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2025-05-07

Deposited version:

Publisher Version

Peer-review status of attached file:

Peer-reviewed

Citation for published item:

Kaate, I., Salminen, J., Jung, S., Santos, J. M., Häyhänen, E., Xuan, T....Jansen, B. (2024). Modeling the new modalities of personas: How do users' attributes influence their perceptions and use of interactive personas?. In Ludovico Boratto, Panagiotis Germanakos, Cristina Gena, Elvira Popescus, Mirko Marras (Ed.), UMAP 2024 - Adjunct Proceedings of the 32nd ACM Conference on User Modeling, Adaptation and Personalization. (pp. 164-169). Cagliari: Association for Computing Machinery.

Further information on publisher's website:

10.1145/3631700.3664882

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Modeling the New Modalities of Personas: How Do Users' Attributes Influence Their Perceptions and Use of Interactive Personas?

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ABSTRACT

We investigate the impact of user demographics (age, gender) and experience (with personas and chatbots) on users' perceptions of interactive personas. A within-subjects study was conducted with 54 participants, mostly engineers and computer scientists. Each participant used interactive personas with two interfaces: a web-based profile persona and a chat persona. The findings from regression analysis indicate that users' age and gender (as well as persona's gender) affect multiple perceptions of personas. In addition, the interface modality (profile vs. chat) has a significant impact. Findings highlight the need for designing interactive personas that appeal to diverse user bases to increase the general accessibility of interactive personas. They also support the notion that the persona interface itself regulates user perceptions even when the persona's information remains the same.

CCS CONCEPTS

• **Human-centered computing** → Human computer interaction (HCI).

KEYWORDS

Personas, User-centered design, Interactive systems, User attributes

ACM Reference Format:

Ilkka Kaate, Joni Salminen, Soon-Gyo Jung, João M. Santos, Essi Häyhänen, Trang Xuan, Jinan Y. Azem, and Bernard Jansen. 2024. Modeling the New Modalities of Personas: How Do Users' Attributes Influence Their Perceptions and Use of Interactive Personas?. In *Adjunct Proceedings of the 32nd ACM Conference on User Modeling, Adaptation and Personalization (UMAP Adjunct '24)*, July 01–04, 2024, Cagliari, Italy. ACM, New York, NY, USA, 6 pages. <https://doi.org/10.1145/3631700.3664882>

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UMAP Adjunct '24, July 01–04, 2024, Cagliari, Italy
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ACM ISBN 979-8-4007-0466-6/24/07
<https://doi.org/10.1145/3631700.3664882>

1 INTRODUCTION

By embodying user archetypes [21], *personas* facilitate empathy and understanding among designers, enhancing the development of products and services that resonate with end-users [6]. Personas have been applied in various domains, from human-computer interaction (HCI) to user experience (UX) design, and marketing [1]. While personas are traditionally offered to designers, developers, and other *persona users* via a paper interface (e.g., posters and printouts), it is becoming increasingly common to offer personas via digital interfaces, like Web-based systems and chat interfaces [3, 8, 15–17]. We know from HCI theory that the interface itself can affect how the personas are perceived (i.e., the interface is a confounding variable when presenting the same information to the same users [2, 10]). Hence, we present evidence on how users interact with (and perceive) *interactive personas*, offered via a web- or chat-based system.

Interactive personas denote a clear separation from “static file” or paper personas [15]. Interactive personas employ various interaction techniques to enhance the interaction between users and the persona. In the case of *profile personas*, users can search and click on the persona information. In the case of *chat personas*, users can engage in a conversation with the persona via a chat interface. This interaction can be influenced by several user characteristics, including demographics (age, gender), and experience with personas.

While studies on static persona profiles indicate that user characteristics matter for the persona-user interaction [13, 19, 24, 26], we do not know the effect of these factors in the context of interactive personas. Interactive personas may not necessarily be uniformly experienced across all persona user groups (hereby referred to as ‘users’). Variations in user demographics, such as age and gender, as well as differences in users' experience with personas or their underlying modality (e.g., experience with chatbots), can influence the perception and use of personas. This study explores these effects to better understand how to optimize interactive personas for diverse user groups, which is crucial for making personas more applicable to inclusive design that considers all user groups [11, 12]. Note that, traditionally, inclusivity in persona studies has focused on understanding different end-user groups (i.e., those that personas represent) rather than considering the accessibility of personas as

a medium of communicating information about end-user groups to persona users. Nonetheless, this latter, *persona accessibility* aspect, matters.

The research gap we address, therefore, lies in understanding how age, gender, and experience with user representation interfaces—specifically two interactive persona types of web-based profiles and chat personas—affect user perceptions of personas [25, 28], such as perceived credibility, consistency, similarity, stereotypicality, and empathy of interactive personas (for this testing, we use two validated HCI scales; see Section 3). Overall, there is a need to meet the diverse requirements of varied user groups to support personas' effectiveness as a design tool across a broad spectrum of users [4]. To this end, the study aims to contribute insights into the design and implementation of interactive personas, offering a pathway to user-sensitive personas that work across demographically diverse user groups.

2 RELATED WORK

The relationship between age and user personas in design and UX research typically focuses on tailoring personas to represent specific age groups accurately, considering their unique characteristics, needs, and preferences. This adaptation is crucial for designing products, services, or systems that are accessible and satisfying for users of different ages. However, much less attention, if any, is paid to the consideration of *persona users'* age.

For example, Moser et al. [20] highlight the challenge of assessing requirements for diverse special user groups, such as the elderly (aged 50 to 90) and children (aged 6 to 14), and propose creating personas that consider the characteristics of these groups. Holden et al. [14] developed biopsychosocial personas of older patients with heart failure using quantitative analysis of survey data. In a similar vein, Wöckl et al. [31] introduced a set of basic senior personas covering a broad range of characteristics of European older adults, developed using quantitative data from approximately 12,500 individuals. These personas serve as a tool to extend empathy when developing ICT solutions for older adults, addressing the representativeness and cost-efficiency often lacking in existing personas describing this age group.

On the other end of the age spectrum, Da Costa et al. [7] created child personas for designing a political educational game for Brazilian students aged 9–15. Their approach demonstrated the utility of personas in capturing the characteristics of younger users for designing content that resonates with their interests and learning needs.

These studies illustrate the approach required when creating and using personas across different age groups. By considering the unique aspects of each age group, personas can effectively guide the design of products and services that cater to the specific needs and preferences of users from different age groups. However, the extant research does not provide a direct answer to the question of how age affects persona use. Because age may be a relevant factor in persona use, further research is needed to explore this topic.

The relationship between gender and user personas in HCI focuses on the need for inclusive design practices that account for diverse user groups. A few studies have examined this topic. An empirical study using the *GenderMag* cognitive walkthrough was

used for identifying usability issues in a learning management system when using gendered personas [29]. This method, by invoking specific gender-associated characteristics, helped uncover more usability issues, particularly with the persona representing characteristics typically associated with females. Such approaches highlight the importance of considering gender in HCI usability studies to enhance software design and UX [13, 22, 29].

Another study found that the gender of the persona significantly affected scores for several variables, including completeness, usefulness, clarity, and empathy [27]. Increased transparency of the female persona had a notable positive effect on completeness and empathy, while increased transparency of the male persona had a negative effect on several constructs. These findings extend and challenge prior research on stereotypes in personas and suggest that male and female personas are perceived differently by at least some end users. It is an open question whether these findings hold with interactive personas, indicating that further research on this topic is needed.

The relationship between experience with and perceptions of personas has been investigated to understand how users' familiarity and prior use of personas influence their perceptions and willingness to use this method in design and decision-making processes. Salminen et al. [24] explored how user's persona experience influenced their perceptions of personas. The research involved participants with varying levels of experience with personas, finding that previous experience with personas significantly increases several important perceptions related to personas, including the willingness to use them, empathy towards them, likability, and perceived completeness. These findings suggest that as users gain more experience with personas, their positive perceptions and the likelihood of using personas in decision-making processes increase. However, the analysis used a conventional persona profile and it did not extend to other modalities, particularly not to personas delivered via a chat UI. Because the modality itself may affect persona use and perceptions, an extended inquiry into the effect of user attributes on the use of interactive personas is needed.

3 METHOD

3.1 Data collection

An in-person user study was conducted with 54 participants in a computing research institute, with participants being mostly researchers ($n=36$, 66.67%) and engineers ($n=9$, 16.66%) with other professions comprising a lab coordinator, a security and health director, a bioinformatics specialist, five undergraduate students, and a business development manager (all other professions: $n=9$, 16.66%). The participants (see Figure 1a) included slightly more males ($n=30$, 55.6%) than females ($n=24$, 44.4%). No other genders were reported. Their average age was 33.1 (SD = 10.6) (see Figure 1b).

The participants used two types of interactive personas: a persona profile that could be scrolled, searched, and clicked upon, and a chat persona that could be conversed with (see the online supplementary material¹ for detailed information of each). The study was conducted as a within-subject study where all participants

¹Online supplementary material: [https://osf.io/gwvve8/?view_only=\\$7de5ec227cd74f39ad489fc97a95811a](https://osf.io/gwvve8/?view_only=$7de5ec227cd74f39ad489fc97a95811a)

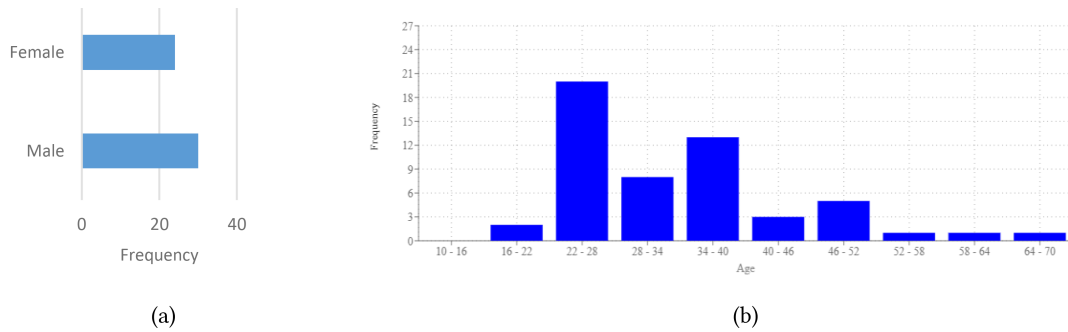


Figure 1: Participant (a) gender and (b) age distribution.

interacted with a web-based persona profile and a chat persona of two genders; the order of interaction was counterbalanced to mitigate learning and order effects. The participants were provided with a fictitious scenario asking them to take the position of a software engineer or a manager in a software company developing artificial intelligence (AI) solutions by using two different personas. In the task, the participants were asked to answer seven questions (six multichoice and one open-ended question) about the personas that their superior had identified as important. We computed the success rate based on their answers' correspondence with the actual persona information. The participants were informed that the personas had been created from survey data² from the US with ~10 000 respondents using the publicly available *Survey2Persona* system [23] which uses survey data for persona generation with generative AI and machine learning (personas were generated with S2P with a machine learning-based clustering similar to those used in quantitative persona generation [5, 9, 30]. Personas were presented on a computer screen along with the task and survey. After interacting with a persona and completing the task, the participant would answer survey questions about the persona (see the online supplementary material). These questions originated from two validated scales: the *System Usability Scale (SUS)* [18] and the *Persona Perception Scale (PPS)* [28]. After completing the task with both personas, the participant was thanked and given a gift card as thanks for their time.

3.2 Statistical analysis

Due to the repeated measurements employed in the study's design, we conducted a multi-level linear regression, where each stimulus was treated as a case, and nested within a participant (as each participant was exposed to two different stimuli), to account for within-subject variability. The analysis uses the combined data, accounting for both profile and chat personas. In the findings, we report the regression model coefficients (B = unstandardized coefficient) of statistically significant findings (P -value $< .05$). The full results are available in the online supplementary material. For the task answers, success rate was calculated based on participants' correct answers. I.e., how many answers a participant answered correctly.

²Dataset available from Pew Research: <https://www.pewresearch.org/internet/dataset/american-trends-panel-wave-99/>

4 FINDINGS

Figure 2 illustrates the significant findings of the study. These will be discussed in the following subsections.

4.1 Interaction modality

In analyzing the impact of various factors on the interface modality, several significant findings emerged. Profile was positively associated with perceived transparency of the persona, $B = 0.419$, $P = 0.031$. Profile was negatively associated with the usability of the persona when using the PPS scale, $B = -1.423$, $P < 0.001$. This finding was confirmed when using the SUS scale, $B = -1.104$, $P < 0.001$. Profile was associated with less enjoyable use, $B = -1.502$, $P < 0.001$. Consistently, the profile was also perceived as more difficult to use than chat, $B = 1.778$, $P < 0.001$. This translated into higher dwell times for the profile persona, $B = 111.089$, $P < 0.001$. Interestingly, higher dwell times might actually do the user a favor, since the task success rate was higher among the sessions where the profile persona was used, $B = 0.122$, $P = 0.036$.

4.2 User's age

Regarding age, several dependent variables demonstrated significant P -values.

First, as user age increases, the perceived clarity of personas decreases, $B = -0.022$, $P = 0.007$. This indicates that older users find personas less clear in their representation or information.

Second, older users perceive personas as less consistent, $B = -0.031$, $P = 0.037$. Thus, age may influence expectations or perceptions of how coherent and logical personas appear.

Third, the usability of personas decreases with user age increase, $B_{USABILITY} = -0.055$, $P = 0.001$. This suggests challenges in accessibility or interaction design that may not fully appeal to older users.

Fourth, as users get older, their willingness to engage with personas declines, $B = -0.043$, $P = 0.009$. This could be related to perceived relevance, ease of use, or the perceived benefits of interacting with personas.

Fifth, older users rate the system usability of personas lower, $B = -0.046$, $P < 0.001$. This emphasizes the importance of designing personas that are accessible to all age groups.

Sixth, older users find personas more difficult to use, $B = 0.060$, $P = 0.003$. This aligns with the findings for usability and willingness

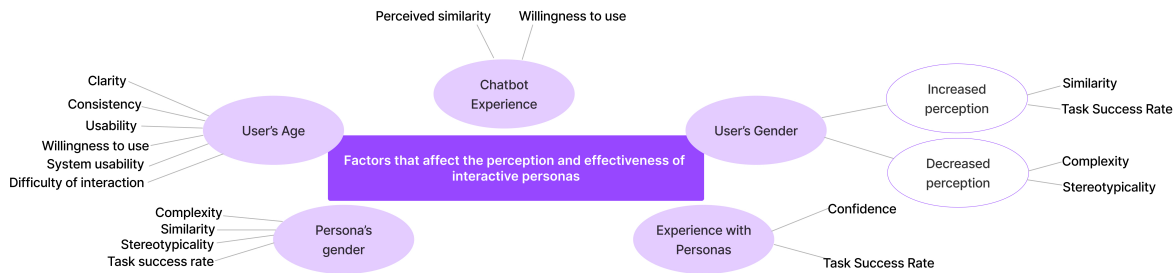


Figure 2: Significant factors relating to users' demographics and experience (and persona's gender).

to use, suggesting that age-related factors may impact how easily users can engage with personas.

4.3 User's gender

Regarding the gender of the users (male or female; other genders were not reported), significant findings emerged.

First, female users perceive personas as less complex, $B = -0.441$, $P = 0.022$. This might indicate a preference or greater ease in understanding personas among females compared to males.

Second, female users feel a stronger resemblance or connection to the personas, $B = 0.835$, $P = 0.002$. This finding emphasizes the importance of designing personas that are inclusive and reflect diverse user identities.

Third, female users perceive personas as less stereotypical, $B = -0.680$, $P = 0.017$. This could suggest that these personas are viewed as offering a more diverse representation, avoiding oversimplified gender roles or characteristics.

Fourth, female users experience a higher rate of success in tasks involving personas, $B = 0.108$, $P = 0.004$. This could indicate that the personas' design or implementation is more effectively addressing women's needs or preferences.

4.4 Persona's gender

The persona's gender was either male or female. Several significant findings emerged.

First, personas with a male gender are perceived with less compassion by users, $B = -0.441$, $P = 0.022$. This could indicate that male-identified personas are designed or interpreted in a way that seems less compelling.

Second, users feel a stronger similarity to male-identified personas, $B = 0.835$, $P = 0.002$. This finding might reflect the gender distribution among the participants (there were more male participants; see Section 3.1).

Third, male personas are perceived as less stereotypical, $B = -0.680$, $P = 0.017$. This suggests that male personas may more easily avoid common gender stereotypes.

Fourth, interactions involving male personas are slightly more successful in helping users achieve their tasks, $B = 0.108$, $P = 0.004$. This implies that persona gender affects task-oriented engagement.

4.5 User's prior persona experience

Users' experience with personas was measured using a three-point scale ("I had never heard of personas before this study" [$n=21$],

"I knew what personas are before this study" [$n=17$], and "I had used personas before this study" [$n=10$]). Two significant findings emerged.

First, users with more experience with personas have higher confidence when interacting with them, $B = 0.279$, $P = 0.041$. This could indicate that familiarity with personas contributes to a user's self-assurance in understanding and using personas effectively, enhancing their overall interaction experience.

Second, increased experience with personas is associated with a higher rate of task success, $B = 0.063$, $P = 0.034$. This finding suggests that as users become more accustomed to using personas, they are better able to leverage them for tasks dealing with user understanding. This could be due to a deeper understanding of how to interact with personas.

4.6 User's prior chatbot experience

Chatbot experience was measured using a three-point scale ("I had never heard of chatbots before this study" [$n=0$], "I knew what chatbots are before this study" [$n=3$], and "I had used chatbots before this study" [$n=45$]).

Two significant findings emerged. First, users with more experience with chatbots perceive a lower similarity between themselves and the personas, $B = -1.327$, $P = 0.03$. This could indicate that increased familiarity with chatbots leads to more critical evaluations of personas, possibly due to heightened expectations for UX.

Second, users with greater chatbot experience show less willingness to engage with personas, $B = -1.194$, $P\text{-Value} = 0.045$. This decrease might reflect users' dissatisfaction with the current state of persona and chatbot integration, highlighting the need for improvements in how personas are presented in chat-based interfaces.

5 DISCUSSION

5.1 Contributions to persona research

Despite the widespread use of interactive personas, there has been a notable gap in understanding how individual differences affect the perception and effectiveness of personas. Existing research often overlooks how these user characteristics influence engagement with personas, leading to a one-size-fits-all approach that may not adequately address diverse user needs. To this end, our study provides empirical contributions to persona research.

First, the user's age significantly impacts perceptions of clarity, consistency, usability, willingness to use, system usability, and the difficulty of interacting with interactive personas. These findings

highlight the need for age-inclusive design practices that consider the needs and preferences of different user groups, especially the more elderly persona users. Second, gender influences perceptions of and interactions with interactive personas. The decreased perception of complexity and stereotypicality among female users, alongside increased similarity and task success rates, highlights how gender affects UX with personas. These findings emphasize the necessity of possibly paying more attention to supporting male users in their use of personas.

Third, the persona's gender significantly influences user perceptions, particularly in terms of complexity, similarity, stereotypicality, and task success rates. Specifically, male-identified personas being perceived as less complex and stereotypical, and more similar to the users, suggest a need for thoughtful consideration of gender representation to serve all segments of the population.

Fourth, users' experience with personas significantly impacts their confidence and task success rate when interacting with personas. Increased familiarity and experience with personas enhance both the confidence users feel in their interactions and their ability to complete tasks using personas. So, designing personas that account for varying levels of experience matters.

Finally, the analysis of chatbot experience reveals insights into how chatbot experience impacts user engagement with personas, particularly concerning perceived similarity and WTU.

5.2 Implications for persona design

The findings from the analysis offer insights into the design and utilization of interactive personas. We propose the following guidelines based on our findings.

5.2.1 Customization and flexibility. The significant effects of user demographics (age, gender) and experience levels (with personas and chatbots) on perceptions of personas suggest that designers should consider adaptive personas that can adjust in complexity, presentation, and content based on user characteristics and prior experience. This adaptability can enhance the effectiveness of personas, making them more accessible and engaging for diverse user groups.

5.2.2 User experience and confidence. The positive impact of experience with personas on confidence and task success rate highlights the role of familiarity and proficiency in facilitating effective persona interactions. Incorporating educational components or guidance within persona tools can help users navigate and understand personas more effectively, building their confidence and enhancing task performance. Design strategies that support user learning and acclimatization can make personas more intuitive and user-friendly, particularly for those new to the concept.

5.2.3 Addressing age-related usability. The influence of user age on perceptions of complexity, usability, and task success rate points to the necessity of considering age-related preferences and capabilities in persona design. Ensuring personas are straightforward, clear, and easy to interact with can mitigate potential usability challenges faced by older users. Design solutions might include simplified interfaces, clearer explanations of persona elements, and customizable settings to accommodate varying levels of technological proficiency.

5.2.4 Optimal chat experiences. The decreased willingness to use personas among experienced chatbot users suggests a need for more optimal integration of personas within chatbot interfaces. Because users with extensive chatbot experience appear to have higher expectations for interaction quality and personalization, persona designers and chatbot developers should work collaboratively to innovate and push the boundaries of what is currently possible, aiming to delight users with engaging meaningful interactions. This could involve refining chatbot conversational flows, ensuring personas are contextually relevant, and enhancing the overall UX to meet or exceed users' expectations. For example, personas' responses could be tailored to better reflect individual user characteristics and preferences. This would involve incorporating more personalized elements into personas, especially when delivered through chat-based interfaces.

Overall, as prior research on HCI and user modeling suggests, the interface of providing information to users (about users, in this case) affects how they perceive such information. Our results in the persona domain show evidence of this in the context of web-based profile and chat personas. In future studies, sample size could be increased. Further studies can investigate human factors related to users' demographic, ethnicity, education, and experience attributes toward creating interactive profile and chat personas that support the widest possible range of user attributes, thereby improving the overall accessibility of personas as a user-centered design and user modeling technique.

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