Research Article

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Fashion or Technology? A Fashnology Perspective on the Perception and Adoption of Augmented Reality Smart Glasses

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Abstract: Smart glasses are a new family of technological devices that share several characteristics with conventional eyeglasses. Yet, little is known about how individuals process them. Drawing upon categorization theories and prior research on technology acceptance, the authors conduct two empirical studies to show that (a) smart glasses are perceived as technology but vary in their degree of fashion, (b) the perception of smart glasses determines the factors that explain adoption intention, and (c) a majority of consumers process smart glasses as a combination of fashion and technology ("fashnology"), whereas a smaller number of consumers perceive them exclusively as technology or fashion, respectively.

Keywords: Technology, Fashion, Fashnology, Augmented Reality, Acceptance, Adoption, Categorization, Smart Glasses, Segmentation

1 Introduction

A recent study conducted by PricewaterhouseCoopers [65] on wearable technologies concludes that "there is a wearable future around the corner, it's more immediate than we think–and it can dramatically reshape the way we live and do business" (p. 11). Scholars have made first attempts to study wearable devices through the lens of technology acceptance research. For example, they extended the traditional technology acceptance model (TAM) [23] with various additional, technology-specific factors for smart watches [18], smart glasses [67], and other wearable devices (e. g. [59, 83]).

One particular type of wearable device is augmented reality smart glasses, that is, smart glasses that integrate virtual images in a user's view field [67]. Smart glasses have gained increased attention in public discussions and practice. Also, in academia, scholars from various disciplines, including medical research [2], education [93], manufacturing [63], engineering practice [17, 27], cultural management [48, 81], information systems [80, 91], marketing [67], and others have addressed issues related to smart glasses. In general, these studies conclude that smart glasses have some unique characteristics that distinguish them from other technologies. However, public discussions on smart glasses are not always positive. For example, users of Google Glass are often insulted as 'glassholes' and excluded at bars because of the fear of violating privacy laws [76].

Unlike many technologies that are often used in privacy, wearables are for consumers to wear in social environments. Consumers carefully select clothing and jewelry to present themselves in public settings. So what will they think about wearables? This leads to a very basic but yet unanswered question: Are wearables really (only) a technology? If yes, then the application of technology acceptance and adoption models seems suitable. If not, what then are wearables?

We select an innovative technology in wearables, smart glasses, as the subject of our research. Grounded in the literature on technology acceptance, uses and gratifications, and categorization theory, the general hypothesis of this research is that at least some consumers perceive smart glasses as "fashnology". Fashnology refers to a term that we propose in this research, which represents consumer perceptions of wearable technologies as a combination of 'fashion' and 'technology'. We study this

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assumption by conducting two different studies. Specifically, in Study 1, we propose that different smart glasses provide different perceptions in terms of fashion and technology, which influence the importance of particular determinants to adoption.[1] In Study 2, we find empirical evidence that consumers can be divided into three groups: those who perceive smart glasses as a type of technology, as a form of fashion, or as both ("fashnology").

The findings of this investigation have several important implications for smart glasses research. First, we extend our smart glasses knowledge by specifically incorporating the "wearable" aspect. These results provide a better understanding of the nature of smart glasses from a psychological perspective. Second, we show that categorization theories provide a promising extension for established media and technology acceptance models. Third, we show that the perception of smart glasses as technology, fashion, or fashnology is influenced by characteristics of the product and the consumer.

2 Theoretical Background

We organize the theoretical background of this research as follows: First, we define augmented reality smart glasses by integrating them into the body of augmented reality and wearable devices. We then provide a brief overview of the mechanisms of human long-term memory, particularly categorization models. We argue that both fashion and technology categories can be relevant in explaining individuals' reactions to smart glasses. Finally, we provide an overview of related technology acceptance and fashion research.

2.1 Augmented Reality Smart Glasses

Broadly speaking, augmented reality smart glasses are a wearable technology with integrated augmented reality (AR) features. Before providing a more detailed definition, we lay the groundwork by giving an overview of AR and wearables.

2.1.1 Augmented Reality

The concept of AR is used to describe a "medium in which digital information is overlaid on the physical world that is in both spatial and temporal registration with the physical world and that is interactive in time" ([19], p. 20). Various AR devices and applications have been developed during the last few years, including virtual mirrors and mobile applications. Virtual reality (VR) is a related concept in which a user is entirely closed off from the real world [19].

Market forecasts for AR and VR applications are tremendous. For example, a recent study by Goldman Sachs [32] concludes that "as the technology advances, price points decline, and an entire new marketplace of applications (both business and consumer) hits the market, we believe VR / AR has the potential to spawn a multibillion-dollar industry, and possibly be as game-changing as the advent of the PC" (p.4).

2.1.2 Wearable Technologies

Wearable devices (syn: wearables) as a product category were initially described by Mann [54], who proposed three constituting modes of operation for these devices: they are supposed to be on constant alert without any need to be turned on by their user (constancy); they do not claim the user's full attention because the computing power is not supposed to be the focus, but rather the computation's output (augmentation); they allow for at least partial encapsulation of the user, serving as a filter to inbound information and protect users against unwilling outbound communication [54]. A part of these features is made possible through the ubiquitous availability of access to cloud computing potential [5].

2.1.3 Augmented Reality Smart Glasses: A Definition

Augmented reality smart glasses (synonym: data glasses, smart glasses) is the new frontier of wearable technologies. According to Rauschnabel, Brem, and Ro [69], augmented reality smart glasses are wearable augmented reality (AR) devices that are worn like regular glasses and able to merge virtual information with physical information in a user's view field. Some models exist that are made up of a supplementary device mounted on regular glasses (e. g., Google Glass). Several technologies (e. g., camera, GPS, microphones, etc.) capture physical information and augment it with virtual information that can be gathered from the internet and / or stored in the smart glasses memory, primarily accomplished through location-, object-, facial-, and image-based recognition technologies. This virtual information is then displayed in real time on a display, which consists of a transparent surface in front of a user's eye(s).

1 We use the terms adoption and acceptance as interchangeable.

Microsoft HoloLens Google Glass Sony SmartEyeglass Epson Moverio BT-200

Figure 1: Examples of Augmented Reality Smart Glasses.
Photo credit: Microsoft HoloLens: Microsoft Sweden on Flickr; Google Glass: Wikimedia Commons, user: Mikepanhu; Sony SmartEyeglass and Epson Moverio BT-2000: authors' own copyright.

Through this, a user can see both the virtual and the real world. Prominent examples of smart glasses are the Microsoft Hololens, Google Glass, ODG R-7 and Everysight Raptor. Figure 1 shows some examples.

We propose that for a better understanding of smart glasses, three streams of research are necessary: First, smart glasses are a technology, and thus, theories that explain consumers' reactions and adoption processes seem to be relevant. Second, smart glasses are worn like regular glasses; thus, theories that explain fashion adoption and use are proposed to play an important role in smart glasses adoption. Third, the importance of these two theories might depend on how consumers perceive and classify smart glasses: as a technology gadget, a fashion accessory, or both? Broadly speaking, answers to this question can be derived from the third relevant theory stream, termed categorization research.

2.2 Categorization Research

Categorization is a mental process performed by individuals of building and using categorical representations in order to respectively structure encountered stimuli in order to help them navigate the multitude of daily experiences [50]. Categories are organized hierarchically and can be described as superordinate, base-level, and subordinate categories, which vary in terms of detail and react differently in terms of accessibility under time-constrained exposure to stimuli [53, 73]. For example, the superordinate categorization of beverages is that they are liquid and can allay thirst. Soft drinks are a subordinate category of beverages: all soft drinks are beverages (and thus are liquid and can allay thirst) but also have unique characteristics: a soft drink contains carbonated water, is sweet, and has flavoring. That is, once a consumer learns that a drink (e. g., Fanta) is a soft drink, all the knowledge of soft drinks becomes linked to the drink (e. g., base level: is sweet, is flavored; superordinate: is liquid, can allay thirst). Thus, rather than remembering all of these attributes, a consumer just remembers "Fanta is a soft drink with orange flavor."

For the case of smart glasses, which are an inherently new technology with a familiar shape, the question arises as to how consumers respectively perceive and categorize them and how this inference process can and should be influenced [50]. Research on how the assignment of products and services to these categorical representations takes place has developed various approaches for explanation. The three most prominent ones are the prototypicality view, the exemplar view and the connectionist view.

The *prototypicality view* states that assignments happen based on abstract composites that possess the features that are most likely to occur with a category's already-known instances (e. g., [72]). It is sufficient for a prototype's properties to appear for its respective assignment to a concept, with some instances being stronger representatives of the abstract composite than others. Application of this view to smart glasses may translate as follows: in the mind of the consumer, an abstract representation of the concept "glasses" would be present already, based on the constituting elements that make up glasses (e. g. transparent / translucent lenses and a spectacle frame shaped in a prototypical way). Due to most of the lenses' transparency (in the case of conventional eyeglasses, not sunglasses), consumers should find the shape of a spectacle frame to be prototypical, if not the constituting element, of the base-level concept "glasses." Any structure shaped accordingly should thus trigger strong associations to this core concept and thereby infer a specific categorical representation. Specifically, consumers, when first confronted with smart glasses, see a glasses-like form or shape. Depending on the product design, technical features may not show immediately, inducing a categorization conforming to features associated with the concept of regular glasses.

The *exemplar view*, in contrast, states that rather than abstract prototypes, already-encountered specimens represent categories. For any new stimulus, exemplar theorists postulate that it triggers similar exemplar representations in the consumer's memory. The stimulus then gets sorted into the category with which it shares the most similar exemplar representation [56]. Applied to smart glasses, this would suggest that consumers perceive them as the product category they share most commonalities with.

The *connectionist view* in turn suggests that stimuli become processed in such a way that consumers draw correlations between associations triggered by stimuli to the networks of associations of existing categories in order to identify the category with the highest fit. The stimulus then gets assigned to that category [55]. Depending on the design and context they are offered in, smart glasses may activate different associations, for example, towards technology, to fashion, or even to medical devices: technology for possibly its futuristic looks (e. g. Microsoft Hololens), fashion for its open visibility and sometimes stylish exterior, and medical purposes for the reason that glasses typically appear with curative intention such as correcting defective vision or protecting the eyes from the sun's UV radiation. However, glasses, because of their open visibility and their often distinct design, mainly have a fashion aspect, and Germany's biggest retailer of lenses and spectacle frames, Fielmann, presents itself as being proficient in "eyewear fashion." As smart glasses are a form of augmented glasses, Rauschnabel, Brem, and Ro ([69], p. 13) assert that "Smart glasses are, as any wearable devices, also a new form of fashion accessory for users."

There is an intense discussion in the literature regarding which of the aforementioned views is the 'best' [39], and all of them have received empirical evidence. More importantly, all of them share the common thread that consumers' existing knowledge about categories and products (i. e. familiarity) plays an important role in the categorization processes. This is an important finding that Study 1 builds on (H1).

2.3 Adoption of Fashion Accessories

As smart glasses are quite visible to others, some observers may associate visibility as the main purpose of wearing smart glasses regardless of their technological capabilities. As correlations to other categories are drawn, the observer may search for a category of products that are also used for the main sake of being visible, which draws the line to fashion products: consumed products are a means of communicating social information to oneself and others, as Belk noted in an influential article [10]. In brief, objects interact with their owner's social identity, thereby extending the owner's notion of self. This extension works twofold, as individuals reassure themselves through their possessions' properties while at the same time using their possessions to communicate information about themselves to their social surroundings [9, 22]. Davis [22] notes that it is these mechanisms that allow the fashion industry to thrive.

Additionally, social interactions are mainly very brief. Therefore, individuals have to come to judgments about one another with limited-time effort. Social categorization meets this need, as it occurs spontaneously without the involvement of large cognitive resources [20]. In these situations, and for this purpose, external cues like consumer products, including items like automobiles, furniture, or clothing, are of particular importance (e. g., [8, 34, 42, 75, 82]), as they are particularly rich in symbolic information [78]. One very simple form to operationalize these issues is to look at the evaluation of the design, particularly how this impacts one's appearance to others. This will be addressed in Studies 1 and 2 and termed as 'social benefits'.

2.4 Technology Acceptance Research

Technology acceptance is a label for a research agenda into the antecedents to the acceptance and adoption of new technologies. Starting with the now classic stream of technology adoption launched by the technology acceptance model (TAM) by Fred Davis [23], a wide field of modifications of the original model has opened up (e. g. [3, 4, 31, 40, 46, 64, 86, 87]. These modifications provide meaningful adaptations to the initial model and enable insights into the adoption process of various technologies introduced over the past decades, such as, for instance, the acceptance of mobile applications [60]. An extensive review of the TAM literature can be found with Turner et al. [84] and King and He [44]. The original TAM, however, covered the essentials of any technology adoption process, with the two factors of perceived ease of use and perceived usefulness driving the attitude toward, and acceptance of, technologies. TAM at its core is an extension of the theory of reasoned action (TRA) [1, 7]. TAM's simplicity, as it involves only the perceived ease of use and perceived usefulness, has evoked both criticism for too narrowly focusing on a few utilitarian constructs [6] and the notion of the high inherent robustness of the model [44].

As a result, related theories of the original TAM and the model itself underwent refinements by numerous authors (e. g., [85, 87]), or it was adapted to specific contexts (e. g., [31, 46, 64]. Some authors included hedonic benefits in the model to explain the level of entertainment, fun, and enjoyment that the use of a technology can offer [85]. Likewise, in order for TAM to fit the application of augmented reality smart glasses, Rauschnabel and Ro [67] enriched the model with specific factors such as privacy concerns. For the purpose of this research, we build on the basic premise of TAM and its extensions by incorporating utilitarian, hedonic, and, as discussed in the fashion section above, social benefits.

The three constructs reflect three distinct motivations that consumers may involve in using smart glasses: pursuing utilitarian and instrumental purposes after cognitive deliberations, seeking pleasure driven by emotional desires, and managing social identity directed by social symbolic information. The three motivations may not be exclusive to each other. For example, an appreciation of social benefits may influence one's calculation of instrumental values derived from technical functions of the device, and vice versa. The complete interplay among the three motivations, however, is not the focus of this research.

3 Study 1

The objective of Study 1 is to describe differences in the perception of smart glasses from the view of consumers. Additionally, exploratory *post hoc* analyses were conducted in order to identify the directionality of effects.

3.1 Hypotheses

Cognitive psychologists assert that "the world is structured because real-world attributes do not occur independently of each other" ([73] p. 383). Human thinking and memory use this property of the world to efficiently and effectively assign stimuli to categories in the categorization process described in more detail above. This process, as implied by the connectionist view, draws on correlations of stimuli with other, already-available correlation networks of categories [55]. A new member of a category thus will benefit in terms of accessibility, as the new member itself will become part of the correlation network that led to its categorization in the first place. In terms of categorization, familiarity can then be thought of as the process by which a stimulus becomes an established part of a correlation network through its repeated activation by repeated cognitive exposure. As time passes, this process should lead to a stronger perception of the new stimulus as belonging to the initially associated category. Accordingly, we hypothesize that:

H1a: Familiarity with smart glasses will have a positive impact on their perception as fashion.

H1b: Familiarity with smart glasses will have a positive impact on their perception as technology.

It is also important to note that not only does the familiarity with smart glasses influence the categorization, but also various other factors. Maybe most importantly, when consumers look at a particular pair of smart glasses, their design is likely to play a core importance in determining the perception as technology and / or fashion. To mitigate this variance, we control for the device consumers evaluate.

The second part of the model proposes two routes to adoption: the technology route and the fashion route.

The fashion route (H2a) proposes that individuals tend to adopt smart glasses because of the fashion value it provides. A core motivation for choosing a particular fashion item is that it influences people's perceptions in a desired way. What we term "social benefits" describes the extent to which wearing a particular model of smart glasses influences the perception of the wearer in a positive way.

The technology route (H2b) proposes that utilitarian benefits drive the intention to adopt smart glasses. As discussed above, scholars in IS research [23, 85, 88, 89] and media usage [21, 62] have investigated antecedents to technology and media use. Utilitarian benefits (also termed functional benefits, perceived usefulness, or performance expectancies) were found to be important predictors of technology use influencing the adoption intention of any technology [44], including smart glasses [67, 68]. That is, the more people expect that a technology will help them in improving various tasks, the more likely they are to adopt it.

H2a: Social benefits will have a positive influence on the purchase intention of smart glasses.

H2b: Utilitarian benefits will have a positive influence on the purchase intention of smart glasses.

We also propose that the effects hypothesized in H2a and H2b are not equally strong for all individuals. We propose that the extent to which humans apply the fashion and / or technology route is dependent on the categorization of a particular smart glasses model. We argue that this is in line with the connectionist view, which states that categorizations occur based on networks of correlations [55]. Belonging to a respective category will make highly correlated associations more accessible. In this case, consumers who categorize smart glasses as a technology should favor utilitarian benefits over social benefits, as the functional value of technology lies in its perceived usefulness. Likewise, consumers who categorize smart glasses as a form of fashion should then favor social benefits as a cause related to smart glasses adoption. We thus hypothesize

> **H3a**: The perception of smart glasses as fashion will have a positive moderating effect on the influence social benefits exert on the purchase intention.

> **H3b**: The perception of smart glasses as technology will have a positive moderating effect on the influence utilitarian benefits exert on the purchase intention.

3.2 Methodology and Research Design

In the early spring of 2016, two-hundred and sixty-six students (age: m = 23.6, SD = 6.1; 51.5 % male) enrolled at a North American university took part in an online survey for partial course credit / extra credit. The survey began with a brief description of smart glasses (see [67]). Then, familiarity with smart glasses in general (i. e., not toward a particular device) was measured. Respondents were then randomly assigned to one of seven groups, and each group was assigned to a particular smart glasses model (see table 4). Then, two pictures of that particular smart glasses model were presented (one presenting only the technology, and another presenting a person wearing the smart glasses). Respondents were asked to describe the smart glasses for at least 45 seconds (after that, the continue button was displayed) to ensure that they spent sufficient thought on the pictures. After that, we measured the degree to which the smart glasses were perceived as technology and fashion, and their utilitarian and social benefits, as well as purchase intention, while always providing the same two smart glasses photos in the header of the online survey. We used predominantly 7-point scales, with higher values representing a higher level of agreement. All items are presented in Table 1, as well as the Cronbach's alpha values and results of a confirmatory factor analysis (CFA).

Table 1: Measures for Study 1.

Familiarity with smart glasses (α = .89; C. R. = .90; AVE = .75)[(a)]
(adapted from Rauschnabel & Ro, [67])
These smart glasses are unfamiliar to me – These smart glasses are familiar to me
I do not recognize – I do recognize
I have never heard of before – I have heard of before
Perception as Technology (α = .74; C. R. = .77 ; AVE = .54)
(ad hoc scale)
These smart glasses are…
…a computing hardware
…a technology
…a device
Perception as Fashion (α = .83; C. R. = .84; AVE = .64)
(ad hoc scale)
These smart glasses are…
…stylish glasses
…fashion
…a garment
Purchase Intention (α = .85; C. R. = .86; AVE = .76)
(adapted from [51])
I intend to purchase these smart glasses.
If I have the financial resources, I would buy these smart glasses.
Utilitarian Benefits (α = .94; C. R. = .94 ; AVE = .81)
(adapted from Venkatesh et al. [89])
Using these smart glasses can help me accomplish things more quickly.
Using these smart glasses can increase my productivity.
These smart glasses can make my life more efficient.
Social Benefits (α = .93; C. R. = .93; AVE = .76)
(adapted from [57, 70])
If I was wearing these smart glasses, it would…
worsen my appearance (R)
make me unattractive to others (R)
make me look worse (R)

[(a)] Seven point semantic differential (R) reverse coded item
α: Cronbach's alpha; C. R.: Composite Reliability; AVE: Average Variance Extracted; Common suggestion in the literature are α > .7; C.R > .7; AVE > .50, see [33, 61];
Overall fit of the measurement mode: CFI = .98; TLI = .97; SRMR = .04; RMSEA = .05; $\chi 2(136) = 3105$; p < .001) / ML estimator in Mplus 7.11; recommended thresholds for fit measures are as follows: CFI > .95; TLI > .95; SRMR < .08; RMSEA < .07 [38].

3.3 Results

Due to the restrictions of the sample size, we split the model into two sub-models and estimated the effects independently. Model 1 tests H1a and H1b. Consequently, Model 2 investigates H2 and H3. In the subsequent sections, we will present the standardized beta coefficients (path-coefficients) of the structural equation model and relevant fit indices, as well as the corresponding p-values based on two-tailed t-tests. A hypothesis is supported if the p-value is below .05. Figure 2 summarizes all results.

3.3.1 Main Effects

In line with H1a and H1b, familiarity with smart glasses in general positively influences the perception of particular smart glasses models in terms of fashion (b = .132, p = .026) and technology (b = .213). Important to note is that both fashion and technology were controlled for the device consumers rated (binary coded, with Google Glass being the reference category). Fit measures were excellent (CFI = .998; TLI = .984; RMSEA = .028; SRMR = .036; Chi2 = .79.85; df = 66, p = .12).

The data supports H1a and H1b. Familiarity with smart glasses is positively related to the perception of smart glasses as a form of fashion (β = .213; p = .026) and as a type of technology (β = .213, p = .001), while controlling for the type of model. Detailed results are shown in Table 2.

Table 2: Results of Model 1 (Study 1).

Dependent Variables:	**Fashion**	**Technology**
Familiarity	.213 (p = .026)	.213 (p = .001)
Epson Moverio	-.160 (p = .030)	.004 (p = .959)
Microsoft HoloLens	-.236(p = .001)	.032 (p = .714)
Sony SmartEyeglass	-.263(p < .001)	.046 (p = .593)
Zeiss Glasses	.281(p < .001)	-.128 (p = .142)
Everysight Raptor	.107(p = .015)	.023 (p = .791)
ODG R-7	-.209(p = .005)	-.02 (p = .813)
R^2	.315 (p < .001)	.069 (p = .051)

All devices are dummy-coded (1 = yes, 0 = no); device 1 (Google Glass) serves as reference category (all other devices are coded as zero; dummy regression).

Model 2 looks at the evaluation of a particular smart glasses model. We chose the utilitarian benefits construct from the literature on technology adoption and media usage [44, 85–87] and social benefits from research in fashion and symbolic consumption [77, 95]). The basic model (excluding the moderators) represents the data quite well (CFI = 1.0; TLI = 1.0; RMSEA = .00; SRMR = .01; Chi2 = 9.0 df = 17, p = .001).

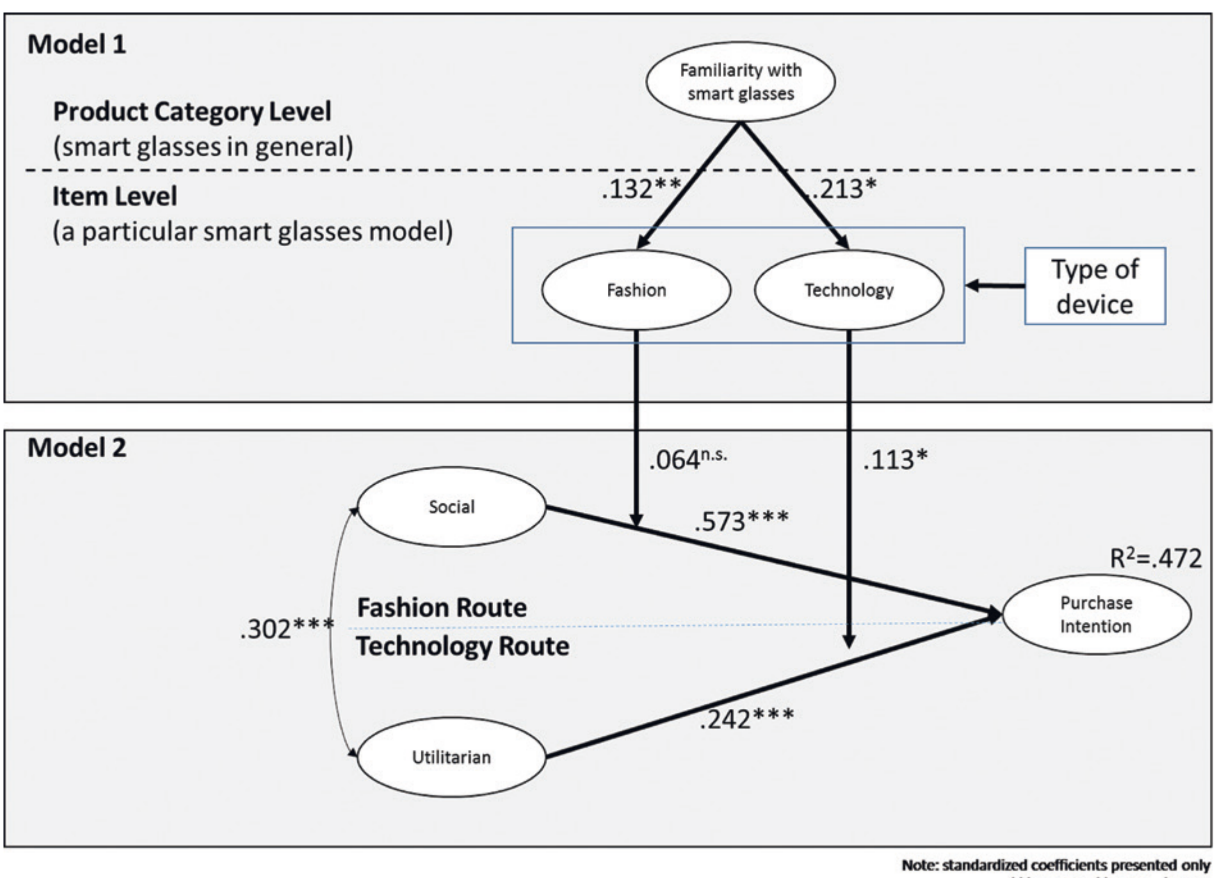

Figure 2: Results of Study 1.

The results of the main effects are presented in Table 3. The results support H2a and H2b, as indicated by significant effects of utilitarian (β = .572; p < .001) and social (β = .242) benefits. Figure 2 visualizes these effects in the 'fashion route' and in the 'technology route'.

Table 3: Results of Model 2 (Study 1).

Dependent Variable:	Purchase Intention
Utilitarian Benefits	.573 (p < .001)
Social Benefits	.242 (p < .001)
R2	.472 (p < .001)

Standardized path coefficients presented only.

3.3.2 Moderators

To assess whether the strength of the hypothesized effects differ between consumers, we applied moderation analyses on the data. We first estimated the impact of the latent interaction scores using an LMS-approach [45] while controlling for the direct effects of the moderators (perception of the glasses as fashion versus technology). The interaction effects (β_{Int}) are presented on the vertical arrows in Figure 2.

Although the moderating effect of the perception of the smart glasses model as fashion is in the proposed direction (β = .064), it does not reach significance (p = .267). Thus, H3a is not supported. However, results clearly show the moderating effect of the perception of a smart glasses model as technology (β = .113; p = .026), supporting H3b.

3.3.3 Robustness Tests

We also assessed the results by comparing the beta-coefficients of the independent variable between respondents that scored high versus low on the moderating variable. Additionally, we included the model type as a control variable. The findings reported above remained stable.

3.3.4 Additional Analyses

Table 4 provides an overview of the average fashion and technology score. As the results show, the studied devices score relatively similar in terms of the perception as technology (F(259,6) = .682; p = .664) but show higher variation in terms of fashion (F(259,6) = 15.350; p < .001). With 4.21, Zeiss received the highest fashion score; Epson and HoloLens scored lowest. Everysight Raptor was the technology that most respondents classified as 'fashnology' (27 %), followed by Google Glass (24 %).

Table 4: Perception of smart glasses models.

Smart Glasses	n	Technology	Fashion	Fashnology (%)
Everysight Raptor	41	5.91(SD = 0.93)	3.47(SD = 1.57)	27
Google Glass	38	5.97(SD = 0.81)	3.09(SD = 1.33)	24
Zeiss Glasses	40	5.65(SD = 1.21)	4.21(SD = 1.58)	20
Epson Moverio	35	5.99(SD = 0.95)	2.40(SD = 1.21)	14
ODG R-7	37	5.87(SD = 1.07)	2.24(SD = 1.11)	14
Microsoft HoloLens	38	6.03(SD = 1.07)	2.05(SD = 1.08)	13
Sony SmartEyeglass	37	6.02(SD = 0.87)	2.04(SD = 1.24)	8
Total	**266**	**5.92(SD = 0.99)**	**2.81(SD = 1.52)**	**17**

Fashnology: Percent of respondents who evaluated the smart glasses above the median in terms of fashion and technology.

3.4 Conclusions of Study 1

In Study 1, we have shown that there is variation in the perception of smart glasses in terms of technology and fashion. This variation can be partly explained by consumers' levels of familiarity with smart glasses. That is people with higher levels of familiarity of smart glasses in general perceive a particular smart glasses model higher in terms of fashion and technology.

Likewise, variation in the fashion dimension can be explained by the type of smart glasses model. Some devices, such as Everysight Raptor or Zeiss, score particularly high

Table 3: Moderator Analyses.

Independent variable	Moderator	β_{IV}	β_{Mod}	β_{Int}	Proposed Direction	Support
Utilitarian	Technology	.573(p < .001)	-.029 (p = .600)	.113 (p = .026)	(+) ✓	YES
Social	Fashion	.205 (p = .002)	.093 (p = .222)	.064 (p = .267)	(+) ✓	NO

Standardized path coefficients presented only.

in terms of fashions whereas others (e. g. Sony SmartEyeglass) score very low. Interestingly, the model type does not influence how 'technology-like' people perceive a particular smart glasses device. Our results also provide partial evidence that this perception influences the importance of antecedents.

However, the findings also suggest that more psychographic consumer-level factors are important in explaining this variation. In Study 2, we aim at exploring this notion using a latent finite mixture approach.

4 Study 2

Study 2 addresses the hypothesis concerning consumers' perception of smart glasses devices in general, i. e., independent from a particular model. We consider three different categorizations of individuals on how they evaluate smart glasses – those consumers who evaluate the concept of smart glasses as a technology, those who evaluate it as fashion, and those who evaluate it as both ("fashnology").

4.1 Methodology

We re-used the data from Rauschnabel et al. [67] that consisted of responses from one thousand, six hundred eighty-two US consumers surveyed by a commercial market researcher in November and December 2015. The sample covered a broad range of consumers and demographics (53.9 % female; Age: m = 46.5, SD = 15.8; Job situation: Work full-time for an employer: 45.7 %; Work part-time for an employer: 9.2 %; Self-employed: 7.5 %; Unemployed but desire to work: 6.5 %; Stay-at-home parent: 5.4 %; Student: 3.8 %: Retired: 21.9 %; from all states in the US).

The survey started with a brief description of smart glasses (see [67]), and single items were used to measure the independent variables. Using single items in robust theoretical frameworks, such as TAM [43, 74], is not uncommon. Despite criticism (c. f. [26] for a discussion), single items are associated with numerous advantages such as reduced response fatigue. Nunnally [61] and Venkatraman and Grant [90] argue that the use of single-item measures is appropriate if the constructs, as in this study, being investigated are unidimensional.

To reduce the risks associated with single-item constructs (see [26]), such as their deficiencies in terms of reliability and validity, various pre-studies and validation studies were conducted, as discussed in Rauschnabel et al. [67].

The dependent variable of adoption intention was measured with three items (usage intention at home, in public, and at work). We focused on the variables that showed significant effects on adoption intention in the initial study, particularly ease of use, the risk of threatening other people's privacy, along with social, hedonic, and utilitarian benefits.

5 Results

5.1.1 Finite Mixture Model

The main focus of this study lies in the evaluation of the different groups. Traditional cluster analyses in survey studies aim at identifying homogeneous subsets among respondents based on the magnitude of the cluster variables. Multi-group analyses in structural equation models can compare the effect size in different respondent groups (e. g. males versus females). However, multi-group analyses require *a priori* knowledge about the groups, which is often not given, as in this study.

In this case, we are particularly interested in differences based on the *beta-values* of the independent variables, rather than (just) based on the means of each variable. That is, can the respondents be grouped based on the structural coefficients? This question can be answered by applying a finite mixture model [41], an iterative approach to identify unobserved heterogeneity. That is, this method aims at identifying a latent cluster structure in the data. As a result, each respondent is assigned with a probability value of belonging to each group (latent class).

Figure 3 presents the model. We modeled the endogenous variables as a fixed-effect model (CFA) and allowed the beta weights (visualized by the vertical arrow) and the latent means (visualized by the arrows from the latent class on the exogenous variables) of the independent variables to vary randomly between groups. This is based on the assumption that, for example, people who perceive smart glasses as a technology might perceive higher technological benefits, and higher benefits also might have a stronger impact on the adoption intention.

Finite mixture models are based on an iterative optimization process. Different estimators and specifications were applied, such as AIC, BIC, entropy, segment sizes, and interpretability. A solution with three latent classes was most appropriate (enthropy = .734) [16].

Once the final, stable three-group-solution was identified, we re-estimated the final analyses based on a larger

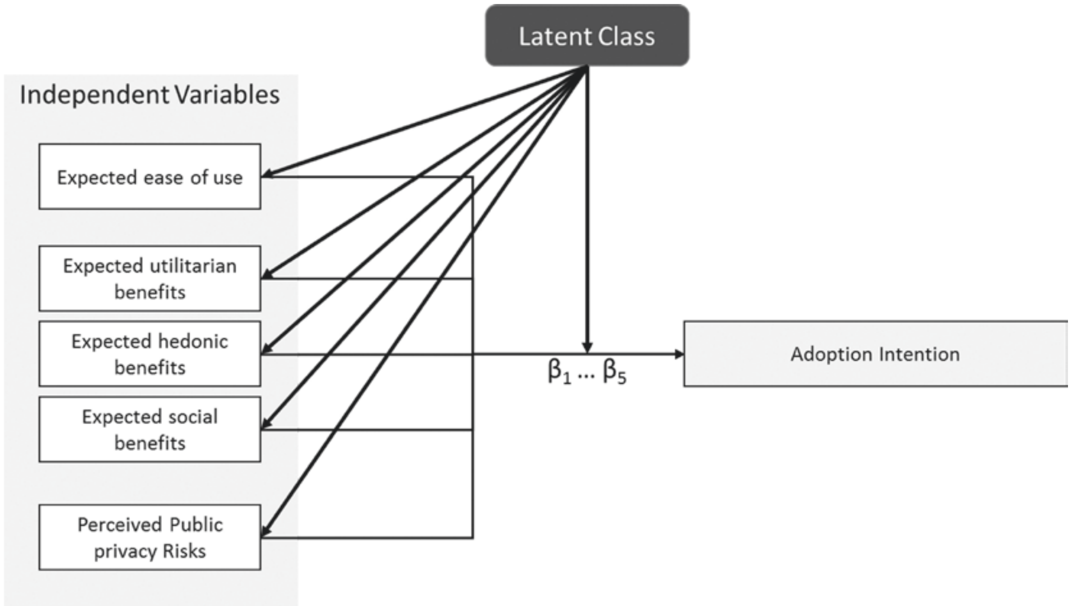

Figure 3: Finite Mixture Model.

number of random sets in order to avoid having the results represent local (as compared to global) optimum. Particularly, we specified the estimation procedure with 100,000 initial-stage random sets of starting values to generate, and used 20,000 optimizations for the final stage. Table 5 presents the results of the three classes that were identified in the finite mixture model.

Table 5: Finite Mixture Model (Study 2).

	Class 1	Class 2	Class 3
Class name	**Technologists**	**Fashionists**	**Fashnologists**
Class size	12.78 % (n = 215)	12.25 (n = 206)	74.97 % (n = 1,261)
R squared	.228	.274	.610
Standardized Beta Values			
Perceived ease of use	-.047(p = .575)	**0.269(p = .015)**	**0.238(p < .001)**
Utilitarian benefits	**.467(p = .001)**	-0.042(p = .795)	**0.435(p < .001)**
Hedonic benefits	.068(p = .432)	0.097(p = .306)	**0.226(p < .001)**
Social benefits	.084(p = .415)	**0.363(p < .001)**	**0.090(p = .003)**
Risk of threatening other people's privacy	.057(p = .474)	**-0.221(p = .025)**	**-0.067(p=.030)**
Means			
Perceived ease of use	3.088	3.340	3.987
Utilitarian benefits	2.853	2.966	4.468
Hedonic benefits	4.058	2.966	4.971
Social benefits	1.243	3.697	3.450
Risk of threatening other people's privacy	6.790	3.578	4.440

As the results indicate, the three groups show substantial differences: Group one consists of 215 out of 1,682 cases (12.78 %) and is characterized by an adoption intention driven only by expected utilitarian benefits. As this is very similar to traditional technology usage ("perceived usefulness"), we term this group as "**technologists**." Here, only utilitarian benefits showed a significant effect on usage intention ($\beta = .467$; $p = .001$). The second, contrasting, group of users has a similar size (206 cases; 12.25 %). Consumers in this group evaluate smart glasses predominantly by their influence on other people, particularly how they influence their perception by others (expected social benefits; $\beta = .363$; $p < .001$) and how others might react because of the potential to threaten other people's privacy ($\beta = -.221$; $p = .025$). As these consumers were highly aware of symbolic values and possible signaling cues they convey to their social surrounding through using smart glasses, we term these consumers "**fashionists**". Additionally, fashionists tend to value a user-friendly device ($\beta = .269$; $p = .015$). This could indicate these consumers' fear of interacting with highly complex and sophisticated technology. Finally, the largest group (1,261 cases, 74.97 %) is composed of what we term "**fashnologists**." The results show that among fashnologists, all five independent variables show a significant effect on adoption intentions. That is, fashnologists perceive and process smart glasses both in terms of fashion (e. g., social benefits; $\beta = .090$; $p = .003$) and technology (e. g., utilitarian benefits; $\beta = 0.435$; $p < .001$; hedonic benefits: $\beta = 0.226$; $p < .001$) factors. Additionally, Table 5 also shows the means of the independent variables and the R squared values for each model.

6 General Discussion

Wearables, such as smart glasses, are examples of the latest technological developments. Moreover, smart glasses are probably the most distinct and most visible examples. They include an AR function, and by adorning a user's face, they impact a user's appearance much more than any other existing wearable or mobile technology. Surprisingly, although various forecasts propose immense growth rates of smart glasses in the near future, not much research has been done to understand consumers' reactions to them. In particular, one important question has been unanswered: Are smart glasses, from the view of consumers, a type of technology, a fashion accessory, or both?

This research provides a first attempt to answer this question. In Study 1, we showed that consumers' levels of familiarity with smart glasses in general influences how they perceive a particular smart glasses model in terms of fashion and technology. The level of fashion is also dependent on the type of smart glasses device. In addition, the more consumers are familiar with smart glasses in general, the more likely it is that they classify a given smart glasses model as fashnology.

In Study 2, we show that these results also hold for smart glasses in general. More precisely, we focused on latent consumer heterogeneity. Results of Study 2 show that consumers can be clustered into three groups that we termed technologists, fashionists, and fashnologists. Technologists perceive smart glasses in general as a technology. Technologists base their adoption decision predominantly on the utilitarian benefits they expect to achieve from using smart glasses. In contrast, fashionists tend to see smart glasses predominantly as a social cue. That is, their adoption decisions are mostly driven by factors that incorporate other people. They center on questions of what information they convey to their surrounding when they wear smart glasses (social benefits) and the potential risk of threatening their privacy. Finally, the majority of the surveyed people can be classified as Fashnologists. Fashnologists' adoption decisions are driven by the evaluation of the technology and fashion related factors. Thereby, this group acknowledges both the complexity of social interactions and the technological aspects of smart glasses, showing the most complex reception of smart glasses' aspects that may play a role in adoption.

6.1 Theoretical Contribution

This study contributes to a better understanding of a novel type of device: smart glasses. As we have shown in the Literature Review, not much research on smart glasses has been conducted, and with this study we add another piece to the overall understanding of smart glasses. These findings are of particular importance as they are derived in a pre-market situation, that is, before most people have had experiences with smart glasses. Results of this study support the importance of this, as categorization processes are driven by this experience. Studies on other (mobile) technologies usually were conducted once these technologies were established on the market. Thus, from a 'retro perspective', understanding how and why these technologies became established is difficult.

In addition to this better understanding of smart glasses, this study also contributes to the literature on technology adoption. For example, in both studies, we showed that social benefits (conceptualized as the potential of smart glasses to improve one's appearance to others) serve as an antecedent to smart glasses adoption, thus extending, for example, Chuah et al. [18], who argue that smartwatches adoption is strongly influenced by their perceived visibility. We echo this view but add that it is not just the visibility, but more particularly also *how* it impacts one's perception by other people – positively or negatively.

Technology acceptance researchers have traditionally included variables such as demographics [86] and experience [89] as moderators. Categorization represents a novel moderator which we introduced in this research to explain heterogeneity of consumers. However, especially when technologies are very novel, theories for adoption might not exist, and scholars might lack knowledge of particular moderators. In this study, we introduced, discussed and applied the idea of identifying latent segments based on finite mixture models [41]. To the best of our knowledge, this is a novel approach in the technology acceptance and media literature. That being said, applying this method can also extend prior research on technology acceptance [89], usability research and the development of computer tools for computer systems that work in a human-like way, (i. e., anthropomorphic [49, 92]) in the future.

Linking technology acceptance research with categorization theories is also something novel in this study. This research provides partial evidence that categorization serves as a moderating factor in acceptance models. In the future, more and more physical products will acquire digital components (often summarized with the term the 'Internet of Things'). Thus, technology acceptance theories might need to be adjusted and scholars might need to borrow theories traditionally not related to technology acceptance–as, for example and discussed here, from the fashion literature. In addition, while Chuah et al. [18] have discussed the role of categorization as an antecedent of the smart watch technology acceptance model, we add a potential explanation as a moderator, too.

6.2 Implications to Practice

The development of smart glasses means getting the latest AR technologies to a size that fits into glasses-like devices. This is a tremendous accomplishment of product development and engineering. Addressing particular gratifications of users, such as improving the utilitarian benefits by offering successful applications, are and will be feats of software developers.

The core managerial implications of this study are that manufacturers should make decisions on how their smart glasses should be perceived by consumers – more like a fashion accessory or more like a technology, or as both? It is important to note that the categorization as technology seems to be difficult to influence by manufacturers' marketing activities, but design elements can influence the fashion component (Study 1). However, results of the first study also show that consumers' degree of familiarity with smart glasses, in general, influences this. So far, most consumers are not yet very familiar with the technology, indicating that once the technology evolves, perceptions (i. e., categorization) will change. In Study 2, we showed the existence of different segments of consumers that process smart glasses as fashion, technology, or both. To develop effective marketing and communication strategies, using consumers' perceptions of smart glasses as fashion, technology, or fashnology as segmentation criteria is recommended. Also, with fashnologists being the largest group, this holds implications for companies that aim at targeting a mass market.

6.3 Limitations and Future Research

As does any study, this study also has some limitations. In Study 1, using student samples might limit the generalization, while this limitation is not given in Study 2. However, the use of single item measures remains a potential limitation of Study 2 [26]. Although various scholars praise the advantages of single item measures [11, 74] and various TAM studies have successfully applied those [43, 74], some risks remain that other constructs were not covered completely [26]. Finally, although the direction of the moderating effect of fashion categorization was in the proposed direction, it did not reach significance. One can only speculate about the reasons for this. Reasons could be associated with the measurement model or characteristics of the sample (small in size, students etc.). A more precise categorization could also be more suitable (e. g. 'eye glasses' rather than fashion). Research is needed to investigate this deeper.

Future studies should address these limitations. In addition to this, we theorized the perception as technology and fashion 'on the same conceptual level'. Future studies could extend this view by studying situations in which people perceive technology as fashion – for example, when people post pictures of them wearing 'nerdy' smart glasses in social media to improve their technological credibility among their peers. Future research could also look at the interplay between personal characteristics (e. g. technology and fashion involvement), and characteristics of smart glasses (e. g., more fashionable or more technological). Finally, understanding which categorization theories work best for wearable technologies would improve the theoretical understanding of smart glasses (and also of other wearables) substantially.

7 General Conclusion

To the best of the authors' knowledge, this is the first study to investigate the categorization and perception of smart glasses. We propose that, in order to understand smart glasses more fully, scholars and managers need to think of them in terms of fashnology rather than just as a novel technology.

Conflict of Interest Statement: We do not have any conflicts of interest and did not receive funding for this research. The data used in Study 2 has already been used in a second manuscript [67]. A copy of this manuscript was shared with the guest editors of this special issue, and all authors of Rauschnabel et al. [67] are also authors of this study.

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