

## What Does the Brain Tell about Scarcity Bias? Cognitive Neuroscience Evidence of Decision Making under Scarcity

Wi-Suk Kwon, Gopikrishna Deshpande, and Jeffrey Katz, Auburn University, USA  
Sang-Eun Byun, University of South Carolina, USA

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**Justification.** Scarcity associated with a product or promotional offering enhances its desirability and perceived value (Brock, 1968), creating a sense of urgency (Byun & Sternquist, 2008), framing the transaction in the “loss” term (i.e., “If I don’t buy now, I will lose the opportunity”), and thus biasing decision making (Inman, Peter, & Raghurir, 1997). Prospect theory explains cognitive processing of gains and losses of choices under uncertainty and why people respond differently to similar transactions depending on whether the choices are framed as gains or losses (Kahneman & Tversky, 1979). This theory, however, tends to focus on economic gains/losses of a choice. While economic gains/losses are relevant to consumer decision making in scarcity conditions, this theory largely ignores the psychological aspect of a purchase decision associated with the symbolic and/or emotional meanings of possessing or using the product. Further, most of the existing research on scarcity effects has relied on self-report based data collection methods. Given that consumer decisions under scarcity tend to be made fast, driven by the scarcity-based urgency, consumers may find it difficult to comprehend or explain their decisions through self-reports and often end up justifying their decisions retrospectively. To address this methodological limitation of self-reports, this study employed a neural experiment utilizing functional magnetic resonance imaging (fMRI). Using brain activity and neural network metrics from fMRI scans of consumers’ brains at the moment of their purchase decision making under varying scarcity conditions, this study aimed at disentangling the cognitive and affective mechanisms of decision making under scarcity and exploring underlying psychological meanings of the gains/losses that consumers associate with a scarce offering.

**Method.** The fMRI experiment was conducted with 102 stimuli (34 product categories  $\times$  3 scarcity levels [high vs. low vs. no scarcity]). A series of pretests were conducted to identify 34 product categories which were gender neutral, commonly purchased by college students, and non-seasonal. For each product category, three visual stimuli were created to show the same promotional offering (40% off) with varying scarcity levels (“Today Only” for high scarcity, “1 Week Only” for low scarcity, “Always” for no scarcity; see Figure 1). A total of 12 subjects (6 males), recruited among students at a Southeastern university, participated in the experiment. Subjects laid still and supine inside the fMRI scanner and viewed the 102 visual stimuli, presented in random order. After viewing each stimulus, subjects indicated whether or not they would purchase the product, using a MR-compatible button box.

**Results and Discussion.** Results from the fMRI brain scan data revealed that self-related brain regions, such as the posterior cingulate, were more active as the scarcity level went up, providing neural evidence for the role of scarcity in elevating *symbolic value* information



**Figure 1.** Example scenarios for scarcity manipulations

processing. Symbolic values are associated with consumers' social cognition and desire for products that provide social benefits such as conveying their taste or status or enhancing their self-image (Keller, 1993). Further, when subjects decided to purchase (vs. not purchase) a scarce product, brain regions related to emotion (e.g., amygdala) were more active; whereas when they decided not to purchase a scarce product, brain regions involved in controlled processing were more active. Specifically, when a scarce product was not bought, brain regions activated included not only the reward circuit but also frontal regions involved in controlled processing (e.g., pre-frontal cortex). These results imply that when scarcity leads to a purchase decision, the amount of controlled processing of information that does not favor the purchase decision is likely to be reduced.

**Implications.** Scarcity may shift the reference point regarding the available decision making time, creating a “buy it now” mentality. This sense of urgency hinders decision makers' cognitive ability to analytically process costs and benefits in a balanced manner, driving their cognitive resources to be focused on processing the product benefits (e.g., symbolic values), while suppressing resources to process other thoughts that may interrupt the decision to purchase. This study unraveled the neural underpinnings of the scarcity effect on cognitive and emotional decision making processes, advancing theories on consumer decision making under scarcity. Findings of this study are relevant across a broad range of contexts because choices involving scarcity underlie many of society's most pressing decisions.

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