Impact of Directness in Language and Gaze on Motivational Interviewing Virtual Agent Effectiveness

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Embodied Conversational Agents (ECAs) are increasingly preferred over text- or voice-only agents in some domains like health behaviour change, where Motivational Interviewing (MI) is one of the most effective techniques for building confidence and motivation to change. While communication style is known to affect ECA satisfaction, preference, and effectiveness, the impact of directness specifically on MI ECA effectiveness is not well understood, despite its importance in balanced MI delivery. We designed an ECA to deliver MI sessions with two conditions: a more direct or more indirect communication style, using accessible, automated tools: a Large Language Model to alter the language style, and Unity game engine animations to control Gaze Aversion. We conducted a user study measuring whether these conditions affected MI effectiveness in increasing participant motivation or confidence for healthy eating or screen use reduction. Directness affected confidence for behaviour change differently by gender: women's confidence increased further with a more direct agent and men's with a more indirect one. Our findings offer guidelines for personalising MI ECA communication style by participant gender to improve effectiveness and adoption.

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

1. INTRODUCTION

Making changes towards a healthier lifestyle can be challenging, but important. Increasing motivation and confidence to change can be difficult but is often the first step as it is predictive of future behaviour change (Olafsson et al. 2020). Motivational Interviewing (MI) is one of the most effective methods of improving motivation for behaviour change (Galvão Gomes da Silva et al. 2018). MI is used to help participants talk openly about their behaviour, promote talking about how they would like to make changes (change talk), help them resolve any ambivalence towards their current behaviour, and encourage them to consider changes (Olafsson et al. 2019). Some people will seek support from MI-trained practitioners, but professional help can be inaccessible or unavailable.

Embodied Conversational Agents (ECAs) are capable of holding conversations with people and have been applied to numerous domains such as customer support, health, and education. ECAs are cheap, accessible, always available, and the potential for them to deliver effective MIs has already been investigated (ter Stal et al. 2020). As face-to-face interaction is one of the best ways to communicate health information, the use of ECAs in health is growing. MI sessions delivered by ECAs can be effective in increasing participant motivation and confidence for behaviour change, but the level of effectiveness is affected by the communication style of the agent (Olafsson et al. 2020). Furthermore, advances in Large Language Models (LLMs) have improved the ability to generate natural dialogue.



Figure 1: *Agent gaze aversion examples*

Communication style is how something is said rather than what is said. There are often many ways to deliver the same information. Communication

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style takes many different forms, such as direct or indirect, formal or informal, elaborate or concise. Communication styles can be perceived through different channels including the choice of language (Miehle et al. 2022), or non-verbal behaviours (NVBs) (Chu et al. 2023), including directness which can affect user perception, satisfaction, and outcomes in user-agent interactions (Pragst et al. 2019; Miehle et al. 2018a; O'Mahony et al. 2024). Our prior work has shown that indirectness in NVBs influences the perception of indirectness when paired with indirectness in language (O'Mahony et al. 2025).

There are many domains where striking the right balance of directness is important for effective communication. One of these is MI, where the balance between directive and evocative approaches is important for success. MI practitioners sometimes need to use directness, for example, when offering straightforward encouragement, or indirectness when evoking change talk that is not coming easily from the participant. However, to our knowledge, the impact of indirectness or directness in communication style has not been studied in MI ECAs in relation to effectiveness, especially when it comes to controlling communication style multi-modally.

To investigate the role of indirectness on MI effectiveness in ECA communication style, we designed an ECA to convey different levels of indirectness through language and NVB using an LLM to control the style of language, and animations in the Unity game engine for gaze aversion (GA). These tools were chosen as they are automated and accessible, which will make our findings easier for designers of MI ECAs to implement.

2. RELATED WORK

Multiple studies have already demonstrated the potential for effective MIs delivered by ECAs. These agents were designed to deliver MI sessions on topics such as healthy eating, exercise behaviour, or quitting unhealthy behaviours including excessive alcohol consumption (Galvão Gomes da Silva et al. 2018, 2020; Olafsson et al. 2019, 2020, 2023). Olafsson et al. (2019) found their ECAs increased motivation, confidence, and self-efficacy; Olafsson et al. (2020) found increased motivation for behaviour change; and Chauvin et al. (2023) found their empathic MI ECA increased barrier self-efficacy. However, unlike our study, participants selected pre-set options from a menu on the screen rather than talking about changes to their behaviour aloud, which is a fundamental principle of MI (Galvão Gomes da Silva et al. 2020) and less in line with a natural conversation. LLMs are capable of simulating natural conversations and adapting to user responses, giving them great potential for powering MI agents. There has been limited work on the use of LLM-powered MI ECAs, but there are still concerns about their safety and controllability, though some progress has been made (Steenstra et al. 2024; Galland et al. 2025). Communication style variations on ECA MI sessions have been studied in various works, and have been shown to have an impact (Lisetti et al. 2013; Chauvin et al. 2023; O'Mahony et al. 2024).

Indirectness is a conversational strategy considered essential to conversational discourse (Goel et al. 2019). In some cases, it is crucial to deliver information directly and precisely, though it can sometimes be more important to use indirect language to communicate more effectively, including counselling, healthcare, education, and negotiation. The level of indirectness can also be influenced by the relationship and relative social status between speakers (Madaio et al. 2017; Holtgraves 1986), which may be relevant given the social dynamic between an MI ECA and a participant differs from that between two humans.

The level of directness in a dialogue system influences the user's perception and satisfaction, which could lead to different outcomes in a task-based setting (Pragst et al. 2019; Miehle et al. 2018a). The user's preference for directness in a system's communication style can depend on the role of the system (Miehle et al. 2018b). Zhang et al. (2021) found that a behaviour change app which delivered information with an indirect style positively impacted user exercise behaviour more than a direct style, illustrating the importance of tailoring directness to enhance task-specific goals, though this finding was with a behaviour change app, not with MI or an ECA.

NVB is also associated with communication styles such as indirectness (Abulimiti et al. 2023; Chu et al. 2023; Pang et al. 2024), though more work in the area focuses on language-based features. In human-human interaction, NVBs such as GA, facial shrug, head tilt, and palm reveal can be associated with the identification of indirect utterances (Chu et al. 2023; Pang et al. 2024). In ECAs, we previously observed that NVBs contributed to the perception of indirectness when aligned with indirect language, and that GA was considered the most indirect NVB in an MI setting (O'Mahony et al. 2025).

We previously found that a more direct MI ECA was preferred by users, though it was contrasted with a warmer condition rather than one that was specifically designed to be indirect, and we did not vary the NVB modality of communication style, or

investigate the influence of these communication styles on task effectiveness. While more prior work has separately examined MI ECAs, and directness in communication style, despite promise, research on the communication styles of MI ECAs remains more limited, and the role of indirectness in NVBs has received little attention. Notably, there is a gap regarding the effects of directness in both language and non-verbal communication style of MI ECAs on MI effectiveness, which this paper addresses.

3. METHOD

To investigate whether a difference in indirectness in ECA communication style could have an impact on MI effectiveness, we designed two ECAs, one more indirect and one more direct, and conducted a human-avatar interaction study. As participants were recruited for one-hour sessions, we did not have the ability to track their actual behaviour change over time. However, the first step with MI for behaviour change is typically increasing the motivation and confidence of the participant (Olafsson et al. 2020); therefore, the difference in motivation and confidence measured before and after each interaction was used as our measure of effectiveness. Our hypotheses were the following:

- H1: MI sessions with one of the agents will lead to a significantly greater change in **motivation**.
- H2: MI sessions with one of the agents will lead to a significantly greater change in **confidence**.

3.1. Stimuli Creation

We designed two versions of the MI ECA based on its language and non-verbal communication style: more direct and more indirect, to deliver MI sessions to participants. We adopted an MI script which was designed and validated by an earlier study (Galvão Gomes da Silva et al. 2018). The structure of the script was the same for each conversation to avoid introducing unwanted variation when comparing conditions. We used the GPT-5 LLM to change the level of indirectness in the communication style of the script using the following prompt: "I will provide you with a script. Please adjust the language to be more [in]direct while maintaining its original intent and structure. - Do not remove any sentence. - Do not change a sentence so much that the original meaning changes more than a stylistic change". We manually validated the presence of increased/decreased indirectness in the respective scripts considering features described in related work (Goel et al. 2019; Miehle et al. 2022). This was generally achieved through introduced or removed hedging/probability terms, or softer or more tentative language (see table 4).

After the text style of the scripts was changed, two further small changes were made: adding a topic introduction clarifying the topic of the interview, and removing parts where the agent asks for a confidence rating from participants, as we wanted to measure participant confidence alongside motivation before and after each interaction, like similar studies (Olafsson et al. 2019, 2020). The agent still asked participants about their confidence as this is an important element of the MI session, but did not elicit a rating of their confidence.

To represent the agent visually, a Reallusion Character Creator 4 avatar was deployed in the Unity game engine. A female-appearing avatar 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). She was given a neutral-sounding voice with an Irish accent using ElevenLabs text-to-speech, natural blinking and lip sync in Reallusion iClone 8, and baseline upper body-only gestures and motion which are linked to agent speech using CaMN (Liu et al. 2022).

As GA has been associated with indirect utterances, we designed the more indirect agent to avert her gaze while speaking. We used the same proportion of GA found in indirect replies in human-human conversations (0.44) (Chu et al. 2023). Each GA lasted 3.5s, matching the average duration for GAs during cognitive events (Andrist et al. 2013). Therefore, there were 24 GAs in total. These were set to occur in line with more indirect language.

3.2. Experiment Design

We designed a within-subjects human-interaction study to test our hypotheses, using a Wizard-of-Oz (WoZ) interface to simulate conversations with a responsive agent while ensuring the experience was controlled. We recruited 40 participants (24f/15m/1nb, 4 aged 18-24, 29 aged 25-34, 5 aged 35-44, and 2 aged 45-54) from local communities to achieve 80 per cent power. All participants were over 18 and fluent English speakers; 16 were native speakers. For further analysis, we grouped participants into two age categories, 18-34 and 35-54.

The experiment took place in a room on campus (see figure 2). Participants were given a short document explaining the details of the experiment and signed an informed consent document which was more detailed. Participants were briefed that they would have motivational conversations with a virtual agent,

but were not made aware of the indirect or direct conditions, or that the agent would be controlled through a WoZ-mediated system until debriefing. This project was approved by the research ethics committee of our institution.

Two topics were used to avoid repetition effects: healthy eating and screen use. These topics were selected as broadly applicable to many people, easing recruitment. The order of condition and topic was random to avoid order effects. Every participant had one conversation about each topic. Participants filled out questionnaires before and after each interaction. The researcher left the participant alone in the room during both conversations. The experiment typically lasted around 45-60 minutes per individual, with each interaction usually lasting between 5-15 minutes.



Figure 2: *Experiment setup*

3.3. Measurements and Questionnaires

The pre-interaction questionnaire recorded basic demographics, readiness to change for each topic (similar to Olafsson et al. (2020)), familiarity with virtual humans, modified Technology Acceptance Model (TAM) scale (Gagnon et al. 2012; O'Mahony et al. 2024), motivation and confidence for behaviour change before the interview for the first topic. The mid-interaction questionnaire contained motivation and confidence to change behaviour after the interview for the first topic, a general agent ratings questionnaire (Olafsson et al. 2019), and motivation and confidence for behaviour change before the interview for the second topic. The post-interaction questionnaire recorded motivation and confidence to change behaviour after the interview for the second topic, a general agent ratings questionnaire, validation questions to measure if participants noticed/were distracted by the GA, or noticed the difference in indirectness between conditions, and a general feedback text box.

4. RESULTS

Firstly, the overall effectiveness in increasing motivation and confidence was tested with two *t*-tests. Overall, there was a positive average effect from the interviews. There was a statistically significant ($t(79) = 5.69$, $p < .0001$) positive increase in confidence ($M = 0.80$, $SD = 1.26$) (assuming a change of zero if participants had not taken part in the interview). There was a minor average increase in motivation ($M = 0.15$, $SD = 1.01$), though it was not statistically significant ($t(79) = 1.33$, $p = .1868$).

We used related samples *t*-tests and a linear mixed model to determine if there were statistically significant differences in the change in motivation and confidence within the more direct and more indirect conditions. The mean change in motivation was equal across the more direct ($M = 0.15$, $SD = 1.00$) and indirect ($M = 0.15$, $SD = 1.03$) conditions. Therefore, the first hypothesis was rejected, as no significant difference in motivation was found between conditions. The mean change in confidence was greater for the more direct condition ($M = 0.90$, $SD = 1.50$) than the more indirect condition ($M = 0.70$, $SD = 0.97$). However, the *t*-test result did not reach statistical significance $t(39) = .7587$, $p = .4526$; therefore, hypothesis two is currently unproven without controlling for other factors.

4.1. Gender

When considering mean changes in confidence across genders, there appears to be an interaction effect between gender and the experiment conditions. The direct condition increased confidence in female participants ($M = 1.12$, $SD = 1.57$) by more on average compared to male participants ($M = 0.53$, $SD = 1.41$). Within female participants, direct was also more effective than indirect ($M = 0.71$, $SD = 0.95$) (see table 1, figure 3). As there was only one non-binary participant in the study, no conclusions were able to be drawn on how the experiment conditions affected them compared to other genders.

Table 1: *Change in motivation and confidence means (and standard deviation) by gender and condition*

Condition	Men	Women
Overall	0.60 (1.22)	0.92 (1.30)
Direct	**0.53** (1.41)	**1.12** (1.57)
Indirect	0.67 (1.05)	**0.71** (0.95)

4.2. Effect of Starting Motivation and Confidence

Generally, across motivation and confidence, there appears to be an inverse relationship between the starting value and change value for each metric (see

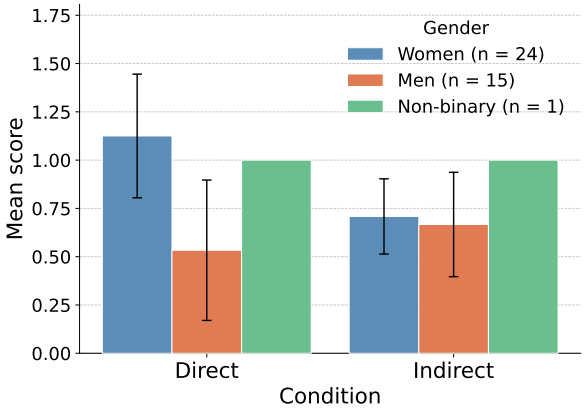

Figure 3: *Gender means and standard error*

table 2). Moreover, starting motivation (*M* = 5.05, *SD* = 1.42) was generally higher than starting confidence (*M* = 4.34, *SD* = 1.40), which may have influenced the lower change in motivation scores.

Table 2: *Motivation and confidence by starting level (I = number of interactions)*

Group	Motivation I	Motivation Mean	Confidence I	Confidence Mean
All	80	0.15	80	0.80
< 6	46	0.52	59	1.14
< 5	26	0.77	45	1.38
< 4	12	1.00	23	1.74
< 3	5	0.40	8	2.75

4.3. Linear Mixed Model Regression

To investigate the effect of the conditions (direct and indirect) on change in confidence while controlling the other factors, linear mixed model regression was used (see table 3). Change in confidence was used as the dependent variable, participant as a grouping variable, condition ("I" = Indirect) as a fixed effect, and the interaction between condition and gender ("W" = women), demographics (gender, native language, age group), topic, order, and starting confidence as controls. All variables were binary categorical, other than starting confidence, which was treated as numerical, and participant. Change in confidence was a discrete variable [-6, +6] but was modelled as continuous. The one non-binary gender participant was removed from this stage of the analysis as it would otherwise introduce another variable in the model for one participant.

Residual spread did not differ significantly between order positions (Levene's test: p = .4475), indicating no order-related heteroscedasticity and supporting the independence assumption. Assumptions of normality were supported by a Q-Q plot. Residuals plotted against fitted values showed a roughly constant spread with no funnel pattern, consistent with homoscedasticity and linearity. Variance inflation factors for all fixed-effect predictors were below 4.0 indicating no problematic multicollinearity. Residuals plotted by participant showed no evidence of systematic bias. Random intercepts were approximately normally distributed, as indicated by a Q-Q plot and a Shapiro-Wilk test (W = 0.99, p = .9190). Random intercepts showed no evidence of systematic association with participant-level predictors (gender, native language, age group); mean intercepts were near zero and residual spread comparable across groups. After controlling for the other factors, a statistically significant effect of condition on change in confidence (β = 0.77, p = .0225) supported the second hypothesis. Furthermore, there were statistically significant effects of the interaction between gender and condition (β = -0.98, p = .0231), and gender (β = 1.05, p = .0018) on change in confidence. Starting confidence also had a statistically significant effect (β = -0.63, $p < .0001$).

Table 3: *Mixed effects model results*

	Coef.	S.E.	$P > \|z\|$
Intercept	2.70	0.51	$< .0001$
Cond.[I]	0.77	0.34	**.0225**
Native lang.[non-eng.]	-0.22	0.26	.3936
Gender[W]	1.05	0.33	.0018
Age group[younger]	0.36	0.32	.2487
Topic[screen use]	-0.27	0.20	.1850
Order[second]	0.11	0.21	.5906
Cond.[I]:Gender[W]	-0.98	0.43	**.0231**
Starting confidence	-0.63	0.09	$< .0001$
Group Var	0.17	0.21	

4.4. Other

To validate the perception of our GA stimuli, at the end of the second conversation we asked participants if they noticed the agent's GA during their last interaction. As the order of the indirect condition (the condition containing GA) was random, approximately half of the participants were expected to respond with "yes", and half with "no". "Unsure" was also an option. 24 participants responded as expected, 11 were unsure, and 5 responded unexpectedly. Of the participants who noticed the agent's GA in their last interaction and were expected to, 2 found it to be distracting, 11 did not, 3 responded "maybe", and 1 was unsure. Overall, the conversation with the more indirect agent (*M* = 3.10, *SD* = 1.15) was rated more natural than with the more direct agent (*M* = 2.83, *SD* = 1.15), using a 5-point Likert scale.

5. DISCUSSION

The results revealed that the direct and indirect conditions had a significant effect on MI effectiveness with respect to confidence, supporting the second hypothesis. This effect was influenced by participant gender, consistent with prior work showing agent characteristics interact with user traits to shape outcomes (Nass and Lee 2000). The direct agent was more effective in increasing confidence in women, and the indirect agent was more effective with men. This finding is consistent with other literature; user traits can be used to personalise systems to users to improve their effectiveness (Arazy et al. 2015). Furthermore, participants in a related study advocated for the MI agent to be more personalised, including based on gender (Olafsson et al. 2019).

Overall, the direct condition was more effective, which aligns with our previous work which found that a direct agent was preferred by participants to a warmer agent (based on general agent ratings) (O'Mahony et al. 2024). Other works on directness in (non-embodied) conversational agent communication style generally find that one style is preferred, or more effective for the task, though which style varies by individual and by task (Miehle et al. 2016, 2018b; Zhang et al. 2021). Therefore, it is important to investigate the impacts of directness in communication style for the specific task, and this work was the first for MI ECA effectiveness. Our result supports previous work which found that directness was preferred by participants overall, and women sometimes had a further preference towards directness (Miehle et al. 2018b). However, this depended on participant culture, which we did not control for. Other work has similarly shown that culture affects directness (Miehle et al. 2016; Pang et al. 2024), calling for further work to investigate this phenomenon in an MI ECA context.

No evidence for an effect of directness or indirectness on change in motivation was found. Therefore, the first hypothesis was rejected. However, overall, a notably smaller change in motivation compared to confidence was observed. This may have been influenced by many participants having high starting motivation, which had an inverse relationship to change in motivation. Typically, in a real-world scenario, participants with high starting motivation or confidence would not seek out an MI session to change their behaviour. These participants may have already been in a more advanced stage of change for an MI session to be as effective according to the transtheoretical model of behaviour change (Prochaska and Velicer 1997), especially since the agent's script was not designed to adapt to the user's stage (Galvão Gomes da Silva et al. 2020).

6. CONCLUSION

A Motivational Interviewing Embodied Conversational Agent was designed with two communication styles: more direct and more indirect. This was achieved by varying the level of indirectness in the agent's language using a Large Language Model, and whether gaze aversion, a non-verbal behaviour associated with indirectness in communication style, was included. Then, a Wizard-of-Oz human-avatar interaction study was conducted with a within-subjects design to investigate the impact of directness in communication style on Motivational Interviewing effectiveness. A statistically significant effect of communication style on change in confidence was found, and the more effective style differed across gender: more direct for women, and more indirect for men.

The study has shown that controlling the level of directness in an MI ECA can have a positive impact on MI effectiveness. However, there are limitations. The average effect is relatively small, a little under one Likert-scale value. However, a communication style change is relatively subtle, and as emerging technology makes style easier to control, there is a strong argument for its benefit. Due to project constraints, participants were only recruited for one brief MI (per topic). Real-world participants may have multiple MIs to increase their motivation and confidence for behaviour change. As set scripts were used to keep the interactions more controlled, the agent was not able to adapt well to user responses or tailor the interview to the individual's stage of change, which could have improved effectiveness overall.

Future work will focus on exploring the effects of direct and indirect communication styles on MI effectiveness using a more adaptive dialogue framework allowing a wider range of language manipulations and more natural interactions that can adapt to participant stage of change. In addition, more dimensions for personalisation will be investigated to further enhance effectiveness, including culture, which prior work suggests has a notable relationship with directness.

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A. TEXT EXAMPLES

Table 4: *Script text variation excerpts*

More Direct	More Indirect
Given all this, what goal would help you get these positive changes?	So, thinking about all this, what goal might help you move toward these positive changes?
Let's make this specific—what steps will you take, and when? What's the first step?	Let's see if we can make this as specific as possible—what steps would you likely need to take, and when. What would be the first step?
Summarise what's likely to get better if you change your behaviour.	Try summarising the things that seem likely to get better if you change your behaviour.

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