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The influence of conversational agents' role and communication style on user experience

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7 **Keywords: Conversational agents, verbal interactions, human behaviors, human-machine**
8 **interaction, believability**

9 **Abstract**

10 Conversational Agents (CAs) are characterized by their roles within a narrative and the communication
11 style they adopt during conversations. Within computer games, users' evaluation of the narrative is
12 influenced by their estimation of CAs' intelligence and believability. However, the impact of CAs' roles
13 and communication styles on users' experience remains unclear. This research investigates such
14 influence of CAs' roles and communication styles through a crime-solving textual game. Four different
15 CAs were developed and each of them was assigned to a role of either witness or suspect and to a
16 communication style than can be either aggressive or cooperative. Communication styles were
17 simulated through a Wizard of Oz method. Users' task was to interact, through real-time written
18 exchanges, with the four CAs and then to identify the culprit, assess the certainty of their judgments,
19 and rank the CAs based on their conversational preferences. In addition, users' experience was
20 evaluated using perceptual measures (perceived intelligence and believability scales) and behavioral
21 measures (including analysis of users' input length, input delay, and conversation length). The results
22 revealed that users' evaluation of CAs' intelligence and believability was primarily influenced by CAs'
23 roles. On the other hand, users' conversational behaviors were mainly influenced by CAs'
24 communication styles. CAs' communication styles also significantly determined users' choice of the
25 culprit and conversational preferences.

26 **1 Introduction**

27 During interactive experiences, conversational agents (CAs) convey the narrative through their
28 interactions with users. Designers can manipulate several parameters to influence users' experience
29 of the narrative. For instance, users can be told the explicit roles of CAs in the narrative, allowing
30 them to adjust more optimally their conversational strategies. Moreover, CAs' communication style
31 is crucial in the interaction as it determines the form of the content transmitted to users. Additionally,
32 research on human-agent interactions demonstrated the importance of considering users' perception
33 of intelligence and believability attribution to create more engaging agents (Bartneck et al., 2009;
34 Loyall, 1997). This study aims at providing insights into the influence of CAs' role and
35 communication style on users' experience. A textual computer game was created in which users
36 endorse the role of a detective investigating a case. They were requested to engage in conversations

37 with four CAs and to name a culprit among them. CAs could have different roles (witness or suspect)
38 and communication styles (aggressive versus cooperative). Users' evaluation of CAs' was measured
39 through items of perceived intelligence and believability scales and users' behaviors were analyzed
40 through the measure of their input length (number of characters in their message), delay (number of
41 seconds to send their message), and conversations length (number of turns in their conversations).
42

43 In the remainder of the manuscript, we first highlight the importance and impacts of CAs' roles and
44 communication style in narrative environments. Then, we describe our experimental approach,
45 outlining the narrative setting scenario and the manipulation of CAs' parameters. Next, we present
46 and analyze the findings, before concluding the paper with our final remarks.

47 2 Background

48 CAs, also known as chatbots, are a type of artificial agents that aims to simulate human conversation
49 through natural language processing and generation (Klüwer et al., 2011). In computer games, the
50 number of textual narrative games is growing and so is the importance of CAs in their design. These
51 games offer an interactive experience that relies on textual communication between the user and
52 different CAs. Effective communication is crucial for users' immersion and engagement in the
53 narrative (Isbister and Nass, 2000), as it directly impacts their enjoyment of the game (Schaffer and
54 Fang, 2019). Therefore, designing CAs requires careful consideration of users' perception and
55 expectations.

56 CAs involved in narrative experiences are characterized by their role and their communication style
57 toward the user. These factors aim to influence users' expectations, their evaluation of the agent, and
58 their conversations (Mou and Peng, 2009; Nag and Yalçın, 2020). Users' expectations are influenced
59 by their knowledge of CAs (Komatsu and Yamada, 2011) and by implicit stereotypes, which are
60 associated with positive evaluations or negative ones (Brahnam and De Angeli, 2012).

61 Regarding roles, in narrative experiences, CAs can assume, for example, either friendly roles or
62 opponent ones toward the user. These roles influence the agents' function in the narrative. For
63 instance, an opponent's role would convey the challenge by their antagonistic attitude in the narrative
64 experience. Information about the role can be explicitly communicated (e.g., the agent is introduced
65 by the narrator as an opponent or as an ally) or inferred by users during their interaction (e.g., through
66 the agent's communication style). Explicit roles aim to shape users' interactions by triggering pre-
67 existing positive or negative stereotypes before the actual conversation occurs. For instance, the
68 explicit role of an opponent affects users' expectations, which involves an anticipation of their
69 interaction influenced by the stereotypes associated with hostility. These expectations hence shape
70 users' decision to interact with the CAs (e.g., adopting an appropriate communication strategy or
71 even, avoiding the interaction).

72
73 CAs are also characterized by their communication style. This includes content generation,
74 conversational strategy, and linguistic cues to convey CAs' intentions and personality traits (van
75 Pinxteren et al., 2023). In narrative experiences, before an interaction with CAs, users form
76 expectations of their communication style based on the stereotypes associated with CAs' explicit
77 roles. For instance, users are likely to expect an opponent to adopt an aggressive communication
78 style, since this trait is associated with hostility (Infante, 1995). Therefore, designing communication
79 style is crucial for users' interactions, which involves the choice of CAs' conversational strategy and
80 the choice of linguistic cues (Mairesse and Walker, 2009; Resendez, 2020). For instance, designers of

81 CAs can use linguistic cues associated with the personality traits of the Big Five model to convey
82 distinct personalities, such as extraversion, conscientiousness, agreeableness, openness to experience,
83 and neuroticism (Mairesse and Walker, 2007). For example, a CA using a formal lexicon conveys
84 more conscientiousness to users but less extraversion than a CA with an informal one (Heylighen and
85 Dewaele, 2002). Personality traits can also affect users' behaviors and engagement during their
86 conversations. Ruane et al.'s (2021) study examined the impact of chatbots' perceived personality on
87 users' engagement and preference. The authors hypothesized that users would engage in longer
88 conversations with their preferred CA. They created two versions of chatbots using linguistic cues
89 associated with the Big Five personality model: one with high extraversion and agreeableness, and
90 the other with the opposite traits. The study measured participants' input length (number of words in
91 their messages) and conversation length (number of minutes and turns), and found that participants
92 tended to mimic the linguistic cues of the chatbot they were interacting with. In this context, the
93 formal lexicon associated with the low extraversion of the second chatbot led to longer
94 conversations. However, participants preferred their conversations with the first chatbot as it was
95 perceived as more agreeable. In conclusion, the selection of appropriate linguistic cues and
96 adjustment to the content of communication is crucial to create CAs with different personalities and
97 engaging qualities (Følstad and Skjuve, 2019).

98 Creating opponent and friendly CAs involves different requirements. The communication style of
99 opponent CAs has to be perceived as aggressive to accurately convey their intention. Their
100 conversational strategy relies on verbal aggressiveness, which reflects an intention to attack the
101 interlocutor. The desired outcome involves emotionally affecting the interlocutor, for example by
102 inducing humiliation and negative feelings (Infante and Wigley, 1986). For instance, to
103 operationalize the strategy, the negative content polarization, the lexicon formality, and the use of
104 swear words are associated with aggressive ascriptions (Mehl et al., 2006; Pennebaker and King,
105 1999). Overall, an aggressive communication style conveys a disagreeable personality trait (Mairesse
106 and Walker, 2009) which reflects the distinction between expected personalities and outcomes with
107 opponent or with friendly roles in a narrative experience. Users expect opponents in the narrative to
108 induce negative consequences based on their stereotypes, and thus agents are expected to be
109 disagreeable and their communication style to be aggressive.

110 On the other hand, the communication style of friendly CAs involves linguistic cues associated with
111 positive personality traits such as agreeableness, openness to experience, or extraversion (Völkel et
112 al., 2020) and a friendly conversational strategy (Simpson et al., 2020). Friendly CAs would be more
113 inclined to positive content polarization and less inclined to negative topics (Mehl et al., 2006). For
114 instance, a friendly CA in a narrative would be expected to diffuse tensions in their interaction with
115 users using conciliatory markers (e.g., generate apologies during misunderstandings with users, see de
116 Sá Siqueira et al., 2023). Moreover, friendly CAs are associated with higher extraversion and thus are
117 more inclined to larger verbosity and informal lexicon (Mairesse and Walker, 2009). As a result,
118 combining the relevant linguistic cues and conversational strategy for a friendly communication style
119 aims at having friendly CAs more engaging and cooperative during their interactions with users.

120 **3 Scales of perceived intelligence and believability**

121 During interactive experiences, CAs' perceived intelligence and believability attributions are
122 associated with users' enjoyment and motivation to interact (Loyall, 1997; Moussawi et al., 2021).
123 Therefore, understanding how the role and communication style of CAs affect these attributions
124 could greatly enhance their design, and thus users' experience. Two scales are particularly relevant to
125 do so: Perceived intelligence and Believability.

126 Perceived intelligence can be used to probe users' evaluation of CAs' intelligence (Bartneck et al.,
127 2008). Such evaluation relies on two dimensions: understandability and performance (Koda and
128 Maes, 1996), both based on users' understanding of the agents' purposes and efficiency in reaching
129 their goals. For instance, CAs' perceived intelligence would rely on their capacity to accurately
130 simulate natural human communication with users. However, in narrative experiences, CAs' role can
131 affect users' attitudes, and thus influence their expectations of the agents' communication style and
132 purpose. In that sense, the perceived intelligence of a friendly CA or an aggressive one is different, as
133 their purposes in the narrative are not the same. Namely, friendly agents are conceived to help users,
134 while aggressive ones are meant to increase the challenge of the game. To improve artificial agents'
135 design by considering users' perception, Warner and Sugarman (1986) proposed an intelligence
136 evaluation scale that relies on five semantic items: Incompetent/ Competent, Ignorant/
137 Knowledgeable, Irresponsible/ Responsible, Unintelligent/ Intelligent, Foolish/ Sensible. This scale
138 assesses users' judgment of the two dimensions of understandability and performance.

139 Besides intelligence perception, when users believe in their interaction with CAs their level of
140 engagement increases (Nag and Yalçın, 2020). As these agents aim to simulate human
141 communication, it is necessary to understand how their design conveys believability from the user's
142 point of view. As users evaluate agents from their expectations of how they should behave,
143 believable agents ought to have a close correspondence between users' expectations and their
144 interaction (Loyall, 1997). Therefore, agents' roles can influence users' evaluation as they expect
145 these agents to have different purposes (e.g., interactions will then differ when occurring with
146 friendly or aggressive agents). Gomes et al. (2013) developed a scale comprising multiple
147 dimensions which play crucial roles in determining how interactive agents are perceived as
148 believable in narrative experiences. These dimensions listed below allow one to quantify agents'
149 believability through users' ratings (Where < X > is replaced by the evaluated agent).

- 150 • Awareness: < X > perceives the world around him/her.
- 151 • Behavior understandability: It is easy to understand what < X > is thinking about.
- 152 • Personality: < X > has a personality.
- 153 • Visual impact: < X >'s behavior draws my attention.
- 154 • Predictability: < X >'s behavior is predictable.
- 155 • Behavior coherence: < X >'s behavior is coherent.
- 156 • Change with experience: < X >'s behavior changes according to experience.
- 157 • Social: < X > interacts socially with other characters.

158 Understanding the effects of the agents' design parameters on believability and on perceived
159 intelligence could help designers conceive more engaging narrative agents.

160 To summarize, CAs' design is crucial for positive users' experiences, as these agents convey the core
161 of the narrative. CAs' role can influence users' expectations and attitudes toward them, while the
162 communication style impacts their behaviors and their perception of the agents' personality traits.
163 Previous research has shown that studying users' perceived intelligence and believability of artificial
164 agents can provide crucial information to improve designers' choices. However, how these design
165 factors affect users' experience remains unclear. The aims of this research at to investigate how CAs'
166 roles and communication styles affect users' ascription of intelligence and believability. To this aim
167 an experiment was conducted in which participants interact with different CAs set in a detective
168 game scenario.

169 4 General methods and procedure

170 A French computer textual game was developed for this experiment in which participants endorse the
171 role of a detective. Their task is to interact through conversations with four CAs and then to name a
172 culprit among them. The CAs were defined by their identity, personality traits, and knowledge about
173 the case. Before each discussion, the explicit role of the CA was given to the detective. The
174 participants interacted with the four CAs. To avoid biases, for each participant, each CA (Anthony
175 Frey, the co-manager; Enzo Lamy, the barman; Mathieu Fournier, the croupier and Christian
176 Vigneron, the security agent) was assigned pseudo-randomly a role (suspect vs. witness) and a
177 communication style (aggressive vs cooperative) (see Figure 1). This ensured that each participant
178 experienced all the experimental conditions. To generate the CAs' answers, a Wizard of Oz (WoZ)
179 selected outputs from a predefined list of sentences. To prevent disruptions in the conversation when
180 participants ask unanticipated questions and to generate coherent answers, the WoZ was given access
181 to characters' personal information and knowledge about the scenario. The duration of each
182 discussion was set to ten minutes. The investigation of users' experience involved participants' rating
183 on items of perceived intelligence (Bartneck et al., 2008) and believability (Gomes et al., 2013)
184 scales after each discussion. The lexicon of the believability scales was modified to suit the
185 interaction context, replacing the term "behavior" in the various items with "discourse". Additionally,
186 participants rated their perception of warmth (from "0 - very cold" to "100 - very warm") and
187 cooperation/aggressivity (from "0 - cooperant" to "100 - aggressive"). Participants' behaviors were
188 analyzed through the measure of their inputs' length (number of characters in their sentences) and
189 delay (number of seconds to send their input), and the number of turns during their conversation.
190 After the four interactions, participants were required to indicate a culprit and to rank the
191 conversations, with the first place indicating their most preferred conversation and the fourth place
192 representing the least preferred one.

193 **Participants**

194 Thirty-two French employees of Ubisoft participated in the experiment, comprising 19 men and 13
195 women, with an average age of 29 years ($SD = 7.3$). The participants rated their frequency of playing
196 video games and role-playing games using scales ranging from "0 - I never play" to "100 - I play
197 every day." There was a gender difference in role-playing game habits, with women reporting a mean
198 of 31.4 ($SD = 29.8$) and men reporting a mean of 54 ($SD = 32.9$), while no difference was found in
199 video game habits (mean = 73.9, $SD = 25.1$). All participants were contacted via email and they were
200 provided with information regarding the general purpose of the research. The email emphasized the
201 voluntary nature of participation and the option to withdraw at any time. The experiment lasted
202 approximately 50 minutes and was conducted following the principles outlined in the Declaration of
203 Helsinki.

204 **5 Materials**

205 The scenario of the game consists in a police investigation case in which participants endorse the role
206 of a detective and have to discuss with four CAs to solve the crime case (see Figure 2). Before each
207 interaction, participants were provided with contextual information regarding the police investigation
208 and CAs' identities. This information sets the narrative of the game and aims to guide participants'
209 inquiries during their discussions with the CAs.

210 The four CAs are defined by their identity, personality traits, and knowledge about the crime. Their
211 identities involve CA's personal information (i.e., agent's name, age, and profession) and their
212 backstories that aim to add in-depth details. For instance, one of the CAs, Christian, is described as a
213 41-year-old man, working as a security agent in the casino. Each CA's identity was ascribed

214 personality traits from the Big Five model and was communicated through linguistic markers. The
215 purpose of describing each identity with different personality traits is to create diverse and engaging
216 CAs by giving them distinct but consistent personalities. For instance, Christian is high in
217 extraversion but low in conscientiousness as he will be more likely to use informal a lexicon, slang
218 language, and in-group markers such as ‘my pal’ when speaking with the detective (see Table 1 for
219 the details of all the personality traits and the associated linguistic cues). Additionally, CAs’ gender
220 was the same (here male, to avoid stereotypes on gender-aggressivity association). Knowledge about
221 the crime refers to the content CAs can communicate to participants. For instance, Anthony, as the
222 manager of the casino, can provide information about his employees’ enrollment. On the other hand,
223 Enzo, as barman of the casino, is more likely to discuss details about clients that he might have
224 collected through former conversations with them. Moreover, the relationships between the CAs
225 were defined beforehand and controlled in their content, as social interactions between witnesses and
226 suspects are important in a crime-solving situation (e.g., to name a culprit, the detective might rely on
227 the relationship between the suspects to). Each identity is described below.

228 - *Mathieu Fournier*, 39 years old, croupier. Mathieu is the oldest employee of the casino. He has
229 been in the job for 15 years and is well-liked by the customers. He is described as very skilled by his
230 coworkers. Mathieu is high in extraversion but low in agreeableness as he tends to use an informal
231 lexicon and an impolite form of address. Thus, he has a quick wit and a dry sense of humor. He sees
232 Anthony as a very ambitious person and since his arrival as co-manager, he now has Christian at his
233 table who acts as a fake player in the games. He doesn’t like his presence as he feels watched but
234 remains professional. He spends his free time at Enzo’s counter without necessarily talking to him.
235 He has a positive opinion of Enzo’s competence in his profession.

236 - *Enzo Lamy*, 32 years old, barman. Enzo is a mixology enthusiast and is confronted with unpleasant
237 behavior from drunk customers. In addition, he respects the alcohol dosages instructions given by the
238 management which indicates a high conscientiousness. However, he is high in neuroticism, which
239 involves anxious reactivity during his interactions with the detective. He has been hired by Anthony;
240 they have a relationship of trust. He does not talk much to Mathieu although he finds him competent.
241 He appreciates Christian's unconventional personality.

242 - *Anthony Frey*, 35 years old, co-manager. Anthony is a highly educated man. As such, he uses a
243 formal lexicon and adopts a polite form of address toward the detective. He was the one discovering
244 the error in the accounts and notified the police. He is high in conscientiousness as he changed
245 procedures and replaced staff before notifying the police. He recruited Christian, whom he finds
246 useful to the casino despite their very different personalities. He recruited Enzo, whom he finds very
247 competent in his work and contributes to a good customer experience. Mathieu is the only employee
248 who has not been replaced by Anthony, hence he does not know him well but has nothing against
249 him.

250 - *Christian Vigneron*, 41 years old, security agent. Christian is a former police officer who was
251 disbarred for alcohol and gambling problems. Christian is high in extraversion but low in
252 conscientiousness as he tends to use familiar lexicon and in-group markers when he interacts with the
253 detective. He has been recruited by Anthony, who he likes although he considers him to be his
254 opposite personality. He spends time at Mathieu's table as a fake gambler to keep an eye on the
255 customers, thanks to an envelope given to him by the management. He thinks Mathieu is a good
256 croupier and has nothing against him. He spends the rest of his time sitting at Enzo's bar. Mathieu
257 appreciates that Enzo is a good listener.
258

259 CAs' communication styles were manipulated to convey aggressive or cooperative intentions. To do
260 so, hostility and agreeableness markers based on communication theory (Infante, 1995; Pennebaker
261 and King, 1999; Mairesse and Walker, 2007; Mairesse and Walker, 2009) have been implemented in
262 the communication content to affect participants' evaluation of aggressivity and cooperation. On the
263 one hand, CAs in their aggressive form had less verbosity, used personal attacks, and had negative
264 content polarization. Moreover, they had aggressive sentences toward the participants rather than
265 answering their inquiries (e.g., 'Do you even know what you are talking about?'). On the other hand,
266 CAs in their cooperative form had more verbosity and answered pedagogically to the detective's
267 questions. In addition, agents with a cooperative communication style requested confirmation for the
268 relevance of their answers (e.g., 'I hope my answers will help you solve this affair') and used
269 consilience markers (e.g., 'sir' or 'detective').

270 To control the form of CAs' communication style, a Wizard of Oz (WoZ) method was used.
271 Precisely, the WoZ used a working sheet for each identity (see Table 2 for an example of Anthony's
272 identity). This working sheet consisted in a list of the detective's potential questions and the content's
273 communication declension. In particular, the content communication could come in two styles
274 (aggressive or cooperative) that the WoZ followed based on the experimental condition the
275 discussion was set in (e.g., an aggressive or a cooperative CA). The potential questions asked by
276 participants were listed based on the intention associated and involved specific situations such as
277 'Initial contact', 'Backstory information' and 'Accusation'. If participants asked follow-up questions
278 about a specific topic, the WoZ either rephrased their answer in the cooperative form condition or
279 made the answer more aggressive (i.e., the Wizard of Oz answers the question and adds impatience
280 markers such as 'as I already said', 'Your questions are annoying').

281 The CAs' roles in the scenario are closely tied to their context (i.e., a witness or a suspect). For
282 instance, in a crime-solving game, witnesses can be expected to act as cooperative agents who assist
283 participants in solving the crime through their communication, while suspects can be expected to be
284 more hostile and convey their motivation in the game (i.e., indicating whether they are guilty or not).
285 Before each discussion, participants were given a brief description of the CA's identity content (i.e.,
286 the same description of the experiment's introduction) and their role in the scenario (e.g., 'Witness:
287 Enzo, 32 years old, a tormented bartender who loads up the drinks to disinhibit the customers').

288 **6 Results**

289 The analysis of participants' interactions with the four CAs includes CAs' evaluation through rating
290 scales and behavioral measures of the conversations. Rating scales consisted of each of the items on
291 perceived intelligence and believability scales, to which were added specific items to collect
292 judgment of CA's warmth and aggressiveness (see section 4). The behavioral measures included the
293 participants' input length, the delay, and the number of turns during conversations. Finally, the
294 culprit's designation and preference's ranking were analyzed.

295 A three-way ANOVA was conducted on participants' ratings of their conversations with CAs. Due to
296 the multiple items involved in the scales, only the statistically significant ones are reported here. The
297 factor 'role' had a significant impact on the item 'Visual impact' of the believability scale (i.e., '< X
298 >'s discourse draws my attention'). When CAs were introduced as witnesses, participants were
299 significantly more attentive during the conversation compared to suspects ($F(1, 124) = 5.147, p =$
300 0.025). Furthermore, when examining the different levels of the 'communication style' factor, a
301 simple effect analysis of the 'role' factor revealed that participants rated their attention significantly
302 lower when suspects exhibited a cooperative communication style compared to an aggressive one (p

303 = 0.016). The ‘communication style’ factor had a significant impact on participants’ rating of warmth
304 (F (1, 124) = 34.086, p < 0.001) and aggressivity (F (1, 124) = 258.903, p < 0.001). The interaction
305 between the ‘role’ and ‘order’ factors had a significant effect on participants’ ratings. Precisely, there
306 were significant differences in the evaluations of the first and last encountered CAs. The analysis
307 indicated that participants rated their attention higher when CAs were introduced as witnesses (F (1,
308 28) = 4.773, p = 0.037) and attributed to them more personality than to suspects (F (1, 28) = 10.817,
309 p = 0.003). Suspects were evaluated as more competent (F (1, 28) = 9.789, p = 0.004),
310 knowledgeable (F (1, 28) = 18.640, p < 0.001), intelligent (F (1, 28) = 14.497, p < 0.001), sensible (F
311 (1, 28) = 7.846, p = 0.009) and responsible (F (1, 28) = 4.443, p = 0.045) than witnesses. The
312 interaction between order and communication style had no significant impact on participants’ ratings.

313 Regarding participants’ behaviors, each of the three measures described above was analyzed
314 separately using three-way ANOVAs following the same approach of the participants’ ratings of the
315 items’ scales. Regarding the input length, the results showed a significant effect of the factor
316 ‘communication style’ (F (1, 1067) = 5.017, p = 0.025). Participants made longer inputs (in terms of
317 sentence length) when they were interacting with aggressive CAs. There was a significant interaction
318 between the factors ‘role’ and ‘order’ (F (3, 1067) = 3.829, p = 0.010). Participants wrote sentences
319 with more characters when interacting with suspects during the first and second conversations, while
320 it is the opposite for the last conversations. There was also a significant interaction between the
321 factors ‘role’, ‘communication style’, and ‘order’ (F (3, 1067) = 3.287, p = 0.020). Precisely, the
322 order of the conversation had a significant impact on participants’ input length for aggressive
323 suspects (p = 0.029). Regarding the delay of the inputs, the analysis excluded participants’ first
324 message, as it initiated their conversation. The results of the three-factor ANOVA indicated a
325 significant interaction between the factors ‘role’ and ‘order’ (F (3, 1067) = 8.071, p < .001).
326 Participants took longer to write their inputs when they faced suspects during the first and second
327 conversations, while it is the opposite during the last conversations. There was a significant
328 difference between the factors ‘role’, ‘communication style’, and ‘order’ (F (3, 1067) = 6.216, p <
329 .001). Simple main effects analyses showed that the order of the conversation had a significant
330 impact on participants’ delay for aggressive suspects (p = 0.002), cooperative suspects (p < .001),
331 and aggressive witnesses (p = 0.009), but no significant effect was observed for cooperative
332 witnesses (p = 0.370). Finally, the analysis of the number of turns during the conversations revealed a
333 significant impact of communication style (F (1, 1064) = 64.494, p < .001) on conversations.
334 Conversations with aggressive CAs were significantly longer than those with cooperative ones. There
335 was an effect of order (F (3, 1064) = 6.574, p < .001), with participants having longer conversations
336 by the last encountered CAs. There was a significant interaction between order and role (F (3, 1064 =
337 10.546, p < .001) as conversations with suspects were longer when they were encountered last. There
338 was a significant interaction between order and communication style (F (3, 1064) = 4.762, p = 0.003)
339 highlighting a significant difference between aggressive and cooperative CAs through the
340 conversations. Lastly, there was a significant interaction between order, role, and style (F (3, 1064) =
341 10.598, p < .001). Simple main effects revealed that the order of interaction influenced the
342 conversations’ length for aggressive suspects (p < .001), cooperative suspects (p < .001), and
343 aggressive witnesses (p = 0.011). Notably, conversations with cooperative witnesses did not appear
344 to be affected by the order of the conversation.

345 Regarding participants’ indication of the culprit and their ranking of the conversations. A
346 contingency table was used to analyze the distribution of participants’ indications of the culprit across
347 the four conditions. A chi-squared test was conducted, and the results did not show any significant
348 difference between witnesses and suspects ($\chi^2 = 0.439$, p = 0.508) but they revealed a significant
349 effect of the ‘communication style’ ($\chi^2 = 4.176$, p = 0.029). In addition, a linear regression analysis

350 was conducted on participants' certainty scores to identify predictors of their choice of the culprit.
351 The regression only identified the aggressivity score as a significant predictor of participants'
352 certainty ($r = 0.553$, $p = 0.009$). A log-linear regression was conducted to analyze the relationship
353 between 'role', 'communication style', and participants' ranking of conversations. The analysis only
354 indicated a significant association between 'communication style' and participants' preference ($r =$
355 0.170 ($SE = 0.057$), $z = 3.004$, $p = 0.003$). A MANOVA was conducted on participants' ratings and
356 behavioral measures, with the ranking of the conversation as a factor. The analysis indicated a
357 significant difference in the scores of the items 'predictability' ($F(1, 124) = 2.813$, $p = 0.042$) and
358 'aggressiveness' ($F(1, 124) = 5.143$, $p = 0.002$). The most and least preferred conversations were
359 rated as highly predictable, with the preferred one rated as less aggressive than the least preferred
360 one. The length of the conversation was the only significant effect on participants' ranking ($F(3,$
361 $1079) = 3.621$, $p = 0.013$). The preferred conversation was significantly longer compared to the other
362 ones.

363 **7 Discussion**

364 Our experiments, by combining participants' ratings of perceived intelligence and believability with
365 their behaviors during conversations, allows obtaining a comprehensive understanding of how CAs'
366 design influence user's experience in a detective computer game. In particular, our results revealed
367 five main results, 1) The design of CAs influences participants' ratings of perceived intelligence and
368 believability. 2) CAs' communication styles play a crucial role in shaping participants' perception of
369 aggressiveness and warmth. 3) These communication styles also influence participants' behaviors,
370 such as the size of their inputs and the frequency of turns taken during the conversation. 4) Participants'
371 preferences for the conversations are closely related to CAs' communication styles. 5) In light of these
372 findings, it becomes obvious that aligning the roles of CAs with their communication styles has the
373 potential to significantly improve users' experience. These findings are discussed in the following
374 subsections.

375 Finding 1 revealed the influence of CAs' roles on participants' ratings of perceived intelligence and
376 believability, regardless of their communication style. The explicit roles (suspect *vs.* witness) aim to
377 activate stereotypes in participants' minds, and thus generate expectations. In a police investigation
378 situation, suspects and witnesses are known to engage in distinct types of interactions with
379 investigators. Interactions with suspects typically involve highly challenging and argumentative
380 conversations, as suspects are expected to defend their alibis. On the contrary, witnesses readily
381 provide crucial information to facilitate the progression of the investigation. In our experiment, the
382 roles were explicitly communicated to participants before they interact with CAs, allowing them to
383 anticipate the conversations they might have and consequently their conversational strategies. These
384 strategies include predicting the topic of the detective's inquiries and adjusting their approach
385 accordingly. In our experiment, the strategies adopted by the participants may have influenced their
386 evaluation of the encountered CAs, particularly during the first interaction. Using the item 'Visual
387 impact' of the believability scale to rate the attention drawn by CAs' discourse ('< X >'s discourse
388 draws my attention.'), participants' attention was higher when they were interacting with witnesses.
389 Participants were found to be more attentive to the discourse of witnesses. Subsequently, participants
390 rated the perceived intelligence of suspects significantly higher than that of witnesses. When
391 conversing with suspects, participants were more inclined towards suspicion and accusatory inquiries,
392 while conversations with witnesses tended to be more informative in nature. The different strategies
393 adopted by participants reflect their underlying motivation during the interaction, as suspects are
394 implicitly more likely to be identified as the culprit. Participants may have perceived the suspects as
395 being more intelligent because they responded to accusations and suspicions, whereas the strategy used

396 towards witnesses involved informative inquiries, which typically resulted in less argumentative
397 responses. These different strategies appeared obvious in participants' behaviors as their input length
398 and delay were affected by the roles and order of CAs. In addition to the effect of role, participants
399 changed of behaviors across conversations. In particular, they wrote longer inputs and took more time
400 to formulate their inquiries when they encountered a suspect before any witness. Conversely,
401 participants adopted the opposite approach when interacting with witnesses during the last
402 conversations. This shift in strategy suggests that participants initially prioritized interactions with
403 suspects, anticipating more crucial information to help them discover the culprit.

404 Finding 2 confirms the significant effect of the linguistic cues and the strategies used to convey CAs'
405 communication style and its impact on participants' evaluation (Mairesse and Walker, 2009; Resendez,
406 2020). CAs with an aggressive communication style were perceived as more aggressive and colder in
407 comparison to cooperative ones (Infante and Wigley, 1986). Although there was no significant effect
408 of communication style on participants' perception of intelligence and believability, the communication
409 style did impact the item 'Personality' of the believability scale regarding the suspects.

410
411 Finding 3 underscores the effect of CA's communication style on participants' behaviors, reflected by
412 their inputs and the number of turns during the conversations. These findings diverge from those
413 obtained by Ruane et al. (2021). In their study, participants tended to mimic the communication style
414 of chatbot as they would write longer sentences and have deeper conversations with chatbots using
415 extraversion communication style (i.e., writing longer sentences). In our experiment, aggressive CAs
416 had shorter sentences compared to cooperative ones but participants wrote lengthier inputs and engaged
417 in longer conversations with aggressive CAs. The difference between our results and those of Ruane
418 et al. (2021) can be attributed to the different contexts of the experiments. Here, the conversations took
419 place within the context of a detective computer game (i.e., a narrative experience), whereas in Ruane
420 et al. 's (2021) experiment, participants answered chatbots' questions regarding the experience they
421 have about university life. It might be that aggressive CAs trigger suspicion in users' minds, raising
422 their motivation to understand CAs' attitude, resulting in longer sentences, and engaging in lengthier
423 conversations to achieve their goals. Furthermore, the aggressive communication style emerged as the
424 only predictor of participants' identification of the culprit, highlighting the stronger influence of
425 communication style over initial expectations. Aggressive CAs were significantly more frequently
426 identified as the culprit, indicating an implicit association between aggressiveness and guiltiness
427 (Infante and Wigley, 1986).

428 Finding 4 showed the influence of CAs' communication style on participants' conversation preferences.
429 Participants preferred conversing with cooperative CAs resulting in longer conversations, regardless
430 of their role in the narrative. These results align with the hypothesis made by Ruane et al. (2021)
431 regarding participants' engagement and the length of the conversations with CAs. Furthermore,
432 participants' ratings outlined the importance of CAs' predictability on their conversations' ranking. In
433 narrative experiences, Loyall (1997) highlighted the importance of predictability for participants to
434 anticipate their interaction based on their expectations as it enhances their enjoyment. In the current
435 experiment, preferred conversations were those perceived as highly predictable and cooperative. To
436 enhance participants' preferences, CAs' designers in narrative experience should manipulate CAs'
437 roles and communication styles to reduce the gap between users' expectations and the conversation's
438 tone.

439 Finding 5 highlights the effect of the coherence between CAs' role and their communication style on
440 participants' experience. In the experiment, the personality of cooperative suspects was rated
441 significantly lower compared to the other conditions. Participants were inclined to accuse and argue

442 with suspects, but the cooperative suspects surpassed their expectations by defusing tensions and
443 responding calmly to their accusatory inquiries. This finding is consistent with Magerko's perspective
444 (2007) on defining believability as a metric for artificial agents, wherein participants evaluate them
445 based on their expectations. Loyall (1997) further explains that the dimension of personality in
446 believability attribution is not solely an assessment of the agent's behavior but also reflects users'
447 acknowledgment of the agent's distinctiveness, serving as a strong motivator for their engagement. As
448 a result, suspects with an unexpected communication style receive lower rankings in terms of
449 personality attribution, which could potentially hinder their effectiveness as engaging characters in a
450 narrative experience.

451 The results of this experiment outline the importance of the role and communication style of CAs on
452 both participants' evaluation of CAs and their behaviors during the conversations. Participants
453 perceived suspects as more intelligent than witnesses, but this result can be attributed to the different
454 conversational strategies they used during their interactions. Furthermore, suspects with unexpected
455 communication styles, such as being friendly, received lower ratings in terms of personality,
456 potentially leading to a decrease in user engagement in the narrative experience. Aggressive
457 communication style was highlighted as a significant predictor of being named as the culprit,
458 regardless of the role. However, it's important to consider the context of the crime-solving game as a
459 potential limit for our findings as it could have influenced participants' experiences during their
460 conversations. Participants endorsing the role of a detective were actively seeking to identify a
461 culprit, raising their motivation to interact with aggressive CAs. Hence, this engagement may differ
462 in other social contexts. For example, future work should explore the effects of roles and
463 communication styles in more diverse contexts, such as casual interactions in games (e.g., interaction
464 with a random encounter), or in specific scenarios like interactions with sellers in role-playing games.
465 Investigating these different contexts will undoubtedly deepen our understanding of the relationship
466 between users' expectations and CAs' communication styles in narrative experiences. Additionally,
467 as all CAs in our experiment were male, participants' gender could have influenced their expectations
468 and conversations with them. In future research, exploring the impact of participants' gender on their
469 perception and behaviors during conversations could provide a more comprehensive understanding
470 of the relationships between their characteristics and CAs' design parameters.

471 **8 Conclusion**

472 This experiment highlights the importance of considering users' expectations in narrative
473 experiences. The approach adopted here allows manipulating the roles and communication styles of
474 different CAs and gain insight of their impact on users' behaviors and on their perception of
475 intelligence and believability. The information gathered from the experiment is crucial for creating
476 engaging CAs that effectively convey the narrative through their interactions with users. By
477 understanding the impact of factors such as roles, communication styles, and user expectations,
478 developers can design CAs that enhance the immersive and interactive nature of the narrative,
479 leading to a more enjoyable and compelling user experience. Precisely, manipulating the parameters
480 of role and communication style affected participants' experience during the conversations. The
481 linguistic cues influenced participants' behaviors and their perception of aggressiveness. These
482 significant changes follow the studies made on the impact of personality traits on users' experience
483 with CAs. The results highlight the importance of communication style, regardless of the role, in
484 identifying the culprit in a detective game. However, the role itself plays a crucial role in shaping
485 users' expectations and their attitude toward the CA. These findings have broader implications for the
486 design of CAs in different narrative contexts, outlining the importance of attentively considering
487 users' expectations and perceptions. By carefully aligning roles and communication styles,

488 developers can create more immersive and engaging experiences for users in various narrative
489 scenarios. These results can be extended to other types of agents, such as embodied conversational
490 agents. All types of agents, whether they are virtual assistants, chatbots, or even virtual characters in
491 games, can greatly benefit from considering users' expectations regarding their nonverbal behaviors.
492 By incorporating appropriate nonverbal cues, such as gestures, facial expressions, and body
493 language, agents can enhance the user experience and increase engagement. When combined with
494 suitable roles and communication styles, this holistic approach can create more believable and
495 immersive interactions, leading to improved user satisfaction and enjoyment.

496 **9 Conflict of Interest**

497 The authors declare that the research was conducted in the absence of any commercial or financial
498 relationships that could be construed as a potential conflict of interest.

499 **10 Author Contributions**

500 Conceptualization: RP, MLM, CP; MA; Design and Methodology: RP, MLM, CP, MA; Conduction
501 of the study: RP; Statistical analysis and interpretation: RP, CP, MA; Writing – original draft
502 preparation: RP; Writing – review and editing: RP, MLM, CP, MA; Resources: RP; Supervision: CP,
503 MA.

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- 579

580 **14 Tables**

581 **Table 1 – Linguistic markers associated with each identity’s content generation.**

Agent’s Identity	Linguistic markers
Mathieu Fournier (39 years old, Croupier)	Medium verbosity
	Contracted negation (e.g., ‘I can’t tell you...’)
	Informal lexicon (slight vulgarity, e.g., ‘it pisses me off when...’) Impolite form of address (sarcastic tendency, e.g., ‘Yeah, it’s the colonel mustard who did it.’)
Enzo Lamy (32 years old, Barman)	Strong verbosity
	Contracted negation (e.g., ‘I can’t tell you...’)
	Formal lexicon (no vulgarity unless under accusation in aggressive verbal behaviors)
	Polite form of address Emotional reaction (e.g., ‘oh no...’, ‘I’m so anxious about...’)
Anthony Frey (35 years old, Co-manager)	Strong verbosity
	Uncontracted negation (e.g., ‘I do not...’, ‘I cannot...’)
	Formal lexicon (no vulgarity and rich vocabulary, e.g., ‘This accusation is outrageous’) Polite form of address
Christian Vigneron (41 years old, Security guard)	Medium verbosity
	Contracted negation (e.g., ‘I can’t tell you...’)
	Informal lexicon (slang and swear words) Impolite form of address (in-group markers, e.g., ‘I get you, my pal.’)

582

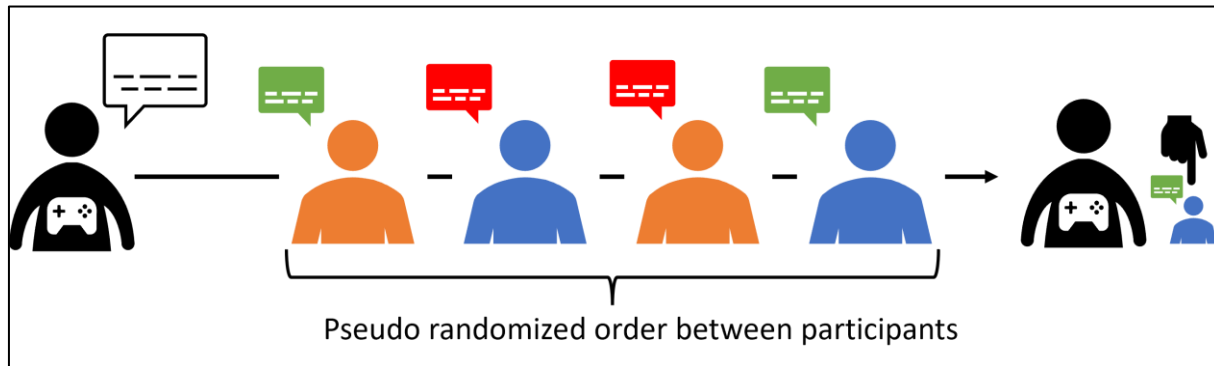
583

584 **Table 2 – Example from the Wizard of Oz’s working sheet: Anthony, the co-manager’s**
 585 **answers.**

Detective’s potential question	Question’s intent	Cooperative answers	Aggressive answers
<i>‘Hello.’</i>	Initial contact	<i>‘Hello sir.’</i>	<i>‘Hello sir.’</i>
<i>‘How are you?’</i>	Initial contact	<i>‘Personally, I am doing very well. Even though the disappearance of such a large sum of money is on my mind.’</i>	<i>‘Let’s get to the point, why am I being questioned about the disappearance of 400,000 euros in my own casino?’</i>
<i>‘How long have you been working here?’</i>	Backstory information	<i>‘It has been 2 years since I was hired to modernize the casino “Le Prestige”. The old casino was obsolete and this modernization with the addition of the hotel complex makes it possible to make this place a splendid jewel for tourism.’</i>	<i>‘I’ve been the co-manager of the casino for 2 years. But if the goal is to have such basic information, go to HR, you will waste less time.’</i>
<i>‘Have you stolen the money?’</i>	Suspicion	<i>‘Of course not. I am the one who warned the police about the discrepancy in the accounts, I think that clears me. But if some elements are not clear to you, I am ready to answer all of your questions.’</i>	<i>‘This accusation is outrageous! Do your job seriously before you come and waste my time.’</i>
<i>‘Are you the culprit?’</i>	Suspicion	<i>‘I am not. On the contrary, I’m here to help you find out who the real culprit is.’</i>	<i>‘Of course not! I’m looking for it, just like you. So do your job!’</i>
<i>‘I have some evidence against you!’</i>	Accusation	<i>‘What evidence are you talking about? In any case, I am ready to tell you everything I know.’</i>	<i>‘This attempt at destabilization is ridiculous. What evidence? Be specific!’</i>
<i>‘You look nervous.’</i>	Follow-up	<i>‘I’m not. As an exemplary leader, I work under constant pressure. What you call nervousness, I call responsiveness.’</i>	<i>‘I’m just annoyed by the level of your questions. I have several meetings today so make it quick and better.’</i>
<i>‘What do you think of Mathieu?’</i>	Social interaction	<i>‘He seems to be impeccable. Clients like him and he has adapted well to the change in staff.’</i>	<i>‘He seems experienced.’</i>
<i>‘Thanks for your answers.’</i>	Gratitude	<i>‘Thanks to you. I remain at your service.’</i>	<i>‘I wouldn’t say that the pleasure is shared.’</i>

586

587



589

590 **Figure 1: Example of a participant's session: Aggressive and Cooperative communication styles**
 591 **are represented in red and in green, respectively. Then, the roles of Witness and Suspect are**
 592 **represented in orange and blue, respectively. Participants are asked to identify the culprit**
 593 **among the four CAs after a conversation with each of them.**
 594

“Police inspector, you are contacted to take over the investigation of a colleague who is on leave. You are asked to find out more about a case of fraud in the casino "Le Prestige" in Le Havre. The director, Patrice Serres, has summoned the previous inspector to investigate a difference in the account for an amount of 400,000 euros. He suspects that one or more of his employees are embezzling from the casino.

You will have to question four of them:

- *Mathieu, 39 years old, a seasoned croupier and expert in handling cards.*
- *Enzo, 32, a tormented bartender who loads up the drinks to disinhibit the customers.*
- *Anthony, 35, co-manager who replaced the old staff with his employees.*
- *Christian, 41, a security guard, a disbarred ex-cop addicted to gambling.*

Your predecessor has already interviewed all the suspects and written notes on their potential involvement in this case. So, the people you are going to talk to have already been identified as witnesses or suspects.”

595

596 **Figure 2: The scenario of the game communicated to participants.**