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Does a Smile Matter if the Person Is Not Real?: The Effect of a Smile and Stock Photos on Persona Perceptions

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ABSTRACT

We analyze the effect of using smiling/non-smiling and stock photo/non-stock photo pictures in persona profiles on four key persona perceptions, including credibility, likability, similarity, and willingness to use. For this, we collect data from an experiment with 2,400 participants using a 16-item survey instrument and multiple persona profile treatments of which half have a smiling photo/stock photo and half do not. The results from structural equation modeling, supplemented by a qualitative analysis, show that a smile enhances the perceived similarity with the persona, similar personas are more liked, and that likability increases the willingness to use a persona. In contrast, the use of stock photos decreases the perceived similarity with the persona as well as persona credibility, both of which are significant predictors to a willingness to use a persona. These professionally crafted stock-photos seem to diminish the sense of identification with the persona. The above effects are consistent across the tested ages, genders, and races of the persona picture, although the effect sizes tend to be small. The results suggest that persona creators should use smiling pictures of real people to evoke positive perceptions toward the personas. In addition to presenting quantitative evidence on the predictors of willingness to use a persona, our research has implications for the design of persona profiles, showing that the picture choice influences individuals' persona perceptions even when the other persona information is identical.

1. Introduction

Defined as fictive people representing real user groups, personas (Cooper, 1999) are a means for analyzing and communicating the goals and needs of different user types. Personas have been widely employed in many domains and with many stakeholders, e.g., designers, software developers, and marketers (Marsden & Haag, 2016; Matthews, Judge, & Whittaker, 2012; Nielsen & Hansen, 2014). Personas summarize core user groups or customer segments of an organization (Floyd, Cameron Jones, & Twidale, 2008), including website or mobile application users, online game players, content audiences, users of a software system, or target groups for advertising campaigns (Dong, Kelkar, & Braun, 2007; Nacke, Drachen, & Stefan, 2010; Pruitt & Grudin, 2003; Scott, 2007). Thus, personas are used in many industries and contexts, and at different organizational levels (Nielsen, 2013) for a variety of tasks. In these activities, having personas as decision-making guidelines can result in better commercial outcomes, such as yielding a positive return-on-investment (Forrester Research, 2010). The root cause of why personas are useful can be attributed to personas being an effective vehicle of communication about the users or customers of an organization (Matthews et al., 2012), providing a shared mental model of the end users' needs and wants, and summarizing data about users in an empathetic format that is more memorable than numbers (Goodwin, 2009; Hill et al., 2017; Pruitt & Adlin, 2006).

Persona creators are known to have design power when crafting persona profiles, resulting in varied sense-making and possible biases by the end users of personas (Hill et al., 2017; Salminen et al., 2018). One of the most prominent sections is the picture, typically a portrait photo, that is an essential part of a persona profile (Nielsen, Hansen, Stage, & Billestrup, 2015). The picture choice has been shown to affect the end users' perception of the persona (Salminen, Jung, Jisun, Kwak, & Jansen, 2018), influencing the end users' thinking concerning the persona. For example, Salminen et al. (Salminen et al., 2018) found that a black person's picture leads end users to interpret the same information differently. Prior work has shown that aspects of profile photos reflect the personality of the individual (Kim & Kim, 2019) and that people can infer the emotional aspects of the individuals in the photos (Kätsyri & Sams, 2008). However, there is little research on how to effectively design the persona profile, and there is even less prior research on how to choose the types of pictures used in persona profiles.

Even though there are a variety of areas to investigate, in this research, we are interested in the effect of two related conditions on *persona perceptions*[1]: (a) *the use of smile in the persona profile pictures (with two types of treatments: smiling and non-smiling)* and (b) *the use of stock photos displaying professional models versus using photos of "real" people (with two types of treatments: stock photo and non-stock photo)*. Like photos of smiling people, the use of stock photos on *persona perceptions* has not been

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investigated, even though – according to our experiences of various persona designs in the field – the use of stock photos is quite common in persona profiles.

While several studies have looked at the impact of smiling on individual attributes such as attractiveness (Deutsch, 1990; Lau, 1982; Reis et al., 1990), emotional contingent (Krämer, Kopp, Becker-Asano, & Sommer, 2013), and the effect of emotion for information process (Mori, Yamane, Ushiku, & Harada, 2019), there is no existing research on the impact of the smile on *persona perceptions* that we could locate. Nevertheless, prior research has shown that individuals' perceptions of the personas influence the adoption and use of personas in real organizations (Rönkkö, 2005; Rönkkö, Hellman, Kilander, & Dittrich, 2004), and such visual stimuli can influence how people process the available information (Jiang, Guo, Yaping, & Shiting, 2019). Often mentioned perceptions in association to personas include credibility, trustworthiness, and believability (Howard, 2015; Miaskiewicz, Sumner, & Kozar, 2008; Pruitt & Grudin, 2003), likability (Anvari, Richards, Hitchens, & Babar, 2015), immersion, and identification (Chang, Lim, & Stolterman, 2008; Marsden & Haag, 2016; Miaskiewicz et al., 2008; Nielsen, 2013), empathy (Friess, 2012; Pruitt & Grudin, 2003), and usefulness (Kari, 2005; Nielsen & Hansen, 2014; Rönkkö et al., 2004). Therefore, it is worthwhile to pursue a better understanding of individuals' perceptions toward personas and what kind of choices drive these perceptions if personas are to be utilized effectively in customer-facing decision making. With this research, we aim to provide actionable insights to aid persona designers in developing better persona profiles. If the perception of a persona can be influenced by the choice of a smiling image or not (or using a stock photo), then this has direct implications for the persona profile design.

To this end, we measure whether and how the smile of the person in persona profile pictures and the use of a stock photo influence *persona perceptions*. Considering the research question at hand, we evaluate four relevant perceptions, namely *persona likability, persona credibility, perceived similarity*, and *willingness to use a persona*. We measure the impact of a *smile in the persona profile* and *use of stock photos* on these perceptions, defined in Table 1. The research questions are as follows:

(1) *How does using a smiling persona picture in the profile affect individuals' perceptions of the persona?*
(2) *How does using a stock photo in the persona profile affect the persona perceptions?*
(3) *Are the perceptual effects consistent across different age, gender, and ethnicity of the persona?*

Table 1. Operational definitions of the research constructs, adapted from (Salminen et al., 2018).

Construct	Operational definition
Credibility	Persona information is clearly presented to the individual the persona is shown to.
Likability	The persona is liked by the individual the persona is shown to.
Similarity	The individual feels like the persona is like him or her.
Willingness to use	The individual would make use of this persona in his or her work or in the use case provided.

Credibility has been considered as a notable perceptual challenge of personas, as individuals need to be able to find the personas plausible and authentic to take them seriously (Chapman & Milham, 2006). Likability is similar to interpersonal attraction; another construct often evoked in social psychology research (Byrne, 1961). However, we find likability more appropriate for the scope of our study than attraction, since attractiveness often implies a relationship between opposite genders, whereas likability is more applicable between genders.

The perceived similarity to the persona is akin to the identification of a common bond. As we explain in the literature review, being exposed to smiling pictures increases similarity and identification in general. However, this has not been tested with personas. In this research, we particularly want to know if perceived similarity increases with smiling personas, as we similarity might influence individuals' willingness to use the persona for their information needs.

Willingness to use is crucial for personas in practice; as pointed out by several persona scholars, personas often lack employment in real use after their creation and they risk being "left in the desk drawer" (Friess, 2012; Rönkkö, 2005; Matthews et al., 2012). Thus, to better understand the applicability of personas, it is important to analyze how the persona picture influences willingness to use, either directly or indirectly (via other perceptions).

In the following section, we review the related literature, along with formulating specific hypotheses. After this, we explain the experimental setting, including the creation of the treatments and data collection. This is followed by an analysis of the results. We conclude by presenting practical advice for persona creators, along with identifying important questions for future research.

2. Literature review

2.1. Smile in persona profiles: An open research gap

There are a plethora of studies investigating the effect of a smile in human-computer interaction contexts. These studies tend to relate to encounters between humans and virtual agents, creating "virtual rapports" between the two actors (Huang, Morency, & Gratch, 2011) that can enhance the attitudes and first impressions of humans when dealing with artificial human-like interfaces (Cafaro et al., 2012). As noted by Qiu and Benbasat (Qiu & Benbasat, 2005), "Naturalistic avatars are usually humanoid in form, but with a degraded level of detail. This type of avatar can emulate natural protocols just enough to achieve recognition of familiar features, like a smile, a waving hand, and a nodding head." (p. 81). Östberg et al. (Östberg, Lindström, & Per-Olof, 1989) consider that "smile or a frown will serve as powerful feedback" (p. 151) in a videophone system, while Brito and Stoyanova (Brito & Stoyanova, 2018) note, in augmented reality context, that "[t]he smile is the most complex of the facial expressions." (p. 820). Overall, these studies tend to be concerned with how users can use a smile for interacting with computer systems.

However, from our review of literature, we could locate no previous research that investigates the presence of a smile specifically in persona pictures. This relates to the general lack of research on the effect of images on the design of personas or the effectiveness of their use on end users' perceptions. Among the few studies on this topic, Salminen et al. studied the inclusion of contextual photos in persona profiles (Salminen et al., 2018) and the confusion and information inferred from different persona photos (Salminen et al., 2019). Eriksson et al. (Eriksson, Artman, & Swartling, 2013) found that through pictures, the users of personas draw inferences and memories about similarly-looking people they have met previously. In a similar vein, Nielsen et al. (Nielsen et al., 2017) found the persona pictures to be a considerable source of sense-making by the persona users. In their meta-analysis of 47 persona templates, Nielsen et al. (Nielsen et al., 2015) found the picture to be an integral part in almost all of the analyzed persona profiles.

Because we found no studies concerning the use of a smile in persona profiles, we decided to investigate if the research papers reporting personas show smiling or non-smiling pictures. For this, we manually analyzed a sample of 45 persona articles published in peer-reviewed journals and conferences between 2002 and 2017 (retrieved by searching the ACM Digital Library). Reviewing these articles, we found that 71% of these publications did not include a persona profile within the article, highlighting a general lack of attention on profile design as a part of persona research. In the 13 articles (29%) that did include a persona profile, all included one to five images of a persona for a total of 42 persona images. We then coded each persona image presented in these articles with a binary classification of 'smiling' or 'not smiling', finding that, from the found persona profiles, 55% (23) contained smiling images and 45% (19) contained non-smiling images. Therefore, there seems to be no consensus on whether the image of the persona should contain a smiling or not smiling person.

Nevertheless, understanding the effect of the smile has a direct impact on the design and implementation of personas, especially given (a) the effects of the smile discovered in social psychology research, and (b) the general importance of pictures for sense-making of persona users. In the following section, we explore the former.

2.2. Smile and person perceptions

Because we could locate no prior studies that would investigate the effect of smiling images on persona design, we turn to research concerning actual people, as person perceptions can be viewed as conceptually applicable to personas (Marsden & Haag, 2016; Salminen et al., 2018). Most of the research done on this topic originates from the field of social psychology, although there are also studies in human-computer interaction that have explored the interaction of smiles and technology. For example, Turner and Hunt (Turner & Hunt, 2014) investigated social network users' assessment of other users' personality traits based on their profile pictures and found that smiling had a significant impact on personality assessments.

One of the first studies examining smile and person perception is from Brannigan and Humphries (Brannigan & Humphries, 1972) who studied nonverbal behavior as a means of communication. The authors identified three types of smiles: *closed smile, upper smile*, and a *broad smile*. Results showed that there is a difference between the perception of each type of smile; the upper smile was considered to be the most common smile in social interactions, while the closed smile was used in non-social interactions (Brannigan & Humphries, 1972). Kalick (Kalick, 1977) investigated plastic surgery, physical appearance, and person perception and the researcher found that women that have undergone plastic surgery were perceived as more attractive, kind, sensitive, responsive, and likable. In a similar vein, Reis et al. (Reis et al., 1990) found that a smile was perceived as more attractive compared to neutral facial expressions. Smiling people were also considered to be more sociable, sincere, and competent than neutral people but showed a lower level of masculinity and independence (Reis et al., 1990).

Otta, Abrosio, and Hoshino (Otta, Abrosio, & Hoshino, 1996) who studied the communicative impact of smiling found that smiling was associated more with happiness, kindness, and attractiveness. In a similar vein, Lau (Lau, 1982) investigated the effect of smiling on person perception (however, not on *persona perception*) and found that smiling people were more liked and positively perceived than non-smiling people. Also, smiling was associated with intelligence and warmth (Lau, 1982). Wang et al. (Wang, Mao, Li, & Liu, 2017) observed that the intensity of the smile affects interpersonal perceptions, specifically the perceptions of warmth and competence. The aggregated consensus from these previous studies suggests that smiling generally evokes positive sentiments, for example, liking. Following the previous research, we formulate the following hypothesis:

H01: Smile and persona likability are positively associated.

Moreover, Lau (Lau, 1982) found that positive associations can be linked to emotional contagion, i.e., feeling happy by looking at other people being happy. Such an effect was also found by Barger and Grandey (Barger & Grandey, 2006) who analyzed the relationship between smile and appraisal mechanisms relating to services. They found that mimicry, a type of primitive emotional contagion, was significantly used in encounters between strangers during food service. Even though smiling was not correlated with post-encounter mood and appraisals, it was correlated with high customer service ratings (Barger & Grandey, 2006). In a similar vein, Hinsz and Tomhave (Hinsz & Tomhave, 1991) found that participants reacted back with a smile to a smiling facial expression, and the effect was stronger than the frown-to-frown reaction. In support of these findings, Chartrand and Bargh (Chartrand & Bargh, 1999) detail an assimilation effect, according to which a smile results in a greater sense of communality between the subject smiling and the subject exposed to smile. Overall, emotional contagion has been observed in a range of contexts, also in online systems (Del Vicario et al., 2016; Kramer, Guillory, & Hancock, 2014). The broad array of research suggests that emotional mimicry is an innate human

ability, with intrinsic and instinctive manifestation in social engagement with others. These previous studies suggest that smiling is positively associated with a sense of similarity and identification. Following this logic, we formulate the following hypothesis:

H02: Smile and perceived similarity with the persona are positively associated.

Note: with "perceived similarity," we indeed refer to perceived similarity, not the real similarity (in terms of matching age and gender). This is because a person belonging to a different demographic group might have a feeling of similarity with a persona based on shared interests instead of shared demographics (for example, a middle-aged woman and teenage buy can both be interested in *Pokémon Go*).

Moreover, we hypothesize that the willingness to use a persona – a construct operationalized with items measuring how much the individual wants to learn more about the persona as well as use the persona for professional decision making (Salminen et al., 2018) – is enhanced by the smile:

H03: Smile and willingness to use a persona are positively associated.

Smile perceptions seem to be related to the gender and age of the smiling individual. Otta et al. (Otta et al., 1996) found age differences showing that young people were considered to be more extroverted and ambitious than middle-aged and older people and middle-aged and older women were perceived as less attractive in comparison to middle-aged and older men, for whom results were the same as for young men. The study concluded that positive attributes associated with a smile affect the person perception (Otta et al., 1996). In contrast, Lau (Lau, 1982) did not find gender differences in their research, but Deutsch (Deutsch, 1990), who examined the effect of role on smiling in men and women, found that gender differences can arise, involving, for example, the more frequent association of non-smiling female persons as unhappier, less carefree, and less relaxed than men. This may influence perceivers' associations and create biases (Deutsch, 1990). The gender stereotype of women, both smiling and receiving more smiles than men, is also postulated by Hall (Hall, 1990). Therefore, smile perceptions are mediated by demographic attributes such as age and gender.

To account for these effects, we vary age and gender in our experimental treatments. Also, we include race as an experimental variable, as the persona's race has been noted to influence user perceptions in previous persona studies (Hill et al., 2017; Salminen et al., 2018). While Floyd, Jones, and Twidale (Floyd et al., 2008) advise against racial, gender, or age profiling when creating personas, choosing *any* picture of a person forcefully means assigning the race of a persona. Therefore, the effects of such choices should be empirically tested.

Finally, the type of smile has been shown to affect person perception, so that smile intensity (Abel & Kruger, 2010) and attractiveness of the person smiling (the "beautiful people" effect, i.e., the smile of an attractive person has a larger impact) (Van der Geld, Oosterveld, Van Heck, & Kuijpers-Jagtman, 2007) affect the perceptions of the smiling person. Here, we consider this prior finding by adding an experimental condition of the stock photo. Particularly, stock photos tend to depict *professional models*, whereas authentic pictures portray *ordinary people* that can be thought of as more representative of real users. It is, thus, an important question to clarify how using ordinary or stock photos affects how the personas are perceived. We present the following hypotheses:

H04: Smile and persona credibility are negatively associated.

H05: Use of stock photos and persona credibility are negatively associated.

H06: Use of stock photos and perceived similarity with the persona are negatively associated.

The rationale for H04–H06 is that use of stock photos comes with a certain sense of "fakeness," so that the personas seem less authentic and less like real people ("less like me"). This is because stock photos typically represent professional models that may reduce the sense of identifying with the persona that the picture represents. For example, Stanford et al. (Stanford, Ip, & Durham, 2014) analyzed individuals' views of dentofacial appearance and found some participants referring to "too perfect" smiles: "I mean Simon Cowell's teeth are just, I don't like them because they're just, you can tell that they're … they're too perfect. (…) I think they're not real. (Patient 7)" (p. 292). In contrast, we expect that there is a positive effect between the use of stock photos and the likability of the persona, as individuals are likely to "idolize" attractive professional models:

H07: Use of stock photo and persona likability are positively associated.

2.3. Persona perceptions

To conclude our hypothesis development, we form some hypotheses relating to the internal relationships of the *persona perception* constructs. These are justified in the following.

From a psychological perspective, the benefits of personas are rooted in self-identification (Miaskiewicz & Kozar, 2011). Through the cognitive processing of persona information, decision makers can obtain an empathic understanding of users, immersing themselves in real situations of others. Decision makers can use this ability to predict the users' behavior under different circumstances (Pruitt & Grudin, 2003). This mental modeling relies on human beings' innate ability of empathy and immersion (Krashen, 1984); therefore, it is a powerful agent for motivation and purpose. Typically, personas are communicated in the form of a story or narrative, e.g., "*Mary is a 35-year-old woman who likes …* ". A persona can be seen as a story that conveys critical experiences, those that the decision makers would not necessarily know otherwise. Since human beings tend to be receptive to narratives (Polkinghorne, 1988), storytelling facilitates the conveying and absorption of key attributes of the personas (Madsen & Nielsen, 2010). As argued by Hill et al. [17, p. 6660], *"[a decision maker's] ability to engage and*

empathize with personas comes in part from the fact that a persona seems like a person – not like a list of facts, a philosophical stance, or an educational document – but an actual person."

For this reason, we hypothesize that individuals are more inclined to like personas that they perceive as similar to themselves, and they are more interested in knowing more about the personas they like. Therefore, the following hypotheses are presented:

H08: Perceived similarity with the persona and persona likability are positively associated.

H09: Persona likability and willingness to use a persona are positively associated.

However, since personas are human representations of data, they are likely to be judged like humans by other humans (Marsden & Haag, 2016). Therefore, there are also perceptual challenges involved in the creation, adoption, and use of personas. Most notably, lack of credibility has been raised as a major concern in the persona literature (Chapman & Milham, 2006), arising from the fact that personas are often created from relatively few qualitative interviews without formal representativeness of the actual user base. Decision makers are unlikely to adopt the personas for real use if there are doubts about their credibility (Rönkkö et al., 2004). For example, in a study by Long (Long, 2009), designers were shown to lack trust in a persona if they did not participate in the persona creation. In a study by Matthews et al. (Matthews et al., 2012), the participants found the personas abstract, impersonal, misleading, and distracting.

Considering these studies, we expect that a credible persona enhances the willingness to use the persona. To empirically investigate this association, we formulate the following hypothesis:

H10: Persona credibility and willingness to use a persona are positively associated.

Moreover, according to Marsden and Haag (Marsden & Haag, 2016), users of personas implicitly infer attributes from personas, and this process typically involves biases and stereotyping. Similar results have been found by Hill et al. (Hill et al., 2017) and Salminen et al. (Salminen et al., 2018), suggesting that the cognitive processing of personas is greatly influenced by individualized sense-making. This sense-making is directed by the information that the persona creators have decided to include in the persona profiles (Nielsen et al., 2017). As Marsden and Haag (Howard, 2015) note, "*the use of personas seemed to activate pre-understandings, prejudices, and assumptions [of individuals exposed to personas]*" (p. 4020). In summary, the cost of increasing empathy and immersion by presenting user information as personas seems to be that there is a heightened degree of stereotyping and perceptual biases involved in interpreting the persona information. To investigate these effects, we formulate our final hypothesis:

H11: Perceived similarity and willingness to use a persona are positively associated.

The consensus of previous work is, therefore, that perceptions are crucial in the deployment of personas and that they are inherently associated with the cognitive process and attitudes of individuals viewing the personas. Therefore, we expect the probing of smile and stock photo conditions to yield interesting results.

3. Methodology

Our research process comprises six steps: (1) We first collect smiling/non-smiling and stock photo/non-stock photo image pairs, then (2) create the personas using those image pairs, after which we (3) create the questionnaire, (4) create the crowd experiments, (5) collect data and, finally, (6) analyze it, using both quantitative and qualitative means. The following sections explain the steps of the research process.

3.1. Experimental design and image selection

The study follows a between-subjects experimental design. We present crowd workers with persona profiles that vary by the following experimental variables (levels in brackets): **age** [young, mature], **gender** [male, female], **ethnicity** [White, Black, Asian], **smile** [smiling, not smiling], and **stock** [stock, non-stock]. We then query how these pictures affect *persona perceptions*, including credibility, likability, similarity, and willingness to use.

To test the smile variable, the persona profiles have a smiling version and non-smiling version of a picture portraying a person, both stock and non-stock photos. To test the stock photo variable, we create two sets from each demographic combination (Age, Gender, Race), one with a stock photo and the other one with a non-stock photo. Likewise, we ensure that each demographic combination has a smiling and non-smiling version.

Overall, combining the variable levels requires us to obtain 48 images (2 age groups × 2 genders × 3 ethnicity × 2 smile × 2 stock = 48 photos), of which 24 are stock photos, and 24 are photos of regular people.

To collect the images, we utilize two tactics: (1) find image pairs of smiling/non-smiling people from online stock photo banks and (2) take photos of real people smiling and not smiling. For the former, we browse both free and paid online stock photo services (e.g., Pixabay, 123rf.com, iStockPhotos). We devised the following criteria for finding stock photos: (a) looks like a professional photo, (b) is technically high quality, and (c) corresponds to the demographic profile of the taken photos (age, gender, ethnicity). Stock photos are typical of professional models and often used for marketing and advertising purposes.

To test the effect of stock photos against photos of regular people, we engaged a professional photographer to take facial pictures of people with different age, gender, and race. The photos were taken at a popular tourist destination in the Philippines, where it was possible to locate people from diverse age, gender, and ethnic groups. We instructed the photographer to keep everything else constant for the image pairs apart from the smile condition. In other words, the

image pairs need to have the same pose, background, and gaze direction. When taking the pictures, the people being photographed were explained that the pictures are to be used in academic research, and their consent was obtained for this purpose.

Figures 1 and 2 show examples of the obtained photos, and Appendix 1 contains all the photos.

We validated the smiling/non-smiling condition by recruiting eleven external raters from Upwork[2], an online freelancer service, and asked them to evaluate if a person in the picture contains a smiling or non-smiling person. All the 48 face pictures were shown for each participant, mixing their order randomly to avoid direct comparison between the faces of the same person. Furthermore, the participants were instructed to give their first impression of a smile or not and not to change their evaluation if they saw the same person later. Each participant was given a reward of $5 USD (in total $55 USD). This way, we obtained 48 × 11 = 528 manual ratings.

For each picture, we calculated a majority vote from the external raters; if the number of ratings exceeded 50% (6/11), then the winning class was assigned as the majority vote. We compared the majority votes with the smile/non-smiling conditions we had assigned for each picture ("ground truth"), obtaining an agreement of 98% (47/48) (Cohen's kappa = 0.95, "almost perfect agreement" (Richard Landis & Koch, 1977)). Only one majority vote deviated from the expected class (see Figure 3). Thus, the smiling/non-smiling conditions we assigned correspond to general smile perceptions of people.

3.2. Creation of persona profiles

After collecting the photos, we proceed with creating the persona profiles (treatments). The key attributes of personas typically include age, gender, location, topics of interests, even psychological attributes such as attitudes, beliefs, feelings (Faily & Flechais, 2011), goals, skills, and needs (Vincent & Blandford, 2014). Although there are dozens of different layouts for persona profiles (Nielsen et al., 2015), in this research, we adopt the layout and information content presented by Jung et al. (Jung, Salminen, Jisun, Kwak, & Jansen, 2018; Jung, Salminen, Kwak, Jisun, & Jansen, 2018), as it is a common layout. The personas were created manually using Photoshop image editing software. Overall, we created 48 treatments,

Figure 1. Example stock pictures: (a) White young male, (b) Asian young female, and (c) Black mature female, not smiling (top row) and smiling (bottom row).

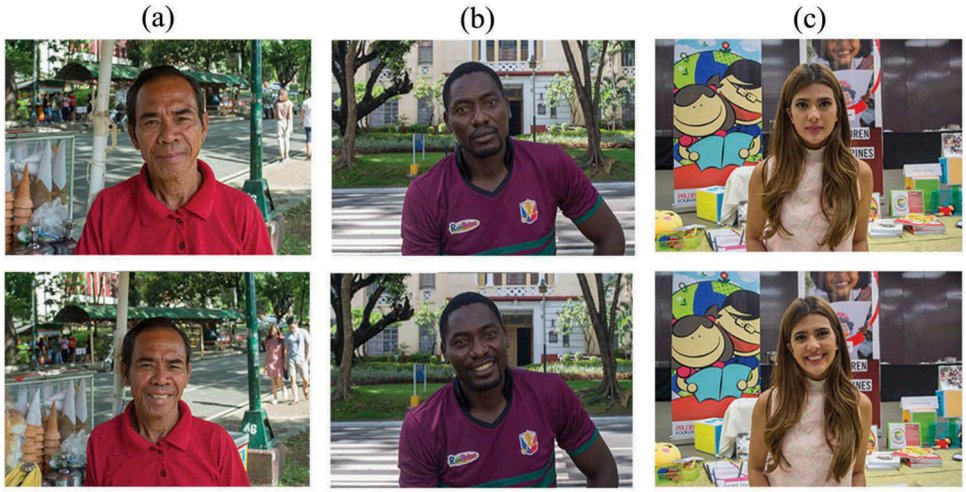

Figure 2. Example non-stock pictures: (a) Asian mature male, (b) Black young male, and (c) White young female, not smiling (top row) and smiling (bottom row).

Figure 3. The picture, corresponding to "mature female, non-smiling, non-stock photo", was rated as smiling by six out of eleven and non-smiling by five out of eleven external raters. This picture represents a borderline case where individuals have a high disagreement of whether a person smiles or not and is the only case where the assigned condition deviated from the expected result.

varying age, gender, race, smile, and stock photo condition. Figure 4 illustrates the treatments.

Apart from changing the picture according to the experimental variables, all other information (e.g., topics of interest, most viewed content, quotes) was kept unchanged in the persona profiles. Table 2 defines the information elements of the persona profile.

3.3. Survey creation and data collection

The measured constructs, along with their levels, are shown in Table 4. We utilize the constructs and items from the *Persona Perception Scale* introduced by Salminen et al. (Salminen et al., 2018). This instrument deals with various dimensions related to users' perceptions toward personas, including credibility, clarity, consistency, and so on. From this instrument, we chose four constructs, as outlined above, with their associated measurement items.

We created a questionnaire using the items of Table 3 as statements shown to respondents. For each statement, we utilized a seven-point Likert scale with the options ranging from (1) Strongly disagree to (7) Strongly agree. Altogether, we created 48 crowd experiments, according to the multiplication of [3 races] × [2 ages] × [2 genders] × [2 smile conditions] × [2 stock photo conditions]. Each experiment shows the respondent one persona profile and then asks answers to the statements. We recruited 50 respondents for each treatment; there were 2,400 respondents in total.

For data collection, we used the crowdsourcing platform FigureEight (formerly known as CrowdFlower). This platform has been used in several human-computer interaction studies, for example, to annotate tweets or images (Alam, Ofli, & Imran, 2018; Michalco, Simonsen, & Hornbaek, 2015; Plotnick & Hiltz, 2018). To control the answer quality, we

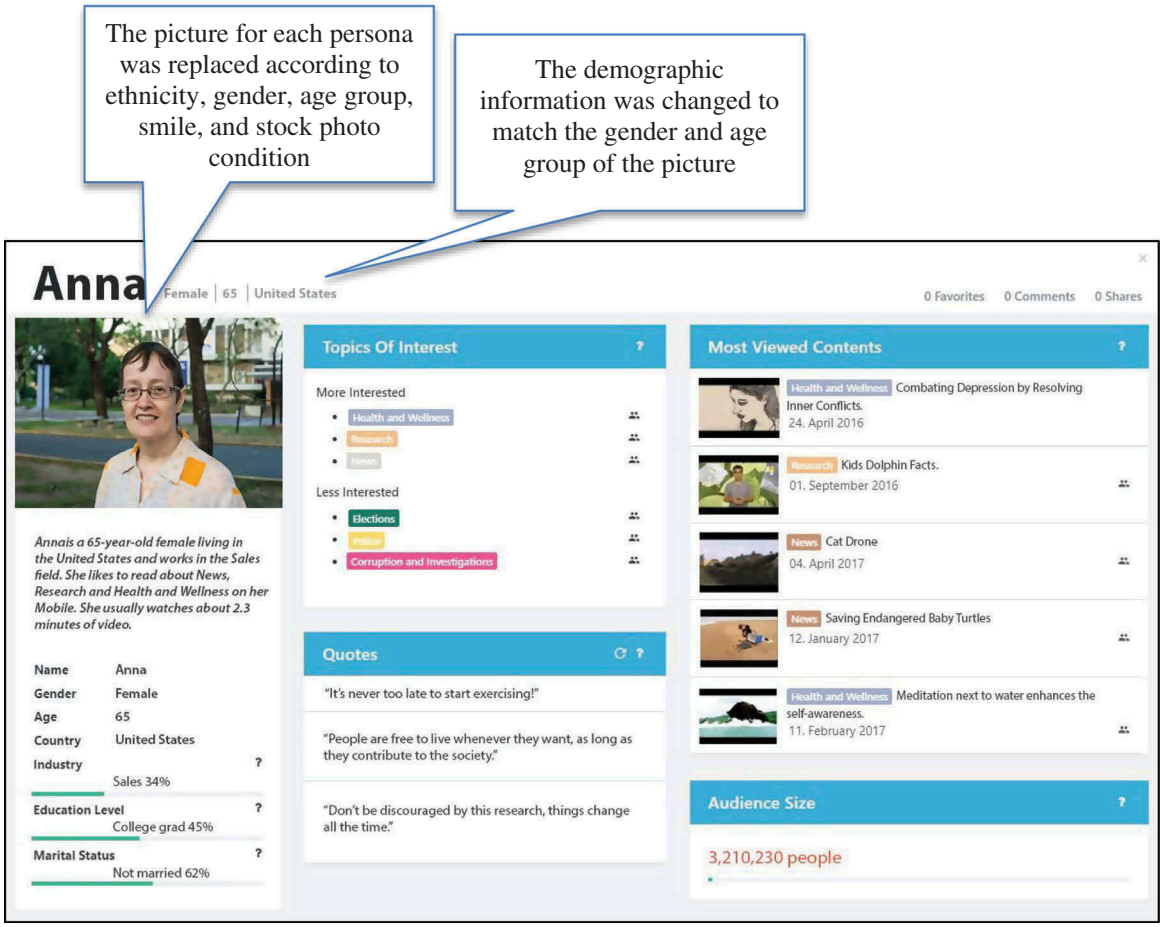

Figure 4. Example treatment (Mature woman smiling non-stock photo). The picture of the persona was changed to one of the 48 tested versions, and the age group and gender were matched with each picture. Other than that, the information in the created persona profiles remained the same.

Table 2. Definitions of the sections in the persona profile, adapted from (Jung et al., 2018).

Persona Profile Section	Definition
Name	Persona's name is chosen by retrieving common names from a popular online social network of people with a given age, gender, and country.
Picture	Persona's picture is chosen from pictures downloaded from online photo banks or the non-stock photos, tagged for age, gender, country, and ethnicity.
Demographic information	Persona's demographic information (age, gender, country) is retrieved from aggregated user statistics.
Industry	Industry is the most common industry of people on Facebook that correspond to this persona's age, gender, country, language, and topics of interest.
Education Level	The most common education level of people on Facebook that correspond to this persona's age, gender, country, language, and topics of interest.
Marital Status	The most common marital status of people on Facebook that correspond to this persona's age, gender, country, language, and topics of interest.
Topics of Interest	Topics of interest are retrieved by classifying the content to descriptive categories and choosing the most corresponding ones for this persona.
Most Viewed Contents	Individual content is chosen to describe the content preferences of this persona.
Quotes	Persona's quotes are retrieved from the comments of most viewed videos of this persona.
Audience Size	Calculated by searching the number of people in Facebook with attributes of the persona, including age, gender, country, language, and topics of interest.

Table 3. Constructs and items adapted from (Salminen et al., 2018).

Construct	Items
Willingness to use a persona	• I would like to know more about this persona. • I could see myself making use of the information about this persona in my work. • This persona would improve my ability to make decisions about the customers it describes. • I found this persona helpful for understanding the people it describes.
Persona likability	• I find this persona likable. • I could be friends with this persona. • This persona is interesting. • This persona feels like someone I could spend time with.
Persona credibility	• This persona seems like a real person. • The persona seems natural. • The persona seems to have a personality. • The picture of the persona looks authentic.
Perceived similarity	• I like the same things as this persona. • This persona feels like me. • The persona and I have similar opinions. • I can relate to this persona.

Table 4. Path coefficients for the structural model (significant results bolded).

Dependent Variable	Independent Variable	Estimate	Standardized Est.	Std. Error
Similarity	**Smiling**	**0,159 ***	**0,066**	**0,069**
Similarity	**Stock**	**−0,219 *****	**−0,092**	**0,069**
Similarity	Stock * Smile	0,037	0,013	0,097
Credibility	Smiling	0,052	0,022	0,065
Liking	Smiling	0,056	0,023	0,052
Liking	**Similarity**	**0,632 *****	**0,635**	**0,015**
Liking	**Stock**	**−0,245 *****	**−0,103**	**0,052**
Liking	Stock * Smile	0,030	0,011	0,073
Credibility	Stock * Smile	0,033	0,012	0,092
Credibility	**Stock**	**−0,542 *****	**−0,234**	**0,065**
Similarity * Credibility	Stock * Smile	−0,100	−0,036	0,057
Liking * Credibility	Stock * Smile	−0,047	−0,016	0,060
Willingness to Use	Smile	0,024	0,012	0,031
Willingness to Use	**Liking**	**0,246 *****	**0,292**	**0,017**
Willingness to Use	**Credibility**	**0,298 *****	**0,345**	**0,013**
Willingness to Use	**Similarity**	**0,248 *****	**0,296**	**0,017**
Willingness to Use	**Liking * Credibility**	**−0,034 ****	**−0,044**	**0,012**
Willingness to Use	**Similarity * Credibility**	**0,083 *****	**0,101**	**0,013**

Notes: *** $p < .001$; ** $p < .01$; * $p < .05$

undertook several measures following the approach by Huang et al. (Huang, Weber, & Vieweg, 2014). First, we set the participant quality level to Level 3 (Highest quality). Second, we set a minimum time of 120 seconds for the experiment; any answer taking less time than this would be disqualified. Third, we prevented the same participants from enrolling in many surveys by using the "custom blacklist" feature of the survey platform.

The sampling was geographically narrowed to four English-speaking countries: United States (USA), United Kingdom, Canada, and Australia. The reward for filling in the survey was 0.30 US dollars. The respondents were explained that we are interested in knowing their thoughts about the persona they were shown. We defined the persona as follows: *A persona is a fictive person describing a bigger customer segment. It can be understood as a typical or average customer*. We instructed the respondents to review the persona information carefully, paying attention to the picture, name, and other information in the persona profile. Then, we asked them to answer the statements about the persona. At any time while responding to the survey, they could review the persona profile.

Note that the platform does not report sociodemographic data like gender, age, socio-economic status; rather, the crowd workers are participating anonymously. The only demographic variable we can retrieve for our sample is country: out of the 2400 ratings, 2252 (93.8%) were obtained from crowd workers located in the USA, 47 (2.0%) from Canada, and 101 (4.2%) from Great Britain. Posch et al. (Posch, Bleier, Flöck, & Strohmaier, 2018) conducted a study on sociodemographic variables of CrowdFlower workers in general. They collected data of workers from ten countries, with 900 participants per country. The countries were selected from three groups: high-income (USA, Germany and Spain), middle-income (Brazil, Russia, and Mexico), and low-income group (India, Indonesia and the Philippines). They also collected data from Venezuela because this was the most active country on CrowdFlower at the time. The findings showed that, in most countries, crowd workers were predominantly male, with the proportion of male workers exceeding 60%. Most crowd workers were between 18 and 34 years of age, and, most countries had a higher share of non-married workers than married workers. Also, most countries had a household size of two or more people, with a low share of single households (below 10%). Typically, over a third of the crowd workers had a full-time job besides their activity on the

crowdsourcing platform. Moreover, CrowdFlower workers were found to be well educated in general, with more than 30% of workers having a Bachelor's degree or higher in all countries.

4. Findings

4.1. Path analysis

In this analysis, we specified the structural model to be tested. Composite scores were computed based on the simple mean for the items in each scale (DiStefano, Zhu, & Mindrila, 2009), as previous validation exercises indicated good psychometric properties of the scale in terms of both reliability and factorial validity (Salminen et al., 2018). We employed the Maximum Likelihood (ML) for model specification, as it is a common and robust estimation method (Kline, 2015). Interaction terms were created by the multiplication of the standardized variables, except for the Stock * Smiling term that refers to the condition where both "Stock" and "Smiling" are set to zero. After the initial model was specified, we conducted a multi-group analysis to evaluate moderating effects from Age, Gender, and Race (Zhou, Xingda, Helander, & Jiao, 2011), which we coded as nominal variables (e.g., 1 = Female and 2 = Male, for Gender). The nested models for each sub-group were initially compared with a chi-square test to identify candidate models for a path-by-path analysis (Maroco, 2003). Figure 5 shows the path analysis for the global model using the full sample.

From our analysis, we observe that a considerable number of predictors have significant paths. Smiling has a marginally positive effect on perceived similarity ($B^3 = 0.066$, $p < .05$), which matches the hypothesized effect (H02). However, unlike what we hypothesized, smiling was found to have no significant impact on likability (B = 0.023, $p = .285$) (H01). The effect of similarity on likability was aligned with our hypothesis (H08), with a significant positive effect (B = 0.635, $p < .001$). Moreover, as we expected, likability was found to have a significant positive effect on willingness to use (B = 0.292, $p < .001$) (H09). Credibility was also found to have a significant positive effect on willingness to use (B = 0.345, $p < .001$) (H10). Moreover, there was not a significant effect of smiling on credibility (B = 0.022, $p = .423$) or willingness to use (B = 0.012, $p = .442$), which refutes our hypotheses on the significance of these paths (H04 and H03).

However, conforming to our hypothesis (H05), stock photos were found to negatively impact credibility (B = -0.234, $p < .001$). This negative effect of the stock photo was also present on the similarity path (B = -0.092, $p < .001$), which is aligned with our hypothesis (H06). These two findings can be interpreted as an indication that stock photos have a significant impact on *persona perceptions*. A negative effect was found between stock photos and likability (B = -0.103, $p < .001$), contrary to our hypothesized positive relationship (H07). Finally, similarity had a positive effect on the willingness to use (B = 0.296, $p < .001$), confirming the postulated hypothesis (H11). Other notable effects are the interaction between likability and credibility (B = -0.044, $p < .01$), indicating that the combined effect is less than the sum of the individual effects, and the interaction term between similarity and credibility (B = 0.101, $p < .001$), indicating that there is a synergistic effect between these two variables regarding willingness to use. Table 4 summarizes the results of the structural modeling.

4.2. Moderation analysis of demographic variables (age, gender, race)

The moderation analysis was conducted using multi-group analysis, using the procedure described by Maroco (Maroco, 2003), where the unconstrained model (i.e., path coefficients

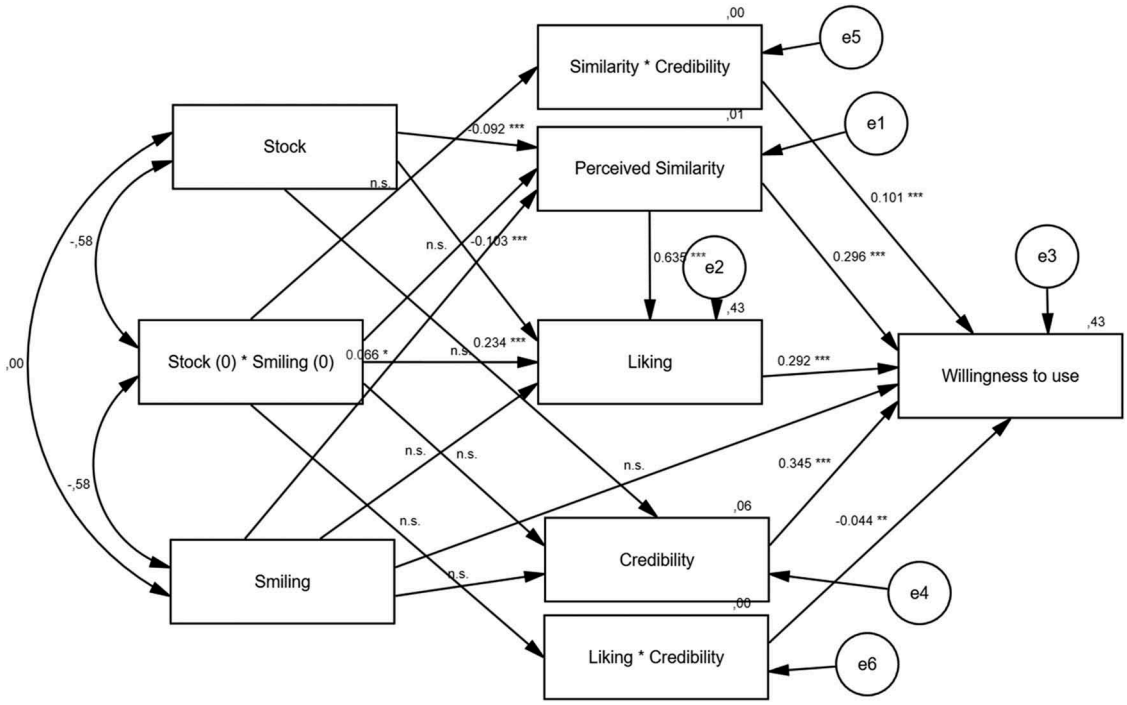

Figure 5. Path analysis for the global sample. Values indicate standardized regression coefficients. Latent variable "e" indicates the error term. *** $p < .001$; ** $p < .01$; * $p < .05$.

are free to vary across groups) is compared with a constrained model where path coefficients are assumed to be identical across groups. We test differences using a chi-square test. In this test, a significant result indicates that there are significant differences between groups, i.e., a moderation effect. In this scenario, a follow-up path-by-path analysis can be conducted to determine in which specific paths the differences lie.

We began by testing for a moderation effect of the Age variable, i.e., whether the models differ for personas classified as Mature or Young. The personas were divided into classes by appearance of age. Although we did not know the exact age of the person in the picture, this division was not difficult, as we purposefully collected pictures of young and older people. Figure 6 shows an example of young and mature people. To ensure that this age comparison is valid, we conducted an independent rating of pictures to "young" or "mature" among two raters (i.e., two researchers independently coded the tested pictures). As expected, we reached a perfect agreement (Cohen's Kappa = 1.00), a by-product of the young pictures being distinguishable from the mature pictures. The chi-square test indicates that no significant differences in perceptions exist between the models in terms of age ($\chi2(18) = 27.989$, $p = .062$). Thus, there is no evidence of a moderation effect regarding the Age variable.

We proceed by testing for the moderation effect of the Gender variable, i.e., whether the models differ across persona genders (*levels*: male, female). As previously, verifying that a picture contains a male or female yields a perfect agreement (Cohen's Kappa = 1.00) between two independent raters. Again, the chi-square test was not significant ($\chi2(18) = 20.813$, $p = .289$), indicating the absence of a moderation effect of gender. Finally, we tested for a moderation effect of the Race of the persona (*levels*: Asian, White, Black). Contrasting the unconstrained with the constrained models yielded a non-significant chi-square test ($\chi2(36) = 25.354$, $p = .907$). In other words, there is no evidence of a moderating effect from the Race of the persona, either.

The non-significance of all three moderating effects provides evidence of model invariance across age, gender, and race (Kline, 2015) – thus, suggesting that the effects identified in the global model are universal, at least for these three demographic variables. Thus, it can be concluded that a smile – and whether the photo is stock or not – is an important determinant of user perception, regardless of the intrinsic features of the person being pictured. Table 5 summarizes the results.

4.3. Qualitative analysis

To better understand the impact of smiles on *persona perceptions*, we conducted a qualitative survey with 40 respondents using the Prolific survey platform (Palan & Schitter, 2018). This platform enables online participants to voice their opinions on various matters. To investigate the perceptions toward personas, we showed the respondents four persona profiles: **Black Young Male Smiling Stock Photo** (BYMS_sp), **White Mature Male Smiling Stock Photo** (WMMS_sp), **White Young Male Not Smiling Not Stock Photo** (WYMNS_ns), and **Black Young Male Smiling Not Stock Photo** (BYMS_ns). We asked the respondents to write answers to three tasks:

- *Please describe this persona in your own words*
- *Tell us why you think that way about the persona*
- *Write down three adjectives that describe this persona*

The responses were stored in a spreadsheet and analyzed manually by searching for mentions of the pictures. In other words, we counted the times specific persona information (e.g., picture, demographics, quotes, etc.) was mentioned. For example, the participant response "He is young, but he looks to be someone who is who he says he is." was counted as demographic information = 1 (cue word: "young"), picture = 1 ("looks"), quotes = 1 ("he says he is"). The average answer length was 93.6 characters, which highlights the brevity of responses to online surveys (i.e., about the length of a typical English sentence). However, the participants still made frequent references to the persona information.

Table 6 shows the frequencies of different persona information elements. The results indicate that the influence of pictures on *persona perceptions* is varied. Many respondents do not explicitly express that the pictures influence their perceptions. Also, it is possible that, in written explanations, respondents either are unaware of the impact of pictures on their perceptions or try to avoid appearing judgmental by not basing their perceptions on the looks of the persona. Nevertheless, several respondents did refer to the pictures when explicating their sense-making process. For example, Respondent 14 (R14) (commenting on BYMS_sp): "*He seems to be a nice, smart, energetic person who thinks about others (is kind)*".

When asked why R14 thinks like this, she said: "*They have a nice smile, went to college and the way they commented on things.*"

Moreover, lifestyle aspects are inferred from the smiling pictures:

Figure 6. Example of age comparison.

Table 5. Results for hypothesis testing: (✓) indicates confirmed, (–) not confirmed.

Hypothesis	Result	Potential explanation
H01: Smile and persona likability are positively associated	–	Smile is not the only feature individuals are basing their *persona perceptions* on.
H02: Smile and perceived similarity with the persona are positively associated	✓	**A smile in the persona picture enhances individuals' identification with the persona.**
H03: Smile and willingness to use a persona are positively associated	–	Unlike the hypothesis, the perceiver is not more likely to want to know more about a smiling persona.
H04: Smile and persona credibility are negatively associated	–	A smile does not reduce the authenticity of the persona.
H05: Use of stock photos and persona credibility are negatively associated	✓	**Stock photos of professional models are not perceived to be as authentic as pictures of ordinary people**
H06: Use of stock photos and perceived similarity with the persona are negatively associated	✓	**Stock photos using professional models reduce the sense of immersion by individuals ("I'm not like this guy" effect).**
H07: Use of stock photo and persona likability are positively associated	–	The models in stock photos are not "idolized" by the perceivers.
H08: Perceived similarity with the persona and persona likability are positively associated	✓	**Individuals find the personas they perceive similar to themselves as more likeable.**
H09: Persona likability and willingness to use a persona are positively associated	✓	**Individuals find the use of personas they like more enjoyable.**
H10: Persona credibility and willingness to use a persona are positively associated	✓	**A believable persona makes the usefulness of the persona more impactful.**
H11: Persona similarity and willingness to use a persona are positively associated	✓	**Individuals want to learn more about personas they perceive similar to themselves.**

- "*his picture, dress code, data in his cv, and the smile [make me think he is] active young person. entrepreneur, competitive.*" (Respondent 10 on BYMS_sp)
- "*Warm, optimistic, hopeful, active [because of] smiling face, positive quotes, liking of frivolity, the mid 60s but still living life to the full.*" (R29 on WMMS_sp)

Also, stock photos are associated with a sense of fakeness by some respondents. For example, "*Seems to be a bit condescending, maybe a little fake, Big audience so popular, professionally shot photo.*" (Respondent 1, BYMS_sp). Respondent 1 continues, when shown another persona with a non-stock photo (WYMNS_ns): "*Looks the same to me, if not a little more likable because of his more likable profile picture, its not perfect which is nicer.*" In a similar vein, R28 on WMMS_sp: "*Older person interested in heath & fitness, looks fake & artificial [because] the photo is professional and or Photoshoped.*" Additionally, R28 elaborates on BYMS_ns: "*More normal person [because] photo looks natural, still a bit fake.*" However, more authentic photos can also raise stronger antipathy, possibly because they are more relatable: "*His profile picture doesn't look especially friendly, and he looks a little like he might be a bit smug. He's also unmarried, which makes me feel the same way.*" (R18 commenting on WHMNS_ns). R4 on the persona with non-stock picture (WYMNS_ns): "*He seems a bit smug, but more relatable than the previous persona.*"

Table 6. Frequency of mentions about different persona information.

Persona profile section	Mentions	%
Topics of Interest	44	24.4%
Quotes	33	18.3%
Picture	32	17.8%
Demographic Information	24	13.3%
Most Viewed Contents	18	10.0%
Industry	12	6.7%
Education Level	9	5.0%
Marital Status	5	2.8%
Name	3	1.7%
Audience Size	0	0.0%
	180	100.0%

Both R4 and R18 are Western women with the same age range as the persona, which supports an anecdotal proposition that individuals rate the persona of their age differently from personas in other age groups. For example, when this age range of respondents was evaluating the elderly male persona, the interpretations seem to be less critical. Thus, further research should investigate the question of age match between the users and personas to evaluate whether there is a systematic effect.

Finally, the qualitative analysis supports the findings from previous research showing that people tend to infer non-obvious information from the persona profiles (Marsden & Haag, 2016; Nielsen et al., 2017; Salminen et al., 2018). For example, consider the answer by R18: "*His profile picture looks confident, and his quotes and interests tell me he is active and not interested in heavy issues. He's wearing a suit which implies he is professional. His videos show me he enjoys funny things, but also looks for advice on meditation and depression which tells me he may suffer from depression/anxiety.*" This answer shows that respondents may infer non-related information from the persona profiles, such as the mental health of the persona. Another example is from R6, showing that the stereotypical thinking of the respondents affects their interpretation of the persona: "*Kani is a bit more modern-thinking but he's still quite controlling. Plenty of disposable income. Wants to marry.*" When asked why, the respondent answered: "*He's male, he'll dominate. He's young.*" (i.e., young males are controlling); and "*He's male, he's single, perhaps been a bachelor all his life.*" (i.e., singles want to marry).

5. Discussion and implications

5.1. Positioning findings to earlier research

Table 5 contains potential explanations of the results. Here, we focus on positioning the findings to the previous body of literature.

The lack of support for H01 (smile and likability), H03 (smile and willingness to use), and H04 (smile and credibility) suggests that the role of the smile is not overwhelming when individuals interpret persona profiles. This proposition is consistent with the idea that *personas are composite descriptions* (Bødker, Christiansen, Nyvang, & Zander, 2012), with each piece of information playing a role for the end-user perceptions. It suggests that the overall effect of smiling pictures, although having some effect on *persona perceptions*, is not overwhelming, meaning that respondents form their overall perception using other informational cues as well.

The qualitative answers also support this conclusion, as the respondents repeatedly referred to other informational content along with the picture, mainly the topics of interest and quotes of the persona. Again, this is consistent with previous research that shows the persona's quotes and topics of interest are particularly impactful information for end users (Salminen et al., 2019, 2018). While previous research has conceptually established the point of personas being composite descriptions (Chapman & Milham, 2006), this study is among the first to empirically verify that idea through the analysis of *persona perceptions*.

The fact that smile and perceived similarity with the persona are positively associated is consistent with the previous studies in social psychology postulating that a smile enhances the sense of identification between individuals (Barger & Grandey, 2006; Hinsz & Tomhave, 1991). What is interesting is that similarity is positively associated with likability. In other words, when the respondents viewed the persona similar to them, they liked the persona more. These findings are consistent with social group behavior theory, implying that "people like like-minded people" (Bessi, 2016; Del Vicario et al., 2016).

Stock photos decreased the credibility of the persona and the sense of perceived similarity with the persona, suggesting that, for many respondents, using professional models made the personas seem more elusive than using the pictures of "regular people". Moreover, contrary to what we expected, the respondents did not like the "beautiful people" in the stock photos more than the regular people – in fact, to the contrary, there was a negative relationship between use of stock photos and persona likability. These results are advising against the use of stock photos in favor of more authentic pictures of real people when creating persona profiles. A possible explanation for these findings is that, as stock photos are not viewed as realistic, individuals might experience more difficulty in relating to personas portrayed using stock photos.

Finally, according to our knowledge of the persona literature, this study is the first one to present quantitative evidence on *the perceptual predictors for willingness to use a persona*. By applying structural equation modeling, we were able to establish multiple significant linkages between *persona perceptions* and willingness to use a persona – with perceived similarity, credibility, and likability contributing positively to the willingness to use a persona. Overall, these results imply that individuals want to learn more about personas (people) that they like, find authentic, and can relate to. Therefore, the way the persona profiles are crafted is likely to have a sizable impact on how and if individuals in real organizations adopt the created personas and use them in their work.

5.2. Limitations and future research avenues

Concerning the limitations, the study sample was restricted to four English-speaking countries. It remains, therefore, an interesting question for future research to validate the findings in other cultures and regions of the world. Different sociodemographic variables of the participant sample were not available, so their effects remain unknown. Encoding the type of smile in a more granular fashion, for example, closed smile, upper smile, and a broad smile (Brannigan & Humphries, 1972) or Duchenne/non-Duchenne smile (Ilicic, Kulczynski, & Baxter, 2018) could make a difference in the observed effects. Likewise, "smile perception" (i.e., individuals' different perception of whether a person is smiling or not) should be measured and controlled for in future studies. Here, we expected all subjects to agree on the smile condition in the pictures but, while generally true, the validation of smiling hints to this not being the case.

Moreover, other conditions beyond a smile and a stock photo, such as the technical quality of photos, their lighting, applied styles/editing, and backgrounds could influence *persona perceptions* and could be tested in future research. The selected stock photos can have some quality variation that is hard to quantify, as we had to use several photobanks to cover all the experiment variables. Specifically, stock photos in our sample tend to have reduced background elements relative to non-stock photos. While this is an unfortunate source of

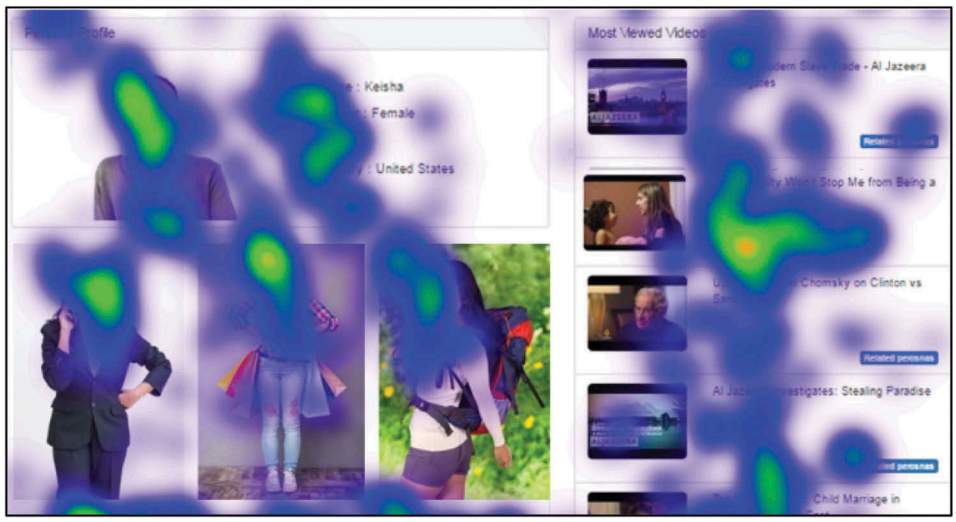

Figure 7. Eye-tracking heatmap from a persona user study (Salminen et al., 2018), showing the gaze densities toward screen areas. In general, the attention of the participants is focused on people rather than backgrounds.

potential confounding, eye-tracking experiments on persona profiles show that there is a tendency of individuals to focus on faces and people instead of backgrounds (see Figure 7).

Finally, future studies should investigate dissecting the relative effect of different information elements (e.g., picture, quotes, topics, etc.) on the overall *persona perceptions*. While we provided some indicative evidence on the role of the information elements – especially pictures – for the *persona perception* formation, a more nuanced understanding of this topic is needed.

5.3. Practical advice for persona creators

The results presented here directly aid in the design and implementation of personas within organizations. We provide the following recommendations:

- We recommend persona creators to use smiling pictures because this increases the perceived similarity with the persona, which, in turn, increases the willingness to use a persona.
- We recommend against the use of stock photos because the use of stock photos decreases the persona credibility and likability, while also decreasing the perceived similarity between the persona and the perceiver.
- We advise persona creators to focus on improving persona credibility and likability as well as perceived similarity with the persona to increase people's willingness to use personas. A non-stock picture of a smiling person can help in this.

6. Conclusion

We find that individuals feel more similar to personas with smiling pictures. Individuals are also inclined to like personas they perceive like themselves, and they are more willing to use personas which they like. Therefore, although smiling did not have a direct effect on willingness to use, it increases the perceived similarity that, in turn, increases the willingness to use a persona. However, the type of persona picture matters. Using stock photos in personas reduces their credibility, likability, and sense of similarity, likely because individuals find stock photos less authentic than pictures of normal people. These effects advise against the use of stock photos in persona profiles, while supporting the use of smiling pictures. From a theoretical point of view, the way that the persona profile information influences the *overall impression of a persona* is a complex process, where a smile, albeit having some effects, is not overwhelming for many of the tested *persona perceptions*. In addition to the profile picture, the quotes and topics of interest seem to play an especially important role in interpreting the persona. Relatively, rather than the choice of smiling picture, the choice is of stock photo vs. real photo is more impactful for the *persona perceptions*, with photos of regular people resulting in more favorable impressions.

Notes

1. Note that throughout the manuscript, we italicize the concept of *persona perception*, in order to make it more visually distinct for the reader, relative to person perception. Conceptually, the difference is that person perceptions are targeted to real people, whereas persona perceptions are targeted to personas, i.e., fictitious people that represent a certain customer or user segment.
2. https://www.upwork.com.
3. B is the standardized regression coefficient. It is similar to the unstandardized regression coefficient β, except it measures shifts in standard deviations rather than absolute values. It is more often used in structural equation modeling since it always direct comparison of the relative intensity of the effect.

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Joni Salminen is a postdoctoral researcher at Qatar Computing Research Institute, Hamad Bin Khalifa University, and Turku School of Economics at the University of Turku. His current research focuses on multiple aspects of automatic persona generation, including computational challenges, information design, and value creation with personas.

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João M. Santos is a researcher based at the Lisbon Universitary Institute (ISCTE-IUL) in Portugal. João collaborates regularly with other higher education institutions such as Instituto Superior Técnico (IST) in Portugal and the University of Hong Kong, and provides consultancy for governments, trans-national organizations, and private businesses.

Bernard J. Jansen is a Principal Scientist in the Social Computing group of the Qatar Computing Research Institute, and a professor with the College of Science and Engineering, Hamad bin Khalifa University, and an adjunct professor with the College of Information Sciences and Technology at The Pennsylvania State University.

Appendix 1. The pictures used in the experiments

Image	Gender	Age group	Race	Smile	Stock
	MALE	MATURE	ASIAN	NON-SMILE	STOCK
	MALE	MATURE	ASIAN	SMILE	STOCK
	FEMALE	MATURE	ASIAN	NON-SMILE	STOCK
	FEMALE	MATURE	ASIAN	SMILE	STOCK
	MALE	YOUNG	ASIAN	NON-SMILE	STOCK
	MALE	YOUNG	ASIAN	SMILE	STOCK

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Image	Gender	Age group	Race	Smile	Stock
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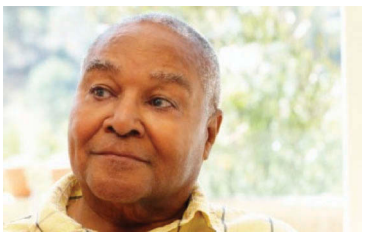
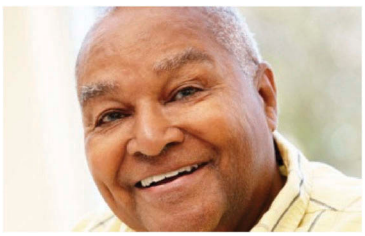
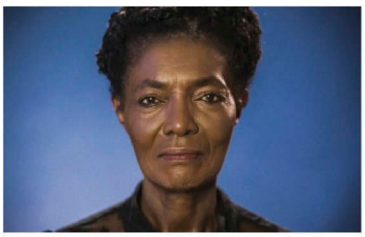
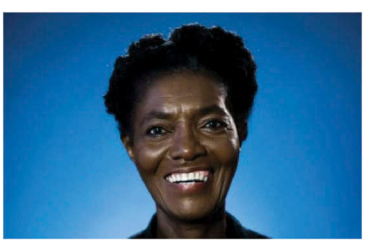
	FEMALE	YOUNG	ASIAN	SMILE	STOCK
	MALE	MATURE	BLACK	NON-SMILE	STOCK
	MALE	MATURE	BLACK	SMILE	STOCK
	FEMALE	MATURE	BLACK	NON-SMILE	STOCK
	FEMALE	MATURE	BLACK	SMILE	STOCK

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Image	Gender	Age group	Race	Smile	Stock
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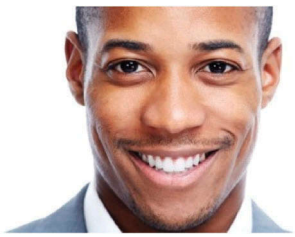
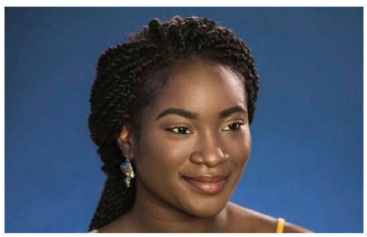
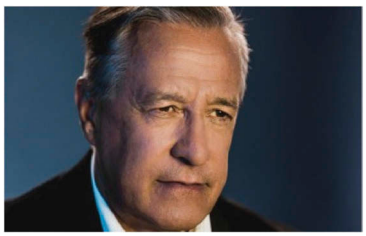
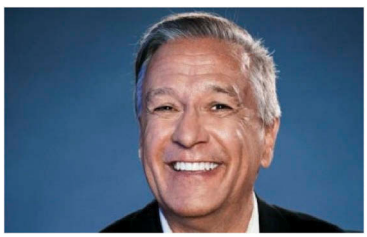
	MALE	YOUNG	BLACK	SMILE	STOCK
	FEMALE	YOUNG	BLACK	NON-SMILE	STOCK
	FEMALE	YOUNG	BLACK	SMILE	STOCK
	MALE	MATURE	WHITE	NON-SMILE	STOCK
	MALE	MATURE	WHITE	SMILE	STOCK

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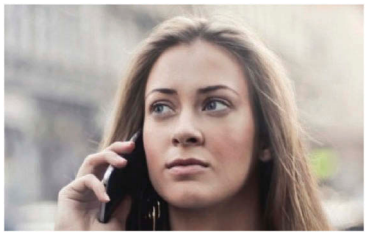
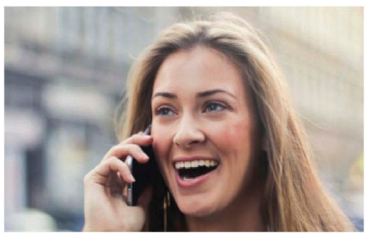
Image	Gender	Age group	Race	Smile	Stock
	FEMALE	MATURE	WHITE	NON-SMILE	STOCK
	FEMALE	MATURE	WHITE	SMILE	STOCK
	MALE	YOUNG	WHITE	NON-SMILE	STOCK
	MALE	YOUNG	WHITE	SMILE	STOCK
	FEMALE	YOUNG	WHITE	NON-SMILE	STOCK
	FEMALE	YOUNG	WHITE	SMILE	STOCK

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Image	Gender	Age group	Race	Smile	Stock
	MALE	MATURE	ASIAN	NON-SMILE	NON-STOCK
	MALE	MATURE	ASIAN	SMILE	NON-STOCK
	FEMALE	MATURE	ASIAN	NON-SMILE	NON-STOCK
	FEMALE	MATURE	ASIAN	SMILE	NON-STOCK
	MALE	YOUNG	ASIAN	NON-SMILE	NON-STOCK
	MALE	YOUNG	ASIAN	SMILE	NON-STOCK

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Image	Gender	Age group	Race	Smile	Stock
	FEMALE	YOUNG	ASIAN	NON-SMILE	NON-STOCK
	FEMALE	YOUNG	ASIAN	SMILE	NON-STOCK
	MALE	MATURE	BLACK	NON-SMILE	NON-STOCK
	MALE	MATURE	BLACK	SMILE	NON-STOCK
	FEMALE	MATURE	BLACK	NON-SMILE	NON-STOCK
	FEMALE	MATURE	BLACK	SMILE	NON-STOCK

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Image	Gender	Age group	Race	Smile	Stock
	MALE	YOUNG	BLACK	NON-SMILE	NON-STOCK
	MALE	YOUNG	BLACK	SMILE	NON-STOCK
	FEMALE	YOUNG	BLACK	NON-SMILE	NON-STOCK
	FEMALE	YOUNG	BLACK	SMILE	NON-STOCK
	MALE	MATURE	WHITE	NON-SMILE	NON-STOCK
	MALE	MATURE	WHITE	SMILE	NON-STOCK

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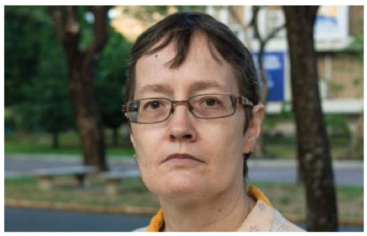
Image	Gender	Age group	Race	Smile	Stock
	FEMALE	MATURE	WHITE	NON-SMILE	NON-STOCK
	FEMALE	MATURE	WHITE	SMILE	NON-STOCK
	MALE	YOUNG	WHITE	NON-SMILE	NON-STOCK
	MALE	YOUNG	WHITE	SMILE	NON-STOCK
	FEMALE	YOUNG	WHITE	NON-SMILE	NON-STOCK
	FEMALE	YOUNG	WHITE	SMILE	NON-STOCK