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Can Unhappy Pictures Enhance the Effect of Personas? A User Experiment

AUTHORS ANONYMOUS

There has been little research into what type of image to use in persona profiles. One aspect to consider is whether the picture should portray a happy or unhappy individual, and what are the ramifications of this choice for user perceptions of personas. We report an experiment with 235 participants, testing the effects of happy/unhappy image styles on user perceptions, engagement, and personality traits attributed to personas using a mixed methods analysis. Results indicate that the participant's perceptions of realism and pain point severity of the persona increase with the use of unhappy pictures. In contrast, personas with happy pictures are perceived as more extrovert, agreeable, open, conscientious, and emotionally stable. The participants' proposed design ideas for the personas scored more lexical empathy scores for happy personas. There were also significant perception changes along the gender and ethnic lines both in empathy and perceptions of pain points.

Keywords: Personas, Design, Pictures, User Experiment

1 INTRODUCTION

A persona is a fictitious person representing a real user group of particular interest [13]. Personas are a well-established user-centered design technique [44] for (software) supporting developers, designers, and other stakeholders engaged in product development, requirements engineering, UX/UI design, marketing, user support, and other tasks requiring understanding of users or customers [6,13,47,56]. Personas are presented in profiles that portray information, such as goals, needs and wants of the user segment, and thus help designers contextualize users [79].

An essential part of the design of these user profiles is the persona picture [48,60]. Persona pictures constitute a non-verbal form of communicating details of the persona to the users [24]. The picture influences how the persona is perceived and what connotations and stereotypes are associated with the persona by the stakeholders [27,67]. As such, the choice of the persona picture is a crucial step in the design process of personas.

The current study investigates if the effect of happy versus unhappy pictures on the perceptions of those using the persona. Research on person perception in psychology lends support to the general idea that people perceive others differently based on the observed mood of these others [37,40]. Specifically, "happy people" may be perceived differently from "unhappy people" [7]. However, there is no evidence if using happy/unhappy pictures would be better for personas. In this study, we specifically test if using "unhappy" pictures enhances central persona perceptions [70], such as empathy, pain point perception, usefulness, realism, and completeness. These persona perceptions are key to the effective employment of personas by end users. We also perform quantitative and qualitative analyses on the written outputs of the users' design task to investigate if design ideas generated using happy versus unhappy personas are qualitatively different. This analysis is based on the participants' proposed products idea that address the remote work needs of a persona.

Given that there can be found examples of design personas of both types (see Figure 1), it can be stated that both approaches (happy/unhappy) are used by persona creators. However, that fact there is study investigating the pros and cons of each approach, implies there is a research gap to address, which our study focuses on.

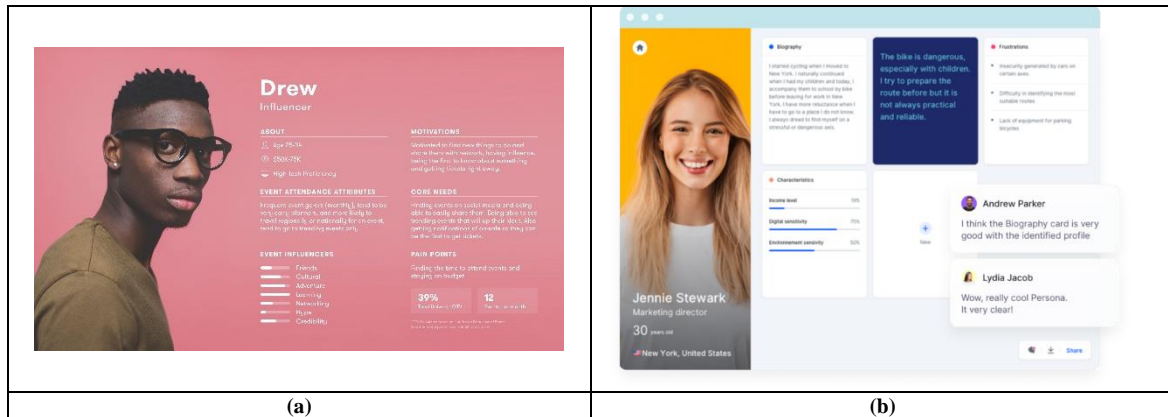


Figure 1: (a) Unhappy Persona (picture credit: <https://dribbble.com/shots/3338369-Universe-User-Personas/attachments/723326>). (b) Happy Persona (picture credit: <https://evolt.io/platform-tour/user-persona/>). Whether persona creators should use pictures of happy or unhappy individuals is unclear – both practices are used.

The design scenario we use concerns developing a product that addresses the remote work needs of a given user segment that the persona represents. We create the personas profiles representing people with remote work needs [18], and by varying the personas’ gender, ethnicity, and picture happiness to address our research questions (introduced in Section 2). User needs (and personas) for remote work are extremely topical, not only because of the issues such as the COVID-19 pandemic, but because of the long-term trend of work moving towards remote (nomadic) work and distributed teams [14,43,73], especially in knowledge-intensive industries and professions dealing with digital inputs and outputs. Therefore, the design issue itself of importance and is of practical relevance.

2 RELATED LITERATURE

2.1 Persona Pictures as Critical Design Cues

Researchers have found persona pictures to be influential for persona users’ perceptions of the persona [27,34,51,64,65,67]. Pictures attract the user’s focus of attention to personas; guide the user through the processing of persona information; and convey emotional signals about the persona to its users. Perception of the personas, in turn, affect the attitudes and deployment of personas in design tasks [38,39,57,58]. Therefore, the choice of a persona picture matters for the outcome of persona adoption and use in organizations by teams engaged in user-centered design activities.

Despite the broadly acknowledged importance of pictures for the design of personas, it is unclear what kind of pictures persona developers should choose when creating persona profiles. The typical choice, thus far, has been to use online photobank pictures, with smiling, good-looking people [63,64] that appear happy and content in their lives. However, the issue is – *is this optimal for persona design, or are there better alternatives for persona imagery?*

This issue is exacerbated by the fact that there is scarce research on persona pictures in the literature. Also, design studies employing personas do not typically explain the rationale behind choosing particular photos [30], which is interesting given the amount of effort taken to generate the other persona information.

Out of the few studies focusing on persona pictures, Long [34] analyzed the use of illustration style pictures versus photographs, and found that photographs were more optimal for user recall, with the participants recalling more details of the persona when using real photographs. Long also found that illustrations resulted in more vague answers about the

persona in post-session interviews, and risked the participants superimposing self-referential information about themselves onto the personas (a general challenge of the persona technique [75]).

Nieters et al. [51], in turn, found that using the pictorial style of action figures enhanced the memorability of the personas. The downside was that these personas were taken less seriously by corporate stakeholders, who found the action personas amusing and joked about them. Nevertheless, the findings of Nieters and colleagues raise the important question of whether “seriousness” is an essential quality for the persona to be remembered by the stakeholders.

Often, design studies employing personas do not explain the rationale behind choosing particular photos [30]. From our review of persona profiles in the literature, most appear to be stock photos (i.e., photos from commercial or open source photo archives). There is some evidence that using stock photos of professional models would not always be optimal for persona design. Salminen et al. [64] conducted a large-scale survey study with 2,400 participants where they compared the effect of photographs taken of “real people” against those taken of professional models on various user perceptions of personas, as well as investigating the effect of a smiling picture on the perceptions. Their findings indicated that a smile increased the perceived similarity with the persona, similar personas had a higher likability, and likability increased the willingness to use a persona [64]. Furthermore, the use of stock photos decreased the perceived similarity with the persona and the persona’s credibility, both of which were significant predictors to a willingness to use a persona.

The collective evidence from these prior studies suggests that there is room to investigate the optimal pictures for persona design. In particular, this research focuses on the question of “picture happiness” (i.e., the person in the image is feeling or showing pleasure or contentment). We pose the following research questions:

RQ1: *Does the use of happy/unhappy pictures alter the persona users’ perceptions of personas?*

RQ2: *Does the use of happy/unhappy pictures alter the users’ engagement (time participants spend viewing) with the persona?*

RQ3: *How does the use of happy/unhappy persona pictures affect the design outcomes in a design task?* For the first and second research questions, we formulate specific hypotheses in the following subsection. For the third research question, we conduct a qualitative analysis on the task outputs obtained from persona users, reported in Section 5.

2.2 Hypotheses

For our hypothesis formulation, we draw from previous persona research investigating *persona perception* [38,66], referring to persona users perceiving the personas as any other human being. This notion is actually consistent with Cooper’s initial idea of personas being fictitious but realistic in their portrayal of user groups [13], but the concept of persona perception specifically makes the connection between persona research and social psychology studies, in which person perception (i.e., the views and attitudes held by a person about others [31]) is a well-studied field of inquiry. Through this conceptual linkage, persona studies in HCI can borrow terms, concepts, and theories from social psychology to better understand how persona users perceive personas in various design tasks [38]. Particularly, our hypotheses deal with the dualism of perceiving others as happy (or not), and how this dualism affects the perception of personas for a design task.

To this end, we formulate the following hypotheses:

- **H1:** Picture happiness increases the users’ empathy towards the persona. [RQ1]
- **H2:** Picture happiness decreases the users’ perceptions of the persona’s pain points. [RQ1]
- **H3:** Picture happiness increases the users’ perceptions of the persona being useful for their task. [RQ1]
- **H4:** Picture happiness decreases the users’ perceptions of the persona as being realistic. [RQ1]
- **H5:** Picture happiness increases the users’ perceptions of the persona having complete information. [RQ1]
- **H6:** Picture happiness increases the users’ interpretation of the persona’s personality. [RQ1]

- **H7:** Picture happiness increases the users' engagement with the persona. **[RQ2]**

On one hand, previous research suggests that “persona creators should use smiling pictures of real people to evoke positive perceptions toward the personas.” [64] (p. 1). On the other hand, stock photos (of mostly happy people) were interpreted, in the same study, to diminish the users’ sense of identification with the persona [64]. The “real” pictures deployed in this previous study were not portraying professional models but “every-day people”. However, acquiring such photographs, even if they would be optimal, is difficult due to constraints of time, cost, and usage rights (privacy). Therefore, most typically persona creators resort to photobank pictures containing, typically, professional models. Given this bounded realism of persona design, the interesting question is if “unhappiness” in the picture can curb some of the challenges of stock photos observed previously – in a word, make the persona appear more “real” **[H1]**.

Research in social psychology suggests that negative people may be taken more seriously than happy people, especially when negative messages are communicated with unhappy facial expressions, as these expressions enhance the effect of the message [20]. In turn, happy people may be, in some circumstances, perceived as “fake” or non-serious [22] **[H4]**, especially when dealing with understanding of the person’s needs [26] **[H2]**.

Based on Gestalt theory, suggesting that parts of the design are more than their sum [41], we hypothesize that personas with unhappy pictures are perceived more useful **[H3]**, as they emphasize and support the pain point information (i.e., relevant information for the task), whereas happy pictures could be seen as redundant information. Similar to holistic processing of faces [28], the information in persona profiles is processed in a holistic manner [5]. This same effect may lead to personas with unhappy pictures being perceived as more complete than those with happy pictures **[H5]**, as the latter may conflict with the other information the users are focused on (i.e., the pain points themselves).

Furthermore, users can make inferences about the persona’s personality based on the persona picture [67]. These personality ratings can then affect what kind of solutions are developed for the persona [3,4]. For example, extrovert personas may be considered to require different kinds of products than introverts. The underlying notion here is that people tend to extrapolate one’s personality from a single picture (the first impression effect [36]): hence, the momentary “mood” of the persona therefore affects how its personality is judged **[H6]**.

Finally, happy people may be perceived as more pleasant, which may affect how receptive users are towards them [32]. The underlying notion here is positivity bias [78] – that people are more drawn towards happy people, and therefore spend more time getting to know such individuals. Therefore, we expect that users would be more interested in personas with happy pictures, and consequently spend more time reviewing their information **[H7]**. Overall, these reasonings suggest that the choice of picture happiness can have an impact on persona design, especially when considering personas as individual human beings. The impacts are far reaching, as the findings can be leveraged for a range of systems that employ pictures of people, and the facial expression for happy/unhappy tends to be universal [16,17].

2.3 Measurement Items

Table 1 reports the constructs and measurement items (indicators). The indicators for empathy, usefulness, realism, completeness, and likability were adopted from the Persona Perception Scale [70], an instrument specifically developed for measuring user perceptions of personas and applied in several previous persona user studies [61,62,64,69]. The indicator for physical attractiveness was adopted from Berscheid and Walster [9]. The pain point intensity indicator was specifically developed for this study – for this, we used Chattopadhyay et al. [12] as inspiration, as the researchers in that study operationalized user needs statements in a contextual manner.

Personality rating items were from obtained from the *Ten Item Personality Measure* (TIPI) scale by Gosling [21], which measures the Big Five personality traits: **Extroversion** (EX), **Agreeableness** (AG), **Conscientiousness** (CN), **Emotional**

Stability (ES), and **Openness (OP)**. The constructs were measured with Likert scale (7-point) response options, ranging from ‘Strongly agree’ to ‘Strongly disagree’. For Picture happiness, the options ranged from ‘Extremely happy’ to ‘Extremely unhappy’. Finally, the indicator for Engagement was obtained from Qualtrics by recording the duration (in seconds) the participant spent perusing the persona they were presented with.

Table 1: Constructs and measurement items used in the study. The last column shows their connection to the hypotheses.

ID	Construct	Measurement item	Hypothesis
EM	Empathy	I felt I could understand the persona as a human being.	H1
PP	Pain point intensity	The persona struggles with remote work.	H2
US	Usefulness	The persona contained useful information for my task of creating a remote work product.	H3
RE	Realism	The persona seemed realistic.	H4
CO	Completeness	The persona profile was complete, so that it contained all the necessary information to understand the users it represents.	H5
PE	Personality (Big Five)	I see the persona as: — Extraverted, enthusiastic. — Critical, quarrelsome. — Dependable, self-disciplined. — Anxious, easily upset. — Open to new experiences, complex. — Reserved, quiet. — Sympathetic, warm. — Disorganized, careless. — Calm, emotionally stable. — Conventional, uncreative.	H6
EN	Engagement	Dwell time (duration)	H7
PH	Picture happiness ¹	How (un)happy did the persona look like?	Independent variable for H1-06

We used the Big Five due to two reasons: (1) its commonness in psychological studies and in HCI [11,29], and (2) the fact it has been deployed in previous persona studies [3,4,68]. We chose the TIPI scale for the operationalization of the Big Five traits because this scale affords ease of completion by non-psychology experts while simultaneously providing valid personality assessment [21]. The definitions of the Big Five traits are as follows [1]:

- **Extrovert (EX):** Active, amicable, assertive, energetic, enthusiastic, outgoing, talkative. These individuals are friendly and draw inspiration from social situations.
- **Agreeable (AG):** Compassionate, cooperative, generous, helpful, kind, nurturing, sympathetic. These individuals are generally optimistic and trusting of others.
- **Conscientious (CN):** Efficient, hardworking, organized, persevering, responsible, self-disciplined. These individuals tend to be reliable and focused on achieving and planning for the future.
- **Emotionally stable (ES):** Calm, relaxed, self-confident. Emotionally stable individuals are not moody or tense, and they are not easily tipped into experiencing negative emotions.
- **Open (OP):** Artistic, creative, curious, deep, intelligent, imaginative, open-minded, reflective. Open individuals tend to appreciate diverse views, ideas, and experiences.

¹ Picture happiness is inversely correlated to the “Picture unhappiness” in the hypotheses. In other words, a high Picture happiness is low Picture unhappiness.

These definitions were not shown to the participants, as they are not required for assessing the personality traits, which is done by calculating the score of each trait from the statements posed to the participants. TIPI is usually administered as a form of self-evaluation of personality [21]. However, as we wanted the participants to evaluate the personality of the personas, we transformed the original statement of “*I see myself as ...*” into “*The persona seemed like ...*” The scores were processed using the instructions given by Gosling [21] to obtain the final personality ratings.

3 METHODOLOGY

3.1 Overview

Three separate within-subject experiments were conducted, each with a different set of personas (see Figure 2). The unhappy/happy conditions and the order was mixed within each 2×2 by randomized assignment and counterbalancing. In other words, each participant sees two different personas, one with a “happy” picture and another one with an “unhappy picture”. We used the configuration options in the survey software (Qualtrics) to apply grouping for different persona pairs, and we then applied randomization and counterbalancing to the groups. This removes the possibility of a participant seeing the same persona or the same pain point profile twice.



Figure 2: Final persona picture pairs (happy/unhappy versions). The pictures were manually curated from an online photobank service (<https://www.123rf.com>), with license for research use purchased. AO = African origin; EO = European origin; MEO = Middle Eastern origin. The source for ethnical terms in the study is American Psychological Association [2].

3.2 Persona Creation

To address our hypotheses and to analyze the consistency of results by demographic groups, we created personas from multiple genders (male/female) and ethnic backgrounds (see Figure 2), leaving the study of other genders and other ethnicities for future research. We selected three ethnic backgrounds from the listing of the American Psychological Association [2]: persons of African origin, persons of European origin, and persons of Middle Eastern origin. As far as we know, this is the first study to investigate persona perceptions of persons of Middle Eastern origin (African and European origins have been investigated previously, along with Asian origin [64]). The inclusion of personas with different ethnic backgrounds is important, as it enables us to investigate possible effects of stereotyping [75].

The persona pictures were selected by browsing online photobanks and identifying suitable picture pairs of happy/unhappy individuals. We defined several guidelines for this process, which involved the following selection criteria for the pictures:

- (1) the pictures are taken by the same photographer (to ensure consistent technical quality),
- (2) the environment (“scene”) of the picture is at home (consistent with the remote work scenario),
- (3) the human model is the same in each picture pair (to avoid possible inconsistencies from the use of different people for the same persona demographics),
- (4) each picture has a laptop that the person is using (to signify remote work scenario), and
- (5) in all pictures the gaze is indirect, i.e., not looking at the camera (to mitigate the possibility that the persona-user rapport is affected by the persona’s pose in the picture).

In other words, we kept as many aspects in the pictures constant as possible, only varying the sentiment of happiness. Multiple iterations of identifying candidate pictures were conducted, with one of the authors identifying the pictures and the others commenting on observed inconsistencies. Finally, an internal agreement on the pictures was reached (Figure 1), and the treatments incorporating these pictures were created, with examples provided in Figure 2. The process for this image selection was quite lengthy, demonstrating the issues of using photobanks for persona profiles. All treatments are available in the Supplementary material².

The above choices resulted in the creation of 12 baseline persona treatments (2 happiness levels \times 2 genders \times 3 ethnic backgrounds). Because each participant would see two personas, it was required to vary the personas’ text content as well. For this purpose, we created two different “Pain point profiles” that reflected different user needs for remote working.

We chose the research context of *remote work*, because of the topicality of remote work, especially during the global COVID-19 pandemic that is strongly affecting the design profession (and other professions) at the time of study. As the research context was remote work, the personas were created to contain pain points and other information related to remote work user types. We created two “Pain point profiles” (see Figure 3) for the purposes of counterbalancing (i.e., we cannot show one participant two identical persona descriptions, but the personas need to differ by their content). The pain point profiles are based on a previous study on challenges observed by remote workers [18].

² <https://www.dropbox.com/sh/fe7oyiekzikngjj/AAB9knFVzgx-sHUUOqGn0apwa?dl=0>



Pain point profile 1	Pain point profile 2
 <p>About Hind Hind is 24 years old. She has a six-month old baby. Hind works in a management position. She describes herself as <u>not proficient with technology</u>. She does <u>not have a high-speed Internet connection</u>. Hind is good at separating work from leisure, especially when working remotely. Lately, she has had a good focus and productivity.</p> <p>Education: College graduate Relationship status: Married</p> <p>Quotes "I wish I was better with computers!" "My Internet is frustratingly slow." "I'm proud to keep a good work-life balance." "My work efforts have been pretty good lately."</p>	 <p>About Hind Hind is 24 years old. She has a six-month old baby. Hind works in a management position. She describes herself as proficient with technology. She has a high-speed Internet connection. Hind <u>struggles to separate work from leisure</u>, especially when working remotely. Lately, she is feeling a <u>loss of focus and productivity</u>.</p> <p>Education: College graduate Relationship status: Married</p> <p>Quotes "I'm pretty good at computers." "I have a fast Internet connection." "Sometimes I end up working the whole day." "Lately, I've been struggling to keep up with my work."</p>

Figure 3: Two persona profile treatments. Left picture shows Pain Point Profile 1 (lack of computer skills + slow Internet) with a happy persona picture. Right picture shows Pain Point Profile 2 (inability to separate work from leisure + lack of focus and productivity) with an unhappy persona picture. Pain Point Profiles and happy/unhappy pictures were combined for each persona, resulting in 4 treatments per persona and 24 treatments overall.

This [18] study was based on two surveys with a total of 3,634 responses addressing remote workers’ challenges faced during the COVID-19 pandemic. The study found several challenges, of which we chose the following: problems with connectivity (slow/shared Internet connections, unstable home Internet; captured in Pain point 2: “*My Internet is frustratingly slow.*”), managing work-life balance (Pain point 3: “*Sometimes I end up working the whole day.*”), interruptions and distractions (leading to a loss of focus and productivity; Pain point 4: “*Lately, I’ve been struggling to keep up with my work.*”). We also included one other aspect from the research on digital divide [77], namely, the fact that not all remote workers feel comfortable with or are proficient at using remote work hardware/software (Pain point 1: “*I wish I was better with computers*”). Overall, with these personas, we wanted to represent “regular people” with these pain points – not only those who are proficient with software, have high speed Internet connections, and find remote work “easy” and “natural”.

3.3 Data Collection

For data collection, we used Prolific³, an online survey platform. This platform has been deployed in several previous persona user studies [63–65,69,70] and survey-based research in other domains [52,76], with evaluation studies showing high data integrity relative to other platforms [53,54]. The survey was pilot tested with three participants, two of which from the research team and one external reviewer. Based on the comments by the test participants, several changes were made to the study introduction. Some minor wording changes were also made to the statements.

To reach adult professionals working in industries relevant for personas, we applied the following sampling criteria in Prolific: **student status** ('no'), **highest education** ('at least undergraduate'), **age** ('25-60 (inclusive)'), **industry** ('art/design; product development; college, university and adult education; information services and data processing; other education industry; software; and scientific or technical services').

The survey platform had 5,079 matching participants who had been active in the past 90 days. For each 2×2 persona pair, we recruited 80 participants (240 in total). Three studies were administered sequentially, and participants were prevented from participating in more than one study by using the blacklist option in the Prolific platform. The estimated survey completion time was 21 minutes, according to Qualtrics' estimation tool, which our pilot testing confirmed to be close-to-accurate. Thus, we offered the participants an hourly rate of £8.94, which exceeds the UK minimum wage (£8.72 for workers above 25 years of age in April 2020⁴). Based on these parameters, the total data collection cost was $340.55 \times 3 = £1,021.65$ that included the VAT and the platform's commission (30%).

3.4 Survey Protocol

Here, we explain how the survey was administered to the respondents. Each step taken by the respondents is explained in the following.

A. Survey introduction (1/2): "Welcome to this online survey on using personas for the development of remote work products. Your responses will be used for an academic study. Participation is voluntary and you can stop at any time. For any questions about the study, you can reach out to Dr. [name and email of the principal investigator]."

B. Survey introduction (2/2): "You will be shown a persona (a fictional character) that contains key information about the remote working needs of a given user segment. Your task is to develop a product that addresses the remote working needs of this user segment. In this survey, you will be shown two different personas." The introduction was split into two pages to facilitate the participants' absorption of information.

C. Persona definition: "A persona is defined as a fictitious user type and is not a real person. It is a character that portrays many users." Acknowledgment of understanding this definition was required (see Figure 4a.)

³ <https://www.prolific.co/>

⁴ <https://www.gov.uk/national-minimum-wage-rates>, accessed December 2020.

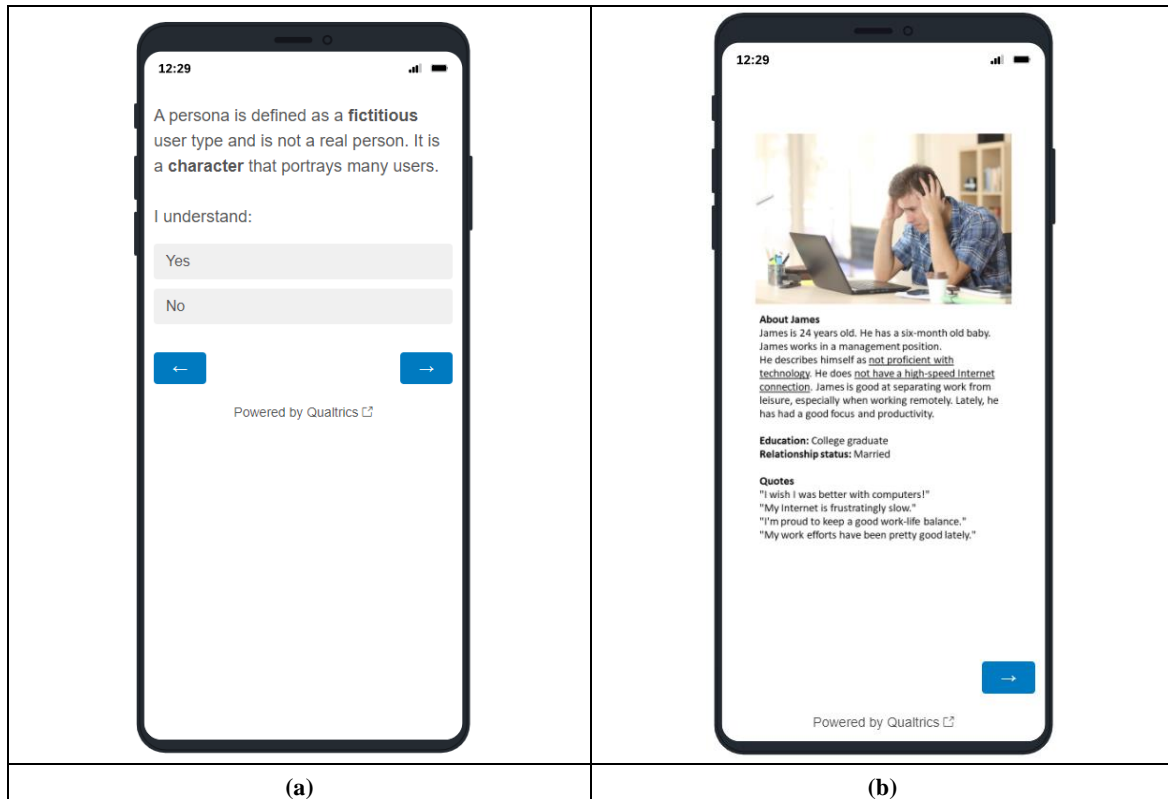


Figure 4: (a) Persona definition in mobile view of survey. (b) Persona profile example in mobile view (James, male of European origin, unhappy version).

D. Persona experience: “Your experience with personas” was asked, with the options:

- Unfamiliar – no experience of personas whatsoever
- Novice – have used personas before, but not much
- Proficient – have used personas several times before

E. Task introduction: “Review the information shown about the persona. Afterwards, you will be asked some questions about this persona. Then, you will be asked to describe the product that you want to develop for the persona. The product can be any offering – digital or physical – that helps the persona to cope with remote work.”

F. Persona profile: One of the tested persona profiles was randomly loaded, see an example in Figure 4b.

G. Task: “Describe your product idea that addresses a remote working need of this persona. Please write as detailed concept as possible, provide information from the persona to support your product, and explain what need(s) the product addresses. (Min. 300 characters.)”

H. Background information: The following was asked: age, gender, ethnic background, and job title (if not currently at work, the most recent occupation). After this, the participants were thanked, and they were redirected to the survey platform’s confirmation page.

3.5 Participant Information

The three pilot test participants were removed from the dataset. Additionally, five participants who failed an attention check included in the survey were also removed. This led to a final sample size of 235 participants. The sample had slightly more males ($n = 142$; 60.4%), with 92 being females (39.1%) and a single non-binary / third gender (0.4%). In terms of age, the sample was relatively young ($M = 34.51$; $SD = 7.858$). The most represented ethnicity was European ($n = 189$; 80.4%), followed by Latinx ($n = 19$; 8.1%), Asian ($n = 17$; 7.2%), African ($n = 4$; 1.7%), Middle Eastern ($n = 3$; 1.3%) and Other ($n = 3$; 1.3%). The most represented countries were Portugal ($n = 33$; 14.0%), United Kingdom ($n = 30$; 12.8%), Poland ($n = 24$; 10.2%), Italy ($n = 17$; 7.22%), Spain ($n = 12$; 5.1%), with the remainder of the sample representing numerous other countries. Regarding previous experience with personas, 91 (38.7%) participants reported no previous experience, with 115 (48.9%) indicating they had previous experience and 29 (12.3%) considered themselves proficient.

Due to the low number of participants from African and Middle Eastern participants, these participants were group into one group, “Middle East and Africa”, which is conceptually similar to the cultural region of Middle East and North Africa (MENA⁵). The most typical professions among the participants were educators ($n = 36$, 15.3%), software developers ($n = 34$, 14.5%), managers ($n = 29$, 12.3%), researchers ($n = 27$, 11.5%), IT professionals ($n = 22$, 9.4%), designers ($n = 18$, 7.7%), and data scientists or analysts ($n = 12$, 5.1%).

3.6 Statistical Analysis

3.6.1 Control Variables

We compare the consistency of the results by personas’ gender and ethnic background, and by the participants’ gender and ethnic background. This is primarily because gender and ethnic background have been found influential variables by previous persona research [27,64,67]. Therefore, four control variables were included into the model: **Persona Gender**, which indicates the persona’s gender (reference category being Male); **Persona Ethnicity**, which indicates the persona’s ethnicity (reference category is “European origin”); **Participant Ethnicity** (reference category being “European”); and **Participant Gender** (reference category is “Female”). This structuring of the data allowed the hypothesis to be tested through General Linear Modeling (GLM) [23,42], where the aforementioned variables were used as independent variables, and the dependents were the various persona and personality traits mentioned in the hypothesis section.

3.6.2 Manipulation Check

To confirm the effects of the manipulation, participants were asked to indicate whether the persona looked happy, unhappy, or neutral. It was expected that happy personas were correctly identified as happy, and unhappy as unhappy. However, after crossing the observed responses with the expected response, it was noted that, for four treatments (see Table 1), the participants did not identify the persona’s happiness as expected. Because of this, we used the perceived picture happiness as the independent variable, in lieu of the happy/unhappy assignment grouping variable. Potential same-participant bias is not expected since the participant flow was randomized and accounted for all possible combinations of the personas.

⁵ <https://ustr.gov/countries-regions/europe-middle-east/middle-east/north-africa>

Table 2: The observed ratio values. The percentages indicate how many responses from the participants corresponded with the expected value. For example, if 9/10 participants chose “Happy” to the statement “The persona looked...” with the options “Happy”, “Unhappy”, “Neither”, then the Observed ratio would be 90%. Instances where less than ¾ of the participants agreed with the expected value are highlighted in red.

Observed ratio	Khaled	Hind	Roger	Sarah	James	Jane
Happy	84.21%	76.19%	72.97%	85.00%	69.23%	75.00%
Unhappy	95.00%	62.16%	76.19%	48.72%	77.50%	94.74%

4 RESULTS

4.1 Summary of Results

Table 3 shows the main results for **RQ1** (*Does the use of happy/unhappy pictures alter the persona users’ perceptions of personas?*) and **RQ2** (*Does the use of happy/unhappy pictures alter the users’ engagement with the persona?*). Support for the hypotheses is discussed in the following subsections.

Table 3: Regression model coefficients. Negative coefficient between the Picture happiness variable (last row) and other variables indicates that as picture happiness increases, the persona perceptions generally decrease. The opposite takes place for personality perceptions; they increase with Picture happiness. See Table 1 for variable names and definitions.

Variable	Persona Perceptions					Personality Traits (Big Five)				
	EM	PP	US	RE	CO	EX	AG	CN	ES	OP
Persona Gender (Female)	0.100 (0.077)	0.081 (0.151)	0.190 (0.113)	0.110 (0.094)	0.119 (0.118)	0.062 (0.089)	0.218* (0.087)	0.373** (0.124)	0.088 (0.102)	0.138 (0.091)
Persona Ethnicity (Middle Eastern origin)	-0.059 (0.095)	0.458* (0.186)	0.064 (0.139)	-0.023 (0.115)	-0.009 (0.145)	- 0.434*** (0.110)	-0.109 (0.107)	-0.017 (0.153)	-0.073 (0.126)	-0.175 (0.112)
Persona Ethnicity (African origin)	0.090 (0.095)	0.423* (0.187)	0.055 (0.139)	0.076 (0.116)	0.117 (0.145)	-0.029 (0.110)	0.025 (0.107)	-0.179 (0.153)	0.221 (0.126)	0.022 (0.112)
Participant Ethnicity (Middle East and Africa)	0.341 (0.192)	0.089 (0.376)	0.467 (0.281)	0.150 (0.233)	0.556 (0.293)	0.122 (0.222)	-0.121 (0.216)	-0.074 (0.309)	-0.226 (0.255)	0.127 (0.226)
Participant Ethnicity (Asian)	- 0.388** (0.150)	-0.308 (0.294)	-0.137 (0.220)	- 0.498** (0.182)	-0.117 (0.230)	-0.168 (0.174)	-0.174 (0.169)	-0.270 (0.241)	-0.242 (0.199)	-0.420* (0.177)
Participant Ethnicity (Latinx)	0.156 (0.144)	0.622* (0.282)	0.319 (0.210)	-0.010 (0.175)	0.284 (0.220)	0.255 (0.166)	-0.019 (0.162)	0.074 (0.231)	0.025 (0.191)	0.235 (0.169)
Participant Gender (Non-binary / third gender)	-0.540 (0.595)	-0.677 (1.165)	-1.320 (0.870)	-1.611* (0.722)	-0.505 (0.908)	0.600 (0.688)	-0.114 (0.670)	-0.266 (0.956)	0.358 (0.789)	-0.479 (0.699)
Participant Gender (Male)	-0.112 (0.080)	-0.131 (0.156)	-0.100 (0.117)	-0.187 (0.097)	-0.082 (0.122)	-0.014 (0.092)	-0.235** (0.090)	-0.123 (0.128)	-0.079 (0.106)	-0.208* (0.094)
Picture Happiness	-0.024 (0.021)	- 0.251*** (0.040)	-0.033 (0.030)	-0.063* (0.025)	-0.029 (0.031)	0.245*** (0.024)	0.180*** (0.023)	0.178*** (0.033)	0.320*** (0.027)	0.094*** (0.024)

Notes: *** p < 0.001; ** p < 0.01; * p < 0.05. Standard errors are in parenthesis. Persona Gender reference category is “Male”. Persona and Participant Ethnicity reference categories are “European origin”. Participant Gender reference category is “Female”.

4.2 RQ1: Effects on Users' Perceptions of Personas

H1: Picture happiness increases the users' empathy towards the persona. After taking into account the effects of the control variables, perceived happiness was found to have no relation with perceived empathy ($B = -0.024, p = .252$). Therefore, H1 is not supported; picture happiness does not affect the users' perceived empathy towards the persona.

H2: Picture happiness decreases the users' perceptions of the persona's pain points. After considering the effects of the controls, perceived happiness was found to significantly decrease the perceived pain points ($B = -0.251, p < .001$). Therefore, H2 is supported; picture happiness decreases the users' perception of personas' pain points.

H3: Picture happiness increases the users' perceptions of the persona being useful for their task. After taking into account the effects of the control variables, perceived happiness did not exhibit any significant effect regarding the perceived usefulness of a persona ($B = -0.033, p = .274$). Therefore, H3 is not supported; picture happiness does not affect the users' perceptions of the persona being useful for their task.

H4: Picture happiness decreases the users' perceptions of the persona as being realistic. After taking into account the effect of the control variables, it was determined that increases in perceived happiness led to decreases in perceived realism ($B = -0.063, p = .013$). Therefore, H4 is supported; picture happiness decreases users' perceptions of a persona being realistic.

H5: Picture happiness increases the users' perceptions of the persona having complete information. After considering the effect of the control variables, no significant effect could be found regarding the perceived happiness of a persona and the degree of perceived completeness ($B = -0.029, p = .357$). Therefore, H5 is not supported; picture happiness does not affect the users' perceptions of the persona having complete information.

H6: Picture happiness increases the users' interpretation of the persona's personality. After considering the control effects, it was determined that increased perception of a persona's happiness led to increased perceptions of all personality traits, notably, Extraversion ($B = 0.245, p < .001$), Agreeableness ($B = 0.180, p < .180$), Conscientiousness ($B = 0.178, p < .001$), Emotional Stability ($B = 0.320, p < .001$), and Openness to Experience ($B = 0.094, p < .001$). Therefore, H6 is supported; picture happiness affects how users rate the personality of the personas. Personas with happier pictures are perceived more extrovert, agreeable, conscientious, emotionally stable, and open.

Figure 5 illustrates the scores obtained using happy and unhappy personas.

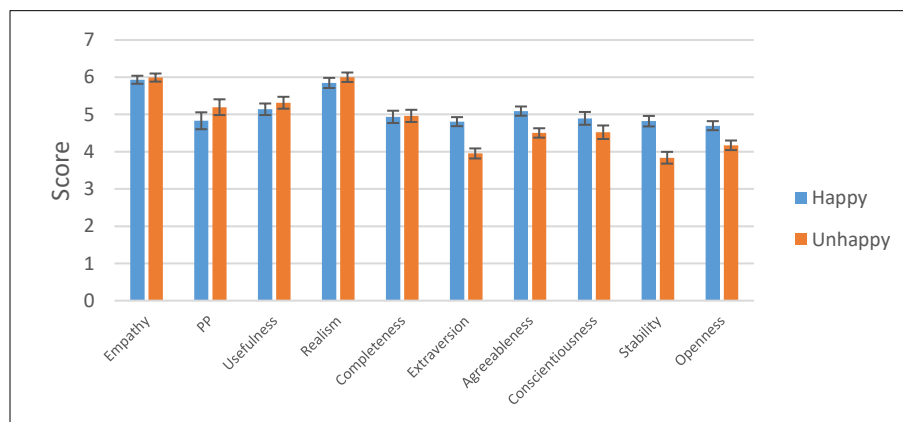


Figure 5: Perception scores for happy and unhappy personas. PPS scores are generally higher for unhappy personas and TIPI scores for happy personas. This implies more positive personality traits are associated with personas when using happy pictures, but perceptions important for design tasks (i.e., the PPS constructs) are slightly higher when using unhappy pictures.

4.3 Effect of Persona Gender and Ethnic Background

Two significant effects were found regarding Persona Gender: the participants perceived female personas more agreeable ($B = 0.218, p < .05$) and conscientious ($B = 0.373, p < .01$) than male personas (see Figure 6). For ethnicity, the pain points of personas of Middle Eastern origin were perceived more strongly ($B = 0.458, p < .05$) than those of personas of European origin (see Figure 7). Interestingly, these personas were also perceived as less extroverted ($B = -0.434, p < .001$) when compared to personas of European origin. The pain points of personas of African origin were also perceived more strongly ($B = 0.423, p < .05$) than those of personas of European origin. Apart from these findings, the observed effects were consistent among persona genders and ethnic backgrounds.

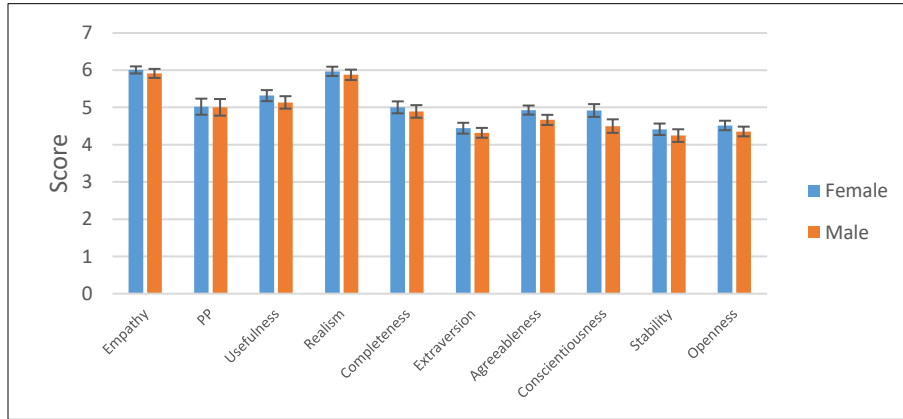


Figure 6: Perception scores for male and female personas. Female personas were perceived more agreeable and conscientious.

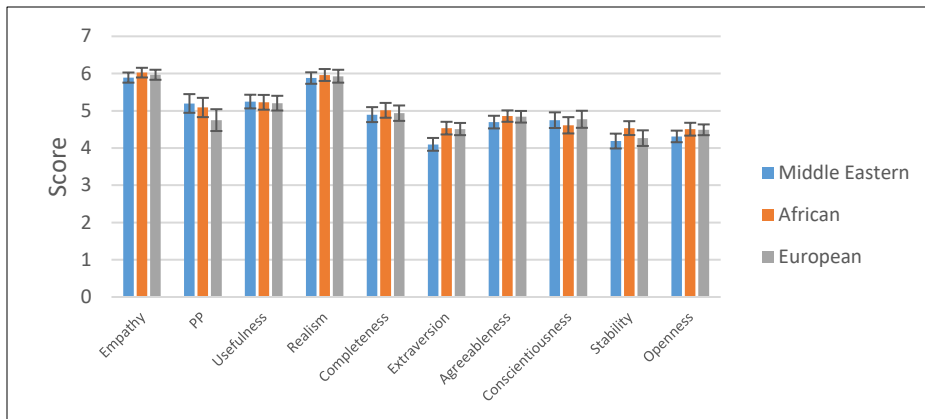


Figure 7: Perception scores for the three persona ethnicities. Pain points (PP) of personas of Middle Eastern and African origin were observed more strongly than those of personas of European origin.

4.4 Effect of Participant Gender and Ethnic Background

Participants of Asian origin indicated less empathy for the personas ($B = -0.388, p < .01$), and also perceived the personas as less realistic ($B = -0.498, p < .05$) and open ($B = -0.420, p < .05$) than participants of European origin (see Figure 8).

Participants of Latin origin tended to perceive the pain points of a persona more strongly ($B = 0.622, p < .05$) than those of European origin. Additionally, male participants tended to view personas as less agreeable when compared to female participants ($B = -0.235, p < .01$), and less open to experience ($B = -0.208, p < .05$) (see Figure 9). Apart from these effects, participants with different genders or ethnic backgrounds provided consistent responses.

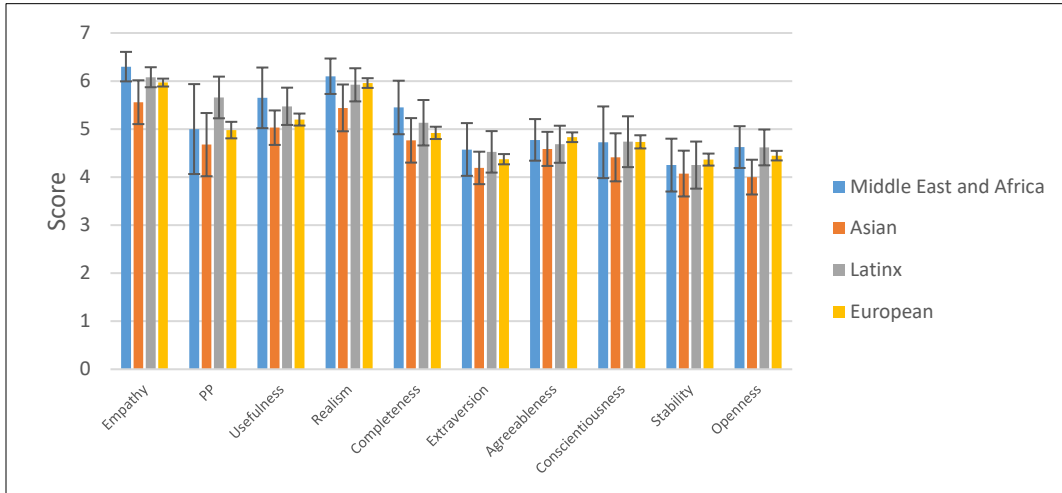


Figure 8: Persona scores by participant ethnic backgrounds. Participants of Asian origin indicated less empathy for personas and viewed the personas less realistic and open. Participants of Latin origin perceived the personas' pain points more strongly.

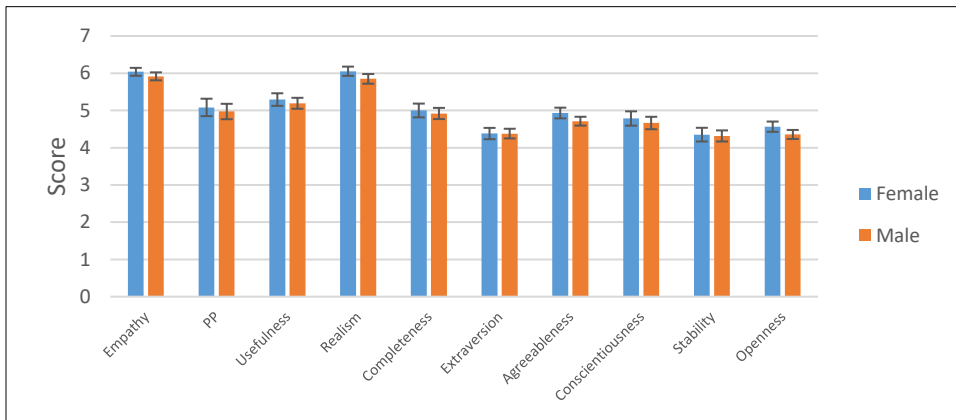


Figure 9: Perception scores for male and female participants. Male participants viewed the personas less agreeable and open.

4.5 RQ2: Users' Engagement with the Persona

H7: Picture happiness increases the users' engagement with the persona. To address our third research question, namely, if participants spend less time viewing unhappy personas than happy personas, we conducted a set of t-tests to compare the amount of time (in seconds) the participants had spent with each persona type in the survey. This information was recorded by an invisible form field in Qualtrics that permits to observe participants' time spent in a given survey page.

We included this question format in each persona page, and thus we could retrieve the time spent with “happy” and “unhappy” personas. This duration was used as a measure for engagement.

We performed multiple t-tests with and without outliers. We used a variant of the t-test whose assumptions are robust to unequal variances (two-sample t-test assuming unequal variances [59]), as the groups had unequal variances. There was no significant effect for duration, $t(303) = -1.3$, $p = .194$, despite “happy” personas ($M = 68.4$ seconds, $SD = 166.3$) attaining higher scores than “unhappy” personas ($M = 53.2$, $SD = 63.9$). This test used the assigned happy/unhappy persona treatments. We repeated the t-test with various configurations, including assigning the groups based on the participants’ evaluation of the persona (“*This persona looks...happy/unhappy*”) and removing outliers, but all test indicated the same: participants spent somewhat more time with happy personas, but this difference was not statistically significant. Therefore, H7 was not supported; the use of happy or unhappy persona pictures does not affect the level of engagement, as measured by duration of interaction, with the persona.

4.6 RQ3: Design Outcomes

The overarching goal of the qualitative analysis is to investigate how the use of unhappy persona pictures alter the design outcomes in a user-centric product development task. Specifically, *are the users more expressive of the users’ pain points in their designs based on personas with “unhappy” images? If so, how does this manifest?*

To address these questions, we performed a qualitative semantic coding of the data following the method of lexical analysis [10,19] that is based on the calculation of word frequencies and revisiting the textual data based on the context and semantically-grouped lexicons as needed. In our analysis, we qualitatively pick or determine lexicon groups that could be associated with our research questions and order the word of the lexicon based on their contextual valence [72]. The valence scoring can be done by a group of researchers on their sense of positive versus negative context [72] or a single researcher over time [45]. Since all our semantic lexicons only contained a small number of words (that will be called descriptors), a single researcher ordered their valence using their contextual importance to the research question.

4.6.1 Expressions of Empathy

Our first hypothesis was aimed at seeing the effects of the persona pictures on participants’ empathy towards the persona. To investigate this question further, we focused on the *persona-address descriptors*—the specific words, names, and adverbs the participants used to address the persona in their written responses. We ordered the descriptors by their potential to show empathy ranging from “no mention” which shows the least amount of empathy to “you” which shows the most amount of empathy. The results are given in Table 4. Examples of each category are given below:

- **No mention of or by-passing the persona:** The participant’s text either does not address the persona in any way or by-passes the persona. Typically, the comments that make no mention of the personas, only focus on the product and its functionalities. (e.g., “A system that would separate the work environment on a computer from the personal environment. [...] The system can only be turned on the following morning during office hours. The system would automatically save all work in progress, so no work is lost during the automatic shutdown.” Participant #308 or P308 for short) Occasionally some comments by-pass the persona by extrapolating their product to a group of people instead of the specific persona provided. (e.g., “My product is an application for people, who are not familiar with the use of technology.” P140)

- **Persona (or Person, Individual, User, Character, Customer) coupled with It or They⁶:** “This persona needs a software [...] that] could provide detailed information on how they are spending their workday so they can see the patterns and improve their performance overall.” (P1)
- **Persona (Person, Guy, Lady) coupled with He or She:** “This persona has several issues about smart working because he barely can separate work form everyday life.” (P6); “This guy definitely needs a router [...]” (P57); “I think routine and structure day will help this lady.” (P77)
- **First-name coupled with He or She:** “[...] James is presented as very unhappy and struggling to balance his work and home lives.” (P7); “I think the issues Sarah has are mainly service issues and lack of computer usage experience. So, my solution would be a program installed in her computer [...]” (P66)
- **You:** “You don’t need a degree to start this business. However, you should polish your skills first. Try enrolling in an online course or reading graphic design books.” (P4); “Calm Down Buddy! This app is for you. If you’re struggling separating work from leisure well, you’re not alone.” (P89)

Table 4: The frequency of persona-address descriptors based on specific personas. Percentages above 25% are highlighted. A weighted score was also calculated with “no mention” being worth 0 points (minimum) and “you” being worth 4 points with 1-point increment for each category.

Persona	Happiness	No Mention	Persona w/ It or They	Persona w/ He or She	First-name w/ He or She	You	Weighted Score (0-4)
James	Unhappy	5.1% (n=2)	30.8% (n=12)	48.7% (n=19)	10.3% (n=4)	5.1% (n=2)	1.79
	Happy	20.5% (n=8)	17.9% (n=7)	41.1% (n=16)	17.9% (n=7)	2.6% (n=1)	1.64
Sarah	Unhappy	7.7% (n=3)	15.4% (n=6)	46.2% (n=18)	28.2% (n=11)	2.6% (n=1)	2.03
	Happy	7.5% (n=3)	20.0% (n=8)	50.0% (n=20)	15.0% (n=6)	7.5% (n=3)	1.95
Jane	Unhappy	15.8% (n=6)	21.1% (n=8)	57.9% (n=22)	2.6% (n=1)	2.6% (n=1)	1.55
	Happy	20.0% (n=8)	15.0% (n=6)	47.5% (n=19)	10% (n=4)	7.5% (n=3)	1.70
Khaled	Unhappy	10.0% (n=4)	40.0% (n=16)	35.0% (n=14)	15.0% (n=6)	0	1.55
	Happy	18.4% (n=7)	13.2% (n=5)	50.0% (n=19)	13.2% (n=5)	5.3% (n=2)	1.74
Roger	Unhappy	21.4% (n=9)	19.1% (n=8)	52.4% (n=22)	4.8% (n=2)	2.4% (n=1)	1.48
	Happy	18.9% (n=7)	5.4% (n=2)	51.4% (n=19)	21.6% (n=8)	2.7% (n=1)	1.84
Hind	Unhappy	16.2% (n=6)	13.5% (n=5)	54.1% (n=20)	13.5% (n=5)	2.7% (n=1)	1.73
	Happy	14.3% (n=6)	14.3% (n=6)	61.9% (n=26)	7.1% (n=3)	2.4% (n=1)	1.69

⁶ Although we recognize that singular “they” can be used as a generic third-person pronoun [33] or, purposefully, to avoid misgendering, in our persona cases wherein gender was specified clearly, we accepted it as a form of distancing language.

The average weighted score for unhappy personas was $\bar{x}=1.69$ and happy personas was $\bar{x}=1.76$, which was a marginal difference. The outliers were unhappy James and Khaled scoring lower and unhappy Sarah scoring higher, thus, falling outside the mean. This led us to believe that there might be a gender-based treatment difference. Men scored lower than women both in the unhappy category ($\bar{x}=1.61$ vs. $\bar{x}=1.77$) and overall ($\bar{x}=1.67$ vs. $\bar{x}=1.77$). We see this as an indication that unhappy female visuals (or female avatars in general) garner more empathy than their male counterparts [35,71].

4.6.2 Expressions of Pain Points

Our second hypothesis was aimed at seeing the effects of the persona pictures on participants' perceptions of persona's pain points. To investigate this question further qualitatively, we focused on the verbs and modal verbs mobilized by the participants as *pain-point descriptors* in all the responses. We grouped the descriptors by their valence scores in existing frameworks (such as [45]) and checked to see how far away they are from the neutral score whether in a positive or negative direction. As a result, we ended up with three categories: weak valence, moderate valence, and strong valence. The results are given in Table 5. An example of each category is given below:

Weak valence (imperatives, should, must, etc.): “Product for him should be complex with many functions.” (P13); “The person should keep the baby at childcare center [...]” (P47); “[...] this persona should work on a product or organization where he could spend most of his day without having to rely on internet” (P53)

Moderate valence (need, benefit, require, suggest, provide, come in handy, could use, be useful, etc.): “He might benefit from some kind of scheduling assistant/app [...]” (P17); “I would suggest a phone app to time work and leisure activities to make sure that Sarah does not get carried away [...]” (P24); “I think she needs a product to better split her day between work and personal activities.” (P21)

Strong valence (help, support, struggle, suffer, having [a problem, issue, or trouble] etc.): “I think that I could help him by giving him a way to get isolated from everyday life.” (P6); “The persona struggles with self-discipline and organizational issues.” (P9); “It's important to see what her problems are.” (P122)

Table 5: The frequency of pain-point descriptors based on specific personas. The dominant category(s) is highlighted. A weighted score was also calculated with “weak valence” being worth 0 points (minimum) and “strong valence” being worth 2 points with 1-point increment for each category.

		Weak Valence	Moderate Valence	Strong Valence	Weighted Score (0-2)
James	Unhappy	23.1% (n=9)	35.9% (n=14)	41.0% (n=16)	1.18
	Happy	46.2% (n=18)	23.1% (n=9)	30.8% (n=12)	.85
Sarah	Unhappy	25.6% (n=10)	38.5% (n=15)	35.9% (n=14)	1.10
	Happy	27.5% (n=11)	25.0% (n=10)	47.5% (n=19)	1.20
Jane	Unhappy	36.8% (n=14)	28.9% (n=11)	34.3% (n=13)	.97
	Happy	42.5% (n=17)	35.0% (n=14)	22.5% (n=9)	.80
Khaled	Unhappy	52.5% (n=21)	22.5% (n=9)	25.0% (n=10)	.73
	Happy	50.0% (n=19)	21.1% (n=8)	28.9% (n=11)	.79
Roger	Unhappy	45.2% (n=19)	33.4% (n=14)	21.4% (n=9)	.76
	Happy	32.4% (n=12)	45.9% (n=17)	21.7% (n=8)	.89
Hind	Unhappy	40.5% (n=15)	40.5% (n=15)	19.0% (n=7)	.78
	Happy	52.4% (n=22)	33.4% (n=14)	14.2% (n=6)	.62

The average weighted score for unhappy personas was $\bar{x}=.92$ and happy personas was $\bar{x}=.86$. Another marginal difference that highlights that participants were more aware of (spoke more strongly about) the pain-points of the unhappy

personas. There were some stark differences between individual personas. For example, the problems of unhappy James and Jane were more recognized, but the problems of happy James and Jane were less mentioned. Pain-points of Khaled and Hind were not voiced either when happy or unhappy. Sarah’s pain-points, on the other hand, were more strongly voiced both when happy and unhappy. This led us to check the results from a racial perspective (see Table 6).

The results confirmed that the pain-points of personas of Middle Eastern origin were not recognized (or handled in a weaker way) whatever way they looked: happy or unhappy. The pain-points of personas of European origin were more easily recognized when they are unhappy, however, the pain-points of personas of African origin were voiced even if they were not unhappy. In other words: (1) it was easy to imagine personas of European origin struggling when they look unhappy; (2) it was easy to imagine personas of African origin struggling even if they look happy; (3) it was not easy to imagine the struggles of personas of Middle Eastern origin at all. This could be explained by bias brought by the participants. Previous studies suggest that race in profile pictures affect interactions in virtual environments such as Airbnb [15] and online loans services [55].

Table 6: Results of pain-point descriptor analysis from a racial perspective.

Weighted Score (0-2)	Personas of European origin	Personas of Middle Eastern origin	Personas of African origin
Unhappy	1.08	0.75	0.93
Happy	0.82	0.70	1.05

4.6.3 Expressions of Usefulness

The third hypothesis was investigating the effects of the persona pictures on participants’ perceptions of the usefulness of the persona. We accepted usefulness in relation with the details and depth of the solution and/or product that the participants could come up with. The more descriptive the participants could get about their solution and/or product, the more useful we accepted the persona profile to be. To check this, we used two types of data: first, we looked at the percentages of sentences in each response that were written to explain the product (thus, the subject of the sentence was the product/solution); and second the word count of each product description section. The results are given in Table 7.

Table 7: The percentages of the responses that relate to solution and/or product description, as well as word counts.

Persona	Happiness	Percentage (%) Mean (\bar{x})	Word Count Mean (\bar{x})
James	Unhappy	63.14	50.86
	Happy	57.78	46.94
Sarah	Unhappy	74.78	73.27
	Happy	54.45	40.87
Jane	Unhappy	43.81	38.54
	Happy	54.89	34.07
Khaled	Unhappy	68.89	59.60
	Happy	60.89	56.60
Roger	Unhappy	59.23	41.20
	Happy	29.36	22.54
Hind	Unhappy	50.19	41.47
	Happy	49.45	41.94
Male Personas	Unhappy	61.96	49.25
	Happy	54.82	45.65
Female Personas	Unhappy	56.01	51.25
	Happy	53.17	38.80
	Unhappy	50.80	42.74

Persona	Happiness	Percentage (%) Mean (\bar{x})	Word Count Mean (\bar{x})
Personas of European origin	Happy	60.66	45.82
Personas of African origin	Unhappy	67.00	57.24
	Happy	41.90	31.70
Personas of Middle Eastern origin	Unhappy	59.17	50.77
	Happy	55.54	49.04
All Personas	Unhappy	58.99	50.25
	Happy	54.15	42.85

Looking at all responses, almost half of the text addressed a solution and/or a product for the persona, with unhappy personas sparking marginally higher density of text both in percentage and word count (58.99% versus 54.15%; 50.25 words versus 42.85 words). One of the outliers was happy Roger who had significantly lower solutions and/or products offered to him. That result qualitatively marks him as a less useful persona in terms of soliciting solutions from the participants. One explanation could be that since Roger looked happy, participants did not feel the need to create solutions for his problems. However, this does not explain why that was not the case for other happy personas. The other explanation can be Roger’s racial identity, however, that does not explain happy Sarah’s case who is also of African origin. As a result, we believe that this stands on an intersection of persona picture, gender, and racial identity. Other outliers were unhappy Sarah and Khaled who had more breadth in their solution discussions. The density of discussions around unhappy Sarah is significant, and again seems to sit at an intersection of persona picture, gender, and racial identity. Results from all personas showed that happy personas of African origin and happy female personas had shorter descriptions of solutions and/or products. However, the imbalance between Sarah and Roger (both personas of African origin) remains unexplained.

4.6.4 Expressions of Realism, Completeness, and Personality

For our H4-6 (that are aimed at seeing the effects of the persona pictures on participants’ perceptions of persona’s realism, completeness, and personality, respectively), we read through the 471 written responses, identified, and grouped those that talk about the said aspects, and coded each group into subcategories. The results are given in Table 8 and Table 9 along with detailed information on each coding.

4.6.4.1 Realism

We coded the segments about the realism of the personas under five categories: storifying, disbelief, environment, family, and baby.

Storifying emerges when the participants create additional details about the personas and their life in ways that were not mentioned, hinted, or highlighted in the profile. For example, “As he is very proficient and successful, and I assume also rich then he surely has money for holiday” (P363) or “It make not help [sic] that the baby wakes often in the night and he is also tired which will have a negative effect on his work” (P14). Neither case has any information on persona’s wealth or sleeping patterns. Storifying is a phenomenon that was previously identified in other persona studies [46,49,50]. Typically, if a user finds a persona realistic enough (e.g., the persona resembles the user somebody in their life or has parallels to the user’s own life), then, the user will start projecting real life experiences and stories onto the persona. We accept this as an indication of realism. In our data, most stories emerged for unhappy male personas with James being the dominant source. Happy personas displayed almost no storifying effect (7.1%).

Family and *baby* categories might be seen as an extension of *storifying*, however, since they have other connotations, they were mentioned separately. The profiles state that the persona has a 6-months old baby. This information is mentioned

in the responses in relation to real life experiences of how challenging it is to live with an infant. The 63% of the baby mentions were made for female personas—a cognitive gender bias that was identified previously between motherhood and labor prospects of women [8]. An interesting reversal was that baby mentions were more prominent for unhappy female versus happy male personas. Also, there were some instances where the personas were assumed to have other family members, in the forms of partners. This was more common for male personas assumed to having wives (67%) who *c/should* take care of the baby while the father works.

Table 8: The results of coding in text segments relating to realism of the personas.

Persona	Segments (N=130)	Storifying 10.8% (n=14)	Disbelief 11.5% (n=15)	Environment 18.5% (n=24)	Family 13.8% (n=18)	Baby 45.4% (n=59)
James	Unhappy	6		3		2
	Happy		2		3	3
Sarah	Unhappy	2	1	5		5
	Happy					4
Jane	Unhappy	1		2	2	10
	Happy		3	2		6
Khaled	Unhappy	2		2	1	2
	Happy	1	1	1	3	5
Roger	Unhappy	2		2	3	5
	Happy		7	2	2	5
Hind	Unhappy			5	3	6
	Happy		1		1	6
James	Unhappy					
	Happy					
Male Personas	Unhappy	10		7	4	9
	Happy	1	10	3	8	13
Female Personas	Unhappy	3	1	12	5	21
	Happy		4	2	1	16

The *environment* coding mentioned the physical working conditions of the personas. Although, there was no textual information about the physical working conditions of the personas, some participants mobilized the content of the persona photo to make suggestions. The suggestions ranged from using a better chair or table to being in a room with a door where isolation would be easier. These codes were more prominent for unhappy personas, and especially for unhappy women. An interesting side note is three participants claiming that unhappy Sarah and Jane both work at a kitchen table—neither photos show the women in the kitchen. Possibly another cognitive slip driven by gender bias.

Finally, we found some instances where participants voiced *disbelief* about the persona. For example, “I find it hard to imagine that a successful manager can have not so good [sic] computer skills” (P259), “I do not understand how it is possible for someone in a management position to work remotely with good result without having a fast internet connection” (P333), or “The fact that the persona looks happy makes me think they are okay with working remote” (P424). These instances were mostly focused on happy Roger (70% of segments from male personas, 67% segments from all personas). Previously, happy Roger was identified as the persona with the least amount of solutions offered.

4.6.4.2 Completeness

We found 26 segments about the completeness of the personas and coded them under 2 categories: company information (30.8%, $n = 8$) and uncertainty (69.2%, $n = 18$).

The *company information* segments were all made for unhappy personas (Sarah 25%, Jane 12.5%, Khaled 37.5%, Hind 25%) and were complaints or assumptions that the personas' companies should solve their problems either by providing them with upgraded equipment or faster connection. Since our persona profiles did not mention specific information about their work and company relationships, this marked a perspective which might be perceived as incomplete in the persona profiles we used. The *uncertainty* segments marked instances when the participant was not sure how to help the persona or mentioned that they had little faith in their solution, such as "[...] he could probably do with some sort of training [...] but these don't really seem necessary" (P422), "it's difficult to say because I don't have enough information about the person" (P421), or "I don't know what kind of product it can be [...]" (P392). These segments were mainly concentrated on unhappy Khaled (22.3%, $n = 4$) and happy Sarah (16.7%, $n = 3$) with happy Khaled and Roger each having two, and happy/unhappy James and Jane and unhappy Sarah each having one.

4.6.4.3 Personality

To understand how the participants perceived the personalities of the persona, we looked for words that were used to describe the personalities and we found 59 segments which we coded to be either negative (55.9%, $n = 33$) or positive (44.1%, $n = 26$).

Table 9: The results of coding in text segments relating to personality of the personas.

Persona	Happiness	Negative	Positive
Male Personas	Unhappy	15	4
	Happy	4	13
Female Personas	Unhappy	14	6
	Happy		3
Personas of European origin	Unhappy	14	4
	Happy	1	4
Personas of African origin	Unhappy	8	5
	Happy		6
Personas of Middle Eastern origin	Unhappy	7	1
	Happy	3	6
All Personas	Unhappy	29	10
	Happy	4	16

As expected, negative personality descriptors were mostly focused on unhappy personas. Also, unhappy personas of European origin had almost twice the number of negative descriptors than personas of African or Middle Eastern origin which was a surprising result. Although it is hard to pinpoint an exact reason for this racial divide, it may be that men of European origin are seen as a more advantageous social category that results in men of European origin attracting more criticism when seen as unhappy. Most common negative descriptors were stressed (36.4%, $n = 12$) and unhappy (9.1%, $n = 3$) with instances of afraid, anxious, distracted, and pessimistic, among others.

Interestingly, both unhappy and happy personas received positive personality descriptors with happy personas having higher (61.5%). This is mainly because although happy men significantly attracted more of the positive comments (76.5%) among men, unhappy women attracted more of the positive comments (66.6%) among women. Much like the explanation

of the previous result, this may be due to women being seen as a comparatively disadvantageous category. As a result, they receive positive comments for support and encouragement even when they look unhappy. Additionally, unhappy personas of Middle Eastern origin received a significantly lower number of positive comments which was not the case for personas of African or European origin that received an equal distribution of positive comments between their happy and unhappy versions. (Thus, there was less encouragement for unhappy personas of Middle Eastern origin.) Commonly used positive descriptors were comfortable (7.8%, $n = 2$), reliable (7.8%, $n = 2$), happy (7.8%, $n = 2$), and focused (7.8%, $n = 2$) with instances of motivated, open for learning, and successful, among others.

These results indicate that, if the design task would benefit from a positive perception of personality, a happy man or an unhappy woman would be the most useful along the lines of gender, and a Middle Eastern persona would be the least useful along the lines of ethnicity. However, the second part could be translated as the need for using a persona profile who is ethnically closer to participants.

5 DISCUSSION

5.1 Theoretical Contributions

‘Why and how personas work’ and showing their real value for design outcomes [61] are quintessential aims in design studies [74]. The quantitative results indicate that happier persona pictures significantly decrease realism and pain point perception. *The less happy the persona looks like, the more realistic it seems, and the more intense its pain points are perceived in a design task.* For this part, the results support the use of unhappy pictures as a way to enhance designer’s immersive experience with personas (**Design Implication 1**). Furthermore, the results indicate no downside of decreasing persona engagement when using unhappy pictures.

The fact that picture happiness decreases the users’ pain point perception is reasonable and expected. (*If you are happy, are you really having trouble?*) The fact that picture happiness does not affect personas’ usefulness implies that the persona’s happiness is not directly related to usefulness. Similarly, our findings suggest that happiness is not related with the persona’s completeness. The fact that picture happiness decreases the realism of the persona is in line with previous findings concerning the effect of stock photos [64]. Unexpectedly, there was no statistically significant differences between unhappy and happy personas. One would expect someone unhappy to evoke empathy, but this was not the case.

Our results showed that the first-impression “mood” of the persona affects how its personality is judged, extending the work on personas and personality traits [3,4]. These Big Five personality ratings matter since they may influence design outcomes, different design solutions might be created for introverted personas relative to extroverts.

As expected, users tend to extrapolate the persona’s personality from a single picture: the momentary “mood” of the persona therefore affects how its personality is judged. To lessen this effect – i.e., to increase the range of perception of personality – multiple pictures could be added to portray the persona in different moods (e.g., happy, unhappy, neutral) (**Design Implication 2**). This could possibly alleviate the first impression effect of users associating the persona with specific (positive or negative) type of personality on a single picture alone.

5.2 Cultural and Gender Effects

Personas provide a vehicle to inclusive design through portraying users from different cultures [25]. Our findings show that varying the persona’s origin can have real consequences in how it is applied for design tasks. The qualitative analysis outlined the difference along the racial lines – it was the easiest to recognize the pain-points of personas of European origin;

it was the hardest to recognize the pain-points of personas of Middle Eastern origin who were clearly marked through their clothing in the photos (shown in Figure 2).

Unhappy Roger was found both less useful and less realistic. Although there was no clear explanation for this, we believe that the phenomenon stands at the intersection of ethnic identity and gender. The participants were more prone to (1) creating stories around unhappy male personas; (2) bringing up baby and family for unhappy female personas; (3) assuming an existence of partners for male personas; and (4) using negative personality descriptors for unhappy men but, in contrast, positive personality descriptors for unhappy women.

These results indicate that the participants tried to come up with explanations around the unhappiness of men and used negative descriptors for them, but the participants were also quick to accept the unhappiness of women due to having a baby and family duties and used positive descriptors for them. The participants were the least empathetic toward the personas with unhappy male pictures and found it easier to empathize with unhappy female personas.

As such, the findings tie back to the discussion on stereotypical thinking associated with personas, and if stereotypes are indeed inevitable when designing with personas [75]. Our findings suggest that stereotyping takes place – however, it is not certain if this affects the design outcomes negatively. It appears that the design outcomes can be detailed despite culture and gender affecting their content. Therefore, the question of stereotyping requires further study to delineate when stereotyping becomes harmful and when it is acceptable (i.e., non-harmful) for design outcomes.

Overall, we speculate the gender stereotypes in the society can explain some of the differences we observed. Characterizing this, society does not like unhappy (should we dare to say, weak) men but wants to protect and support unhappy women. As a result, a design lesson could be (**Design Implication 3**): if your task requires the participants to empathize with the persona, use a happy man instead of an unhappy one, but also use an unhappy woman instead of a happy one. On the other hand, unhappy white men are described very negatively. It almost appears as if the participants were thinking “you are already a member of an advantaged social group, why are you complaining...”

Also, ethnicity is a factor. The pain point perception was the highest for the personas of Middle Eastern origin. However, this does not necessarily mean that the participants sympathize with the personas. The fact that Middle Eastern personas are seen to struggle with remote work could also be perceived from a point of view of racial profiling, so that Middle Eastern people are seen less capable with technology (negative stereotype). In fact, the qualitative findings suggest that Middle Eastern personas are at a disadvantage of being understood and empathized with. These findings could be explained by the participants’ ethnicities (predominance of people of European origin); if more participants were from the Middle East, the results could have been different.

While more research is needed to ascertain to which degree ethnic (dis)similarity affect perceiving and using personas for design, given our limited evidence, we would encourage persona creators to “play safe” by ensuring that the cultural match between the personas and participants is not too wide to negatively affect empathy (**Design Implication 4**). This recommendation may be controversial, since the purpose of personas is precisely to *increase* empathy; e.g., bridge cultural gaps. Nonetheless, our results do not show this purpose being realized; hence, it is uncertain how well personas mitigate stereotypes and how much they instead reinforce them.

5.3 Limitations and Future Research Directions

As with all research, there are limitations and areas for further analysis. The main limitations of this work involve the limited ethnic diversity of the participants: we would have preferred having more varied ethnic backgrounds, but the sample mostly consisted of people of European origin. Future studies can recruit participants from other ethnic backgrounds. Moreover, future research could experiment with more personas of different ethnic backgrounds (e.g., Asian, Latinx). Due

to practical limits imposed by our study design, we were constrained to three personas. We decided that inclusion of personas of Middle Eastern origin was important, as previous studies have applied personas of Asian origin [63,64] but, as far as we know, perceptions towards personas of Middle Eastern origin have not been tested in previous research.

Future research could also investigate if and how “unhappy” personas stand out if mixed with “happy” personas. In particular, unhappy personas may better stand out from happy ones if the majority of personas are happy (and *vice versa*). The happy persona thus becomes more visible, and will receive more attention and be better remembered than its visual surroundings [24]. This might have (un)intended consequences for the design process, depending on the goal of highlighting a certain persona or trying to ensure an even attention of users to all personas.

Furthermore, the degree of unhappiness in the pictures could be varied. Most of the pictures we used could be characterized as ‘moderately unhappy’ – however, there is picture material where the person appears to be strongly dissatisfied, even depressed (i.e., there is a wide range of emotion). The strength of unhappiness could further affect how the persona is perceived; higher level of agony might result even heightened pain point perception. Therefore, testing different levels of unhappiness provides a logical continuum to our work.

While the findings support the association between persona’s happiness and personality attribution, how this association affects design outcomes should be studied further. Finally, future research should focus on varying the design task. It may be that for some tasks, happy pictures are better; for other tasks, unhappy may be better. Task types may require different level of user empathy and pain point immersion, and so the implications of the use of pictures might differ, even when the personas contain pain points.

6 CONCLUSION

Should designers of personas use happy or unhappy pictures? It seems it depends, as there are tradeoffs. Users perceive the pain points of the persona more strongly when using unhappy pictures than when using happy pictures. Users also find personas with unhappy pictures more realistic than those with happy pictures. Happy pictures seem to present a more positive impression of the personas in terms of personality traits. In general, the evidence supports the use of unhappy pictures to strengthen the persona users’ perception of personas being realistic people with real problems.

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