Investigating How Text and Motion Style Shape Directness In Embodied Conversational Agents

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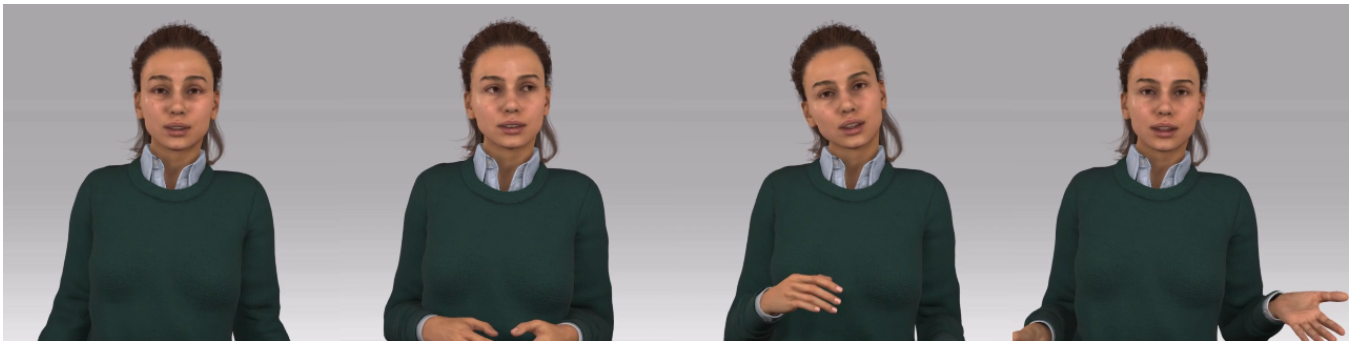


Figure 1: Example NVB Expressed by our ECA. Left to Right: Facial Shrug, Gaze Aversion, Head Tilt, and Palm Reveal

Abstract

Embodied Conversational Agents (ECAs) are becoming more widely used for various applications, notably in health. Some studies have demonstrated the effectiveness of delivering Motivational Interviews (MIs), a patient-centred behaviour change method, with ECAs. Despite showing promise, the effect of agent communication style on MI effectiveness remains underexplored. Directness has been shown to impact satisfaction and preference of dialogue systems, and effectiveness in some cases. However, outside of verbal style, how to control directness in ECAs to achieve these goals is not well understood. We designed an ECA to convey different levels of directness through language and Non-Verbal behaviours (NVBs), then evaluated the impact of language and NVB on directness with a perception study. The results showed that language influenced perceived directness, and that NVB contributed when aligned with indirect language. These findings suggest ways to shape conversational agents' communication style to enhance their effectiveness.

CCS Concepts

• **Human-centered computing** → **User studies**; **Empirical studies in HCI**; • **Computing methodologies** → **Perception**; **Discourse, dialogue and pragmatics**.

Keywords

Human-Avatar Interaction, Human-Computer Interaction, Communication Style, Embodied Conversational Agents, Motivational Interviewing, Text Style Control, Non-Verbal Behaviour



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1 Introduction

During an interaction, communication style is how something is said, rather than what is said. There are almost always different ways to communicate the same information. For example: "I did an experiment" is a less formal way to say "An experiment was carried out by me". Different factors can affect the style of communication, such as the text or verbal style used in text-based or voice-based systems. In embodied systems, additional aspects, such as facial expressions, posture, and motion, can also contribute to the communication style of an Embodied Conversational Agent (ECA). The communication style of an ECA can impact its effectiveness and engagement [Olafsson et al. 2020].

Online health applications are being widely investigated to support the overburdened health sector. As face-to-face interaction is one of the best ways to communicate health information, the use of ECAs is growing in interest [ter Stal et al. 2020]. Some studies on ECAs in healthcare are in the area of behaviour change [Chauvin et al. 2023; Olafsson et al. 2023]. A lot of these studies focus on measuring the effect of a particular aspect of an ECA on the (intention towards) behaviour change of participants [ter Stal et al. 2020]. One common method studied for changing behaviour with ECAs is Motivational Interviewing (MI) [Olafsson et al. 2019].

MI is one of the most effective counselling techniques for increasing participant motivation for behaviour change [Galvão Gomes da

Silva et al. 2018]. Numerous studies have investigated the effectiveness of MIs delivered by ECAs with topics such as reducing alcohol consumption [Lisetti et al. 2013; Olafsson et al. 2023], healthy eating [Olafsson et al. 2019, 2020], and promoting exercise behaviour [Chauvin et al. 2023; Galvão Gomes da Silva et al. 2018; Galvão Gomes da Silva et al. 2020; Olafsson et al. 2019, 2020]. Much less have explored the effects of agent communication style on MI effectiveness, despite positive results with MI [Olafsson et al. 2020], and other work in behaviour change [Zhang et al. 2021].

The level of directness in communication style has been shown to impact user perception and satisfaction with dialogue systems, and could affect outcomes in a task-based context [Miehle et al. 2018a; O'Mahony et al. 2024; Pragst et al. 2019]. The level of directness in dialogue systems can be controlled through language [Miehle et al. 2022], while Non-Verbal behaviours (NVBs) can contribute to the identification of indirect utterances from humans [Chu et al. 2023]. However, to the best of our knowledge, the impact of NVB on directness has not been studied in ECAs.

We designed an ECA with varied animated NVBs, and text style using an LLM, in order to determine whether directness could be manipulated via those signals, and examined the effectiveness of both modalities via a perceptual experiment using an MI scenario. Our results are of interest to developers of ECAs, particularly within the MI domain, seeking to personalise interactions for greater user satisfaction and effectiveness.

2 Related Work

2.1 Directness as a Communication Style

A direct communication style is a "manner of speaking in which one employs overt expressions of intention", and an indirect style is a "manner of speaking in which the intentions of the speaker are hidden or only hinted at during interaction" [Neuliep 2018]. Indirectness is a linguistic phenomenon which can be achieved by a speaker by distancing themselves from their intended meaning or proposition, through methods such as including vagueness, reducing certainty or intensity, or making their statements seem more subjective, among others [Goel et al. 2019]. For example, when discussing the price of an expensive menu item at a restaurant, a direct utterance would be "It costs €80." as it is an accurate and clear description of the price. An indirect utterance would be, "You will need a second credit card." the price is not directly stated, but it can be inferred that it is high. "I think it might cost €80" is more indirect than the original, as a discourse marker and uncertainty term were introduced, however it is not as indirect as the second utterance as the price is stated. Indirectness can be identified using context and intended meaning [Miehle et al. 2022], and sometimes through specific words or terms such as apologising, hedging language, category extenders, or subjectivising [Goel et al. 2019].

Indirectness is a conversational strategy considered intrinsic to conversational discourse [Goel et al. 2019]. Sometimes, it is important to deliver information directly and accurately, though it is often important to use indirect language to communicate more effectively in some contexts, including counselling, healthcare, education, and negotiation. In tutoring scenarios, strangers are more likely to use indirect language than friends, and this improved outcomes [Madaio et al. 2017]. When stakes are high, strategic indirectness can be crucial to soften the blow of the delivery and result in more effective communication, such as during business deals or medical diagnoses [Goel et al. 2019]. In negotiations, indirectness can be employed to express tentative views, reduce commitment to a specific bid, and foster trust between negotiators. It can also be used as a tool for social face management [Holtgraves 1986].

It has been demonstrated that the level of directness influences the user's perception of and satisfaction with a dialogue system, therefore in a task-based setting, it could lead to different outcomes [Miehle et al. 2018a; Pragst et al. 2019]. This follows an earlier work that found that the user's preference for directness in their system's communication style depended on the role of the system [Miehle et al. 2018b]. Participants preferred the direct style for the "social companion" and "personal assistant" systems, but preferences were more even for the "expert" system. Miehle et al. concluded that while there was no overall general preference in the communication style of their system, there appeared to be individual preferences for each participant [Miehle et al. 2018a]. This finding suggests that identifying mechanisms to enhance directness or indirectness can be used to further benefit users of dialogue systems. Zhang et al. showed that delivering information through a behaviour change app with an indirect style positively impacted user exercise behaviour more than delivering the information with a direct style [Zhang et al. 2021]. While not MI, or an ECA, the authors showed that controlling indirectness led to better outcomes. Preferences for direct or indirect interaction styles in conversational agents may depend on context or the individual, but more work is needed, as the extent to which directness has been studied in conversational agents is limited, especially when it comes to ECAs or MIs.

Along with language, NVB can also contribute to the identification of indirect utterances in human-human interactions, and certain NVBs are often produced by humans when conveying information indirectly [Chu et al. 2023]. However, while this work was the first to investigate the independent contribution of NVBs for comprehending indirect utterances, it only considered human-human interaction and not ECAs. It is desirable to understand whether this translates to interactions between humans and ECAs. Chu et al. theorised the specific NVBs: head tilt ("consisted of a single lateral head movement to either the right or left"), eye gaze aversion, facial shrug ("involved pulling back of the mouth corners and raising of the cheeks and eyebrow"), and palm reveal gestures ("the palm is revealed to the listener as if to indicate uncertainty or having nothing to say ... by showing an empty hand" [Chu et al. 2014]) were related to the production or identification of indirectness in humans [Chu et al. 2023]. The authors found that head tilt was related to the production and identification of indirect utterances in all of their scenarios. All four behaviours contributed to the identification of indirect replies when participants could not hear the audio. Facial shrug was a significant predictor of indirectness (with audio) when accompanying less informative speech (but not the condition with more informative speech). There appeared to be a general increase in the effects of NVB when the speech was less informative. However, it is not yet known whether these results translate to interactions with virtual characters. Other works have investigated the effects of NVBs on perceptions of ECAs, though

typically with 'Big Five' personality traits and not directness [Neff et al. 2011, 2010; Smith and Neff 2017; Sonlu et al. 2025, 2021].

2.2 Motivational Interviewing Embodied Conversational Agents

An MI is a counselling method used to increase participant motivation for behaviour change. It has a variety of strategies such as listing pros and cons, talking about the current level of motivation and confidence to change, and encouraging the participant to talk openly without judgement, with the main goal of helping participants resolve ambivalence towards their current behaviour [Olafsson et al. 2019]. As MIs typically involve face-to-face interaction with a counsellor [Galvão Gomes da Silva et al. 2020], numerous works have investigated the effectiveness of MIs delivered by ECAs, as they can simulate face-to-face interaction [ter Stal et al. 2020].

Some studies in this area have employed a non-human agent to deliver MIs to participants to increase their motivation to eat healthier [Olafsson et al. 2019, 2020], exercise more [Chauvin et al. 2023; Galvão Gomes da Silva et al. 2018; Galvão Gomes da Silva et al. 2020; Olafsson et al. 2019, 2020], or quit unhealthy behaviours such as excessive alcohol consumption [Lisetti et al. 2013; Olafsson et al. 2023]. Different mechanisms of delivery have been used, such as ECAs [Chauvin et al. 2023; Lisetti et al. 2013; Olafsson et al. 2019, 2020], a NAO robot [Galvão Gomes da Silva et al. 2018], or video recordings of human actors [Galvão Gomes da Silva et al. 2020] to deliver the MI. These studies broadly reported positive results, showing that these agents can be effective at increasing participants' motivation towards behavioural change.

Some of these works investigated the impact of communication styles. Olafsson et al. found that a humorous MI ECA effectively increased motivation more than one without humour, and was preferred by participants [Olafsson et al. 2020]. Chauvin et al. examined the impact of empathy in MI ECAs [Chauvin et al. 2023]. The authors reported mixed results but showed that the empathic ECA was perceived as more credible and empathic and had the potential to increase some types of participant self-efficacy, and motivation to increase physical activity levels. O'Mahony et al. reported that an MI ECA with a more direct communication style had a positive effect on interactions compared to an agent with a warmer communication style [O'Mahony et al. 2024]. All three studies controlled the communication style of the agents through text only (Chauvin et al. also varied modality), and not through NVBs, which could amplify the perception of the desired communication style. The level of directness in the communication style of dialogue systems and ECAs can impact task effectiveness and user preference. NVB, audio, and language cues have been shown to contribute to building personality profiles in ECAs [Thomas et al. 2022], suggesting a similar potential for expressing directness. While aligning NVB could enhance perceived directness or indirectness, it is unclear how best to achieve this with ECAs.

3 Method

To investigate how users perceived directness in language and NVBs in MI ECAs, we designed different ECAs and evaluated them in a perception study. Participants viewed video clips of an MI agent with varied text style and NVBs, and rated the level of directness they perceived. Our hypotheses are the following:

- H1: In the agent's communication style, the text will have a greater influence than NVBs on directness.
- H2a: Direct text with none of the modified NVBs will be the most direct condition.
- H2b: Indirect text with the most indirect NVB will be the least direct condition.

Chu et al. found that NVBs were more salient when the speech was less informative. As our scripts are more informative we hypothesise that the text will have a greater effect on perception. According to the authors, the four NVBs: head tilt, palm reveal, gaze aversion, and facial shrug can either help identify or are produced with indirect utterances in human-human interaction [Chu et al. 2023]. Therefore, we hypothesise that the absence of these behaviours will be perceived as more direct, and that aligning a more direct style of text with none of these NVBs will be perceived as more direct than when they are not aligned. Conversely, we hypothesise that the alignment of more indirect text with the most indirect NVB factor will be perceived as more indirect than when they are not aligned.

3.1 Stimuli Creation

We designed 12 conditions which were combinations of two text and six NVB factors. The agent delivered sections of MI scripts [Galvão Gomes da Silva et al. 2018; South Dakota Association of Healthcare Organizations 2023]. We modified the format of the scripts to make it more appropriate for our scenario where participants would be watching clips of agent monologues, and would not be able to respond to questions. We created two text conditions, more direct and more indirect, by changing the text style of each script with a Large Language Model (LLM). The OpenAI API was used with the GPT-4.1 model, temperature = 0, and top P = .01 to minimise variation. We used the prompts: *"I will provide you with a script. Please rewrite it while maintaining its original intent and structure, but adjust the language to be more (in)direct:"*. A new session was created for each request so requests would not be influenced by keeping previous ones in context. We validated the presence of increased directness and indirectness, respectively, in the new versions of the scripts through manual assessment, considering features described in related work [Goel et al. 2019; Miehle et al. 2022]. This was typically achieved by the LLM through introduced or removed hedging/probability terms, or softer or more tentative language (see table 1). The two scripts were divided into three parts each. The six segments were used as a random factor to avoid repetition effects and participant fatigue.

Based on Chu et al. [Chu et al. 2023] and others, in the context of human-human interaction, we designed six variations for the NVB factor to investigate the role of NVB on the perception of directness in Human-Avatar Interaction. The six variations were head tilt (HT), eye gaze aversion (GA), facial shrug (FS), palm reveal (PR), none (NONE), and a combination of all four (ALL). The NVBs were designed following descriptions from Chu et al. [Chu et al. 2023], though for FS, we did not manipulate the agent's mouth as it clashed with the lip sync. We created and rendered the stimuli video clips in iClone 8 [Reallusion 2022b] using a Character Creator 4 [Reallusion 2022a] avatar. A total of 72 clips were created (2 text conditions x 6

Table 1: Script Text Variation Excerpts

More Direct	More Indirect
Start by identifying what behaviour you want to change and why.	It might be helpful to reflect on any changes you are considering making and the reasons behind them.
Think about what could happen if you don't make any changes. Does that concern you? Why?	It could be worthwhile to think about what might happen in the future if nothing changes, and whether that brings up any concerns or worries, and why that might be.

Table 2: Setting NVB Markers Example (ALL Condition)

It **[Facial shrug] could be worthwhile** to think about what might happen in the future if **[Gaze aversion-R] nothing changes**, and whether that brings up any concerns or worries, and why that might be.
It may also be useful to try to identify the things that **[Head tilt-L] could** improve if a change were made, and to notice how you feel about that list.
[Palm reveal-R] Perhaps there is one thing that stands out as most important to you at the moment.

NVB conditions x 6 script variations). A female embodiment was chosen as some studies suggest that women are much more likely to prefer a female to a male therapist, and men have a slight preference towards a female therapist or do not have a preference [Liddon et al. 2018; Seidler et al. 2022]. The agent was given a neutral-sounding voice with an Irish accent using ElevenLabs [ElevenLabs 2023] text-to-speech, natural blinking in iClone 8, and baseline gestures and motion using QPGesture [Yang et al. 2023].

Each clip was between 14.9 and 31.6 seconds long, with a mean duration of 23.4 seconds. Clips with indirect text were longer than their corresponding clip with direct text. Chu et al. found the occurrence rate of HT and PR during indirect utterances was around 4 times per 23.4 seconds [Chu et al. 2023]. To keep NVB conditions consistent, each clip contained four NVBs (except for NONE). We set the NVB markers in line with indirect text in the indirect script variations (see table 2), and in the corresponding semantic positions in the direct script variations. The same marker positions were used for every NVB condition. As markers were set in line with indirect language, some NVBs overlapped, though this occurred across conditions. The ALL condition had one of each NVB, the order was set randomly. The behaviours other than facial shrug had left and right variations which were set randomly. Gaze aversions typically lasts for two to four seconds [Andrist et al. 2013]. To keep the duration of each NVB consistent, each behaviour lasted two seconds, with one second to transition in, and out.

3.2 Experiment Procedure

Using a within-subjects design, every participant viewed and rated all 12 conditions. The order the conditions were presented, and the script variation used for each condition was randomised to mitigate unwanted effects. A power analysis revealed that 24 participants were needed to achieve 80% power. To ensure statistical validity, we recruited 30 (15m/15f, 5 aged 18-24, 7 aged 25-34, 7 aged 35-44, 8 aged 45-54, and 3 over 55). Participants were recruited on Prolific [Prolific 2025] from the UK, the US, Ireland, Australia, Canada, and New Zealand. Participants were required to have English as a first language. They were paid £10 per hour for participating.

Table 3: Mean Directness

	NONE	FS	GA	HT	PR	ALL
Direct	5.70	5.63	5.57	5.67	5.47	5.53
Indirect	5.00	5.47	4.50	5.17	5.90	4.97

NVB was not mentioned to participants to avoid priming them to focus more attention on NVB, to keep the experiment as close to natural interactions as possible. Two attention check clips were included to try to ensure that participants watched and listened to each clip fully. One contained text instructions at the end of a video clip to check that participants were watching the videos, and the other contained audio instructions at the end of a clip to ensure participants were listening to the videos. Eight participants who failed an attention check were removed and replaced. The experiment was approximately of 10 minutes duration. Participants were directed to an external survey to view each clip and answer one question per clip: *"How direct was the agent?"* using a 7-point Likert scale, from very indirect to very direct.

This project was approved by the research ethics committee of our institution. Participants were informed of the nature of the study and data collection, and gave consent before proceeding. Participants were instructed to watch each clip fully once, then rate the directness of the agent. Further instructions were to ensure the video sound was on, play each video in full screen, and set the video quality to the highest their internet connection could handle. The following definitions of direct and indirect communication styles were provided (adapted from [Miehle et al. 2022]):

- *A direct style is a manner of communicating in which one employs overt expressions of intention, and*
- *An indirect style is a manner of communicating in which the intentions of the speaker are hidden or only hinted at during interaction.*

4 Results

We used an exploratory repeated-measures two-way ANOVA to investigate the impacts of NVB and text as main and interaction effects, related samples t-tests to validate our text condition manipulation, and for the ANOVA post-hoc tests. A mixed linear model

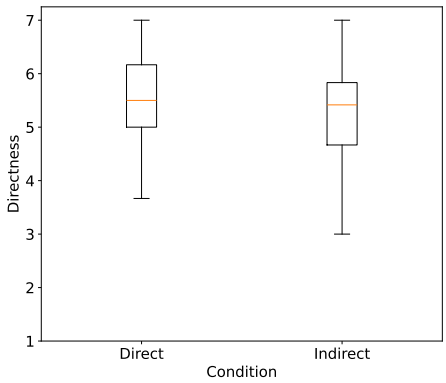


Figure 2: Boxplots of text conditions (1 = very indirect, 7 = very direct)

was used to measure factor effects for our first hypothesis (H1). Related samples t-tests were used to investigate our hypotheses H2a and H2b. Directness was approximated as a continuous variable.

A related samples t-test was used to validate our text condition manipulation. Assumptions of paired observations, independence, and normality (using a Q-Q plot) were met. The more direct text condition *(M = 5.59)* was perceived as more direct than the more indirect text condition *(M = 5.17)* with statistical significance *t(29) = 2.61, p = .0071*. All assumptions of the repeated-measures two-way ANOVA were met aside from sphericity; hence, the reported values use the Greenhouse-Geisser correction. The text factor showed statistical significance *F(1, 29) = 6.8120, p = .0142*. NVB on its own does not appear to show an effect based on the results of the two-way ANOVA *F(5, 145) = 1.4255, p = .2380*. However, there is a significant interaction between text and NVB *F(5, 145) = 2.7248, p = .0398*.

While NVB conditions did not vary within the direct text condition, a significant interaction occurred with indirect text (see figure 3). Post-hoc tests were used to investigate the effects of each NVB condition individually on the perception of directness. To control the family-wise error rate and prevent type I error, we used the Bonferroni correction. To avoid carrying out 66 pairwise comparisons from 12 conditions with a very strict Bonferroni correction, we only compared the pairwise NVBs from the indirect text condition. As there were 15 pairwise groups from the six conditions, the p-value required to reach statistical significance was .05/15 = .0033. Of all the post-hoc comparisons, only GA *(M = 4.5)* and PR *(M = 5.9)* were statistically significantly different *t(29) = -4.15, p = .0003*. PR was perceived as more direct than GA.

ALL *(M = 4.97)* and NONE *(M = 5.00)* conditions were very close in means, and had a high p-value close to one, *p = .9399*. While ALL/PR *(p = .0059)*, FS/GA *(p = .0204)*, PR/NONE *(p = .0243)*, and HT/PR *(p = .0462)* had low p-values, they did not reach statistical significance with our corrected value of 0.0033.

We used the fixed effects of a mixed linear model using directness as the dependent variable, text and NVB as categorical fixed effects, and participant as a grouping factor to identify which factor had a larger influence on directness (see table 4). The text effect (β = *0.4278, p = .003*) was larger than the maximum NVB (PR) effect (β *= 0.3333, p = .186)*, supporting our first hypothesis that text would have a greater effect than the NVB factor.

Table 4: Mixed Linear Model

	Coef.	P > |z|	95% CI
Intercept	5.136	.000	4.694 5.578
text:direct	0.428	.003	0.143 0.713
NVB:FS	0.200	.428	-0.294 0.694
NVB:GA	-0.317	.209	-0.811 0.177
NVB:HT	0.067	.791	-0.427 0.561
NVB:ALL	-0.100	.692	-0.594 0.394
NVB:PR	0.333	.186	-0.161 0.827

A related samples t-test was used to investigate whether the direct text + NONE condition was perceived as significantly more direct than the direct text + ALL, *t(29) = 0.4152, p = .3405*. However, there was not sufficient evidence to support our hypothesis, H2a: Direct text with none of the modified NVBs will be the most direct condition. Similarly, a related samples t-test failed to provide evidence that the indirect text + GA (the least direct NVB) condition was significantly less direct than the indirect text + none condition, *t(29) = 1.16, p = .1277*. Therefore, we did not have sufficient evidence for our H2b: Indirect text with the most indirect NVB will be the least direct condition.

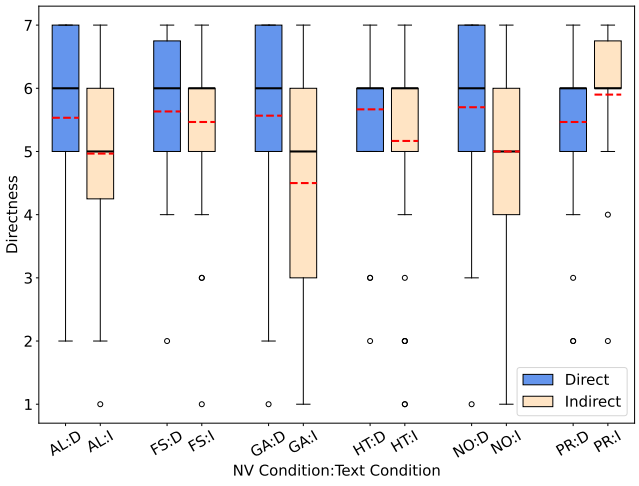


Figure 3: Boxplots of all 12 conditions (1 = very indirect, 7 = very direct, mean: red dashed line, median: black line)

5 Discussion

We have shown that we can make interactions with virtual agents more or less direct. This can be achieved by controlling the text style using LLMs. The effect of NVBs on the perception of directness is more nuanced. While there are some indicators towards some behaviours, such as gaze aversion promoting the perception of indirectness, or palm reveal promoting the perception of directness, it is not entirely clear, as they did not reach our significance

Table 5: Post-hoc Related Samples T-test p-values for Indirect Text:NVB Conditions

	ALL	FS	GA	HT	PR	NONE
ALL	1					
FS	.2052	1				
GA	.1427	.0204	1			
HT	.5795	.3066	.1200	1		
PR	.0059	.1464	**.0003**	.0462	1	
NONE	.9399	.1563	.2553	.6400	.0243	1

threshold when compared to the condition with no added NVBs (NONE).

Moreover, we expected each condition to contribute somewhat to the perception of indirectness, as the literature suggests this can be the case in human-human interaction. We also expected the ALL condition to contribute towards the perception of indirectness, as it includes each NVB. However, compounding them all together makes it unclear, as they may be at odds with each other. For example, palm reveal was considered the most direct NVB condition, which may have increased the perception of directness in ALL. Furthermore, as the NONE and ALL NVB conditions had very similar levels of perceived directness across both textual conditions, it is possible that only having one of each of our NVBs in ALL reduced the effect of each behaviour, and having a higher frequency of a NVB in a clip is required to have a perceived effect.

Based on the two-way ANOVA and boxplots, it appears that there is an interaction between the effects of the text and NVB factors when the text is more indirect. This points towards the benefits of aligning indirect NVBs, such as gaze aversion, with instances of indirect terms to make agents appear more indirect. Though when each NVB is individually compared against each other, the indirect text + gaze aversion condition was not significantly less direct than the indirect text + none condition. This is the first look at using NVBs in MI ECAs to control the perception of directness. We have learned that combining a number of different NVB conditions does not make it less direct, but we will work on refining the design to make the perceptions more direct, and indirect, such as by increasing the frequency or duration of NVBs.

Potential limitations included that participants viewed clips of agent monologues rather than having actual interactions. Needing to engage and respond to the agent may affect participant perception. Each clip was relatively short to avoid participant fatigue. However, longer clips exposing participants to more of each NVB may increase their effects, as participants would have more time to build a mental profile of the agent. Moreover, while the indirect text was found to be less direct than the direct text, on average, it was still considered "slightly direct". Since the NVBs had an interaction effect with indirect text, further increasing the text indirectness may also make the NVBs more salient.

QPGesture was designed to create gestures based on speech [Yang et al. 2023]. However upon review, it was noted that it generated the same gesture file regardless of input speech. So, the same baseline gestures were used for each script before all were divided into three segments. Gestures better matched to speech may have increased naturalness and affected the perception of indirectness. As there were other hand gestures generated by QPGesture, which were blended with the palm reveal gestures, this may have introduced some noise which affected the perception of PR gestures. Furthermore, some of the QPGestures may have been perceived as PR gestures.

We asked a post-experiment validation question: "Which non-verbal behaviours do you remember observing?" providing 10 options: 4 NVBs present, and 5 that were not designed in our ECA, and "none of the above". Participants could select 1-8 options. Results revealed GA 63%, HT 47%, PR 63%, FS 20%, and "hand waving" 67% (all others <10%). It appears that "hand waving" may have been noise introduced by QPGesture, and some NVBs, especially FS may not have been perceived by many participants. Investigating how to remove noise from the baseline gestures while keeping naturalness, and why some of the NVBs may not have been perceived (or remembered) by participants, could be used to improve the design.

6 Conclusions and Future Work

We designed and conducted an online user perception study to investigate how text and Non-Verbal behaviours can influence directness in the communication style of Embodied Conversational Agents in a Motivational Interviewing context. We altered the text style using a Large Language Model, designed Non-Verbal behaviours and inserted them in line with indirect terms using iClone 8. We conclude that Large Language Models can alter the perception of directness in text, and text had the strongest effect of the two factors on the perception of directness. While Non-Verbal behaviour did not have a strong effect alone, its interaction with more indirect text had an influence. Developers of Embodied Conversational Agents and designers of Motivational Interviews with these characters should carefully design the dialogue to be used, and our results show that this can be successfully achieved with relevant prompts via Large Language Models. While Non-Verbal behaviours might not present directness or indirectness alone, gaze aversion may add to the effect of indirectness in appropriate dialogues when paired with sufficiently indirect text.

Future work will focus on exploring and enhancing the effects of gaze aversion while aligned with indirect text. This includes increasing the frequency and duration of behaviours, testing them in longer interactions, pairing them with more indirect text, and reducing noise from baseline gestures. Additionally, we aim to investigate how varying levels of directness in communication styles impact the effectiveness of Motivational Interviewing Embodied Conversational Agents.

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