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Letter

See for Yourself: Perception Is Attuned to Morality

Ana P. Gantman[1] and Jay J. Van Bavel[1,*]

Perception appears preferentially attuned to moral content [1]. Despite the centrality of both morality and perception in cognitive science, little work has attempted to bridge these fields. Research on moral perception has the potential to inform our understanding of morality and perception, and may have important consequences for policy.

Firestone and Scholl recently argued that moral perception does not exist [2]. They claimed that moral perception is not about morality, that evidence of moral perception reflects visual processing 'in a trivial and unexciting sense', or does not pertain to perception [2]. We list the evidence for their claims below and invite you, the reader, to be the judge.

Isn't that Morality?

The stimuli from previous research that Firestone and Scholl claim 'do not invoke morality', include hitting a small child, making a racist comment, and defecating on a crowded street [3]. Extensive evidence suggests that actions such as these shape judgments of moral character [4], but perhaps we have to agree to disagree with Firestone and Scholl.

Isn't that Interesting?

Firestone and Scholl assert that it is 'unexciting' to know that people who learn about a character's bad actions subsequently attend to depictions of bad outcomes because they expect justice [5]. They asserted 'it can hardly be a new or bold claim that people look at what they expect'. While we agree that the relation between moral concerns and attention is mediated by basic cognitive processes, such as expectations, we disagree that this is 'trivial and unexciting'.

The goal of cognitive science is building process-oriented models. Instead of dismissing this research, we humbly submit that more work should focus on the processes underlying morality. This approach seems especially important in domains such as conflict resolution and legal decision-making [6,7].

Are These Phenomena Analogous?

We also disagree with Firestone and Scholl's [2] interpretation of the moral pop-out effect. We found that people correctly detect moral words (e.g., kill) more frequently than non-moral words [e.g., die; matched for length and frequency (http://corpus.byu.edu/coca/)], but only when the words were presented near the threshold for awareness (~40–60 ms; [8]). Moreover, the moral pop-out effect remained after adjusting for ratings of word valence, emotionality, and intensity. We suggested that moral words more readily reached perceptual awareness compared with non-moral words.

Firestone and Scholl [9] recently successfully reproduced the moral pop-out effect, and allegedly similar fashion and transportation pop-out effects. They argued that moral pop-out can be fully explained by semantic priming because 'relatedness is the key factor in such effects, and thus that memory, not perception, improves detection of morally related words' ([12] p. 43). Their claim hinges on similarities between morality and fashion and/or transportation pop-out effects. However, they did not randomly assign participants to detect moral versus fashion and/or transportation words; neither did they obtain sufficient power to test their claim that these other semantic categories show 'entirely analogous' effects to morality ([9] p. 411). As such, any comparisons they made between moral versus fashion and/or transportation effects seem speculative.

To test for semantic priming, they predicted that 'moral words (e.g., crime) may be easier to detect when presented in the context of other moral words (e.g., guilty)–whereas random non-moral words (e.g., steel) are no easier to detect in the context of other random words (e.g., tired)' [2]. The authors predicted that fashion and/or transportation words were easier to detect when presented in the context of repeated fashion and/or transportation words ($M = 81.3\%$) compared with nonrepeated fashion and/or transportation words ($M = 76.0\%$), whereas random control words were no easier to detect in the context of other control words ($M = 74.8\%$) compared with nonrepeated control words ($M = 72.7\%$) [9]. Thus, fashion and/or transportation words do appear more related to one another than do control words.

Curiously, however, Firestone and Scholl did not report the analogous means for their morality study, despite the fact that it was central to their hypothesis (which we quoted above). We are keen to see these values in print.

It is trivially true that semantic memory is implicated in moral word detection as humans learn what stimuli are relevant to the moral domain via acculturation

[10,11]. However, it seems that the burden of proof is on Firestone and Scholl to design and fully report a study that demonstrates how fashion and/or transportation pop-out is 'entirely analogous' to moral pop-out.

Concluding Remarks

We leave it to you, the reader, to evaluate Firestone and Scholl's claims. We fail to see how hitting a small child does not pertain to morality, knowing that expectations of justice affect attention is unexciting, or formal claims about similarity can be made without randomly assigning people to conditions or even presenting similar data. Clearly, moral perception is a provocative topic. Perhaps the only thing we can agree on is that more research is needed.

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Forum

Neural Antecedents of Spontaneous Voluntary Movement: A New Perspective

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Fifty years ago, Kornhuber and Deecke first reported their discovery of the *Bereitschaftspotential* [1], or cortical **'readiness potential' (RP)** (see Glossary), a slow build-up of scalp electrical potential preceding the onset of subjectively spontaneous voluntary movements (SVMs). The RP was interpreted as 'the electro-physiological sign of planning, preparation, and initiation of volitional acts' [2], implicitly presumed to reflect the consequence of a **decision** process in the brain. Then, in the early 1980s, Benjamin Libet found that the onset of the RP precedes subjective estimates of the time of the conscious 'urge' to move by 300 ms or more [3] – a result that has since been confirmed at the single-neuron level [4]. This counterintuitive discovery, which we call 'Libet's paradox', led to the view that the conscious decision emerges well after the action has already been initiated unconsciously in the brain, as reflected in the apparent build-up of the RP. While controversy over Libet's findings has churned vigorously for many years, crucial assumptions about the nature of the RP itself have gone unquestioned.

Now a series of new developments has begun to unravel what we thought we knew about the brain activity preceding SVMs.

Glossary

Bounded integration: also known as integration to bound or evidence accumulation, the term refers to a computational model of decision making wherein sensory evidence and internal noise (both in the form of neuronal activity) are integrated over time by one or more decision neurons until a fixed threshold-level firing rate is reached, at which point the animal issues a motor response. In the case of spontaneous self-initiated movement there is no sensory evidence, so the process is dominated by internal noise.
False-positive rate: how often we decide that a movement will occur when in fact it does not.
Neural decision to move: a neural event or state that commits some part of the body to an imminent movement. It is not necessary for this state to be conscious for it to qualify as a 'decision'.
Readiness potential (RP): originally dubbed the *Bereitschaftspotential* by Kornhuber and Deecke [1], the name refers to a slow build-up of scalp electrical potential, measured using (EEG) or electrocorticography (ECoG), preceding the onset of spontaneous self-initiated movements. When measured using magnetoencephalography (MEG) the build-up is referred to as a 'readiness field' and when measured as a change in firing rate in single neurons it is referred to as a 'readiness discharge'.
Time-unlocked forecasting: movement-locked data give us, at each time point $t - \tau$, the probability of the signal at time $t - \tau$ given a movement at $t0$: $p(S_{t-\tau}|M_{t0})$. Time-unlocked forecasting tells us the probability of a movement at time $t + \tau$ in the future given the signal now and in the recent past: $p(M_{t+\tau}|S_t, S_{t-1}, \ldots, S_{t-n})$.
True-positive rate: how often we decide that a movement will occur when in fact it does.

The main new revelation is that the apparent build-up of this activity, up until about 200 ms pre-movement, may reflect the ebb and flow of background neuronal noise, rather than the outcome of a specific neural event corresponding to a 'decision' to initiate movement. In particular, two independent studies, one using electroencephalography (EEG) recordings in humans [5] and the other using single-unit recordings in rats [6], have converged in showing that **bounded-integration** processes, which involve the accumulation of noisy evidence until a decision threshold is reached, offer a coherent and plausible explanation for the apparent pre-movement build-up of neuronal activity. Bounded integration or 'evidence