

“HELLO! I WILL GUIDE YOU THROUGH YOUR ONLINE JOURNEY TODAY!”

**A PILOT STUDY EXPLORING CHILDREN AND
PREADOLESCENTS' PREFERENCES
REGARDING THE CHARACTERISTICS OF A VIRTUAL ASSISTANT
WHEN USING DIGITAL MEDIA¹**

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Abstract

Due to the technological progress in recent years, which facilitated the simulation of humanlike features in virtual agents, children might be more likely than ever to interact with virtual assistants. However, there is limited research on children's preferences in interacting with such digital entities. The present study investigated the preferences of 226 kindergarten and elementary school students, aged 3 to 13 ($M = 7.38$, $SD = 2.01$) related to the physical appearance of a virtual assistant (i.e., image and color) and to the welcoming message that the assistant will display. The results suggested that children aged 3 to 6 preferred an anthropomorphized heart as an avatar for the virtual assistant, while the other age groups preferred an anthropomorphized fox. Red and blue were the most common favorite colors among the participants. Our results suggest that younger children might be more prone to anthropomorphize and accept a broader category of objects and entities, while children of higher age might show preferences for living beings that already present some humanlike characteristics. Furthermore, the results suggested that children's control in selecting colors of virtual assistants might help them to accept and like the virtual assistants more. The limitations of our research are also discussed.

Keywords: children; preadolescents; virtual assistant; digital use.

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Introduction

Virtual assistants are becoming increasingly present in our daily lives, helping us solve problems or simplifying our tasks (Kim et al., 2020). While centered around the pragmatic role of searching for information and working with digital applications, virtual assistants are also simulating personality traits. For example, they can engage in conversation, thus being perceived as potential social agents by children (Bylieva et al., 2021). Furthermore, due to the increased odds of children being raised in families that use digital assistants, they might be more likely to attribute human-like characteristics to these agents and perceive them as part of their home or family (Maedche et al., 2019).

Furthermore, virtual assistants are becoming more viable for teaching children various digital and cognitive skills. For example, they can be used as reading assistants (Gupta et al., 2021) or to facilitate learning through games and roleplay (Beirl et al., 2019). They can also provide valuable tools for facilitating interactions between adults and children (Marston & Samuels, 2019). Furthermore, some previous studies suggested that virtual agents can be integrated into interventions for children diagnosed with autism (Mower et al., 2011).

Since virtual assistants often lack a physical appearance (e.g., an android body), their users rely on other social cues (e.g., voice, dialogue, jokes) (Feine et al., 2019). While these features are often employed for various virtual assistants (e.g., Siri, Alexa), they are often targeted toward mature users or users of all ages (Bolton et al., 2021). However, virtual assistants built for children might require some specific characteristics. For example, previous research suggested that children are dissatisfied with the jokes made by digital assistants since their humor is usually targeted at more mature audiences. Another problem highlighted in the usage of virtual assistants is their difficulty in understanding children's speech since they often mispronounce specific sounds or words (Lopatovska et al., 2019). Other studies also suggested that, while adults are often driven by utilitarian or social goals when interacting with virtual agents, children are mostly driven by hedonistic pursuits (i.e., seeking entertaining or pleasant interactions with the agent) (Shao & Kwon, 2021). Furthermore, children might be more likely to appreciate virtual agents for their entertainment value, describing them as fun, playful, friendly, or pleasant (Jong et al., 2019).

Previous research offers limited data on children's attitudes and preferences toward virtual assistants. However, some previous studies suggest that children similarly perceive virtual assistants as connected to (or extensions of) smart toys (Bolton et al., 2021). Younger children also seem more receptive to virtual assistants as social actors than other age groups

(Girouard et al., 2021). However, it is also important to consider the ontology that underlies children's attitudes toward virtual assistants.

Previous research suggests that, even though children manifest high interest in the interaction process (i.e., using digital assistants for the excitement they feel during the interaction rather than using them to pursue other goals), they have clear definitions and distinctions for humans and machines. They can identify both human-like (e.g., delayed responses, errors) and machinelike characteristics (e.g., a lack of common sense and limited conversational capacities) for virtual assistants (Festerling & Siraj, 2020). On the other hand, these results don't disprove the possibility that children might perceive machinelike entities as living beings with some human-like characteristics. In a previous qualitative study, most participants (children aged 5 to 6) reported that they considered the virtual assistant a living being, often citing its ability to speak or voice as a reason for their perspective. Furthermore, although the virtual assistant had a minimalistic appearance (i.e., a cylindrical shape), participants attributed human-like physical characteristics to it (Lovato et al., 2019). Even when children know that virtual assistants are machines, they might still explain their functionality through descriptions that resemble human functioning (e.g., describing virtual assistants as possessing a brain-like structure or going to school to learn) (Szczuka et al., 2022).

Finally, it is important to highlight that children's interaction with virtual assistants is heavily influenced by their age and familiarity with these technologies. For example, younger children are more likely to ask incompatible questions (e.g., asking virtual assistants to guess the names of their siblings). In contrast, older children might be more likely to explore various domains and change the conversation topic when the assistant is irresponsive (Oranç & Ruggeri, 2021).

Furthermore, while the research on the interaction between children and virtual assistants is limited, we can rely on other related concepts to better understand this phenomenon. Due to the limited research data on children's attitudes toward virtual assistants, we must shift our attention toward other sources of interest. Important data on the current research topic is also provided from several sources examining the interaction between children and social robots and children's attitudes toward anthropomorphized entities. A considerable body of research also investigated the interactions between children and social robots. For instance, some studies suggested that children presented more social behaviors when a robot addressed them in the second person, using more informal dialogue, compared to a robot that used the third person (Westlund et al., 2016). Also, research suggests that social robots are more

efficient in aiding children when presented in a physical form (i.e., an android body) than when they are displayed as an image on a screen (Kanero et al., 2018).

In this context, it is also essential to discuss the uncanny valley phenomenon (i.e., feelings of unease caused by interaction with a human-like entity that does not resemble a human being perfectly). Previous research suggested that interacting with a virtual agent with too many human-like characteristics might make children anxious; thus, an agent that only contains a moderate level of human-like features might be more appropriate (Tung, 2016). It is also important to note that this phenomenon relies heavily on children's experience and cognitive and emotional development level, as previous studies suggested that older children are more likely to manifest the uncanny valley phenomenon than their younger counterparts (Brink et al., 2019). This perspective is supported by a narrative review suggesting that younger children are more likely to form social bonds with robots and anthropomorphize them. Furthermore, boys might be more likely to prefer a robot with physical traits similar to males (van Straten et al., 2020).

Finally, the broader subject related to the anthropomorphism of virtual assistants has also caught the recent literature's attention, e.g., children's tendency to attribute human-like characteristics to virtual agents (Szczuka et al., 2022). Children, much like adults, tend to anthropomorphize various entities, including toys, ordinary household objects, and cartoon characters, to better understand their surrounding environment by attributing human-like characteristics to it (Airenti, 2018). Previous studies suggested that children tend to show more positive attitudes toward anthropomorphic characters (Russell & Cain, 2020). It is also important to note that already-existing traits might determine children's tendency to anthropomorphize. For example, previous studies suggested that children are more likely to attribute human-like characteristics to robots that already present human-like features compared to less human-like machines (Manzi et al., 2020). Similarly, other studies suggested that children might be more prone to anthropomorphize a virtual agent when they encounter it for the first time, and as they grow more familiar, they might perceive it as less human-like (van den Berghe et al., 2021).

The present study

Previous research suggests that children strongly prefer virtual agents that show moderate levels of anthropomorphism. Furthermore, younger children might be more likely to attribute human-like traits to virtual agents. Also, children are more likely to seek entertainment goals when interacting with virtual agents, looking for opportunities to have fun and experience

excitement, compared to adults, who generally prefer to focus on more pragmatic purposes. However, there is a significant gap regarding the evidence related to the specific characteristics of a digitally-animated assistant that may guide children and preadolescents through their online journeys. More specifically, in the present pilot exploratory study, we were interested in finding the answers to the following research questions (RQ-s): *RQ1*. What kind of virtual character would participants choose as an assistant when using digital media ?; *RQ2*. What type of messages should the virtual assistant use to communicate with children?

Method

Participants and Procedure

Our sample included 226 children and preadolescents aged 3 to 13 ($M = 7.38$, $SD = 2.01$), balanced in gender (48.2% males), who previously interacted with and used digital media (using either smartphones or tablets). They were students from different Romanian kindergartens and schools and voluntarily participated in our study following their parental consent. The study was part of a larger project focused on identifying efficient solutions for healthy digital use among youth. The examination occurred physically, when participants were presented with a written questionnaire. The average time needed to answer the items was around 5 minutes. They were informed that their answers would be anonymous and confidential, and only be used for the present study. They were also told that there were no right or wrong answers and that we were only interested in finding their honest opinion about the questions asked. The research followed the 2013 Helsinki Declaration research guidelines.

Measures

Children filled out a paper-pencil form two-part questionnaire. The first part contained 20 black-and-white pictograms from which they were instructed to choose their favorite (see Appendix A). Following a brief introduction related to digital media, technological use, and Internet use in general, they were told that the researchers were trying to identify how should a virtual assistant look and interact with them while assisting them through their digital journey. The 20 pictograms were selected from a larger group of pictograms following a pretesting procedure involving a similar age group of participants. Following their selection, they were asked the following questions: *Q1*. *What color(s) would fit this virtual assistant the best?* and *Q2*. *What message would you like to hear or read when you see the chosen pictogram?* There were no time restrictions or other further guidance to ensure original and authentic answers.

Results

We first conducted a frequency analysis of the answers related to the most preferred pictogram, based on participants' age. The results suggested that, in the 3 to 6 years old age group, the most preferred character was the 7th pictogram, depicting a personified heart. However, in both the 7 to 9 year-old group, as well as in the 10 to 13 year-old group, the most preferred character was the 11th pictogram, depicting a winking fox (see Table 1).

Table 1.

Participant preferences (N = 226)

Pictogram	Age group	Age group	Age group
	3 to 6 years old (n)	7 to 9 years old (n)	10 to 13 years old (n)
1	5	7	0
2	2	9	0
3	6	14	3
4	5	5	1
5	1	3	2
6	3	1	0
7	8	3	0
8	3	3	0
9	0	4	1
10	1	1	0
11	6	21	4
12	3	8	0
13	1	1	0
14	2	8	1
15	2	9	3
16	1	8	1
17	3	5	0
18	5	15	3
19	1	11	1
20	1	9	1

Regarding the colours preferred for the pictogram they chose, the most preferred colours were blue and red (see Table 2).

Table 2.

Participants' color preferences (N = 226)

Color	N	%
White	29	12.83
Grey	22	9.73
Yellow	46	20.35
Red	54	23.89
Green	48	21.23
Blue	64	28.31
Purple	30	13.27
Black	51	22.56
Brown	41	18.14
Orange	51	22.56
Light orange	5	2.21
Pink	45	19.91
Light Blue	4	1.76

Out of the 226 participants, 201 answered the second question, i.e., *What message would you like to hear or read when you see the chosen pictogram?*. Among these, 33 participants preferred a simple “Hello!” (16.41%), and 30 children (14.92%) preferred a personalized greeting (i.e., the character would specify their name following the greeting, such as “Hello, Anne!”). Furthermore, some of the participants preferred a greeting followed by a play-related question, e.g., : “Hello, Anne! Would you like to play with me?” or an action-related question: “Hello, Anne! Welcome! What would you like to do today?/ Are you ready to enter the technology world?”. Interestingly, 22 participants (10.94%) reported that they would prefer their character to greet them with a compliment (e.g., “You’re beautiful!”) or with a positive message, such as “Thank you for choosing me, I am grateful!”, “How are you, pretty/beautiful?”, “I like you!”, “I love you!”, “You look good today!”, “You are my favorite!”.

Discussions

Our study offered preliminary data on children’s preferences in a hypothetical interaction with a virtual assistant. The results suggested that children aged 3 to 6 preferred a

personified heart as a depiction of the virtual assistant. Previous research suggested that anthropomorphism might predict a stronger attachment to objects (Wan & Chen, 2021). Furthermore, previous studies reported that children that play video games involving anthropomorphized characters, might see a slower decline in their tendency to anthropomorphize objects (Li et al., 2017). Younger children might be more likely to anthropomorphize most non-human entities. Furthermore, while hearts do not possess humanlike abilities, children are likely to learn from an early age that the heart plays a central role in the proper functioning of humans and animals. Hearts are also often associated with affective processes. Therefore, it is possible that children preferred this avatar due to the positive characteristics attributed to it.

The results also indicated that the other age groups preferred the winking fox as an avatar for the virtual assistant. Previous research suggests that children prefer higher-order species (i.e., mammals, reptiles, birds, and amphibians) and domestic animals over other species (Borgi & Cirulli, 2015). Furthermore, this preference might also be explained by the relatively common presence of anthropomorphized foxes in fables and tales (Larsen et al., 2018). Furthermore, foxes are often depicted as possessing various humanlike personality traits or moral characteristics (e.g., high intelligence, cunningness, dishonesty etc.) and are often associated with lessons about avoiding deceitful individuals (Seredkina & Середкина, 2016). Therefore, children's preference for the fox avatar might be explained by their familiarity with the animal, and a high tendency to anthropomorphize it. Finally, it is important to consider that children of recent generations are more likely to anthropomorphize virtual agents, due to their abilities to manifest humanlike behaviors, and due to an early familiarity and exposure to these new technologies (Festerling & Siraj, 2022). Nevertheless, further research is needed to test the validity of these claims.

Our results suggested that children preferred red and blue colors. In this regard, previous research reports various findings on children's favorite colors. However, both red and blue were previously reported as common favorite colors among children, blue being a more common favorite color among boys, while red was a more common favorite color among girls (Jonaskaite et al., 2019). Furthermore, red and blue are among the most basic colors and are often encountered in children's daily lives and have a strong symbolic value (e.g., red is often associated with restrictions, blue is often associated with water) (Siu et al., 2017). While children's favorite color may vary, it plays an important role in building attitudes toward objects. Objects that possess a child's favorite color might determine them to build an intuitive conclusion that the object is more likable or interesting (van Reijmersdal et al., 2017).

Our results might offer some practical implications in designing virtual assistants for children. Developers of these agents might consider the design of avatars that resemble anthropomorphized characters, relying on objects or animals that children are familiar with. Younger children might be more prone to anthropomorphize a broader category of objects, while children from other age groups might prefer objects or living beings that already possess some humanlike features (e.g., animals that are associated with human traits, or that present intelligent behavior). Finally, while children's preferred colors vary, it is important to consider that allowing children to design an avatar using their preferred colors might facilitate likability and willingness to interact.

Some limitations also need to be underlined for the present study. First, we used a convenience sample, which is limiting the ability to generalize the observed results. In order to counter this limitation, future studies should use representative samples that would better reflect the characteristics of the investigated population. Second, we used a limited amount of options for the avatar. Therefore, our results are limited to a very narrow range of options. Future studies might want to employ options that allow more customizability, thus allowing participants to have more control in building a preferred avatar. Finally, our study had an exploratory design, and was limited to investigating children's preferences for avatars, welcoming messages and colors. Future studies should take into consideration various characteristics, including children's tendency to anthropomorphize.

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Appendix A

Please help us choose a character that you would like to accompany you every time you use your phone or computer. Look carefully at the figurines below and choose your favorite. Remember that there are no right or wrong answers.



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