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Movement signatures: how we move, gesture and use facial expressions could be as unique as a fingerprint

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Scientists discover that individual movement patterns—from facial expressions to walking styles—may form a unique "motion fingerprint" that reveals personal identity, offering insights into how we recognize and distinguish people through their distinctive bodily movements.

By Karen Lander, University of Manchester

The way someone walks, talks, smiles, or gestures gives a clue to who they are. Whether through the flick of an eyebrow, the rhythm of our walk, or the tilt of a head, movement speaks volumes.

And my recent paper shows that people may have their own movement fingerprint. This is a style of movement that is characteristic of a person's identity. So, someone who uses expressive facial gestures might also speak with animated hand movements or walk with a lively gait. These consistencies could form a motion fingerprint that is unique to the individual.

First, let's explore how faces move and why this matters.

Everyone has their own style of moving their face, for example, how they raise an eyebrow, purse their lips, or squint when laughing. These patterns of movement help us recognise familiar people even when visual quality is poor – such as in low lighting or from a distance. And as a person becomes more familiar to us, we become tuned to the way they move, learning

their unique patterns of motion, just like we remember their face or voice.

Human faces are constantly in motion; they blink, smile, grimace and talk, to name a few movements. Researchers categorise facial motion into rigid movements (such as turning or nodding the head) and non-rigid movements (like expressing emotion or speaking). It's the non-rigid movements that tend to be most personally distinctive.

The way we gesture with our hands, shift our posture and tilt our heads all carry identity information. Gestures are often shaped by personal habits or cultural norms, for example, someone might habitually nod three times when agreeing, or use a distinctive hand wave common in their home country.

Facial movements are synchronised with the way we sound. When we talk our face plays a role in shaping the sound of our voice. For example, if you talk with a wide open mouth, your speech sounds deeper and richer. Studies show that people can match other people's voices to moving faces more accurately than to static ones. This suggests that dynamic cues to identity are present in the movement of the face and the sound of the voice.

People with face recognition difficulties (those who are "face blind" or prosopagnosic) may be better at recognising moving faces than still ones. Typically, people who are face blind can see faces and the differences between them, but struggle to link the face to a specific person. Here, idiosyncratic information from movement can provide an additional clue to identity.

Gait, a person's walking style, is one of the most studied body movements. Early research, such as a 2005 study, investigated participants' recognition of identity from gait using point-light displays. In this case, bright spots (lights) were placed on key areas of a person's body. All other visual cues were removed. Participants could only see bright spots against a dark background. The study found participants could tell fairly well who someone was from the way the spots moved.

Characteristics such as stride length, limb movement, posture, and pace form a consistent motion pattern that is unique and surprisingly difficult to fake, making gait analysis a reliable clue for identifying people.

Movement fingerprints

My review brought together evidence from behavioural and

brain imaging studies to consider if such consistencies between different types of motion exist and how we might explore this phenomenon further. The paper proposes that people have an overall style of movement.

More work needs to be done to find direct evidence of movement fingerprints. For example, we still aren't sure what part of the brain processes these movement-based identity cues.

So far, research shows that the posterior temporal sulcus – an area of the brain located roughly above your ear on each side – responds not just to faces and bodies, but to how someone moves more generally. This area is active when we hear voices or see people speak, suggesting it may help link motion and sound. Also, this region plays a key role in allowing us to understand our social world, interpreting other people's actions, determining where they are looking, and picking up on social cues such as gestures, facial expressions and changes in gaze direction.

However, it's probably just one part of a larger brain network involved in recognising others through motion.

Real-world applications

Motion-based identity traits aren't as stable or specific as fingerprints or DNA. They're what researchers call soft biometrics: useful but not always accurate.

But as we better understand the link between motion and identity, exciting real-world applications are emerging.

Motion analysis could support contactless identity verification from gait-based authentication at airports to gesture-based identification in smart environments, such as homes, that respond to a user's unique movement patterns. In clinical settings, movement analysis might help support people with social cognition impairments, face recognition or movement issues. For example, helping a doctor identify changes in the way a patient produces non-verbal cues.

But many questions remain. We still aren't sure how consistent motion fingerprints are as someone gets older and in different contexts. Individual differences in people and environmental factors like lighting, clothing, or stress could affect them.

Researchers also aren't sure how exactly we manage to understand all this movement in everyday life without even thinking about it.

Figuring this out could not only help improve technologies like social robots and develop tools for people with recognition and communication difficulties, but also tell us more about how we process and react to other people.

Image: What do you think your movement fingerprint looks like? Studio Romantic/Shutterstock

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