Agents with Faces: The Effects of Personification of Agents

Tomoko Koda / Pattie Maes

MIT, Media Laboratory
20 Ames Street, Room E15-305
Cambridge, MA 02139
U.S.A.
Telephone: +1.617.253.9832 / 7442
Fax: +1.617.253.6215
Email: tomoko/pattie@media.mit.edu

It is still an open question whether software agents should be personified in the interface. How should faces be used to make the agent more usable and likable? In order to study the effect of faces and facial expressions, we compared subjects' responses to and evaluation of different faces and facial expressions of entertaining agents. The result shows that having faces and facial expressions is likable and engaging. It takes users' effort to interpret the meaning the faces. In terms of facial features, realistic faces are better liked and rated as more intelligent than abstract faces.

Keywords: *User interface design, anthropomorphism, facial expression, interface agents*

1. Introduction: Personifying an Interface

There is a growing interest in interface agents which assist a user in performing daily computer tasks. Interface agents will make software more active and work autonomously without waiting for a user's command. This "agent-based" interface should be social and active to support cooperative tasks between a user and an agent (Negroponte 95). Maes addresses that the key HCI issue in building a successful interface agent is to help the user understands what the agent's capacities are, its limitations, and its way of operating, etc. (Maes 94).

This issue has been studied in HCI, especially in terms of personifying computer interfaces. The most commonly used interface for personification is a human face. "Phil" in Apple's Knowledge Navigator video (Laurel 90), Apple's "Guides" project (Oren 90), the Maxims system (Lashkari *et al*. 94) used faces to help users understand the agent's characteristics or behaviors. The above research hypothesizes that users interact with agents more easily by being able to predict the agent's characteristics and behaviors via their external traits.

However, other research indicates that adding faces to an interface does not necessarily provide better human-computer interactions. Walker et al. studied how having a face and facial expressions affects users' performance and productivity. They reported that having a face is engaging but takes more effort and attention from the user. A face with more expression leads to greater engagement, but not always preferable (Walker *et al.* 94). Takeuchi et al. studied the effect of having a face in a game, and reported that users respond differently to systems having a face than to those without. They suggested that a face in an interface takes more effort from the user because people try to interpret the human images. However, it is not necessarily a negative effect in terms of involving the user (Takeuchi *et al.* 95).

The research reported in this paper argues that employing a face as the representation of an agent is engaging, makes a user pay more attention, and takes more effort for a user to interact with the system. It is possible to make advantages overweigh its drawbacks by using faces in appropriate application domains, where conveying the agent's behavior to the user is important in making a user comfortable with the system, or in an entertainment domain where engagement is crucial and users don't try to minimize efforts. This paper reports the results of an initial investigation on people's impressions of faces in an interactive entertaining environment.

2. Experiment

2.1. Purpose

We performed an experiment under several different conditions to answer the questions below:

• Do people like seeing a face or facial expressions of an agent?
• Do people use the face to interpret the agent's behaviors?
• Does a face in an interface increase people's engagement in a task?
• If answers for the above questions are positive, what characteristics of a face makes an agent look intelligent, likable, and comfortable to work with?

2.2. Description of the Experiment

2.2.1 Subjects

The subjects were 10 graduate students at the MIT Media Laboratory. The average age of the subject was 27. Their level of computer expertise was advanced. They all know how to play poker game.

2.2.2 Task

We designed and built a web-based poker game in which four computer poker playing agents play against each other and a user. Reading other players hands from their faces is crucial when playing poker. The task for the user is to play this poker game against the four poker playing agents which have personified representations. Figure 1 shows the interface of the game. The agents have different facial representations (no face, a female realistic face, a female caricature face, a dog's caricature face, and a line-drawn smiley face, shown in Figure 1). They vary in terms of humanity and level of abstraction. Table 1 shows the facial features used in the experiment. Each agent has ten facial expressions and changes its expressions when it deals, bets, and wins/loses. For example, a dog's face might show an anxious expression while betting, or show an excited face when bluffing. Figure 2 shows the ten expressions of the female caricature face. The facial expressions were carefully chosen to convey the emotional states of the agent. Ten subjects played poker for 18 rounds against the four players stated above.

The purpose of this experiment is to analyze whether the subject's impression of an agent changes depending on its representations, not on its performance. In fact, all of the agents use exactly the same algorithm for playing poker, which was not informed to the subjects.

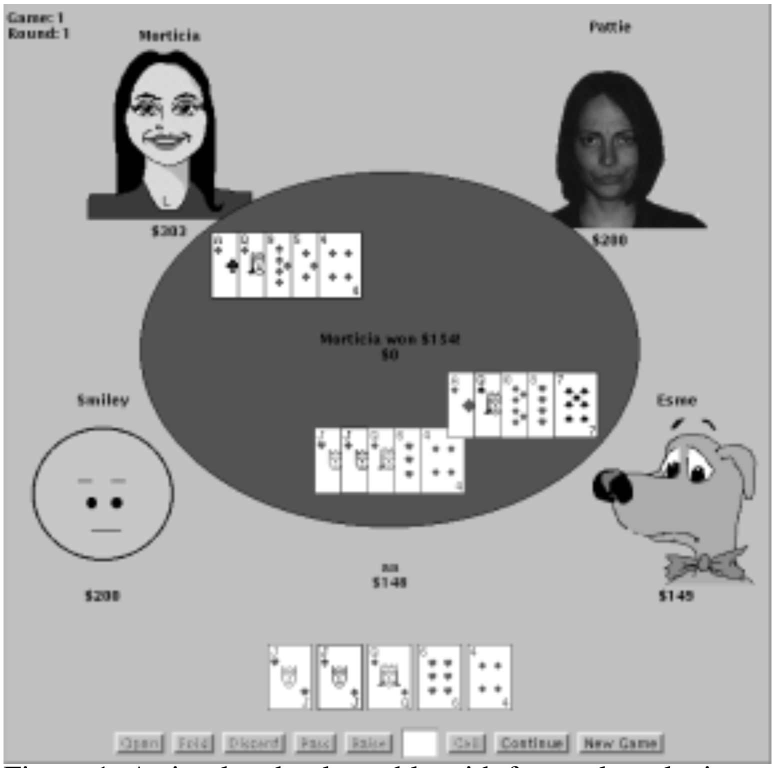

Figure 1: A simulated poker table with four poker playing agents. Each agent has different representations. The user's hands are shown in front of the table.

Table 1: The four features of faces used for the poker playing agents

Humanity	Level of abstraction
Human	Realistic
	Caricature
	Line-drawn smiley
Non-human (Dog)	Caricature

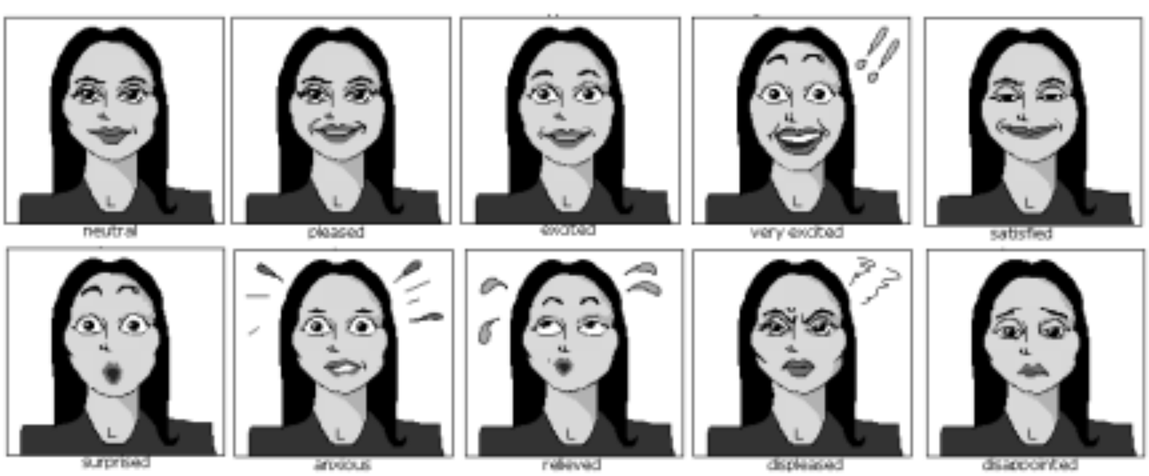

Figure 2: Facial expressions of a female caricature face.

2.2.3 Questionnaire

After playing the poker game for 18 rounds, subjects were asked to complete a questionnaire concerning their impressions of the agents. The questionnaire contained 22 questions: 6 background questions, 6 questions about subjective impressions on perceived intelligence, likability, and level of comfort of each face, and 10 questions about their experience with agents' faces and facial expressions. The questions were fixed-scale questions (i.e., On a scale of 1: least to 5: best, how intelligent did each player seem?).

3. Results

Although results are preliminary due to the small number of subjects, we obtained several interesting observations.

Table 2 shows the subjects' evaluation of likability, engagement, and required attentiveness of with and without a face. Larger numbers in each cell indicate better scores. Seeing faces was evaluated as likable, engaging, and requiring more attention. There were also some interesting comments. Some subjects tried to interpret the meaning of facial expressions so hard that they paid less attention to their hands.

Table 3 shows a summary of the perceived intelligence, likability, and comfort for each face. Larger numbers in each cell indicate better scores. Subjects rated a realistic face as more intelligent, likable, and comfortable than a caricature face. The same is true for a caricature face compared to a smiley face. However, the difference between level of abstraction for likability is smaller than for others. A dog's caricature face is rated highest in terms of likability, and more intelligent than a smiley face.

Table 2: Likability, engagement, and required attentiveness of face. Larger numbers in each cell indicate better scores. (1: least - 5: best. n=10, $p<.05$)

	likablility	engagement	required attentiveness
No Face	2.1	2.1	-
Face	3.8	3.4	3.7

Table 3: Subjects' evaluation on intelligence, likability, and comfort of each facial features. Larger numbers in each cell indicate better scores. (1: least - 5: best, n=10)

Humanity	Level of abstraction	Intelligence	Likability	Comfort
Human	Realistic	3.9	3.0	4.2
	Caricature	2.9	2.5	3.2
	Smiley	2.3	2.2	3.0
Dog	Caricature	3.0	4.0	3.0

4. Discussion and Future Directions

We have the following observations from the analysis of the results.

- Subjects tend to try to interpret faces and facial expressions, which prevents them from concentrating on the task.
- Having faces and facial expressions is considered likable and engaging in a poker game environment.
- The more realistic a human face is, the more it considered intelligent, likable, and comfortable.
- An animal character is more likable than human faces.

People respond emotionally to the agents with faces, and attribute human characteristics to the agents. One subject was worried about his hands being peeked by other poker agents. Another subject was furious when the same agent beat him twice in a row. Interpretation of a face may be caused by attributing human characteristics to a face. This process requires more effort than using non-personified interfaces. Brennan, Walker, and Takeuchi's studies showed similar results (Brennan, *et al. 94* /Walker, *et al.* 94/Takeuchi, *et al.* 95). There are several arguments against personifying interfaces: it takes more effort and lowers performance, leads to over expectations about the system's ability, and increases lack of user control (Shneiderman 95). However, it is clear that faces are useful for entertainment purpose, since engagement is essential for games and people don't care taking more effort for entertainment. Hence it may also be useful for applications which require an engaged user for success, such as education and training.

The results on facial features indicate that the level of abstraction and the humanity of an agent changes its perceived intelligence and likability. Isbister's study shows that people's evaluation about a computer character's intelligence is not based on its true intelligence but its perceived intelligence (Isbister 94). "The look makes difference" effect has to be taken into careful consideration when choosing the appropriate representation for an agent.

The results also suggest that the perceived intelligence and likability do not correspond. A question rises: should we choose "likable" faces or ones that look intelligent? The appropriate face should be determined by the task domain and users' preferences. The effective use of faces should be studied more in different application domains.

Acknowledgments

Special thanks to Adrian Soviani for technical collaboration. Thanks to Autonomous Agents Group, Media Lab, for participating in the experiment and their valuable comments. Anthony Chavez assisted with editing.

References

Brennan, S. et al. (1994) "Effect of Message Style on Users' Attributions toward Agents," in *Proceedings of Conference Companion Human factors in Computing Systems*, Addison Wesley: Reading, 281-282.

Isbister, K. (1994) "Perceived Intelligence and the Design on Computer Characters," http://www.cyborganic.com/People/kath/lccpaper.html

Lashkari, Y. et al. (1994) "Collaborative Interface Agents," in *Proceedings of the National Conference on Artificial Intelligence,* MIT Press: Cambridge.

Laurel, B. (1990) "Interface Agents: Metaphors with Character," in *The Art of Human-computer Interface Design,* ed. B. Laurel, Addison Wesley: Reading, 355-365.

Maes, P. (1994) "Agents That Reduce Work and Information Overload," in *Communications of the ACM*. Vol. 37, No. 7, ACM Press: New York, 31-40,146.

Negroponte, N. (1995) "Being Digital", The Alfred A. Knorpf: New York, 101-102.

Oren, T. *et al.* (1990) "Guides: Characterizing the Interface," in *The Art of Human-computer Interface Design,* ed. B. Laurel, Addison Wesley: Reading, 367-381.

Shneiderman, B. (1995) "Looking for the Bright Side of User Interface Agents," in *Interactions*, vol. II.I, ACM Press: New York, 13-15

Takeuchi, A. *et al.* (1995) "Situated Facial Displays: Towards Social Interaction," in *Proceedings of CHI'95 Human Factors in Computing Systems*, Addison Wesley: Reading, 450-454.

Walker, J. *et al.* (1994) "Using a Human Face in an Interface," in *Proceedings of CHI'94 Human Factors in Computing Systems,* Addison Wesley: Reading, 85-91.