

Insights From a Study on Subtle Mimicry in Human-Agent Interaction – Supplementary Material

Robin Ungruh¹ , Susanne Schmidt¹ , Nahal Norouzi² , and Frank Steinicke¹ 

¹Universität Hamburg, Germany

²University of Central Florida, USA

Abstract

In social interactions, people tend to imitate the behavior of others and to perceive dialogues in which they are imitated to be more natural and smooth. This process of mimicry is not limited to non-verbal behavior, but also involves subtle adaptation of one's own speech style to the communication partner. Although being a natural phenomenon in human-human interaction, it is not yet common for virtual agents to simulate such behavior by adapting their speech style to that of the user.

This work presents a user study ($N = 48$) that explores the participants' perception of a virtual agent mimicking formal and informal speech. The majority of participants preferred agents with a matching speech style over those with a mismatching one. Other positive results of mimicry that were previously found in human-human interaction could not be replicated. To inform other researchers studying subtle agent behavior about possible factors that might dominate participants' perception of an agent, we present the results of a thorough content analysis of qualitative user feedback. From the salient themes, such as mismatched emotionality in language and speech, affordances of agents, and expectations of the agent's role in interactions, we derive recommendations for the design of future user studies of subtle (verbal and non-verbal) agent behavior.

CCS Concepts

• **Human-centered computing** → *Empirical studies in HCI; Natural language interfaces*; • **Computing methodologies** → *Discourse, dialogue and pragmatics*;

For the user study described in the paper, dialogues on four different topics were generated, each with a formal and an informal variant. These dialogues are listed below. Every study participant sequentially conducted interviews on all four topics with the agent,

each with a different combination of user formality of the scripted questions and agent formality of the responses. Note that in two out of four conditions, formal user questions were paired with informal agent responses and vice versa.

Appendix A: Interview on Music

Formal

User: Good day, I am pleased to meet you.
Agent: I hope you are having a pleasant day as well.
What might I help you with?
User: Could you please answer a few questions for me?
Agent: Certainly
User: Excellent, thank you.
The topic is musical genres.
Agent: That sounds interesting.
Please go on.
User: Please tell me which musical genre you prefer most.
Agent: I am especially fond of jazz music.
User: What is it that you enjoy about it?
Agent: I appreciate the sound and dynamism immensely.
It is powerful, and the diversity of moods it may evoke is exhilarating.
Jazz is also very difficult to master, so the level of skill required of a successful musician is impressive
User: It sounds very interesting.
I myself am fond of classical music.
What is your opinion on that topic?
Agent: I am not typically a fan, as I find it a bit dull.
User: OK, then please tell me who your favourite singer is.
Agent: In my opinion, it would be Louis Armstrong.
User: Thank you for your time
I enjoyed our conversation.
Agent: You're welcome.
I would enjoy another discussion with you.
User: And I would look forward to our next discussion, as well.
Agent: Goodbye!

Informal

User: Hey, cool to meet you.
Agent: Hey, what's up?
How can I help?
User: I'll ask you some questions.
Agent: Yeah, that's ok.
User: Sounds good. So, we'll talk about your favourite music.
Go ahead.
User: What's the best music genre?
Agent: I love jazz music.
User: What's so great about it?
Agent: Well, I'm just totally into the dynamic sound.
So exciting and I'm so blown away by the range and emotion!
Jazz seems so hard to play. Those guys are awesome.
User: Cool! Sounds awesome.
Classic music is pretty cool too.
What do you think of it?
Agent: I don't really like it.
Just so boring and dull.
User: Well ok, who is your favourite singer?
Agent: Louis Armstrong, best ever! I mean, he is so good. He is, like, a great musician.
User: OK, thanks again for the help.
Really good talking with you.
Agent: Sure, I'll look forward to next time
User: Bye!
Agent: Bye Bye

Appendix B: Interview on Art

Formal

User: Hello, good to meet you.
Agent: It's a pleasure to meet you.
What will we do today?
User: I would like to discuss art with you.
Agent: Interesting.
Please proceed.
User: I am fascinated by Van Gogh's work.
Which artist do you admire most?
Agent: I typically enjoy French art, but I must admit I find DaVinci most impressive.
User: For what reason do you hold this opinion?
Agent: He is simply superb.
Perhaps one of, if not the most, prolific and innovative artist of all time.
User: What do you consider to be his best piece of work?
Agent: It is likely that it is his "Mona Lisa".
It is commonly thought of as his greatest masterpiece.
Recently revealed details of its creation are quite fascinating.
User: Is there another medium you prefer, besides painting?
Agent: I've discovered some ingenious modern art, however, I am not very knowledgeable in that area.
User: Thank you. This has been a very interesting conversation. I appreciate your time.
Agent: I look forward to our discussion.
User: Yes, I as well
Agent: Goodbye

Informal

User: Hi, cool meeting you.
Agent: Hey, really great seeing you too.
What's the plan?
User: How 'bout we talk a bit about art?
Agent: Great topic!
Shoot.
User: I love Van Gogh's stuff.
What do u think... who's the best?
Agent: No doubt, I like French art.
But the most awesome artist ever must be Da Vinci.
User: Why?
Agent: He's so amazing, isn't he?
He did tons of really crazy stuff, before anyone else.
User: Ok, tell me, what's his best work.
Agent: For sure, it's the Mona Lisa.
Probably pretty mainstream thing to think. But the details are amazing!
User: What else are you into, besides painting?
Agent: Modern art can be so weird and creative. But I don't know so much about it.
User: Alright then, lots of exciting topics today! Thanks for your time.
Agent: Glad to talk again, anytime!
User: Bye!
Agent: Bye bye.

Appendix C: Interview on Cuisine

Formal

User: Good day, I am pleased to meet you.
Agent: I hope you are having a pleasant day as well. What might I help you with?
User: Could you please answer a few questions for me?
Agent: That would be fine.
User: Excellent, thank you.
The topic today is cuisine.
Agent: Delightful.
Please go on.
User: Please tell me which cuisine you typically prefer most.
Agent: I am especially fond of Indian cuisine.
User: What is it that you enjoy about it?
Agent: I appreciate the wide array of flavours immensely. Indian cooks use such a rich assortment of distinctive ingredients.
It takes a great deal of talent and effort to master.
User: It sounds very appealing.
I am quite fond of seafood, myself.
What would your opinion be of it, generally?
Agent: I am not a seafood enthusiast, and would go so far as to say that I consider the taste of fish to be particularly unappetizing.
User: Please tell me about your favourite Indian restaurant.
Agent: In my opinion, it would have to be the restaurant in the city centre. Their chef is truly talented.
User: Thank you for having me.
I enjoyed our conversation.
Agent: I'd be glad to discuss such topics again someday.
User: I look forward to our next meeting.
Agent: Goodbye!

Informal

User: Hey, cool to meet you.
Agent: Hi, what's up?
How can I help?
User: I'll ask you some questions, if that's OK?
Agent: Yeah, that's ok.
User: Glad to hear it.
So, about your favourite foods...
Agent: Sounds cool.
Go on.
User: What's the best, in your opinion?
Agent: I'm addicted to Indian food.
User: What's so great about it?
Agent: I'm totally into the flavors.
Indian cooks have cool, crazy ingredients.
But it's sooo hard to cook.
User: Cool! Sounds awesome.
Seafood is cool too.
What do you think of it?
Agent: I really don't like it.
The fishy taste is gross.
User: Well ok, which is your favourite Indian restaurant?
Agent: That one in the city centre, the greatest ever! I mean, the cook is so good, he is, like, just great.
User: Thanks again for your help.
This was fun.
Agent: Yeah, let's do it again, some time.
User: Bye!
Agent: Bye Bye

Appendix D: Interview on Movies

Formal

User: Hello, it's good to meet you.
Agent: It is a pleasure to meet you.
What might I help you with?
User: I would like to discuss movie directors with you today.
Agent: That is a very interesting topic.
Please proceed with your questions.
User: I am fascinated by Spielberg's work.
Who would you consider to be the best director?
Agent: I enjoy his films too, but must admit that I find Stanley Kubrick to be the very best.
User: What is it that you enjoy about his work?
Agent: He is simply excellent.
His work was always artistically compelling.
User: Please name his best piece of work.
Agent: That would most likely be "2001: A Space Odyssey". It is widely considered to be his masterpiece.
The details are very fascinating...
User: What other media do you enjoy, besides films?
Agent: I've discovered some ingenious television programs, however, I am not very knowledgeable in the details of such things.
User: Thank you. This has been a very interesting conversation. I appreciate your time.
Agent: You're welcome.
I would enjoy another discussion with you.
User: And I would look forward to our next discussion, as well.
Agent: Goodbye!

Informal

User: Hey, cool to meet you.
Agent: Hey, what's up?
What's the plan?
User: How about we talk about movie directors and stuff?
Agent: Great topic!
What's your question?
User: Well, I love Spielbergs work...
What do you think, who's the best?
Agent: No doubt, I like Spielberg.
But the most awesome ever has gotta be Stanley Kubrick.
User: Why?
Agent: He's just so amazing, right?
He did some really crazy stuff.
User: Ok, tell me, what's his best work?
Agent: "2001: A Space Odyssey", for sure.
Guess that's pretty common knowledge.
But the details are mind-blowing!
User: What else do you like besides these movies?
Agent: TV shows can be so weird and creative.
But I don't get so into the details.
User: Alright, there were a lot of exciting things we talked about. Thanks for your time.
Agent: Hope we talk again someday.
User: Bye!
Agent: Bye bye.