Response to Majid: Neurocognitive and Cultural Approaches to Odor Naming are Complementary

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Over the past few years, several studies have investigated the neural pathways and mechanisms underlying olfactory lexical processing. In a recent review, we provided a synthesis of behavioral and neuroimaging work pertaining to odor-source naming and identification, primarily in English speakers [1]. In a separate line of research, Dr Majid and colleagues have documented how odors are described among Maniq and Jahi speakers from the Malay peninsula. An important topic concerns whether the neural organization of language is causing the observed limitation in odor-source naming, or whether this phenomenon merely reflects a lack of priority to odors in our western culture. Thus, we welcome Dr Majid’s commentary on this issue [2].

Three arguments run in parallel in Dr Majid’s commentary. First, she assumes that odors are essential properties of objects (i.e., similar to colors) rather than objects per se (e.g., ‘popcorn’ is an object identifiable through sight, sound, or smell). However, the literature supports our object-based approach to odor-source naming. Objects (e.g., the smell of ‘popcorn’) constitute building blocks of perception and provide the input to lexical systems for source naming. The striking mechanistic similarities between human and rodent data [3] and between vision, audition, and olfaction [4] lead us to believe that odors are universally encoded as objects. Odor properties, such as pleasantness or edibility, are likely secondary features, and need to be derived from the odor object representation [5]. Furthermore, the object-centered approach is promising because it fits with our understanding of odor identification deficits in patients with neurological disorders [6,7].

Second, Dr Majid states that a cross-cultural perspective is necessary to enable an understanding of the nature of olfactory language, whereas other approaches will be insufficient. In fact, universal odor object mechanisms are fully compatible with evidence of cultural flexibility in their interactions with language. For example, cultures that prioritize olfaction might retain object-based perception, but might additionally develop mechanisms that allow for linguistic generalization across objects. Thus, results emanating from odor object source identification and naming should not be conflated with, or refuted by, results emanating from other methods of perceptual or semantic analysis [2]. There is evidence that perfumers and enologists in western countries learn designated odor terms and categories well beyond those present in everyday language [8]. Neuroimaging evidence indicates a corresponding increased thickness of the orbitofrontal gyrus, a key region for odor object identification [1,9].

Might similar effects be shown in speakers of Jahi and Maniq? We hypothesize that the hunter-gatherer populations described by Dr Majid would excel in utilizing source descriptors to name and identify odors, although more research is needed.

Third, Dr Majid suggests that neuroscientific studies have limited relevance for understanding olfactory language, writing that ‘Mapping the neural processes for odor naming cannot explain why speakers of different languages talk about and think about odors in such different ways’ [2]. This position discounts the wealth of neuropsychological insights regarding perception, cognition, and language. The recent emergence of functional magnetic resonance imaging (fMRI) multivariate pattern-based techniques [10] to characterize how, rather than where, information content is encoded in the human brain, could offer powerful ways to test some of the assumptions put forward by Dr Majid; for example, whether the apparent cultural distinctions in odor naming are reflected in qualitatively distinct pattern representations in the odor-language network.

In sum, we believe that neurocognitive and cross-cultural approaches offer complementary insights into olfactory language interactions. Research on odor-source naming in western populations has accumulated a critical mass of data allowing for a mechanistic synthesis of perceptual, cognitive, and neural processes. To date, methodological variations and scarcity of replicated experimental results from hunter-gatherer populations prevent us from drawing firm conclusions regarding cultural universality or biological causality. We welcome further explorations that might bring clarity to these outstanding issues.

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References


Forum

Moral Perception

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Based on emerging research, we propose that human perception is preferentially attuned to moral content. We describe how moral concerns enhance detection of morally relevant stimuli, and both command and direct attention. These perceptual processes, in turn, have important consequences for moral judgment and behavior.

Morality Shapes Perception

We propose that morality shapes perception. While it seems unequivocal that moral content colors our interpretations of situations [1,2], we hypothesize that the influence of moral concerns reaches deeper, shaping what we see and how we come to see it. In particular, moral content has been shown to influence two stages in the perceptual processing stream: moral content is (i) readily detected and (ii) both commands and drives attention (Figure 1). The role of morality in perception is especially important given recent evidence that perceptual processes influence judgments of wrongness, blameworthiness, and even legal punishment decisions [3].

Detecting Moral Stimuli

‘Detection’ is a basic element of perception; a stimulus must be detected for it to reach conscious awareness. The visual system is closely integrated with other parts of the brain, allowing people to segregate significant from mundane stimuli [4]. For instance, recent research suggests that moral concerns might enhance the detection of visual cues. Moral emotions, such as disgust, can tune perception towards the light end of the light–dark spectrum due to moral concerns regarding purity. Specifically, individuals high in trait disgust sensitivity and people exposed to disgusting stimuli are selectively better at detecting a digit presented one shade lighter than the background color [5]. Although this work does not test the effect of morality directly, it does suggest that moral emotions, such as disgust, can alter detection.

Recent research has shown that the visual system is preferentially sensitive to moral content. Specifically, people correctly detect moral words (e.g., kill, moral, should) with greater frequency than non-moral words (e.g., die, useful, could) – a phenomenon termed the ‘moral pop-out effect’. Importantly, the moral pop-out effect is only observed when words are presented ambiguously, near the threshold for perceptual awareness (i.e., halfway between chance and complete accuracy). Not only are the moral and non-moral words similar in length and language frequency, evidence suggests that the moral pop-out effect is not due to differences in the reported intensity, extremity, or arousal of the stimuli [6]. The moral pop-out effect provides initial evidence that perceptually ambiguous moral content reaches conscious awareness more readily than non-moral content, requiring fewer perceptual prerequisites.

Immoral social actions have also been shown to determine the detection of faces. Using binocular rivalry, researchers presented different images to the left and right eye simultaneously (e.g., a house and face), creating ambiguous input, which the mind reconciles by perceiving alternating images (e.g., first seeing a face, then a house). Neutral faces paired with ‘negative’ social actions (e.g., throwing a chair at his classmate) dominated visual awareness relative to faces paired with ‘positive’ (e.g., helping an elderly woman cross the street) or ‘neutral’ (e.g., passing a man on the street) actions [7]. Taken together, moral concerns appear to enhance detection for words, faces, and even minor deviations in color (for more, see Box 1).

Moral Concerns Tune and are Tuned by Attention

At any given moment, it is critical to be able filter and prioritize relevant information in a cluttered visual field. To maximize information processing, low-level features drive attention, and people tune attention (intentionally and unintentionally) toward motivationally relevant aspects of the environment. ‘Attention’ heightens sensitivity to a particular aspect of the visual field and has downstream consequences for what we see and how we interpret our surroundings. According to Just World Theory, people have a need to believe that they live in a world where people get what they deserve. In one study, people listened to auditory scenarios about protagonists acting in morally good (e.g., making dinner for his exhausted wife) or bad (e.g., demands his exhausted wife make him dinner) ways. Before revealing what happened next, participants were given a preview of two possible outcomes for the protagonists: a good one (e.g., a successful business contract) and a bad one (e.g., a terrible car accident). People’s eye gaze

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