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A role for ventromedial prefrontal cortex (VMF) in human decision making was first posited on the basis of clinical case reports: damage to this region can lead to striking (and relatively isolated) changes in personality and behavior marked by poor judgment and impulsive choices. Efforts to study the poor decision making of patients with VMF damage in the laboratory have used a variety of gambling tasks, thereby focusing the research on how such individuals deal with uncertainty (Bechara et al. 1997; Rogers et al. 1999). This and subsequent work has established that VMF damage leads to difficulties in choosing between options with uncertain outcomes, whether in the form of risk or ambiguity (Bechara et al. 1999; Manes et al. 2002; Sanfey et al. 2003; Camille et al. 2004; Fellows and Farah 2005; Hsu et al. 2005). In the words of Bechara and colleagues, such experiments are meant to “simulate real-life decision making in the way [they] factor uncertainty, rewards, and penalties” (Bechara et al. 1997).

A separate body of work has investigated the functions of this region in animal models. There is growing evidence that orbitofrontal cortex (OFC), an area within VMF, is involved in flexibly encoding the relative value of stimuli. Single-unit recordings in nonhuman primates have identified OFC neurons that carry information about the relative, context-specific “economic,” or reward value of stimuli (Tremblay and Schultz 1999; Rolls 2000; Wallis and Miller 2003; Roesch and Olson 2004; Padoa-Schioppa and Assad 2006). Functional magnetic resonance imaging (fMRI) studies of normal human subjects have found activation patterns in ventromedial and OFC that are broadly compatible with the view that these regions represent information about relative value whether in preference paradigms (Zysset et al. 2002; Arana et al. 2003; Cunningham et al. 2003; Paulus and Frank 2003; McClure et al. 2004; Johnson et al. 2005; Volz et al. 2006), reinforcement learning, or choice tasks (reviewed in O’Doherty 2004; Montague et al. 2006).

However, both single-unit and fMRI studies have found that many other areas of the brain, including midbrain nuclei, striatum, parietal cortex, and dorsolateral prefrontal cortex also represent reward or value information (Schultz 2000; Schultz et al. 2000; O‘Doherty 2004; Sugrue et al. 2005; O’Doherty et al. 2006). Such findings alone cannot speak to the question of whether any or all of these regions play a necessar6), s striading an8e plpludiehown.44(8-300(48ot716.blei0.49k)-29p show an increased willingness to eat meat (avoided by intact animals) and are more erratic in establishing relative preferences when offered novel foods (Baylis and Gaffan 1991). On the other hand, another study found that such damage did not affect relative preference for familiar foods (Izquierdo et al. 2004). One recent study of multiattribute decision making screening battery are provided in Table 2. The 2 patient groups differed significantly only in reversal learning performance.

Tasks

A novel preference judgment task was developed that required subjects to choose between stimuli, presented 2 at a time. Three categories of stimuli were used: food, famous people, and colors. Eight names of food (e.g., pizza slice, carrot sticks), 6 photographs of people (e.g., Britney Spears, Shaquille O'Neal), and 6 color swatches (e.g., pink, yellow) were printed on index cards. Each category was examined separately and in the same order for all participants. Pairs of stimuli were presented, and the subject was asked to indicate which of the 2 they preferred, that is, "which of these 2 would you prefer, which do you like better?" Subjects were asked to make each judgment in isolation, without reference to their previous choices. No mention was made of any requirement for the choices to be internally consistent. All possible pairs were presented within each category, for a total of 58 trials. For example, in the "food" category, subjects would choose between carrot sticks and watermelon on one trial and between a donut and a chocolate bar on the next, continuing until they had indicated their preference between all possible pairs of the 8 food items in the set. Overall completion time for the food and color categories was measured by means of a stopwatch. Each participant chose from the same foods and colors, but compared different sets of people. This was necessary to ensure that the people were familiar to each subject. For the "people" section of the task, subjects first sorted a larger set of photographs into those they recognized and those they did not. The experimenter than drew 6 cards at random from the "recognized" group and used these as the stimuli for that subject.

The order of preferences within each stimulus category was established by examining the choices of each subject. Erratic choices were choices that deviated from the overall pattern of preferences. For example, if a subject chose A over B and B over C, they were expected to choose A over C. If they instead chose C over A, this was counted as an erratic choice. The optimal preference ordering for each subject was the order that minimized this "erratic choice" score.

Two perceptual judgment tasks were included as control tasks. They followed the same form as the preference judgment tasks, with stimuli printed on index cards and presented in pairs. The line length task required subjects to judge which of 2 lines (in different orientations) was longer, and the "blueness" task required them to judge which of 2 there was no consistent relationship between total lesion volume and preference task performance in the frontal group as a whole (Spearman rho = 0.26, *P* = 0.25) or in the D/LF group alone (rho = 0.02, *P* = 0.95). In contrast, the extent of VMF damage strongly predicted performance (rho = 0.79, *P* < 0.05). Within the VMF group, the etiology of the damage did not appear to affect performance: the proportion of subjects with damage due to aneurysm to

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when the cake's appeal is diminished after a rich meal. Finally, the value of different options may lie along different, incommensurate dimensions. Take a walk and enjoy the fresh air and exercise, or pull up a chair and savor the taste of that chocolate cake?

Although context-sensitive choices like these would seem to

Pears A, Parkinson JA, Hopewell L, Everitt BJ, Roberts AC. 2003. Lesions of the orbitofrontal but not medial prefrontal cortex disrupt conditioned reinforcement in primates. J Neurosci. 23:11189–11201.
Roberts AC. 2006. Primate orbitofrontal cortex and adaptive behaviour. Trends Cogn Sci. 10:83–90.