Study finds 'law-like' patterns in human preference behavior

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In a study appearing in the journal *PLoS ONE,* Massachusetts General Hospital (MGH) scientists describe finding mathematical patterns underlying the way individuals unconsciously distribute their preferences regarding approaching or avoiding objects in their environment. These patterns appear to meet the strict criteria used to determine whether something is a scientific law and, if confirmed in future studies, could potentially be used to guide diagnosis and treatment of psychiatric disorders.

"Law-like processes are important in science for their predictive value, and finding patterns in behavior that meet criteria for lawfulness is extremely rare," explains Hans Breiter, MD, principal investigator of the MGH Phenotype Genotype Project in Addiction and Mood Disorder, who led the study. "The patterns we observed appear to describe the unconscious range of preference an individual has with a specificity suggestive of that of a fingerprint. We look forward to learning what other scientists find about these patterns." These patterns - which the authors group together under the name relative preference theory - incorporate features of several older theories of reward and aversion into a single theory.

The PLoS ONE study reports on the outcome of three sets of experiments. In each, healthy participants were presented with a series of images and could vary the amount of time they viewed each image by pressing the keys of a keypad. The first group of participants viewed a series of four human faces - average-looking male, average-looking

female, attractive male and attractive female. The second group was presented with a series of photographs of images ranging from children, food, sports and musical instruments to war, disaster, and drug paraphernalia. The third group viewed four different images of food - two of normal appearing meals, one in which the food was abnormally colored, and one of raw, unprepared food - on two different days. For one viewing, participants were hungry, for the other, they had just eaten. Responses were measured by whether participants increased, decreased, or did nothing to change how long they viewed particular images.

All three experiments showed the same patterns in both groups and individuals, patterns that contained a set of features that varied between people. These patterns describe how groups and individuals make tradeoffs between approaching and avoiding items; how value is attributed to objects, which is linked assessments of other objects of the same type; and how individuals set limits to how strongly they will seek or avoid objects.

The authors note that these patterns incorporate aspects of three existing theories in reward/aversion: prospect theory, which includes the fact that people are more strongly motivated to avoid negative outcomes than to attain positive outcomes; the matching law, which describes how the rates of response to multiple stimuli are proportional to the amount of reward attributed to each stimulus; and alliesthesia, which notes that the value placed on something depends on whether it is perceived to be scarce - for example, hungry people place greater value on food than do those who have just eaten.

One of the key differences between relative preference theory (RPT) and earlier theories is that RPT evaluates preferences relating to the intrinsic value of items to an individual, rather than relating preferences to values set by external forces - such as how the overall economy sets the value of the dollar. The patterns observed in this study are similar at

the individual and group levels - a relationship known as "scaling."

"In order for behavioral patterns to be considered law-like, they need to be described mathematically, recur in response to many types of stimuli, remain stable in the face of statistical noise, and potentially show scaling across different levels of measurement," explains Anne Blood, PhD, deputy principal investigator of the Phenotype Genotype Project, director of the MGH Mood and Motor Control Laboratory, and a co-author of the PLoS ONE report.

"Relative preference theory meets those requirements, but these observations need to be confirmed by other scientists," she adds. Other work by our team is examining how these RPT patterns are affected by depression and addiction, with the goal of developing RPT as an Internet tool for psychiatric diagnosis." Earlier studies by the MGH investigators also connected aspects of RPT to reward circuits in the brain, using magnetic resonance imaging, and to measures of genetic variability.

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