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The science of speaking with your eyes

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Credit: Yoshiyoshi Hirokawa/Getty Images

Making eye contact is an integral part of social communication, but a new study reveals that choosing *how* and *when* to do so is just as important in understanding and responding to others.

"We found that it's not just how often someone looks at you, or if they look at you last in a sequence of eye movements, but the context of their eye movements that makes that behaviour appear communicative and relevant," says Dr Nathan Caruana, a cognitive neuroscientist at Australia's Flinders University and lead author of the study published in the journal *Royal Society Open Science*.

The findings could allow researchers to design virtual avatars and social robots which are capable of natural and intuitive interactions with humans. It could also help better support people to communicate with each other.

"These subtle signals are the building blocks of social connection," says Caruana.

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"By understanding them better, we can create technologies and training that help people connect more clearly and confidently."

Caruana and colleagues asked 137 participants to complete a virtual activity where they were tasked with deciding whether a simulated avatar was inspecting, or requesting help to retrieve, one of 3 objects to its side. The only clues to inform this decision were the virtual partner's gaze, which jumped between the participant and object in various sequences and durations.

They found that people were most likely to interpret gaze as a call for help when it was done in a specific sequence: looking at an object, making eye contact, then looking back at the same object. “What’s fascinating is that people responded the same way whether the gaze behaviour is observed from a human or a robot,” adds Caruana.

The authors suggest that the “repetitive display of averted gaze, in combination with eye contact, can signal intentionality or interest in a potential locus of joint attention”.

However, it’s unclear whether this is also the case without the use of eye contact: “That is, when an agent repeatedly looks at an object before and after looking at another object, instead of making eye contact,” the authors write.

In each trial, participants decided whether to 'give' the agent one of the 3 blocks or nothing at all, using the arrow keys on a standard keyboard. Credit: Caruana et al 2025, Royal Society Open Science, https://doi.org/10.1098/rsos.250277

"Future work that separately manipulates these perceptual factors of averted gaze repetition, with and without eye contact, would help fully elucidate their independent and shared influence on perceptions of communicative intent."

"Our findings have helped to decode one of our most instinctive behaviours and how it can be used to build better connections, whether you're talking to a teammate, a robot or someone who communicates differently," says Caruana.

"It aligns with our earlier work showing that the human brain is broadly tuned to see and respond to social information and that humans are primed to effectively communicate and understand robots and virtual agents if they display the non-verbal gestures we are used to navigating in our everyday interactions with other people.

“Understanding how eye contact works could improve non-verbal communication training in high-pressure settings like sports, defence, and noisy workplaces. It could also support people who rely heavily on visual cues, such as those who are hearing-impaired or autistic.”

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