

Designing Persuasive Avatars in mHealth for Arabic Culture: A Qualitative Study

(Research-in-progress Paper)

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Abstract

Mobile health, or mHealth in short, concerns using mobile devices to provide health information to users. Research has shown that the use of avatars within mHealth applications can improve health outcomes. While several studies have investigated the design of avatars for mHealth applications, these studies focused solely on western cultures and most of them have not considered whether design principles are different between Western and Arabic users. This work will investigate the design of Arabic avatars by conducting a qualitative study, which includes semi-structured interviews with multiple stakeholders. The study will adopt a co-design methodology to derive design principles for persuasive Arabic avatars in the context of mHealth. In particular, it is our aim to increase users' perceived social presence and intention to use persuasive mHealth avatars by taking Arabic culture into consideration. The work may lead to a higher level of adoption of avatar-based mHealth applications in Arabic countries.

Keywords Arabic culture, avatars, human-computer interaction, mHealth, interviews.

1 Introduction

Mobile Health (mHealth) describes the use of portable electronic devices with software applications to provide health services and manage patient information (Källander et al. 2013). The rapid growth of these portable electronic devices gives rise to opportunities for targeted health behaviours such as encouraging physical activities or improved dietary intake. mHealth applications and interventions utilise a variety of functions from clinical decision support systems and data collection tools for healthcare professionals (Blaya et al. 2010) to support patients in health behaviour change and chronic disease management (Cole-Lewis and Kershaw 2010). For example, digital representations such as avatars¹ have been used to provide medical information to patients, monitor their recovery progress, and facilitate an engaging experience for them. mHealth offers interactive 2-way communication, thereby providing a wide range of opportunities from improving self-monitoring for those with chronic diseases to improving health outcomes (Källander et al. 2013).

While several studies have investigated the design of avatars for mHealth solutions by taking Western cultures into consideration (e.g., see Kim and Park 2011; Lee et al. 2009), limited research has looked at whether the design principles are different between Western and Arabic users. Non-communicable diseases (NCDs), such as cardiovascular disease, cancer, chronic lung diseases, and diabetes, are not only a growing health burden in Western countries but also in Arabic countries (WHO 2011). The World Health Organisation reported that NCDs in the Arabic region have increased due to physical inactivity. However, the number of mHealth applications that are specifically designed for individuals coming from Arabic background is scarce. Avatar design for mHealth applications should focus on the cultural background of users (Yusof and Zakaria 2007) and incorporate their values (Borning and Muller 2012). Avatars often have human features, e.g., they have faces, body elements, gestures, some form of behaviour and expression, and even sound. Aljaroodi et al. (2017) identified a set of design requirements and principles for empathic avatars to be used in stroke rehabilitation via an mHealth artefact, based on the behaviour change framework of Michie et al. (2011), but they did not consider the cultural background of users.

In this work, we aim to derive design principles for *persuasive avatars* that are not only human-like, but also reflect users' cultural background, to enhance overall user experience in the interaction and increase user intention to use a given mHealth application. To the best of our knowledge, there is no empirical study that has evaluated whether the design requirements and principles of avatars in the context of mHealth should be different for Arabic users. System designers can purposefully design avatars that influence users' affective states in terms of perceived similarity, homophily, and anthropomorphism. User affective states here refer to the 'extra-rational' factors that strongly influence users' reasoning and communication (Li and Ji 2004). Addressing cultural differences in designing user interfaces may improve usability and acceptance of information systems (Khaddam and Vanderdonck 2014). Importantly, what we would like to achieve in this research is to design engaging and motivating user interfaces in the domain of mHealth for health issue prevention, taking into account the cultural background of users by addressing gender differences in Arabic culture in terms of physical similarity, anthropomorphism, homophily, and social presence. A qualitative study will be carried out to identify design principles for persuasive avatars in the context of mHealth that could potentially improve dietary intake, promote physical activities, and decrease NCDs.

The remainder of this paper is organised as follows. Section 2 provides a brief theoretical background and review of related work in the domain of avatars in mHealth. In Section 3, we propose a research model and hypotheses related to how and why the design of an avatar has an impact on Arabic users' intention to use persuasive avatars in mHealth applications. In Section 4, we present the research methodology that will be used in our qualitative study to derive design principles for Arabic avatars. Finally, we describe the data analysis method and highlight expected contributions in Sections 5 and 6.

2 Theoretical Background and Related Work

The design of a system should always be based on user needs and requirements. Culture-aware avatar design is able to facilitate a more effective systems design. In this section, concepts and theories

¹ When using the term "avatar", we consider visual design elements that resemble human features. We are aware that there is a distinction between cases where a human or a computer agent is represented, but for our research this is not a primary concern.

related to the use of avatars in mHealth, persuasive avatars² and systems design for Arabic culture are discussed.

2.1 Avatars in mHealth

Avatars can be designed through a variety of concepts: self-avatar, mirrored self, future self, ideal self, and fictional self (Behm-Morawitz 2013; Song et al. 2013; Vasalou et al. 2008; Vasalou and Joinson 2009). Avatars are used in mHealth mainly as a means to increase user engagement and facilitate behaviour change. For example, avatars have been used in clinical research to stimulate behaviour change in lifestyle habits such as physical activities and dietary intake (Fox, Bailenson, et al. 2009). It has been shown that the use of an avatar can increase the level of trust, e.g., for Parkinson's disease patients (Javor et al. 2016). Previous research also suggests that an avatar can be an effective method for communication (Parks et al. 2014). The use of avatars in mobile applications can help patients to have a more engaging experience by facilitating the provision of real-time feedback. For example, avatar-based mobile applications that show the effects of smoking on a self-avatar physical appearance would increase users' level of perceived risk associated with smoking (Song et al. 2013).

2.2 Persuasive Avatars

In the literature, different aspects of avatar design that affect user behaviour in computer-mediated interaction, including persuasion, have been explored (Hanus and Fox 2015). Persuasive avatars refer to a category of avatars designed to influence user decisions in the interaction towards an idea (Bengtsson et al. 1999). One aspect that could be used to achieve persuasive avatar design is the *appearance* of the avatar (Qiu and Benbasat 2010). Avatars that look like (similar in appearance) the users would be more persuasive and affect their decisions in terms of brand liking (Ahn and Bailenson 2011). Fox, Arena, et al. (2009) argued that users would exhibit a higher level of persuasion, which influences their behaviour, if their avatar has the same gender as themselves. Users from Saudi Arabia tend to choose usernames that reflect their gender (Madini and de Nooy 2013). Arabic users are also more affected and persuaded by an avatar that is similar to their in-group members, i.e., the social group to which a person psychologically identifies as being a member (Leach et al. 2008), or by an avatar that represents an authority figure for the user (Fox et al. 2013). Qiu and Benbasat (2010) stated that avatars are more influential when they match the users' ethnicity. In this study, we particularly consider these design aspects for the case of users with background in Arabic culture.

2.3 Systems Design for Arabic Culture

Yeo (1996) stated that system designers should pay more attention to the cultural values of users when creating and designing user interfaces. He presented the concept of a *cultural user interface*, which takes into account all aspects and fundamentals of user interfaces that are targeted for a particular culture. Applications and interfaces in mHealth should be personalised. For example, avatars within mHealth applications could be tailored by gender or culture (Tate et al. 2013), and reflect users' social group and cultural values. The *national culture model* developed by Hofstede, concerned with how cultural values can affect users' perceptions, has received a lot of attention in Human Computer Interaction (HCI) research. This cultural model has six dimensions (Hofstede et al. 2010), which are power distance, individualism/collectivism, masculinity/femininity, uncertainty avoidance, long/short-term orientation, and indulgence/restraint. Marcus and Gould (2000) investigated the Hofstede cultural model and its influence on Arabic website design. They introduced five elements – metaphors, mental model, navigation, interaction, and appearance – that are affected by the cultural model in terms of designing user interfaces for specific cultures including Arabic culture. Yusof and Zakaria (2007) argued that female avatars for female Arabic users should be designed by covering their head with a headscarf and body with appropriate clothing.

3 Research Model and Hypotheses Development

People feel more comfortable when interacting with user interfaces that suit their culture (Russo and Boor 1993). Yusof and Zakaria (2007) stated that the design of user elements should reflect the cultural background of users, in order to make the design more effective. In some Arabic countries, such as Saudi Arabia, female avatars designed for their users are expected to reflect Arabic values by

² We will use “persuasive avatars” throughout the paper. However, previous research has also used the term authoritative avatars for this avatar concept (e.g., see Fox et al. 2013; Hanus and Fox 2015).

covering their head with a headscarf and body with appropriate clothing (e.g., virtual burqas and hijab) (Yusof and Zakaria 2007). Male avatars, on the other hand, should wear a long traditional dress called a thobe and head covering called a ghutra (Winter Jr and Chevrier 2008). Arabic culture is considered as a collective and high level of uncertainty avoidance culture (Hofstede et al. 2010), which means the perception of the gender between female and male should be made clear to stimulate in-group similarities and avoid uncertainty in the avatar design.

To facilitate the development of design principles for Arabic avatars in mHealth, we introduce a research model as shown in Figure 1. Support for the hypothesised relationships is provided below.

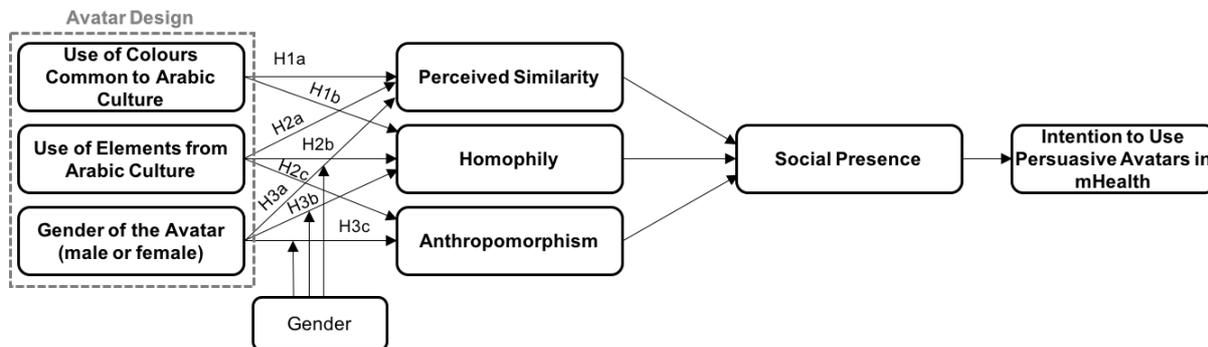


Figure 1: The research model for designing Arabic avatars in mHealth

Social presence, as can be seen in the research model, is an important aspect of designing avatars (Nass et al. 1993). Social presence is “a social factor, specifically addressing the feeling of being present with another person in a virtual environment” (Allmendinger 2010, p. 41) – a concept that can also be used in the context of an avatar. Previous research has shown that social presence can be increased by perceived similarity, homophily, and anthropomorphism (Qiu and Benbasat 2005, 2009, 2010). Homophily refers to the perceived degree of psychological similarity between a human and an object (an avatar) in terms of social and physical characteristics, or background similarities including similar education, training, and knowledge (McCroskey et al. 1975; Nowak and Rauh 2006). Physical similarity between the user and the avatar is very important in terms of making the interaction realistic and within the social boundary of the user. Kim and Park (2011) and Suh et al. (2011) stated that similarity between avatars and users indicates that the avatars belong to the same social group as the users. Additionally, avatars that appear human-like increase similarity and identification with the users (Holzwarth et al. 2006). Nowak and Rauh (2006) concluded that avatars with human-like features are considered more ‘homophilous’ and users are more likely to choose those avatars.

Anthropomorphism refers to the degree of humanness of an avatar, i.e., “the extent to which an image is perceived to resemble human characteristics and has human morphology” (Nowak and Rauh 2006, p. 154). The design of avatars should have human-like features, as this increases social presence in the interaction. An anthropomorphic avatar is perceived to be more credible (Nowak and Rauh 2008) and persuasive (Hanus and Fox 2015). When avatars resemble human form, users tend to apply social cues in the interaction as in how to interact with real people (Bailenson et al. 2003). Previous research has shown that anthropomorphic avatars increase social presence experienced by users in the interaction (Qiu and Benbasat 2005). It is argued that social presence of an avatar can be achieved through user interfaces (Nass et al. 1993). Qiu and Benbasat (2010) stated that avatars can increase social presence when they are designed by matching the users’ ethnicity. Avatars that have human-like features (e.g., face, voice) and appear anthropomorphic are perceived more socially present by the users leading to increased users’ intention to use the avatars (Qiu and Benbasat 2009). Nevertheless, the design of avatars should not be too photorealistic because otherwise it could trigger the uncanny valley effect (see MacDorman and Ishiguro (2006) and Mori (1970) for more details), which makes users feel uncomfortable when interacting with their avatars.

3.1 Influence of Colour

Colours can be used to trigger a broad range of emotional responses, e.g., to increase attention and deliver information (MacKay and Ahmetzanov 2005). Perceived similarity and homophily of avatars are both influenced by colours. For Arabic users, we expect the avatar design to include colours that are commonly used in their culture, such as blue, green and white, as suggested by Marcus and Hamoodi (2009). These colours are frequently used in visual communication within the Arabic context. Using them in Arabic avatar design should therefore yield higher levels of perceived similarity

and homophily between Arabic users and the persuasive avatars used in mHealth applications. This leads to our first hypothesis:

H1: *Employing colours commonly used in Arabic culture (green, blue, and white) in the design of persuasive avatars for Arabic user-oriented mHealth applications yields a higher level of (a) perceived similarity and (b) homophily than colours that are not commonly used in Arabic culture.*

3.2 Influence of Cultural Elements

Cultural elements are used in a design to make users feel more comfortable in the interaction. Specifically, designing avatars with Arabic cultural elements that reflect the users' values are expected to be considered as more useful by the users (Yusof and Zakaria 2007). Using such elements will increase the perceived similarity and homophily between the users and avatars, and the avatars will be considered more similar to in-group members. Using such elements will also increase the level of perceived anthropomorphism in the avatars. Therefore, we hypothesise that:

H2: *Using elements from Arabic culture (hijab, virtual burqa, thobe, and ghutra) in the design of persuasive avatars for Arabic-user oriented mHealth applications yields a higher level of (a) perceived similarity, (b) homophily and (c) anthropomorphism than not using these elements in the avatar design.*

3.3 Influence of Avatar Gender

Previous research has shown that avatars with a clear gender classification increases the level of perceived similarity, homophily, and anthropomorphism. Nowak and Rauh (2006) stated that avatars may be considered anthropomorphic only if their gender is clearly identifiable. Ratan and Dawson (2016) stated that using an avatar whose gender is consistent with the user's gender leads to a higher level of relevance between the user and the avatar. Users prefer avatars that look human-like (anthropomorphic) and match their own gender, indicating that users tend to use avatars that are more similar to them and appear homophilous (Nowak and Rauh 2006). In Arabic culture, we expect that a clear indication of the avatar's gender will decrease uncertainty within mHealth applications. We, therefore, hypothesise that:

H3: *Using avatars with the same gender as the users (male or female) in the design of persuasive avatars for Arabic-user oriented mHealth applications yields a higher level of (a) perceived similarity, (b) homophily and (c) anthropomorphism than using gender-neutral avatars or avatars of the opposite gender.*

4 Research Methodology and Procedure

Based on the design science approach developed by Hevner et al. (2004), we established our research procedure as depicted in Figure 2. This procedure will provide answers in regard to the design principles for Arabic avatars that will be used in an mHealth setting specifically for health issue prevention in Arabic countries. A co-design methodology, also referred to as participatory design, will be used, in which multiple stakeholders contribute to ensure that the design solution aligns with user needs and experiences (Sanders and Stappers 2008). The elements of this co-design methodology involve generating new ideas, understanding issues, prototyping, and narrating. Previous research has shown that involving users and healthcare professionals in the design leads to best healthcare results (Donetto et al. 2014). Co-design goes beyond traditional methods by directly involving users in the design. The procedure comprises of two stages. The initial stage involves inviting and interviewing participants while the second stage involves evaluating and improving the designed avatars.



Figure 2: An overview of the research procedure

4.1 First Stage

A qualitative study based on interviews will be carried out to identify principles for designing Arabic avatars in an mHealth context. The qualitative approach has been selected as it plays an important role in understanding users' needs and evaluating the effective use of a new system (Blandford 2013). This approach involves semi-structured interviews with psychologists, Arabic culture experts, and potential users. These stakeholders are selected for the interviews to ensure that the designed persuasive avatars are acceptable, can enrich users' affective states, and are able to increase users' intention to use

persuasive avatars in mHealth applications. Importantly, the mHealth literature supports such a sample and an interdisciplinary approach (Burke et al. 2015). First, we will show a collection of avatars from the literature to interviewees to create a mental image of avatars. The duration of the interviews will be approximately 30 minutes. Questions will revolve around details of the design of Arabic avatars, the constructs identified in our research model, as well as more general questions about what elements or features are considered appropriate in Arabic culture. Interviews will be transcribed and coded according to thematic recurring elements. We will specifically look into persuasive avatars in the context of preventative mHealth solutions focusing on dietary intake. In doing so, we will determine if users want to use or interact with an avatar that is physically similar to them or prefer avatars that are only psychologically similar to them. These semi-structured interviews will derive design principles for Arabic avatars that are culturally acceptable in Arabic countries.

4.2 Second Stage

The identified design principles will then be used to design Arabic avatars. These avatars will be designed based on recurring design elements received from the interviewees. Design principles might include appropriate colours, looks, and outfits for Arabic males and females. Multiple Arabic avatars will be designed to include elements that reflect Arabic cultures. In addition, Western avatars will be designed as well, so that we can show the two types of avatars to the same stakeholders in a second interview. The final step in our qualitative study includes evaluating the designed Arabic and Western avatars with the same participants in order to determine if they are designed appropriately, and whether they are culturally acceptable to users from Arabic countries.

4.3 Subjects

As mentioned before, subjects will be recruited from three stakeholder groups, namely Arabic culture experts, psychologists, and potential users. The participants will be identified based on their professional background by conducting an online search. Participants will be selected if they do have an understanding of Arabic culture either from their research studies, profession or exposure to Arabic culture. Their contact information will be acquired from their company and/or personal websites. In line with the Ethics approval acquired for this study, participation in this study is voluntary and all participants must give an informed written consent before their interview. The consent form will be sent alongside an information statement, which explains the particulars of the research (e.g., why it is being conducted), and it is an invitation to participate in the research. Participants may exit from participation at any time, even if consent has already been given.

5 Data Analysis

Thematic analysis will be carried out to analyse and interpret data collected, because of its flexibility to be utilised across a range of epistemological and theoretical approaches, and for its ability to identify emergent themes (Braun and Clarke 2006). Interviews will be transcribed and coded into categories, themes, and concepts (Berg and Lune 2012). For example, some interview data may have terminologies such as resemblance, sameness and uniformity, which will be grouped under a theme (construct) we identified from the literature, e.g., perceived similarity. The interview data may also have terminologies related to elements from Arabic culture, such as hijab, virtual burqa, thobe, and headscarf. These themes will subsequently be used in the formation of design principles, which will drive the iteration and refinement of the final design of Arabic avatars.

6 Expected Contributions

Avatars are gaining popularity and importance in various contexts, including mHealth applications for improved health outcomes (Aljaroodi et al. 2017; Fox, Bailenson, et al. 2009; Javor et al. 2016). While at this stage HCI research has primarily focused on the design of avatars for users with Asian and Western backgrounds (Kim and Park 2011; Lee et al. 2009), to the best of our knowledge, no systematic empirical work has been conducted to assess whether avatars should be designed differently for Arabic users. Designing persuasive avatars for mHealth applications is important as NCDs are on the rise in Arabic countries due to poor lifestyle behaviour (WHO 2011). In this paper, we have looked at how commonly used colours in Arabic countries, cultural elements from Arabic culture, and the gender of persuasive avatars could increase the social presence of persuasive avatars by users in terms of perceived similarity, homophily, and anthropomorphism. This could potentially increase users' intention to use persuasive avatars in mHealth applications in Arabic countries.

This project will make its significant and original contributions by employing a co-design methodology in line with design science research to define design principles for Arabic avatars that can be used for preventative mHealth solutions. Incorporating Arabic culture and values into the design will increase Arabic users' intention to use persuasive mHealth applications. This work will provide a reference guide for designing Arabic avatars and offer a means for Arabic users to interact with avatars in a more natural way, which in turn can improve user experience. In terms of theoretical contribution, this study applies the concept of persuasive avatars, mHealth and avatar use, and systems design in Arabic culture to define design principles for Arabic avatars that can be used in mHealth solutions in Arabic countries.

7 References

- Ahn, S. J., and Bailenson, J. N. 2011. "Self-endorsing versus other-endorsing in virtual environments," *Journal of Advertising*, (40:2), pp. 93–106.
- Aljaroodi, H. M., Adam, M. T. P., Chiong, R., Cornforth, D. J., and Minichiello, M. 2017. "Empathic avatars in stroke rehabilitation: A co-designed mHealth artifact for stroke survivors," in *Maedche A., vom Brocke J., Hevner A. (eds) Designing the Digital Transformation. DESRIST 2017*, Springer, pp. 73–89.
- Allmendinger, K. 2010. "Social presence in synchronous virtual learning situations: The role of nonverbal signals displayed by avatars," *Educational Psychology Review*, (22:1), pp. 41–56.
- Bailenson, J. N., Blascovich, J., Beall, A. C., and Loomis, J. M. 2003. "Interpersonal distance in immersive virtual environments," *Personality and Social Psychology Bulletin*, (29:7), pp. 819–833.
- Behm-Morawitz, E. 2013. "Mirrored selves: The influence of self-presence in a virtual world on health, appearance, and well-being," *Computers in Human Behavior*, (29:1), pp. 119–128.
- Bengtsson, B., Burgoon, J. K., Cederberg, C., Bonito, J., and Lundeborg, M. 1999. "The impact of anthropomorphic interfaces on influence understanding, and credibility," in *Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences (HICSS-32)*, pp. 1–15.
- Berg, B. L., and Lune, H. 2012. *Qualitative Research Methods for the Social Sciences*, Boston: Allyn & Bacon.
- Blandford, A. 2013. "Semi-structured qualitative studies," in *Soegaard, Mads and Dam, Rikke Friis (eds.). The Encyclopedia of Human-Computer Interaction*, (2nd Ed.), Aarhus, Denmark: The Interaction Design Foundation.
- Blaya, J. A., Fraser, H. S., and Holt, B. 2010. "E-health technologies show promise in developing countries," *Health Affairs*, (29:2), pp. 244–251.
- Borning, A., and Muller, M. 2012. "Next steps for value sensitive design," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*, pp. 1125–1134.
- Braun, V., and Clarke, V. 2006. "Using thematic analysis in psychology," *Qualitative Research in Psychology*, (3:2), pp. 77–101.
- Burke, L. E., Ma, J., Azar, K. M., Bennett, G. G., Peterson, E. D., Zheng, Y., Riley, W., Stephens, J., Shah, S. H., Suffoletto, B., and Turan, T. N. 2015. "Current science on consumer use of mobile health for cardiovascular disease prevention," *Circulation*, (132:12), pp. 1157–1213.
- Cole-Lewis, H., and Kershaw, T. 2010. "Text messaging as a tool for behavior change in disease prevention and management," *Epidemiologic Reviews*, (32:1), pp. 56–69.
- Donetto, S., Tsianakas, V., and Robert, G. 2014. *Using Experience-based Co-design to Improve the Quality of Healthcare: Mapping where we are Now and Establishing Future Directions*, London: King's College London.
- Fox, J., Arena, D., and Bailenson, J. N. 2009. "Virtual reality: A survival guide for the social scientist," *Journal of Media Psychology*, (21:3), pp. 95–113.
- Fox, J., Bailenson, J., and Binney, J. 2009. "Virtual experiences, physical behaviors: The effect of presence on imitation of an eating avatar," *Presence: Teleoperators and Virtual Environments*, (18:4), pp. 294–303.
- Fox, J., Bailenson, J. N., and Tricase, L. 2013. "The embodiment of sexualized virtual selves: The

- Proteus effect and experiences of self-objectification via avatars,” *Computers in Human Behavior*, (29:3), pp. 930–938.
- Hanus, M. D., and Fox, J. 2015. “Persuasive avatars: The effects of customizing a virtual salespersons appearance on brand liking and purchase intentions,” *International Journal of Human Computer Studies*, (84), pp. 33–40.
- Hevner, A. R., March, S. T., Park, J., and Ram, S. 2004. “Design science in information systems research,” *MIS Quarterly*, (28:1), pp. 75–105.
- Hofstede, G., Hofstede, G. J., and Minkov, M. 2010. *Cultures and Organizations: Software of the Mind*, (Revised 3r.), New York: McGraw-Hill USA.
- Holzwarth, M., Janiszewski, C., and Neumann, M. M. 2006. “The influence of avatars on online consumer shopping behavior,” *Journal of Marketing*, (70:4), pp. 19–36.
- Javor, A., Ransmayr, G., Struhala, W., and Riedl, R. 2016. “Parkinson patients’ initial trust in avatars: Theory and evidence,” *PLoS ONE*, (11:11), e0165998.
- Källander, K., Tibenderana, K. J., Akpogheneta, J. O., Strachan, D. L., Hill, Z., Asbroek, A. H. A. ten, Conteh, L., Kirkwood, B. R., and Meek, S. R. 2013. “Mobile health (mHealth) approaches and lessons for increased performance and retention of community health workers in low-and middle-income countries: a review,” *Journal of Medical Internet Research*, (15:1), e17.
- Khaddam, I., and Vanderdonckt, J. 2014. “Towards a culture-adaptable user-interface architecture,” *Romanian Journal of Human-Computer Interaction*, (7:2), pp. 161–194.
- Kim, J., and Park, H. S. 2011. “The effect of uniform virtual appearance on conformity intention: Social identity model of deindividuation effects and optimal distinctiveness theory,” *Computers in Human Behavior*, (27:3), pp. 1223–1230.
- Leach, C. W., Van Zomeren, M., Zebel, S., Vliek, M. L., Pennekamp, S. F., Doosje, B., Ouwerkerk, J. W., and Spears, R. 2008. “Group-level self-definition and self-investment: A hierarchical (multicomponent) model of in-group identification,” *Journal of Personality and Social Psychology*, (95:1), pp. 144–165.
- Lee, Y., Kozar, K. A., and Larsen, K. R. 2009. “Avatar e-mail versus traditional e-mail: Perceptual difference and media selection difference,” *Decision Support Systems*, (46:2), pp. 451–467.
- Li, X., and Ji, Q. 2004. “User affective state assessment for HCI systems,” in *Proceedings of AMCIS 2004*, pp. 3194–3201.
- MacDorman, K. F., and Ishiguro, H. 2006. “The uncanny advantage of using androids in social and cognitive science research,” *Interaction Studies*, (7:3), pp. 297–337.
- MacKay, D. G., and Ahmetzanov, M. V. 2005. “Emotion, memory, and attention in the taboo stroop paradigm an experimental analogue of flashbulb memories,” *Psychological Science*, (16:1), pp. 25–32.
- Madini, A. A., and de Nooy, J. 2013. “Disclosure of gender identity in Internet forums: A case study of Saudi Arabian forum communication,” *Gender, Technology and Development*, (17:3), pp. 233–257.
- Marcus, A., and Gould, E. W. 2000. “Crosscurrents: Cultural dimensions and global web user-interface design,” *Interactions*, (7:4), pp. 32–46.
- Marcus, A., and Hamoodi, S. 2009. “The impact of culture on the design of Arabic websites,” in *Proceedings of the International Conference on Internationalization, Design and Global Development*, Berlin, Heidelberg: Springer, pp. 386–394.
- McCroskey, J., Richmond, V., and Daly, J. 1975. “The development of a measure of perceived homophily in international communication,” *Human Communication Research*, (1:4), pp. 323–332.
- Michie, S., van Stralen, M. M., and West, R. 2011. “The behaviour change wheel: A new method for characterising and designing behaviour change interventions,” *Implementation Science*, (6:1), pp. 1–11.
- Mori, M. 1970. “Bukimi no tani (The uncanny valley),” *Energy*, (7:4), pp. 33–35.
- Nass, C., Steuer, J., Tauber, E., and Reeder, H. 1993. “Anthropomorphism, agency, and ethopoeia:

- Computers as social actors,” in *Proceedings of the Conference on Human Factors in Computing Systems (INTERACT'93 and CHI'93)*, pp. 111–112.
- Nowak, K. L., and Rauh, C. 2006. “The influence of the avatar on online perceptions of anthropomorphism, androgyny, credibility, homophily, and attraction,” *Journal of Computer-Mediated Communication*, (11:2), pp. 153–178.
- Nowak, K. L., and Rauh, C. 2008. “Choose your ‘buddy icon’ carefully: The influence of avatar androgyny, anthropomorphism and credibility in online interactions,” *Computers in Human Behavior*, (24:4), pp. 1473–1493.
- Parks, P., Cruz, R., and Ahn, S. J. G. 2014. “Don’t hurt my avatar: the use and potential of digital self-representation in risk communication,” *International Journal of Robots, Education and Art*, (4:2), pp. 10–20.
- Qiu, L., and Benbasat, I. 2005. “Online consumer trust and live help interfaces: The effects of text-to-speech voice and three-dimensional avatars,” *International Journal of Human-Computer Interaction*, (19:1), pp. 75–94.
- Qiu, L., and Benbasat, I. 2009. “Evaluating anthropomorphic product recommendation agents: A social relationship perspective to designing information systems,” *Journal of Management Information Systems*, (25:4), pp. 145–182.
- Qiu, L., and Benbasat, I. 2010. “A study of demographic embodiments of product recommendation agents in electronic commerce,” *International Journal of Human Computer Studies*, (68:10), pp. 669–688.
- Ratan, R. A., and Dawson, M. 2016. “When Mii is me: A psychophysiological examination of avatar self-relevance,” *Communication Research*, (43:8), pp. 1065–1093.
- Russo, P., and Boor, S. 1993. “How fluent is your Interface? Designing for international users,” in *Proceedings of the Conference on Human Factors in Computing Systems (INTERACT'93 and CHI'93)*, pp. 342–347.
- Sanders, E. B. N., and Stappers, P. J. 2008. “Co-creation and the new landscapes of design,” *CoDesign*, (4:1), pp. 5–18.
- Song, H., Kim, J., Kwon, R. J., and Jung, Y. 2013. “Anti-smoking educational game using avatars as visualized possible selves,” *Computers in Human Behavior*, (29:5), pp. 2029–2036.
- Suh, K., Kim, H., and Suh, E. K. 2011. “What if your avatar looks like you? Dual-congruity perspectives for avatar use,” *MIS Quarterly*, (35:3), pp. 711–729.
- Tate, E. B., Spruijt-Metz, D., O’Reilly, G., Jordan-Marsh, M., Gotsis, M., Pentz, M. A., and Dunton, G. F. 2013. “mHealth approaches to child obesity prevention: Successes, unique challenges, and next directions,” *Translational Behavioral Medicine*, (3:4), pp. 406–415.
- Vasalou, A., Joinson, A., Bänziger, T., Goldie, P., and Pitt, J. 2008. “Avatars in social media: Balancing accuracy, playfulness and embodied messages,” *International Journal of Human Computer Studies*, (66:11), pp. 801–811.
- Vasalou, A., and Joinson, A. N. 2009. “Me, myself and I: The role of interactional context on self-presentation through avatars,” *Computers in Human Behavior*, (25:2), pp. 510–520.
- WHO. 2011. *Global Status Report on Noncommunicable Diseases*, World Health Organization.
- Winter Jr, F. D., and Chevrier, M. I. 2008. “Conflict resolution in a different culture,” *Baylor University Medical Center Proceedings*, (21:3), pp. 300–303.
- Yeo, A. 1996. “Cultural user interfaces: A silver lining in cultural diversity,” *ACM SIGCHI Bulletin*, (28:3), pp. 4–7.
- Yusof, S. A. M., and Zakaria, N. 2007. “Islamic perspective: virtual worlds as a western-centric technology,” *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, (38:4), pp. 100–103.

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