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RESEARCH ARTICLE

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Virtually enhancing the real world with holograms: An exploration of expected gratifications of using augmented reality smart glasses

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Abstract

Integrating virtual objects into the physical world is about to become real. Augmented reality smart glasses (ARSG), such as Microsoft HoloLens and other head-mounted displays, allow users to augment and enhance their subjective perceptions of reality. However, extant research lacks findings to explain why people intend to use ARSGs in particular situations. To address this highly relevant research gap, this study proposes and tests a theoretical model that examines people's expected gratifications from ARSG usage. In doing so, this research enhances the understanding of ARSGs and adds novel constructs (e.g., desired enhancement of reality) to the stream of technology and media adoptance.

KEYWORDS

augmented reality smart glasses (ARSG), fashnology, mixed reality, uses and gratifications theory, wearable technology

1 | INTRODUCTION

With the advent of smart mobile technologies, people are online anytime and anywhere. For example, people take photos with their smartphones and upload them on Instagram, "check in" at bars, and tag friends who surround them. While technologies and social media have moved the virtual and real world closer together, the next groundbreaking technology is at the ready: technologies that integrate virtual elements realistically into a user's perception of the real world (Javornik, 2016). In particular, a new technology called "augmented reality smart glasses" (ARSGs) offers users the opportunity to integrate three-dimensional, virtual elements realistically and in real time into their view field (Ernst, Stock, & dos Santos Ferreira, 2016; Rauschnabel, He, Ro, and Krulikowski 2016a). While prior research has investigated both augmented reality (AR) and wearable technologies (e.g., Chuah et al., 2016; Scholz & Smith, 2016), ARSGs remain an under-researched but fruitful area. Recently, Google, Alibaba, and other firms have invested roughly $800 million of venture capital into Magic Leap, a start-up specializing in ARSGs. Likewise, companies such as Amazon.com, Microsoft, Samsung, and Elbit Systems have launched or announced ARSGs. Market research supports this development with promising numbers. For example, PWC (2015, p. 4) recently noted that there is a life-changing wearable future "right around the corner," and a Goldman Sachs (2016, p. 4) report concludes that AR has the potential to "become the next big computing platform, and as we saw with the PC and smartphone, we expect new markets to be created and existing markets to be disrupted." Google Glass, in contrast, is an example of ARSGs with limited success. However, extant research does not provide sufficient information about the factors that might determine an ARSG's market success.

Understanding ARSGs is particularly important theoretically because, for most people, they are an entirely novel technology, rather than just an extension of an existing stream of media devices. For example, when comparing traditional cell phones with smartphones, information is still displayed on the front, but the latter provide features (e.g., chat, Internet) with which consumers are often already familiar. The same is true for smartwatches or tablets. However, for ARSGs, three-dimensional, virtual information is not restricted to a display; ARSGs can realistically integrate virtual content into the real world which so far no existing technology could do. This lack of precedence leads to many unanswered questions, such as the following: How can users benefit from altering their real world? What "value" do people want to gain from ARGS to organize their lives, be entertained, or socialize? In addition, use of ARSGs is highly visible to other people, such that users might benefit not only from using them (content gratification) but also from wearing them (process gratification)—another example of an under-research area. Furthermore, ARSGs share several similarities to fashion accessories (Rauschnabel et al., 2016b). Traditional media and technology acceptance theories might not cover all relevant usage motivations and thus might benefit from

findings in fashion research. Therefore, drawing from uses and gratifications theory (U&GT), this research aims to address two research questions:

1. Which gratifications do consumers' receive from using ARSGs? In particular, which expected content and process gratifications are associated with people's intention to use ARSGs?
2. How do these motivations differ between different usage contexts?

Providing answers to these questions serves to contribute to the literature in three ways. First, by developing a comprehensive framework of gratifications associated with ARSG usage in different contexts, we shed light on the theoretical mechanisms that lead to the intended use of ARSGs. While prior research has focused predominantly on utilitarian gratifications, this research identifies three utilitarian gratifications: sensual, social, and symbolic. These new gratifications also extend prior U&GT research, in that we introduce novel, ARSG-specific gratifications that are conceptually linked to fundamental human needs (Claffey & Brady, 2017; Katz, Haas, & Gurevitch, 1973; Rubin, 2002; Ruggiero, 2000; Sundar & Limperos, 2013). For example, we introduce and validate two novel gratifications—desired enhancement of reality and wearable comfort—that address consumers' affective needs by providing sensual gratification. Considering that forecasts predict that ARSGs will soon be ubiquitous, understanding these motivations is highly relevant. Second, this research suggests a two-dimensional conceptualization of usage intention: usage in private and usage in public. The results show that drivers between these two usage dimensions differ substantially. This notion is important for U&GT in particular and technology acceptance research in general because media technologies are often used in different contexts. Third, any findings in the early stage of the product life cycle can help researchers, managers, and policy makers better understand a promising future technology and its diffusion.

2 | THEORY AND PRIOR RESEARCH

2.1 | Augmented and virtual reality, and ARSGs

Neither AR nor wearable technologies are new, but their combination as ARSGs is. To better understand the unique characteristics, in Table 1 we provide a novel classification of media technologies. The *y*-axis describes the physical characteristics of devices: stationary (e.g., desktop computers), mobile (e.g., laptop computers, smartphones), and wearables. Wearable devices often imitate traditional wearable accessories; for example, a smartwatch is worn like a regular watch. Because wearable devices share similarities to fashion, they are also discussed in terms of "*fashnology*," a combination of fashion and technology (Chuah et al., 2016; Dehghani, 2018; Dehghani, Kim, & Dangelico, 2018; Kalantari, 2017; Rauschnabel et al., 2016b). This stream of research argues that to understand how consumers react to wearable devices, scholars must incorporate both fashion- and technology-related factors in their research (Kalantari, 2017). The *x*-axis reports the characteristics of the user and reality. Virtual technologies provide access to a virtual environment through screen-like technologies. For example, desktop and laptop computers have a monitor, smartphones and tablets have touch screens, and virtual reality glasses have built-in screens that help separate a user from reality (Craig, 2013; tom Dieck & Jung 2018).

In contrast, AR aims to integrate virtual elements into a user's perception of reality (Rese, Baier, Geyer-Schulz, & Schreiber, 2017). Stationary AR devices, such as virtual mirrors, are huge screens in which customers can see themselves and virtually explore wearing different clothes (Anderson, Grossman, Matejka, & Fitzmaurice, 2013). Mobile devices, such as smartphones, install AR apps (tom Dieck & Jung, 2018); for example, with an AR translation app a user can hold a smartphone over any foreign language text to read a translation automatically. Likewise, Pokémon Go users can look "through" their mobile devices to see and catch Pokémon, and thus, interact with virtual creatures as if they were real (Rauschnabel, Rossmann, & tom Dieck, 2017).

ARSGs, however, combine the aspects of wearable devices and AR applications: they are worn like regular glasses and integrate virtual information realistically into the user's view field (Craig, 2013) through various sensors (e.g., cameras, GPS, microphone) that capture the real world. Although media and technology researchers agree that the usage context is relevant (e.g., Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012), most prior research studied adoption drivers in one particular context. As discussed later in more detail, we argue that different factors drive ARSG usage in situations where other people are present (e.g., in public) or not (e.g., at home). One particular reason is the fashion component of ARSGs. For instance, if a user expects to gratify from other peoples' feedback on wearing ARSGs (a motivation known from the fashion literature; see, for example, Summers, Belleau, and Xu (2006) or Beaudoin et al. (1998)), they might be motivated to wear ARSGs in public.

Figure 1 shows the functionalities of ARSGs schematically. Here, a user wearing ARSGs is looking at an empty table but sees a virtual car. The left side of the figure is a schematic representation, while the right side shows the user's ego perspective. In contrast, virtual reality glasses are totally closed off from reality (Craig, 2013). That is, a virtual reality user might see the virtual car, maybe on a virtual table, but not the real, physical table.

The objective of this research is to better understand people's reactions to ARSGs. First, from a contextual perspective, this study aims to deepen understanding of the expected "value" users can attain from using ARSGs. Second, from a U&GT perspective, this study strives to identify and test relevant ARSG-specific gratifications. This contribution is important because U&GT research has not yet explored the unique gratifications users can obtain from AR in general and ARSGs in particular. Third, this research argues that gratifications differ between contexts. In particular, we argue that different gratifications relate to the intended use in private versus public contexts.

2.2 | U&GT

U&GT is rooted in communication science and addresses the fundamental question of why people use particular media (Ruggiero, 2000). In contrast with mass-media theories, U&GT assumes that audiences act in a goal-oriented manner and actively choose the media they

TABLE 1 Classification of technologies

Physical Characteristics	Wearable	Smartwatches/fitness trackers (e.g., Apple watch, Samsung Gear, FitBit Flex 2) Virtual reality glasses (e.g., Oculus Rift)	ARSGs (e.g., Microsoft HoloLens, Google Glass, Everysight Raptor, Vuzix m300) Smart contact lens (e.g., as announced by Alphabet)
	Mobile	Smartphones, tablets, laptops (e.g., Samsung S7, iPad, Mac Air)	AR apps for smartphones (e.g., Wikitude)
	Stationary	Desktop computers (e.g., Dell OptiPlex)	Virtual mirrors (e.g., Cisco StyleMe)
		Virtual	Augmented
		Reality	

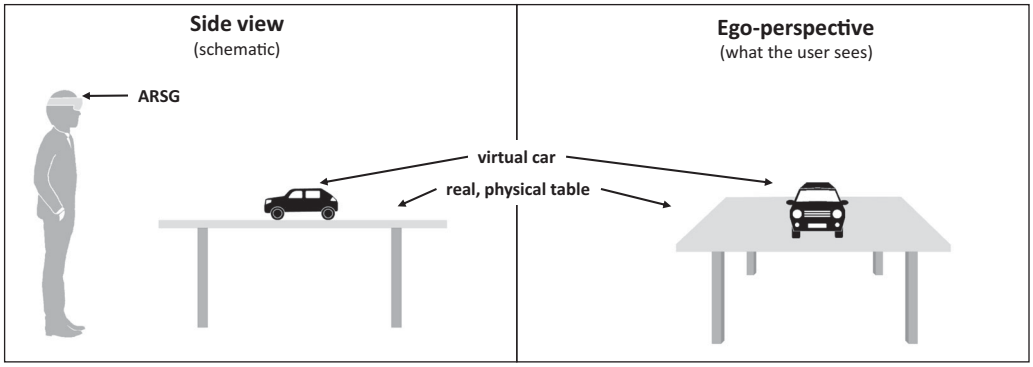

FIGURE 1 Schematic characteristics of ARSGs
Note: ARSG = Augmented Reality Smart Glasses.

want to consume, as driven by their individual needs and motivations (Katz et al., 1973; Rubin, 2002). Needs represent something essential or desirable that a consumer lacks. That is, needs are fundamental elements and the starting point of the process generating behavioral outcomes. According to U&GT, people tend to be motivated to fulfill unsatisfied needs by using particular media. Therefore, motivations represent "general dispositions that influence people's actions taken to fulfill a need or want" (Papacharissi & Rubin, 2000, p. 179). These needs and motivations drive people's media choices through their evaluation of media based on gratifications. Gratifications sought refer to the intended or expected gains from media use, whereas gratifications obtained are the actual gains received from media use (Palmgreen, Wenner, & Rayburn, 1980). Although people's needs may vary depending on individual characteristics, they can be classified into five categories (Katz et al., 1973): (1) cognitive needs (e.g., information gathering, understanding), (2) tension-release needs (e.g., escapism, diversion), (3) affective needs (e.g., aesthetics, emotional experiences), (4) social integrative needs (e.g., social relationships), and (5) personal integrative needs (e.g., confidence building, credibility).

People with one or more of these needs are motivated to use media they expect to attain gratification from by satisfying these needs. For example, a person with social integrity needs (e.g., a person moving to another city who does not know anyone there) might be motivated to use media that helps him or her find new friends (motivation). This person might value an online social network to find new friends (gratifications sought). If this person finds new friends through this social network (gratifications obtained), he or she might be willing to continue using this platform.

U&GT is not without its critics (Ruggiero, 2000), but it remains one of the most widely applied theories in human communication research (Rubin, 2002). For example, studies have applied U&GT to examine reality TV consumption (Patino, Kaltcheva, & Smith, 2012) and other forms of new media formats (Claffey & Brady, 2017; Kim et al., 2008), or online games (Wu, Wang, & Tsai, 2010). In addition, research has integrated U&GT with other theories to investigate the adoption and use of technologies and services (Nysveen, Pedersen, & Thorbjørnsen, 2005), including ARSGs (Rauschnabel et al., 2016a). Indeed, many of the studied U&GT constructs have counterparts in other theories. For example, the technology acceptance model (TAM) is rooted in information systems literature and stems from the theories of planned behavior and of reasoned action (Davis, 1989; King & He, 2006). TAM was initially developed to understand workers' use of computers and was subsequently extended to explain the acceptance of consumer technologies (e.g., Venkatesh et al., 2012). Most TAM research includes a factor termed "perceived usefulness" or "performance expectancies" to describe the extent to which a person believes that using a technology improves his or her performance. Through the lens of U&GT, this construct reflects utilitarian gratification that addresses cognitive needs (Katz et al., 1973). Likewise, perceived enjoyment in the TAM literature describes the amount of "fun" experienced from using a technology (King & He, 2006). This is an example of hedonic gratification that addresses tension-release needs (Rubin, 2002).

2.3 | Prior research

A few studies have investigated factors related to the adoption of ARSGs, largely building on the TAM (Davis, 1989) and its extensions.

TABLE 2 Synopsis of prior ARSG research from a U&GT perspective

			Gratifications					
Study	**Theory**	**Sample**	**Utilitarian functional benefits that allow users to do certain tasks better or faster**	**Hedonic aspects such as fun, enjoyment, and entertainment**	**Sensual (Visual) stimulating and sensory benefits from using ARSGs**	**Sensual (Physical) physical feeling of wearing ARSGs**	**Symboic impact of wearing arsgs on impression of other people**	**Social improving existing or creating new social relationships by wearing ARSGs**
Rauschnabel and Ro (2016)	TAM	*N* = 201 (Germany)	✓				(✓)	
Rauschnabel et al. (2016a)	TAM, U&GT, privacy research	*N* = 285 & *n* = 1,682 (United States)	✓	✓			✓	
Weiz et al. (2016)	TAM	*N* = 111 (Germany)	✓					
Ernst et al. (2016)	TAM	*N* = 109 (Germany)	✓					
Stock et al. (2016)	TAM	*N* = 109 (Germany)		✓				
Hein and Rauschnabel (2016)	TAM	Conceptual	[✓]	[✓]		[✓]	[✓]	
This study	**U&GT**	***N* = 228 (United States)**	✓	✓	✓	✓	✓	✓

Note: ✓ studied and found a significant effect;(✓) studied but did not find a significant effect; [✓] proposed effect conceptually but not empirically tested.Research does not always use the term "gratification," and not all of them argue on the basis of prior U&GT research. This table provides an overview through the lens of U&GT research. For example, for utilitarian benefits, most studies used a construct termed 'perceived usefulness', which, in U&GT, represents a utilitarian gratification. Other investigated factors (e.g., risks) are not included in this table.

Table 2 summarizes these studies and discusses the drivers of people's reactions through the lens of U> it also shows how the current research extends this stream. Most studies have incorporated utilitarian gratifications. For example, Rauschnabel and Ro (2016) examine perceived usefulness (or functional benefits), and Ernst et al. (2016) incorporate the potential of ARSGs to replace physical objects in real life. Prior studies have also examined hedonic benefits, such as entertainment gratification of ARSGs (Rauschnabel et al., 2016a). With regard to symbolic benefits, Rauschnabel and Ro (2016) find no significant effect of using Google Glass on self-expressive benefits among German consumers. However, using two studies based in the United States, Rauschnabel et al. (2016a) confirm that the impact of wearing ARSGs on a user's physical appearance is associated with usage intention.

In addition to these gratification drivers of ARSG usage, studies have examined the role of other variables in ARSG adoption. For example, scholars have investigated individual difference variables (Rauschnabel & Ro, 2016; Rauschnabel, Brem, & Ivens, 2015), social norms (e.g., Rauschnabel & Ro, 2016; Weiz, Anand, & Ernst, 2016), technology-related factors (e.g., user-friendliness; Rauschnabel & Ro, 2016), and risk factors (Rauschnabel et al., 2016a; Stock, dos Santos Ferreira, & Ernst, 2016). Eisenmann, Barley, and Kind (2014) case study provides an exploratory investigation of consumers' reactions to Google Glass. Their findings include other, more "practical" factors, such as battery life and display size. While these studies provide a piece to the overall understanding of ARSGs, the literature remains fragmented. Therefore, the purpose of the current research is to shed additional light on the gratifications associated with ARSG usage by systematically identifying and testing specific gratifications linked to one of the five groups of needs.

3 | MODEL DEVELOPMENT

As discussed, U&GT assumes that personal motivational factors drive people's behavior. Drawing from Katz et al.'s (1973) proposed categorizations, we provide a theoretical framework that consists of six hypotheses that address cognitive, tension-release, affective, social integrative, and personal (symbolic) integrative needs (see Figure 2). In turn, we propose that these needs are related to five broad ranges of gratifications: utilitarian, hedonic, sensual (with two sub-categories, one addressing the physical sense and one the visual one), social, and self-expressive (Rubin, 2002). In the subsequent sections, we identify and hypothesize gratifications for each category that drive consumers' intention to use ARSGs in public or private situations. This distinction is particularly important because ARSGs share similarities to fashion accessories. In fashion adoption, the existence of other people matters (e.g., Grant & Stephen, 2005). Thus, with regard to U&GT and ARSGs, we propose that different gratifications matter in different situations.

3.1 | Cognitive needs and utilitarian gratifications

One reason people consume particular media, such as newspapers, is to gratify their cognitive needs, e.g., by finding relevant information (Sundar & Limperos, 2013). In TAM literature, perceived usefulness and performance expectancies are examples of utilitarian goal-oriented drivers (Davis et al., 1989; Venkatesh et al., 2012). Inspired by theories on general human decision making (e.g., Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), most technology and media acceptance theories argue that people use technologies to improve their performance at work (Venkatesh et al., 2003), in college (Davis et al., 1989), at home (Venkatesh et al., 2012) or in other contexts. U&GT makes use of the same underlying theoretical assumption by stating that users with an unmet cognitive need in a particular situation (e.g., a lack of information) chose media which they expect to address this unmet need (Katz, Blumler, and Gurevitch, 1974; Rubin, 2009; Sundar & Limperos, 2013).

We identify "life efficiency" in this research as a utilitarian gratification, obtained from ARSG usage (i.e., content gratification), that indicates the extent to which people believe that ARSGs can help them do certain daily tasks more efficiently.[1] That is, ARSGs can provide relevant information in real time and, by doing so, help consumers make decisions. Thus, we propose that utilitarian gratifications are important for usage in both private (e.g., organizer functions, information gathering) and public (e.g., navigation system) contexts.

H1: Life efficiency is positively related to ARSG usage intention in both (a) private and (b) public contexts.

3.2 | Tension-release needs and hedonic gratifications

People often use technologies and media to satisfy their tension-related needs (McGuire, 1974). To do so, they tend to choose technologies and media with a particularly high hedonic value (Katz, Blumler, and Gurevitch, 1974; Rubin, 2009; Sundar & Limperos, 2013; Venkatesh et al., 2012)—that is, media that delivers some fun. Hedonic gratifications derive from the use of media and therefore reflect a content gratification (Sundar & Limperos, 2013). We chose enjoyment as an established gratification from the U&GT and TAM domains as a hedonic gratification (Rubin, 2009). Enjoyment reflects the idea of distracting oneself from everyday activities by consuming entertaining media.

On a psychological level, prior research has linked hedonic gratifications to multisensory, fantasy, and emotional aspects of consumption (Babin, Darden, & Griffin, 1994; Holbrook & Hirschman, 1982). These studies have shown that hedonic benefits are associated with various positive outcomes, such as pleasure and reduction of boredom (Close & Kukar-Kinney, 2010; Klinger, 1971; Wolfinbarger & Gilly, 2001), making them strong predictors of technology and media use (Nysveen et al., 2005; Taylor, Lewin, & Strutton, 2011; Venkatesh et al., 2012). As people typically use entertainment media when they are at home, we hypothesize the following[2]:

H2: Enjoyment is positively related to ARSG usage intention in private contexts.

3.3 | Affective needs and sensual gratifications

We chose "sensual gratification" as a term that covers various benefits derived from the stimulation of various human senses through ARSGs.

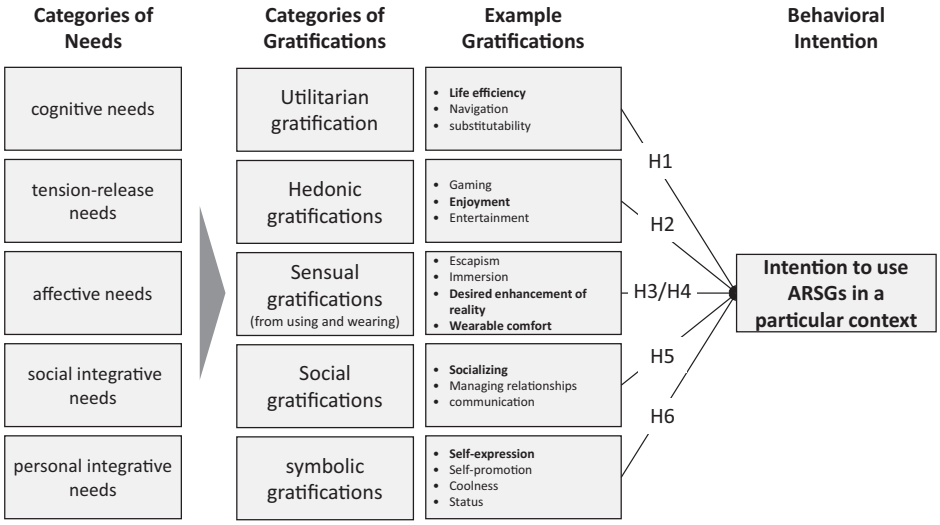

FIGURE 2 Overall conceptual model
Note: ARSG = Augmented Reality Smart Glasses; bolt = empirically tested.

We propose that two types of sensual gratifications are particularly important to explain ARSG usage. The first is the gratification from using ARSGs (content gratification). This specific sensual gratification provides users benefits by changing their perceptions of their environment and, in doing so, addresses their visual senses. Second, the gratification from wearing ARSGs, a process gratification, addresses the sense of touch.

3.3.1 | Desired enhancement of reality

A widely replicated finding in U&GT research is that people tend to use certain media because of their desire to experience emotions (e.g., Lucas & Sherry, 2004; Zeng, 2011). For example, in many cases, people find themselves relating to the characters in movies, leading them to sympathize with them or celebrate their victories. Zillmann's (1988) theory of mood management assumes that people prefer an intermediate level of arousal, which is experienced as pleasant. For example, people who are bored and under-stimulated tend to use arousing media stimuli; in contrast, people who are stressed or over-aroused favor soothing media stimuli.

Prior research on hedonic media and technologies has shown that people tend to feel gratification when immersing themselves into artificial, virtual worlds. For example, Lucas and Sherry (2004) show that gamers tend to feel gratified when doing things they cannot do in real life, such as flying or driving race cars. Likewise, Haridakis and Hanson (2009) find that escaping from reality is a core motivation for watching videos on YouTube. Researchers have also shown that people value the potential of immersion from interacting with hedonic technologies (e.g., Lowry, Gaskin, Twyman, Hammer, & Roberts, 2013). In this context, immersion refers to "the experience of total engagement where other attentional demands are, in essence, ignored" (Agarwal & Karahanna, 2000, p. 674). However, to explain new media, various researchers suggest not just borrowing from established theories but also exploring novel, media-specific gratifications (e.g., Rubin, 2002; Sundar & Limperos, 2013).

While immersion into dream worlds matters, AR can even go beyond this. According to its definition, AR offers people the opportunity to augment reality with virtual information. Although AR itself is not new (Craig, 2013; Javornik, 2016), it has typically been associated with various disadvantages, such as unpractical devices that a user has to hold with one hand. Thus, because many traditional applications of AR are associated with artificial usage situations, the value of gratifications might have been limited. ARSGs now provide a way to solve this issue. In particular, as ARSGs are worn like regular glasses, the integration of virtual information is more realistic (Rauschnabel et al., 2016a). New sensor technologies also allow ARSGs to track and recognize objects in the real world. These features allow people, for example, to decorate their rooms with virtual art elements, photos, movie screens, or even pets or fantasy creatures (Craig, 2013; Ernst et al., 2016). Likewise, Microsoft (2016) promotes its HoloLens as "bringing ideas to life," potentially intended to address this gratification. Ernst et al. (2016) show that people value the opportunity to replace physical items (e.g., pictures at home) with ARSGs.

Consequently, on a more abstract level, ARSGs can also give users the opportunity to enhance their perceptions of their world. In other words, consumers not just "immerse" themselves into a dream world, they now have the opportunity to share their perceptions of the real world in a way that it matches their ideal world. Therefore, we term this content gratification as "*desired enhancement of reality*," which allows users to realize dreams, such as buying objects (e.g., cars, art) they cannot afford or owning fictitious pets or phantasy-like creatures that appear realistic from subjective perceptions of their reality. Since this enhancement is only visible to themselves (and not to other people), we argue that this gratification is relevant in private contexts.

H3: Gratifications from the desired enhancement of reality are positively related to ARSG usage intention in a private context.

3.3.2 | Wearable comfort

In addition, while the desired enhancement of reality is a media-specific gratification, the "feeling" or wearing of ARSGs serves as a

technology-focused process gratification related to physical senses. Therefore, we propose that the wearable comfort, defined as consumers' evaluation of the physical comfortability (e.g., pressure, weight, bulkiness) of wearing ARSGs, determines usage intention. People have a general preference for wearing items that feel good, such as wearing comfortable clothes when at home or using cuddly blankets while watching television (c.f., Jegethesan, Sneddon, & Soutar, 2012; Watson & Yan, 2013). How does this translate to ARSGs? When people talk about using ARSGs, they frequently discuss the weight (Eisenmann et al., 2014). For example, a Google search for "review HoloLens heavy" reveals many blog postings in which people discuss the product's weight (e.g., Goode & Warren, 2016). We propose that when people wear ARSGs, factors such as weight, size, temperature, and pressure should matter. In support of this, research on fashnology suggests that any wearable technology shares psychological similarities to fashion and technology (Chuah et al., 2016; Dehghani, 2018; Dehghani, Kim, & Dangelico, 2018; Kalantari, 2017; Rauschnabel et al., 2016b); however, wearable comfort has not been empirically tested. Thus:

H4: Wearable comfort is positively related to ARSG usage intention in both (a) private and (b) public contexts.

3.4 | Social integrative needs and social gratifications

U&GT scholars have shown that social integrative motivations—that is, improving one's social relationships—are a fundamental driver of various media usages. For example, social media helps people connect with other people (Sheldon, 2008), and messaging apps help organize entire networks of people. Likewise, smartphones and other mobile technologies provide the technological infrastructure to communicate with peers (Joo & Sang, 2013). With regard to ARSGs, there are two social gratifications. First, ARSGs could provide new forms of socializing apps, such as those that foster communication between people (e.g., dating apps) (Parkash, 2013). However, understanding the socializing potential of ARSGs requires a certain level of knowledge about smart technologies in general and ARSGs in particular.

Second, the actual use of ARSGs might help users get in touch with other users of this technology (Koh, Kim, & Kim, 2003; Muniz & Schau, 2005)—for example, in social media communities. In addition, visible technologies such as ARSGs might serve as a form of "conversation starter." If a person is wearing ARSGs in public, other people might ask about them, which could then lead to a conversation. In addition, compliments about ARSGs make people feel good (Bloch & Richins, 1992), and this positive lift can break potential conversation barriers. Prior research has shown that using visible consumption objects can impact appearance (Mackinnon, Jordan, & Wilson, 2011). This is because humans automatically make assumptions about other people based on their physical appearance. In turn, these judgments drive how people interact with and relate to others (Harris, 1991; Mackinnon et al., 2011). In summary, social benefits should also be linked to the intended use in public:

H5: Socializing is positively related to ARSG usage intention in both (a) private and (b) public contexts.

3.5 | Personal integrative needs and impression management

H1–H5 are mainly driven by consumers' expectations of gratifications from *using* ARSGs. In contrast, H6 focuses on the characteristics of the hardware, or the fashion component, of ARSGs. Following Rubin (2009), we argue that people can derive specific process gratifications from using ARSGs. Prior research shows that people use media and technologies to reassure their social status and power and to gain credibility among their peers (Hollenbeck & Kaikati, 2012; Venkatesh & Davis, 2000). For example, people tend to follow brands on Facebook for impression management purposes (Hollenbeck & Kaikati, 2012) or check in on social media for image building (Luarn, Yang, & Chiu, 2015). In line with this, H6 proposes that ARSGs can also contribute to a user's face-fashioning or, more generally, how the user wants to be perceived by others.

People have a general interest to present themselves in a desired way to other people through the use of things such as makeup, hairstyles, beards, piercings, tattoos, and spectacles. Prior research has also shown that people consume products that are visible to others because they hope to alter their image in a particular way (e.g., Hollenbeck & Kaikati, 2012). ARSGs are worn like spectacles and thus are likely to be even more visible and self-defining than most other products. Faces play an important role in social interactions (Bloch & Richins, 1992), and "even simple changes to a face, such as wearing different types of eyeglasses or removing them, might influence how someone is perceived" (Forster, Gerger, & Leder, 2013).

Bloch and Richins (1992) find that adornments can lead to positive outcomes for consumers through two theoretical mechanisms. First, people who feel more attractive (e.g., by enhancing their physical appearance) usually have higher self-esteem and experience positive mood (Humphrey, Klaasen, & Creekmore, 1971; Miller & Cox, 1982; Theberge & Kernaleguen, 1979). Second, if these enhancements to their appearance are successful, people tend to receive compliments and other positive reactions from other people (Bloch & Richins, 1992). In turn, people feel gratified from compliments and other positive feedback they receive, which theoretically links self-presentation benefits to ARSG usage.

Therefore, people will react more positively to using ARSGs if they expect such use to help them present themselves in a particular manner. Because this feeling requires the presence of other people, this effect likely exists only in a public setting. Thus:

H6: Self-expression is positively related to ARSG usage intention in a public context.

4 | RESEARCH DESIGN

We administered an online survey on "new technologies" to students at a North American university. In total, 228 students (50.4% female; age: $M = 23.3$, $SD = 5.0$) took part for partial course credit. Using student samples to understand new technologies is an established procedure (Ono, Nakamura, Okuno, & Sumikawa, 2012), especially because such homogeneity might increase internal validity and because students

are often one early adopters of new technologies. Researchers often criticizes student samples for a lack of generalizability (for a review and critical reply to this assumption, see Druckman & Kam, 2009). However, for ARSGs, prior research has compared results of student and nonstudents samples and shown that student samples do not lead to biased conclusions (Rauschnabel et al., 2016a); meta-analyses on technology acceptance conclude similarly (King & He, 2006). Therefore, the use of a student sample is not likely to be a major problem in this research.

The survey began with a brief description of the functionality of smart glasses in general, followed by a 2-min commercial video on a smart glasses device (ODG R-6 or Microsoft, Hololens Mixed Reality). Then, participants answered the constructs, followed by demographic questions.

4.1 | Measures

When possible, we adopted existing scales from the literature and adjusted them to the current context. Three academic experts with AR and media background and two industry experts with AR experience reviewed the items and proposed minor revisions. We then ran a series of exploratory and confirmatory factor analyses to assess the psychometric properties of the measurement model. An inspection of the overall model fit did not reveal any concerns (χ^2 = 942.783; df = 532; χ^2/df = 1.77). In addition, CFI (.931) and TLI (.923) exceeded the recommended thresholds of .93 and .92, respectively (Bagozzi & Yi, 2012; Marsh, Hau, & Wen, 2004), and both SRMR (.047) and RMSEA (.058) were below .06. Finally, as Appendix 1 outlines, all Cronbach's alpha, composite reliability, and average variance extracted (AVE) values exceeded the recommended thresholds of .7, .7, and .5, respectively (Hair et al., 2006), indicating sufficient reliability and convergent validity.

4.2 | Discriminant validity and common method bias

Following Fornell and Larcker's (1981) recommended procedure, we compared the AVE from each construct pair with its squared factor inter-correlation. The AVE for each of the related constructs was substantially below the squared correlation, providing sufficient discriminant validity (see Appendix 2).

Because we relied on self-reported survey data in assessing all constructs in our model, common method bias might limit the validity of our conclusions (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To assess whether common method variance (CMV) biases the findings, we conducted multiple procedures. First, we compared the multifactor model (see Appendix 1) with a model in which all factors loaded on a single factor (Harman single-factor test). This single-factor model showed a substantially worse model fit among all criteria (χ^2 = 4010.223; df = 563; χ^2/df = 7.13; CFI = .425; TLI = .392; SRMR = .164; RMSEA = .138). A chi-square difference test further showed that these differences were highly significant ($\Delta\chi^2$ = 3067.44; Δdf = 31; $p < .001$). Second, we included a general common method factor (GCMF) in the model. All items were allowed to load on the GCMF. To ensure model identification and with the assumption that CMV should be unrelated to the magnitude of other constructs, we modeled this GCMF as uncorrelated with all other constructs. We then compared the path coefficients of the model with the GCMF with the basic model. The effects were quite similar, indicating that CMV does not bias any effects. In summary, across both methods, CMV did not provide cause for concern. Thus, common method bias is unlikely to threaten the validity of the findings.

5 | RESULTS

We applied structural equation modeling in Mplus 7.1. In particular, we employed a maximum likelihood estimator with robust standard errors (MLR) to estimate the model. Prior research considers this estimator superior to normal theory-based maximum likelihood because it is less dependent on the assumption of multivariate normal distribution, which is often (including in this study) not applicable in survey research (Chou, Bentler, & Satorra, 1991).

The overall evaluation of the model fit shows adequate characteristics. In particular, although the chi-square (χ^2 = 943.51) with 534 degrees of freedom is significant ($p < .001$), the chi-square difference ratio of 1.77 is below the recommended value of 4 (Hair et al., 2006). According to the recommendations of the literature (Bagozzi & Yi, 2012; Marsh et al., 2004), all other fit indices support the psychometric adequacy of the results (CFI = .932; TLI = .924; SRMR = .047; RMSEA = .058).

5.1 | Hypotheses testing

Figure 3 illustrates the significant effects. As hypothesized, consumers' life efficiency (H1a: β = .230; p = .018), enjoyment (H2: β = .230; p = .008), and desired enhancement of reality (H3: β = .216; p = .010) influence their intention to use ARSGs in private. The data do not provide empirical support for the role of wearable comfort (H4a: β = –.063; p = .324) and socializing (H5a: β = .018; p = .837) in private. The R-square of intention to use ARSGs in private is 36.8% ($p < .001$).

In contrast, as we hypothesized, use of ARSGs in public is driven by wearable comfort (H4b: β = .196; p = .006), socializing (H5b: β = .173; p = .047), and self-expression (H6: β = .278; p = .001). The effect of life efficiency (H1b: β = .130; p = .114) did not reach significance. The R-square of intention to use ARSGs in public is 31.0% ($p < .001$).

5.2 | Robustness tests

To further assess the stability of the findings, we conducted a series of robustness tests. For example, we re-estimated all effects using different estimators. In addition, we re-analyzed the model and also included all nonhypothesized paths and/or multiple control variables. As the results in the Appendix 3 show, the findings were quite similar. The findings indicate generally stable results, thus validating the robustness of the conclusions.

6 | DISCUSSION

As noted previously, ARSGs are about to become the next major technological step in the evolution of wearable media technologies.

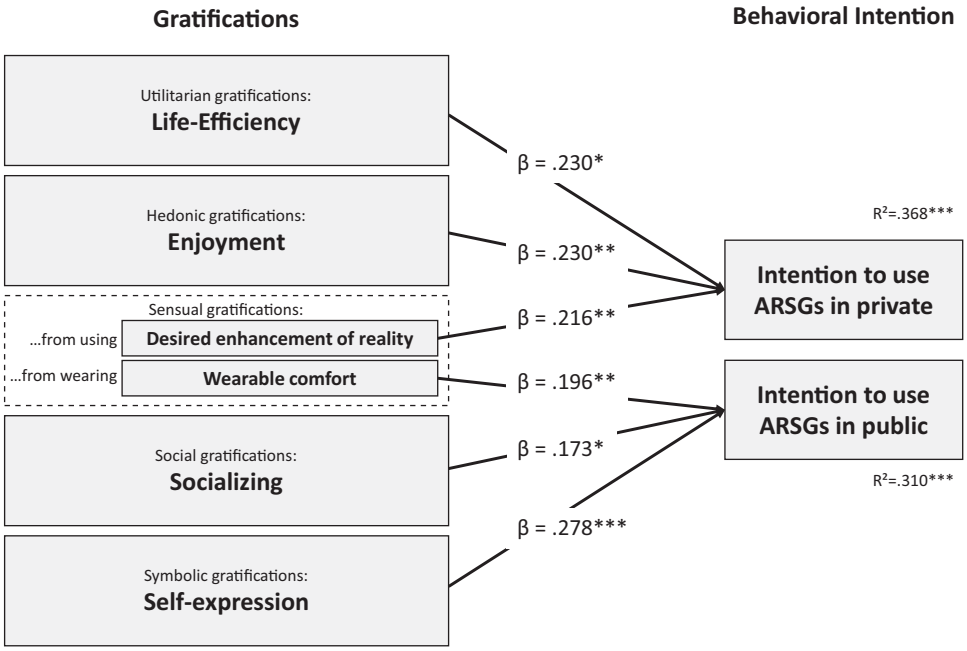

FIGURE 3 Results
Note: ARSG = augmented reality smart glasses.
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$.

Although market research forecasts predict a multibillion dollar industry, to date scant research has attempted to understand consumers' reactions to ARSGs. Building on the established U&GT framework (Katz et al., 1973), we address this fundamental research gap. By including all five media-related groups of needs, we systematically identified and tested six gratifications of ARSGs and their effects on usage intention. The results show that utilitarian (life efficiency), hedonic (enjoyment), sensual (desired enhancement of reality and wearable comfort), social (socializing), and symbolic (self-expression) needs drive ARSG usage intention. Wearable comfort and socializing did not reach significance for use of ARSGs in private. This could be because we focused on expected rather than obtained gratifications. For example, many consumers might not yet be aware of the socializing benefits of this still futuristic technology. The same could be true for life efficiency in public settings. These findings provide several contributions to theory and managerial practice.

6.1 | Theoretical contributions

The first theoretical contribution is a comprehensive framework that consists of six gratifications related to ARSG usage intention. While prior research has investigated the effects of utilitarian, hedonic, and symbolic gratifications on ARSGs (for an overview, see Table 2), we extend these factors with sensual and social gratifications. Table 3 summarizes how this model integrates the established five fundamental categories of human needs (Katz et al., 1973) with established and novel content and process gratifications, while taking into account the technology and fashion component of ARSGs. As discussed in the next section, the process gratification of "wearing" a technology and the gratification of virtually changing and enhancing one's environment are novel gratifications that we introduce to the U&GT literature. In summary, this research extends the stream of ARSG research with a more comprehensive gratifications framework.

The second contribution is the introduction of a novel gratification: desired enhancement of reality. The main idea of AR is the augmentation of reality with virtual objects. For centuries, people have tried to enhance their environments with any suitable object (i.e., the idea of decoration and interior architecture). People use various decorative items such as art, trophies, and souvenirs to provide a homier residence. Most prior media and technologies were just not able to address this desire. AR can help users enhance their physical environment through virtual objects they might not have in real life. Prior research has examined immersion into virtual worlds, for example, in gaming, online communities or television use (Koh et al., 2003). Desired enhancement of reality, however, is different; users are not immersed in an artificial virtual word—they stay in their real world but enhance it by adding certain virtual elements. To our knowledge, prior research on ARSGs has not identified this aspect, which is somewhat surprising because one of the main ideas behind AR is changing the perception of the real word. Thus, this study extends the literature on U&GT (e.g., Claffey & Brady, 2017), ARSGs, and AR in general.

The third contribution extends the idea that ARSGs, as any wearable technology, can be examined through the lens of fashnology, a concept combining fashion and technology theories (Chuah et al., 2016; Dehghani, 2018; Dehghani, Kim, & Dangelico, 2018; Kalantari, 2017). Extant research has exclusively focused on the design aspects of wearables. For example, Rauschnabel et al. (2016b) examine how people can improve their appearance through the use of ARSGs, and Chuah et al. (2016) show that perceived visibility of the device drives smartwatch adoption. The current study extends these findings in terms of self-expression (H6). This study also investigates a second fashion-related factor—wearable comfort—as an example of a sensual

TABLE 3 Summary and contribution

H	Addressed human needs	Hypothesized gratification	Type of gratification	Technology or fashion-related gratification	Identified impact on intended use in		Examples of prior studies that have investigated similar gratifications in a technology or media context
					Private	Public	
H1	Cognitive needs	Life efficiency (utilitarian)	Content	Technology	✓		Utilitarian benefits (Rauschnabel et al., 2016a), perceived usefulness (King & He, 2006)
H2	Tension-release needs	Enjoyment (hedonic)	Content	Technology	✓		Rauschnabel et al. (2016a)
H3	Affective needs	Desired enhancement of reality (sensual)	Content	Technology	✓		n.a.
H4	Affective needs	Physical (sensual)	Process	Fashion		✓	n.a.
H5	Social integrative needs	Socializing (social)	Content	Both		✓	Luarn et al. (2015)
H6	Personal integrative needs	Self-expression (symbolic)	Process	Fashion		✓	Image (Venkatesh & Davis, 2000)

gratification. Therefore, we show that more ergonomic factors are relevant for wearable devices in general, thus contributing to the literature on fashnology and wearable devices (Rauschnabel et al., 2016b).

The fourth contribution is the conceptualization of the dependent variables. In general, U&GT and TAM scholars have used one global measure as the dependent variable, such as the intended use of a technology or media, ranging from very low to very high (e.g., King & He, 2006). Few studies have developed models that integrate the reasons people use media or technologies (see Table 2). In addition, TAM scholars have developed models only for certain contexts. For example, the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003) is a model that explains workers' use of technologies, and UTAUT2 explains use of personal technologies (Venkatesh et al., 2012). This distinction, however, assumes that one particular technology is used either as a personal device or as a technology at work. Today, this distinction seems artificial for many technologies, as people use certain technologies and media (e.g., smartphones) for both personal and professional activities. Therefore, Rauschnabel et al. (2016a) argue that models should integrate and control for different usage contexts in more comprehensive models. They show that the strength of technology drivers of ARSGs differs depending on the use at home, at work, or in public. In this study, we extend this distinction on a more theoretical level by proposing that the existence of other people matters.

6.2 | Managerial implications

The findings of this study also provide a valuable source of inspiration for manufacturers and app developers. Specifically, these producers should focus on communicating not only the utilitarian benefits of ARSGs but also the hedonic, social, and symbolic benefits. The application of branding strategies is one approach to improve self-expressive gratifications. For example, a technology company could co-develop or co-brand an ARSG device with access to certain customer segments; it could also use a self-expressive brand image, such as the one of a luxury brand. In addition, spectacle brands and optical manufacturers might have experience in designing fashionable and comfortable spectacles. To give a practical example, Deutsche Telekom AG (a telecommunications firm) and Zeiss (an optical manufacturer) just recently founded Tooz Technologies Inc., a joint venture specialized on ARSGs. Their devices will use the optics invented by Zeiss and the connectivity services and IT experience by Deutsche Telekom. Combining these competences will make ARGS lighter, more ergonomic and more efficient (Nicola, 2018).

Manufacturers could also show how ARSGs can alter a user's environment. Microsoft shows various examples in its HoloLens trailer, such as virtual television screens or other decorative aspects. In support of this view, Ernst et al. (2016) show that the perceived substitutability of physical objects drives intended adoption of ARSGs.

On a strategic level, manufacturers should consider various position strategies. If positioned as a device used in isolation from other people, manufacturers could focus on and communicate how an ARSG device can make users' life more efficient, how they can use it for entertainment purposes, and how they can alter and enhance their environments. That is, manufacturers should think of ARSGs more in terms of technology rather than fashion. In contrast, if manufacturers want to position their ARSGs more as a fashion accessory that is used in the presence of other people, they should emphasize wearable comfort, socializing, and self-expression. Here, manufacturers should think of ARSGs more in terms of fashion rather than technology. If manufacturers aim to develop unified ARSGs that can be used in the absence or presence of other people, they should incorporate all five gratifications. Then, they should think of ARSGs not just as a fashion accessory or technology but rather as fashnology.

6.3 | Limitations and further research

As with any research endeavor, this study has some limitations. First, although a U.S. student sample increases internal validity, caution must be taken when extrapolating the findings to other contexts. Replications with broader samples and in other cultures could reduce this risk. Second, while we show that ARSGs have the potential to address each of the needs categories that Katz et al. (1973) propose, we examined selected gratifications for each category. Systematic scale development approaches using a combination of qualitative and quantitative could identify a more complex list of gratifications. Further research could also extend our framework by including moderating and mediating effects. In addition, extending prior research on trust and risks (Pavlou, 2003; Suh & Han, 2003) to the context of ARSGs could be a fruitful area for further research. Finally, investigating ARSGs at a time when most consumers do not have hands-on experiences provides a valuable resource to understand the decision processes and unbiased perceptions. However, experience might change the results such that certain dimensions' impact increases or decreases. Prior research has tested this assumption and does not conclude crucial effects (e.g., Chuah et al., 2016). However, as price points decline and new apps come on the market, gratifications and their influence on consumers might change. This potential shortcoming calls for replications among consumers with different usage experience levels.

7 | CONCLUDING REMARKS

Prior studies in disciplines such as communication science, human–computer interaction, marketing, management information systems, and engineering have identified the importance of ARSGs. One crucial success factor is people's acceptance and use of these, and in general, people accept media and technologies when they attain certain "value" from using them. This study develops and empirically tests a framework that shows relevant gratifications in using ARSGs in private and in public.

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ENDNOTES

[1] As shown in the Appendix, we use items from technology acceptance (performance-focused) and U&GT (information-focused) research. Exploratory and confirmatory factor analyses show that these items load clearly on one factor (first factor: eigenvalue = 5.4, second factor: 0.60). A two-factor solution shows substantial cross-loadings between the two factors.

[2] A reviewer stated that entertaining content on ARSGs could also drive consumers' intention to use ARSGs in public. We assessed the relationship between enjoyment and public use (see Appendix 3); it did not reach significance. A potential explanation is that people tend to strive for entertainment in situations where they feel lonely or bored (McGuire, 1974; Wolfinbarger, & Gilly, 2001; Zillmann, 1988), situations that typically occur at home. Likewise, other ARSG-studies argue that the presence of other people might even be distractive and interrupt the enjoyment of the AR experience (e.g., tom Dieck, Jung & Han, 2016).

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APPENDIX 1: MEASUREMENT MODEL/CONFIRMATORY FACTOR ANALYSIS

Construct	Items
Life efficiency[a] C.R. = .949/AVE = .727/α = .949 Adopted from Luarn et al. (2015), Rauschnabel et al. (2016b), Venkatesh et al. (2012)	Make my life more efficient Accomplish my tasks better Accomplish my tasks faster Organize my life better Support me with relevant information Get access to information in real time Automatically receive the information I need
Enjoyment[a] C.R. = .895/AVE = 742/α = .892 Adopted from Ku, Chu, and Tseng (2013)	Have fun Play Pass time
Socializing[a] C.R. = .951/AVE = .766/α = .951 Adopted from Sheldon (2008) and Sundar and Limperos (2013)	Keep in touch with my friends Expand my social network Connect with my friends Connect with others Share important moments with friends Share my life with friends
Desired enhancement of reality[a,d] C.R. = .943/AVE = .768/α = .942	Create my dream world by including things I want to have in real life Augment my perception of reality in a positive way Experience reality in a better way Influence the perception of reality in a better way Get a sensual experience by including inspiring digital objects in the real world
Self-expression[a] C.R. = .915/AVE = .685/α = .914 Adopted from Luarn et al. (2015)	Impress others Feel important Improve my image Improve how others perceive me Increase my popularity
Wearable comfort[b,d] C.R. = .75/AVE = .73/α = .876	Is comfortable Does not cause discomfort while wearing Does not feel uncomfortable
Usage intention in private[c,d] C.R. = .897/AVE = .746/α = .884	At home When I am alone In private situations
Usage intention in public[c,d] C.R. = .959/AVE = .886/α = .959	In public Everywhere While being in public places

Note: [a]Imagine you are using [ARSG]. What 'benefits' would it provide for you? I expect that owning [ARSG] allows me to….
[b]I believe that using [ARSG]…
[c]I could imagine using [ARSG]…
[d]These items were developed for this study and validated with experts as well as in a sorting task with n = 28 students; all (other) items were also discussed with three academic experts with AR and media background as well as with two industry experts with AR experience.
[a]Estimator: MLR, C.R. = composite reliability, AVE = average variance extracted, α = Cronbach's alpha.

APPENDIX 2: CORRELATIONS

	Correlations	1	2	3	4	5	6	7
1	Wearable comfort							
2	Life efficiency	0.22						
3	Enjoyment	0.03	0.48					
4	Socializing	0.22	0.59	0.50				
5	Desired enhancement of reality	0.20	0.55	0.54	0.51			
6	Self-expression	0.25	0.45	0.38	0.44	0.49		
7	Usage intention in private	0.04	0.48	0.53	0.39	0.50	0.33	
8	Usage intention in public	0.33	0.39	0.24	0.41	0.37	0.46	0.33

APPENDIX 3: ROBUSTNESS TESTS

Full model (hypothesized and non-hypothesized effects)		
	Usage intention in private	**Usage intention in public**
Life efficiency	0.224 ($p = .024$)	0.112 ($p = .206$)
Enjoyment	0.277 ($p = .010$)	−0.040 ($p = .570$)
Desired enhancement of reality	0.220 ($p = .011$)	0.077 ($p = .385$)
Wearable comfort	−0.067 ($p = .323$)	0.191 ($p = .007$)
Socializing	0.014 ($p = .871$)	0.163 ($p = .059$)
Self-expression	0.021 ($p = .794$)	0.265 ($p = .004$)
R squared	0.369 ($p < .001$)	0.313 ($p < .001$)
Model Fit		
χ^2/df	1.772	
CFI	.931	
TLI	.923	
SRMR	.047	
RMSEA	.058	
Estimator	SEM with MLR	
Full Model with Control Variables		
	Usage intention in private	**Usage intention in public**
Life efficiency	0.229 ($p = 0.016$)	0.121 ($p = 0.137$)
Enjoyment	0.258 ($p = 0.015$)	−0.052 ($p = 0.455$)
Desired enhancement of reality	0.213 ($p = 0.015$)	0.091 ($p = 0.275$)
Wearable comfort	−0.078 ($p = 0.234$)	0.161 ($p = 0.019$)
Socializing	0.033 ($p = 0.688$)	0.176 ($p = 0.025$)
Self-expression	0.048 ($p = 0.535$)	0.293 ($p = 0.001$)
Age (in years)	0.043 ($p = 0.433$)	0.055 ($p = 0.220$)
Gender (0 = female, 1 = male)	0.134 ($p = 0.015$)	0.160 ($p = 0.004$)
Device (0 = HoloLens, 1 = ODG)	0.029 ($p = 0.628$)	0.125 ($p = 0.028$)
R squared	0.402 ($p < .001$)	0.393 ($p < .001$)

Model Fit	
χ^2/df	1.803
CFI	.920
TLI	.911
SRMR	.064
RMSEA	.059
Estimator	SEM with MLR

Note: More robustness tests are available on request.