job-seeking	3.9%
I am retired	30.0%
Stay-at-home-wife/husband	5.1%
School student (full-time)	0.8%
University student (full-time)	6.9%
n/a	0.7%
Household income	
Below 1.000 Euro	10.8%
Until below 1.700 Euro	20.1%
1.700 until below 2.700 Euro	22.7%
2.700 until below 3.700 Euro	18.2%
3.700 until below 4.500 Euro	7.9%
4.500 Euro and more	6.4%
Not available/don't wish to answer.	14.0%

Appendix 2. Survey description of virtual reality

VR glasses are small computers that are worn like large glasses. They place the user into a virtual world. Some headsets simply use a smartphone (e.g., Samsung) as their display and motion-tracking device. A user wearing such a headset is completely cut off from reality. The VR headset creates the perception of a three-dimensional 360-degree world around the user. Thus, a user can be placed into a foreign city and look around the surroundings much as if he/she was there in reality.

[plus two photos, one of a device and one in use].

Appendix 2. Measurement model and confirmatory factor analysis. VR constructs

Construct, items, reference	CA	CR	AVE
Perceived fashionability (inspired by Moore and Benbasat, 1991)	0.84	0.73	0.84
I look good wearing VR glasses.			
VR glasses are fashionable.			
Wearable comfort (ad hoc scale)	0.99	0.82	0.90
Wearing VR glasses is comfortable.			
It feels good to wear VR glasses.			
Utilitarian benefits (inspired by Davis, 1989; Venkatesh et al., 2012)	0.75	0.61	0.76
I can complete tasks more quickly and/or successfully by wearing VR glasses.			
Using VR glasses can be useful.			

Hedonic benefits (inspired by Davis, 1989; Venkatesh et al., 2012)	0.93	0.81	0.93
Using VR glasses could be fun.			
Using VR glasses could be a welcome distraction from everyday life.			
Using VR glasses could offer entertainment.			
Health risk (inspired by Featherman and Pavlou, 2003)	0.96	0.93	0.96
Wearing VR glasses could damage my eyesight.			
Wearing VR glasses could negatively affect my eyesight.			
Physical risk (inspired by Featherman and Pavlou, 2003)	0.89	0.81	0.90
I could hurt myself on physical, real-world objects wearing VR glasses.			
I am susceptible to injury while wearing a VR headset because I cannot see my surroundings.			
Psychological risk (inspired by Featherman and Pavlou, 2003)	0.91	0.84	0.91
Wearing VR glasses could be psychologically damaging.			
Wearing VR glasses could be dangerous for the human psyche.			
Privacy risk (inspired by Malhotra et al., 2004)	0.96	0.92	0.96
Using VR glasses, a manufacturer could gather too much personal information about me.			
VR glasses could gather too much personal information about me.			
Virtual presence	0.93	0.82	0.93
VR glasses could place me into various new locations.			
I could have the feeling of being at a different location while using a VR glasses.			
VR glasses could give me the feeling of being at a different location.			
Virtual embodiment	0.92	0.80	0.92
VR glasses convey the feeling of having another body.			
VR glasses convey the feeling of being another person.			
VR glasses offer the possibility of being another character.			
Attitude toward using of VR glasses (inspired by Davis, 1989)	0.95	0.90	0.95
By and large, VR glasses are good products.			
Generally, I have a positive attitude toward VR glasses.			
(Re)purchase intention (inspired by Lu et al., 2005)	0.93	0.82	0.93
I would buy VR glasses.			
I plan on purchasing VR glasses.			
Buying VR glasses is a good idea.			
VR familiarity (ad hoc)	n/a	n/a	n/a
[Explanation of VR; see Appendix 1][a]			
Do you own such a device?			
(1) No, and I have never heard of this before.			
(2) No, but I have already heard about this before.			
(3) No, but I have already tried it.			
(4) Yes, and I own the following device: [open text field]			

Note: α = Cronbach's alpha; C.R. = composite reliability; AVE = average variance extracted; VR = Virtual Reality.
7p scales, higher values indicate higher agreement/more favorable evaluations.

[a] Single item; α, AVE and CR are n/a for single items; values 3 and 4 were grouped due to unequal distributions; variable was treated as metric in the model to reduce model complexity. Items were slightly reworded for users/non-users. For example, "I would buy VR glasses" for non-owners and "I would buy VR glasses again" for owners. Detailed wording available upon request.

CFA global fit indices: $Chi^2 = 1107$, df = 371, $p < .001$; $Chi^2/df = 2.99$; CFI = 0.94; TLI = 0.93; SRMR = 0.06; RMSEA = 0.06; we also assessed all two-item scales using correlations between the items; the results reflect the conclusions of CA and CR. All items were measured in German and available upon request.

Appendix 3. Consumers' perception of virtual reality technology: descriptive statistics and correlations

		M	SD	1	2	3	4	5	6	7	8	9	10	11
1	Physical risks	3.89	1.62											
2	Health risks	3.61	1.69	0.52										
3	Psychological risks	3.30	1.70	0.50	0.63									
4	Privacy risks	4.09	1.77	0.47	0.52	0.57								
5	Hedonic benefits	5.06	1.44	−0.05	−0.28	−0.29	−0.15							
6	Virtual embodiment	5.21	1.44	−0.06	−0.24	−0.18	−0.15	0.81						
7	Virtual presence	3.95	1.60	0.06	−0.05	0.04	−0.07	0.48	0.63					
8	Utilitarian benefits	3.49	1.44	−0.09	−0.18	−0.16	−0.12	0.62	0.50	0.62				
9	Wearable comfort	3.07	1.35	−0.13	−0.19	−0.16	−0.16	0.43	0.35	0.39	0.59			
10	Perceived fashionability	2.14	1.31	−0.10	−0.06	−0.08	−0.14	0.11	0.10	0.30	0.47	0.70		
11	Purchase intention	2.58	1.64	−0.16	−0.28	−0.24	−0.24	0.58	0.44	0.35	0.60	0.51	0.39	
12	Attitude toward using	3.70	1.74	−0.19	−0.40	−0.36	−0.31	0.72	0.53	0.33	0.66	0.53	0.28	0.83

References

Ackerman, M.S., 2004. Privacy in pervasive environments: next generation labeling protocols. Pers. Ubiquit. Comput. 8 (6), 430–439.
Adapa, A., Nah, F.F.H., Hall, R.H., Siau, K., Smith, S.N., 2018. Factors influencing the adoption of smart wearable devices. Int. J. Hum. Comput. Interact. 34 (5), 399–409.
Agarwal, R., Karahanna, E., 2000. Time flies when you're having fun: cognitive absorption and beliefs about information technology usage. MIS Q. 665–694.
Armstrong, A., Hagel, J., 2000. The real value of online communities. In: Knowledge and Communities, pp. 85–95.
Arning, K., Kowalewski, S., Ziefle, M., 2014. Health concerns versus mobile data needs: conjoint measurement of preferences for mobile communication network scenarios. Hum. Ecol. Risk Assess. Int. J. 20 (5), 1359–1384.
Banakou, D., Hanumanthu, P.D., Slater, M., 2016. Virtual embodiment of white people in a black virtual body leads to a sustained reduction in their implicit racial bias. Front. Hum. Neurosci. 10, 601.
Barnes, S.J., Mattsson, J., Hartley, N., 2015. Assessing the value of real-life brands in virtual worlds. Technol. Forecast. Soc. Chang. 92, 12–24.
Barnes, Stuart, Understanding Virtual Reality in Marketing: Nature, Implications and Potential (2016) November 3. Available at SSRN: https://ssrn.com/abstract=2909100.
Barney, J.B., Hansen, M.H., 1994. Trustworthiness as a source of competitive advantage. Strateg. Manag. J. 15 (S1), 175–190.
Beaudoin, P., Moore, M.A., Goldsmith, R.E., 1998. Young fashion leaders' and followers' attitudes toward American and imported apparel. J. Prod. Brand Manag. 7 (3), 193–207.
Belk, R.W., 1978. Assessing the effects of visible consumption on impression formation. Adv. Consum. Res. 5 (1), 39–47.
Bierhoff, H.W., 1989. Person Perception and Attribution. Springer, New York.
Biocca, F., Harms, C., Burgoon, J.K., 2003. Toward a more robust theory and measure of social presence: review and suggested criteria. Presence Teleop. Virt. 12 (5), 456–480.
Blascovich, J., Bailenson, J., 2011. Infinite Reality: Avatars, Eternal Life, New Worlds, and the Dawn of the Virtual Revolution. William Morrow Co.
Botvinick, M., Cohen, J., 1998. Rubber hands 'feel' touch that eyes see. Nature 391 (6669), 756.
Bowman, D.A., McMahan, R.P., 2007. Virtual reality: how much immersion is enough? Computer 40 (7).
Bulu, S.T., 2012. Place presence, social presence, co-presence, and satisfaction in virtual worlds. Comput. Educ. 58 (1), 154–161.
Burdea, G., Coffet, P., 2003. Virtual Reality Technology. Wiley-IEEE Press, Second Edition.
Chester, R., 2017. Health Warning as Immersive Virtual Reality Craze Linked to Vision Problems. http://www.news.com.au/technology/gadgets/wearables/health-warning-as-immersive-virtual-reality-craze-linked-to-vision-problems/news-story/a67849532e82d857be7a3524c91ef11e.
Choi, J., Kim, S., 2016. Is the smartwatch an IT product or a fashion product? A study on factors affecting the intention to use smartwatches. Comput. Hum. Behav. 63, 777–786.
Chuah, S.H.W., Rauschnabel, P.A., Krey, N., Nguyen, B., Ramayah, T., Lade, S., 2016. Wearable technologies: the role of usefulness and visibility in smartwatch adoption. Comput. Hum. Behav. 65, 276–284.
Cocosila, M., Turel, O., Archer, N., Yuan, Y., 2007. Perceived health risks of 3G cell phones: do users care? Commun. ACM 50 (6), 89–92.
Collier, G., 1995. Information privacy. Inform. Manag. Comput. Secur. 3 (1), 41–45.
Connolly, R., Bannister, F., 2007. Consumer trust in internet shopping in Ireland: towards the development of a more effective trust measurement instrument. J. Inf. Technol. 22, 102–118.
ContextWorld, 2016. Virtual Reality – Survey Report. https://www.contextworld.com/documents/20182/429003/1.VR+Report+E-Commerce.pdf (retrieved: 8/15/2018).
Craig, A.B., Sherman, W.R., Will, J.D., 2009. Developing Virtual Reality Applications: Foundations of Effective Design. Morgan Kaufmann.
Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. 319–340.
de la Pena, N., Weil, P., Llobera, J., Giannopoulos, E., Pomes, A., Spanlang, B., Friedman, D., Sanchez-Vives, M.V., Slater, M., 2010. Immersive journalism: immersive virtual reality for the first-person experience of news. Presence Teleop. Virt. 19 (4), 291–301.
Dehghani, M., 2018. Exploring the motivational factors on continuous usage intention of smartwatches among actual users. Behav. Inform. Technol. 37 (2), 145–158.
Didehbani, N., Allen, T., Kandalaft, M., Krawczyk, D., Chapman, S., 2016. Virtual reality social cognition training for children with high functioning autism. Comput. Hum. Behav. 62, 703–711.
Easey, M., 2009. Fashion Marketing. John Wiley & Sons.
Ehrsson, H.H., 2007. The experimental induction of out-of-body experiences. Science 317 (5841), 1048.
Eisenmann, T., Barley, L., Kind, L., 2014. Google glass. In: Harvard Business Case Study.
Featherman, M.S., Pavlou, P.A., 2003. Predicting e-services adoption: a perceived risk facets perspective. Int. J. Hum. Comput. Stud. 59 (4), 451–474.
Fishbein, M., Ajzen, I., 1975. Belief, Attitude, Intention and Behavior: an Introduction to Theory and Research.
Forbes Agency Council, 2017. Virtual Reality – The Future Of Media Or Just A Passing Trend? https://www.forbes.com/sites/forbesagencycouncil/2017/05/30/virtual-reality-the-future-of-media-or-just-a-passing-trend/ (Retrieved 8/20/2017).
Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 39–50.
Freina, L., Ott, M., 2015. A literature review on immersive virtual reality in education: state of the art and perspectives. In: The International Scientific Conference eLearning and Software for Education. Carol I, vol. 1. National Defense University, pp. 133 (January).
Gibson & O'Rawe, tom Dieck, C.M., 2018. Virtual reality as a travel promotional tool: insights from a consumer travel fair. In: Jung, Timothy (Ed.), Augmented Reality and Virtual Reality: Empowering Human, Place and Business. Springer forthcoming.
Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L., 2006. Multivariate Data Analysis. vol. 6.
Haque, U., 2015. Google glass failed because it just wasn't cool. In: Harvard Business Review Blog, . https://hbr.org/2015/01/google-glass-failed-because-it-just-wasnt-cool.
Haridakis, P., Hanson, G., 2009. Social interaction and co-viewing with YouTube: blending mass communication reception and social connection. J. Broadcast. Electron. Media 53 (2), 317–335.
Hayes, A.F., 2013. Introduction to Mediation, Moderation, and Conditional Process Analysis: a Regression-based Approach. Guilford Press.
Hayhurst, J., 2018. How augmented reality and virtual reality is being used to support people living with dementia—design challenges and future. In: Jung, Timothy, tom Dieck, C.M. (Eds.), Augmented Reality and Virtual Reality: Empowering Human, Place and Business. Springer forthcoming.
Held, R.M., Durlach, N.I., 1992. Telepresence. Presence Teleop. Virt. 1 (1), 109–112.
Holman, R.H., 1980. Clothing as communication: an empirical investigation. Adv. Consum. Res. 7 (1), 372–377.
Homburg, C., Schwemmle, M., Kuehnl, C., 2015. New product design: concept, measurement, and consequences. J. Mark. 79 (3), 41–56.
Huang, Y.C., Backman, K.F., Backman, S.J., Chang, L.L., 2016. Exploring the implications of virtual reality technology in tourism marketing: an integrated research framework. Int. J. Tour. Res. 18 (2), 116–128.
Jegethesan, K., Sneddon, J.N., Soutar, G.N., 2012. Young Australian consumers' preferences for fashion apparel attributes. J. Fash. Mark. Manag. 16 (3), 275–289.
Jou, M., Wang, J., 2013. Investigation of effects of virtual reality environments on learning performance of technical skills. Comput. Hum. Behav. 29 (2), 433–438.
Jung, Y., Kim, S., Choi, B., 2016. Consumer valuation of the wearables: the case of smartwatches. Comput. Hum. Behav. 63, 899–905.
Kalantari, M., 2017. Consumers' adoption of wearable technologies: literature review, synthesis, and future research agenda. Int. J. Technol. Mark. 12 (3), 274–307.
Kilteni, K., Groten, R., Slater, M., 2012. The sense of embodiment in virtual reality. Presence Teleop. Virt. 21 (4), 373–387.
Kim, K.J., Shin, D.H., 2015. An acceptance model for smart watches: implications for the adoption of future wearable technology. Internet Res. 25 (4), 527–541.
King, W.R., He, J., 2006. A meta-analysis of the technology acceptance model. Inf. Manag. 43 (6), 740–755.
Knight, J.F., Baber, C., 2005. A tool to assess the comfort of wearable computers. Hum. Factors 47 (1), 77–91.
Kuru, A., Erbuğ, Ç., 2013. Explorations of perceived qualities of on-body interactive products. Ergonomics 56 (6), 906–921.
Lee, M., Burns, L.D., 1993. Self consciousness and clothing purchase criteria of Korean and United States college women. Cloth. Text. Res. J. 11 (4), 32–40.
Lenggenhager, B., Tadi, T., Metzinger, T., Blanke, O., 2007. Video ergo sum: manipulating bodily self-consciousness. Science 317 (5841), 1096–1099.
Lewis, J.D., Weigert, A., 1985. Trust as a social reality. Soc. Forces 63 (4), 967–985.
Lucas, K., Sherry, J.L., 2004. Sex differences in video game play: a communication-based explanation. Commun. Res. 31 (5), 499–523.
Luo, X., Li, H., Zhang, J., Shim, J.P., 2010. Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: an empirical study of mobile banking services. Decis. Support. Syst. 49 (2), 222–234.
Maister, L., Sebanz, N., Knoblich, G., Tsakiris, M., 2013. Experiencing ownership over a dark-skinned body reduces implicit racial bias. Cognition 128 (2), 170–178.
Maister, L., Slater, M., Sanchez-Vives, M.V., Tsakiris, M., 2015. Changing bodies changes minds: owning another body affects social cognition. Trends Cogn. Sci. 19 (1), 6–12.
Malhotra, N.K., Kim, S., Agarwal, J., 2004. Internet users' information privacy concerns (IUIPC): the construct, the scale, and a causal model. Inf. Syst. Res. 15 (4), 336–355.
McCrae, R.R., Costa Jr., P.T., 1999. A five-factor theory of personality. In: Handbook of Personality: Theory and Research. 2. pp. 139–153.
Mason, R.O., 1986. Four ethical issues of the information age. MIS Q. 10 (1), 46–55.
Moore, G.C., Benbasat, I., 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. Inf. Syst. Res. 2 (3), 192–222.
Mukamal, Reena, 2017. Are Virtual Reality Headsets Safe for Eyes? American Academy of Ophthalmology. https://www.aao.org/eye-health/tips-prevention/are-virtual-reality-headsets-safe-eyes.
Peck, T.C., Seinfeld, S., Aglioti, S.M., Slater, M., 2013. Putting yourself in the skin of a black avatar reduces implicit racial bias. Conscious. Cogn. 22 (3), 779–787.
Pejsa, J., Gleicher, M., Mutlu, B., 2017. Who, me? How virtual agents can shape conversational footing in virtual reality. In: Proceedings of International Conference on Intelligent Virtual Agents (IVA 2017), Stockholm, Sweden.
Peterson, M., 2005. Learning interaction in an avatar-based virtual environment: a preliminary study. PacCALL J. 1 (1), 29–40.
Petkova, V.I., Ehrsson, H.H., 2008. If I were you: perceptual illusion of body swapping. PLoS One 3 (12), e3832.
Plante, T.G., Aldridge, A., Bogden, R., Hanelin, C., 2003. Might virtual reality promote the mood benefits of exercise? Comput. Hum. Behav. 19 (4), 495–509.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended

remedies. J. Appl. Psychol. 88 (5), 879.
Rauschnabel, P.A., Hein, D.W., He, J., Ro, Y.K., Rawashdeh, S., Krulikowski, B., 2016. Fashion or technology? A fashnology perspective on the perception and adoption of augmented reality smart glasses. *i-com* 15 (2), 179–194.
Rauschnabel, P.A., 2018. Virtually enhancing the real world with holograms: an exploration of expected gratifications of using augmented reality smart glasses. Psychol. Mark. 35 (8), 557–572.
Rauschnabel, P.A., He, J., Ro, Y.K., 2018. Antecedents to the adoption of augmented reality smart glasses: A closer look at privacy risks. J. Bus. Res. *92*, 374–384.
Rese, A., Baier, D., Geyer-Schulz, A., Schreiber, S., 2017. How augmented reality apps are accepted by consumers: a comparative analysis using scales and opinions. Technol. Forecast. Soc. Chang. 124, 306–319.
Riva, G., Mantovani, F., Capideville, C.S., Preziosa, A., Morganti, F., Villani, D., ... Alcañiz, M., 2007. Affective interactions using virtual reality: the link between presence and emotions. Cyber Psychol. Behav. 10 (1), 45–56.
Rizzo, A., Cukor, J., Gerardi, M., Alley, S., Reist, C., Roy, M., ... Difede, J., 2015. Virtual reality exposure for PTSD due to military combat and terrorist attacks. J. Contemp. Psychother. 45 (4), 255–264.
Rogers, E.M., Shoemaker, F.F., 1971. Communication of innovations. In: A Cross-cultural Approach.
Scholz, J., Smith, A.N., 2016. Augmented reality: designing immersive experiences that maximize consumer engagement. Bus. Horiz. 59 (2), 149–161.
Serino, S., Pedroli, E., Keizer, A., Triberti, S., Dakanalis, A., Pallavicini, F., et al., Riva, G., 2016. Virtual reality body swapping: a tool for modifying the allocentric memory of the body. Cyberpsychol. Behav. Soc. Netw. 19 (2), 127–133.
Sheridan, T.B., 1992. Musings on telepresence and virtual presence. Presence Teleop. Virt. 1 (1), 120–126.
Slater, M., Wilbur, S., 1997. A framework for immersive virtual environments (FIVE): speculations on the role of presence in virtual environments. Presence Teleop. Virt. 6 (6), 603–616.
Slater, M., Spanlang, B., Sanchez-Vives, M.V., Blanke, O., 2010. First person experience of body transfer in virtual reality. PLoS One 5 (5), e10564.
Stock, B., dos Santos Ferreira, T.P., Ernst, C.P.H., 2016. Does perceived health risk influence smartglasses usage? In: The Drivers of Wearable Device Usage. Springer, pp. 13–23.
Summers, T.A., Belleau, B.D., Xu, Y., 2006. Predicting purchase intention of a controversial luxury apparel product. J. Fash. Mark. Manag. 10 (4), 405–419.
Sundar, S.S., Limperos, A.M., 2013. Uses and grats 2.0: new gratifications for new media. J. Broadcast. Electron. Media 57 (4), 504–525.
tom Dieck, M.C., Jung, T., 2015. A theoretical model of mobile augmented reality acceptance in urban heritage tourism. Curr. Issue Tour. 1–21.
tom Dieck, M.C., Jung, T., Han, D.I., 2016. Mapping requirements for the wearable smart glasses augmented reality museum application. J. Hosp. Tour. Technol. 7 (3), 230–253.
Tunca, S., Fueller, J., 2009. Impression formation in a world full of fake products. Adv. Consum. Res. 36, 287–292.
Venkatesh, V., Bala, H., 2008. Technology acceptance model 3 and a research agenda on interventions. Decis. Sci. 39 (2), 273–315.
Venkatesh, V., Davis, F.D., 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. Manag. Sci. 46 (2), 186–204.
Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D., 2003. User acceptance of information technology: toward a unified view. MIS Q. 425–478.
Venkatesh, V., Thong, J.Y., Xu, X., 2012. Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS Q. 36 (1), 157–178.
Wang, Q., Sun, X., 2016. Investigating gameplay intention of the elderly using an extended technology acceptance model (ETAM). Technol. Forecast. Soc. Chang. 107, 59–68.
Watson, Z.M., Yan, R.N., 2013. An exploratory study of the decision processes of fast versus slow fashion consumers. J. Fash. Mark. Manag. 17 (2), 141–159.
Witmer, B.G., Singer, M.J., 1998. Measuring presence in virtual environments: A presence questionnaire. Presence Teleop. Virt. 7 (3), 225–240.
Yang, H., Yu, J., Zo, H., Choi, M., 2016. User acceptance of wearable devices: an extended perspective of perceived value. Telematics Inform. 33 (2), 256–269.
Yee, N., Bailenson, J.N., 2007. The Proteus effect: self transformations in virtual reality. Hum. Commun. Res. 33 (3), 271–290.
Yee, N., Bailenson, J.N., Ducheneaut, N., 2009. The Proteus effect: implications of transformed digital self-representation on online and offline behavior. Commun. Res. 36 (2), 285–312.
You, S., Kim, E., Lee, D., 2017. Virtually real: exploring avatar identification in game addiction among massively multiplayer online role-playing games (MMORPG) players. Games Cult. 12 (1), 56–71.
Zeng, L., 2011. More than audio on the go: uses and gratifications of MP3 players. Commun. Res. Rep. 28, 97–108.

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