Commentary on Firestone & Scholl:

Behavior is multiply determined and perception has multiple components:

The case of moral perception

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Abstract: We introduce two propositions for understanding top-down effects on perception. First, perception is not unitary but composed of multiple components. Second, behavior is determined by multiple processes. We re-analyze Firestone & Scholl's (2014) own data, finding that it casts serious doubt on their claims that semantic priming fully explains moral pop-out. This case study underscores the importance of these propositions.

It's tempting to agree that top-down effects on perception (such as our own, *moral pop-out effect;* Gantman & Van Bavel, 2014) constitute a radical reinterpretation of a foundational issue (Firestone & Scholl, this issue). Unfortunately, we can't get excited about a notion of perception that excludes attention, inference, prediction, or expectation; this whittles the fascinating and broad domain of perception to sawdust. It is one thing to argue that the entire field of visual neuroscience is irrelevant to understanding human perception. It is quite another to dismiss evidence of re-entrant processing precisely *because* it is well-established ("whatever one thinks of the relevance," p.10). This renders their cognitive penetrability argument circular.

Firestone and Scholl define perception to "encompass both (typically unconscious) visual processing and the (conscious) perceptions that result" (p.4-5) as they "have the broader aim of evaluating evidence for top-down effects on *what we see* as a whole" (p. 7). Yet, they only consider perception that is separable from attention, and occurs prior to—and independently from—memory, judgment, and social and physical context. It is difficult to understand how this definition might include "*what we see* as a whole." Moreover, their dismissal of unconscious inferences in vision, cross-modal effects, re-entrant processing in neuroscience, and changes in perceptual sensitivity over time, carves the mind at false joints. Their model of the mind seems to mirror the administrative structure of psychology departments, manufacturing natural kinds of perception, cognition, and social processing.

There is no reason to believe that the architecture of the mind recognizes these distinctions. After perceptual input reaches the retina, multiple brain regions operate on this input, selecting the significant from the mundane (Lim, Padmala, & Pessoa, 2014),

often by emotion (Anderson & Phelps, 2001) motivation (Egner & Hirsch, 2005), attention and expectations (Summerfield & Egner, 2009), some via top-down re-entrant processes (Gilbert & Li, 2013; Clark 2013) to construct perceptual experience.

Thankfully, the crux of Firestone & Scholl's argument lies in their empirical re-explanations of a handful of case studies. These are falsifiable. We re-analyzed Firestone & Scholl's own data from their case study regarding the moral pop-out effect and find that it casts doubt on their claims (Firestone & Scholl, 2014). This undercuts not only their explanation for the moral pop-out effect but also their dismissal of other, unexamined, studies as "mere" memory effects. More generally, we ask whether this exposes a fundamental problem with their case study approach.

We previously reported that moral words were more frequently detected than non-moral words (matched for length and frequency), only when presented at the threshold for awareness (termed the moral pop-out effect, Gantman & Van Bavel, 2014; 2015a). The moral pop-out effect occurred over and above any differences in valence, arousal, or extremity. Firestone and Scholl claim that semantic memory is solely responsible for the moral pop-out effect because the moral words were more related to each other than the control words were. They claimed to find "entirely analogous" fashion and transportation pop-out effects.

Although Firestone and Scholl's (2014) argument hinges on similarities between morality and fashion/transportation pop-out experiments, any direct comparisons between studies is limited because participants were neither randomly assigned to experiments nor were any formal comparisons, which are highly underpowered (N = 180 for 80% power),

reported. Accordingly, Firestone and Scholl's inferences rely on merely looking at the data of the studies side by side and judging whether the effects in all three studies appear to be driven by same or different processes. Firestone and Scholl also presented evidence of a repetition advantage as a "telltale signature of semantic priming" (Firestone & Scholl, 2014; p. 413), however, they never reported the repetition means in their morality experiment. We present these means for the first time and show they flatly contradict Firestone and Scholl's empirical claims.

As predicted, the advantage for repeated fashion/transportation words (M = 81%, SD =21%) is greater than non-repeated category words (M = 76%, SD =20%), $t(39) = 2.60$, $p = .01$, and repeated control words (M = 75%, SD =20%) $t(39) = 3.10$, $p = .004$, and significantly different from zero, $t(39) = 2.60$, $p = .01$. However, when we re-analyzed Firestone & Scholl's own morality data, we found no evidence for their claim that moral words (e.g., *just*) were easier to detect when preceded by other moral words (e.g., *kill*; i.e., moral word repetitions), (M = 82%, SD =16%) either as compared to moral words preceded by control words M = 81%, SD =15%), $t(39) = .64$, $p = .52$, or compared to control words (e.g., *even*) preceded by other control words (e.g., *die*; i.e., control word repetitions) (M = 79%, SD =15%), $t(39) = 1.67$, $p = .10$, and the moral word repetition advantage is not significantly different from zero, $t(39) = .64$, $p = .52$ (see Figure 1). If anything, the difference between category and control word repetitions in the morality study is in the *opposite* direction of the fashion/transportation studies. These results appear to contradict Firestone and Scholl's claims that same process underlies fashion/transportation and moral pop-out effects.

Their argument hinges on the assumption that fashion/transportation words and moral words "pop out" by the *same* processes and fails to consider other influences on behavior. Any observed behavior can be explained by multiple processes intervening between perceptual input and motor response. A single process rarely explains any behavior; possible explanations are not always mutually exclusive. It is trivially true that semantic memory plays some role in the moral pop-out effect (how else would our participants know words like "kill" and "die"?), however, a simple re-analysis of Firestone and Scholl's own data appears to contradict their specific claim that semantic priming alone can explain the moral pop-out effect.

We take this to be a "case study of case studies" showing that dismissing an effect with a simplistic model of behavior likely falls short of the facts in *their own* experiments–and may in others as well. What happens if even one card is removed from a card-house of case studies?

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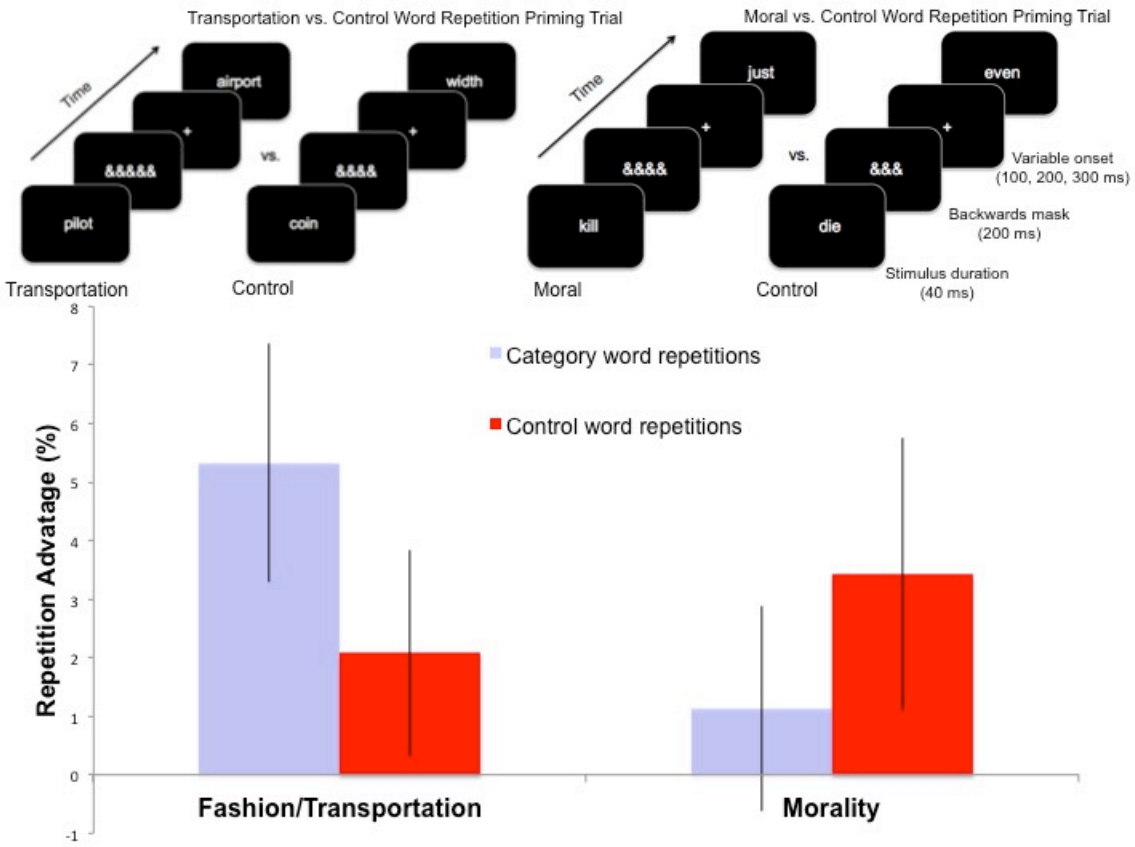

Figure 1. Same or different processes? On some trials, two consecutive word trials would be from the same group, constituting a *category word repetition* (e.g., two moral words in a row; see top left panel for sample transportation and control trials and top right for sample moral and control trials). If the same psychological processes give rise to moral vs. fashion/transportation pop-out effects, we would predict the same pattern of results in the two cases. Instead, *category word repetition advantage* appears to increases word detection accuracy for fashion and transportation —but not moral—words as compared to control word repetitions.