No two are the same: Body shape *is* part of identifying others

A commentary on: Downing & Peelen, 2011, Cognitive Neuroscience

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Abstract

Downing and Peelen argue for a clear distinction between body and identity representation, with the former performed by EBA and FBA, and the latter performed elsewhere in the brain. Under a predictive coding account, we argue that this separation is unnecessary: representing bodies *is* part of representing identity. Whilst neurons in EBA and FBA may only code for body shape and posture, we propose that they are a part of a reciprocally connected cortical network that functions to minimise prediction error when making identity inferences. We propose a novel way to test the hypothesis that EBA and FBA are critically involved in person identification.

Downing & Peelen offer a 'cognitively unelaborate' interpretation of research examining EBA and FBA. The authors argue "*the role of these regions [EBA and FBA] consists in creating a perceptual representation of the shape and posture of the body and its parts, which may then be used by other brain regions (e.g., the anterior temporal lobes; Kriegeskorte et al., 2007) to represent person identity explicitly*" (page 10). Such a proposal assumes that the coding of physical features is separate from a process that determines identity. However, the authors allow for exchange between these distinct processes (and brain regions). For example, "*Note that our account does not exclude the possibility that responses in EBA and FBA can be influenced by identity through top-down modulation: the sight of a romantic partner (or, indeed, the self) may increase responses in EBA/FBA due to increases in attention and arousal*" (page 11). Under this framework, it appears that body processing in extrastriate cortex is *not* part of a "who" system involved in person identification (Geogieff & Jeannerod, 1998), but rather supplies input to it by passing on body shape and postural information. This implies that body-shape and posture are not part of so-called "higher-level" identity processes. Rather, EBA and FBA neurons code physical features in an agent-blind manner; that is, they do not contribute to differentiating between identities.

Whilst we agree that current evidence does not support an interpretation beyond coding of physical features, we propose that EBA and FBA *do* play a critical role in understanding identity by being part of a network of reciprocally connected neural regions, which 'bias' the neural signals involved in making identity inferences. To illustrate this point, we revisit the 'romantic partner' example (page 11). When a romantic partner walks into a room, coding of her physical features in EBA and FBA, such as a small head and skinny arms, would bias a "who" system towards supporting an inference about the person being a romantic partner, rather than a different acquaintance (with a distinct body shape). This biasing process is similar to the predictive coding account of action perception, which hypothesises that the brain relies upon Bayesian models to predict how an action should unfold across time, based on prior experience (Kilner, Friston, & Frith, 2007). Perceiving a body shape that matches your romantic partner's does not mean it is *definitely* your romantic partner, but based on your prior experience with the perceived body shape, it is statistically more likely to be your partner than another person. In other words, whilst neurons in EBA and FBA may code only body shape and posture, in doing so they contribute to reducing prediction error throughout a reciprocally connected network of brain regions, which together determine one's current identity inference. Importantly, EBA and FBA only generate part of the biasing signal, which contributes to making an identity inference; one must link this signal with additional biasing signals that relate to other prior person experiences, such as accent, gait, clothes, hair style etc., which we agree likely occurs elsewhere in this cortical network, beyond EBA and FBA.

To test whether EBA and FBA are involved in identifying "who" somebody is according to a predictive coding framework, we suggest that standard neuroimaging experiments lack the sensitivity to address this issue (e.g., Hodzic, Muckli, Singer & Stern, 2009) and instead advocate the use of causality mapping techniques, such as dynamic causal modeling and granger causality mapping. In a neuroimaging experiment where participants must identify familiar and unfamiliar bodies, causality mapping would enable the flow of information processing to be traced from occipitotemporal areas to anterior regions (e.g., anterior temporal lobes), and the inverse direction. If EBA and FBA do indeed play a role in identifying "who" somebody is, differential directional flow between these regions should emerge when identifying familiar vs. unfamiliar bodies. For example, when perceiving familiar individuals there may be more information flow "backwards" from anterior to posterior brain regions, reflecting a top-down biasing signal based on prior information about the person. In contrast, when perceiving unfamiliar individuals there may be more information flow "forwards" from posterior to anterior brain regions, reflecting more bottom-up processing of body-shape and posture.

In summary, Downing & Peelen imply that body-shape and posture are coded independently from identity, as identity only involves what the authors' label as 'higher-level processes'. Whether labeled high- or low-level, we argue that unique features of a person's body contribute to knowing who a person is. Moreover, we suggest that EBA and FBA are part of a cortical network of brain areas that rely upon Bayesian models to predict likely identity based on prior person experience. As such, rather than being agnostic about identity, EBA and FBA are integral nodes of a "who" system for making identity inferences. We suggest a worthwhile pursuit at this stage would be to employ more sensitive neuroimaging measures to determine whether EBA and FBA might assist with body identification according to a Bayesian framework of predictive coding.

References

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