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NeuroImage

www.elsevier.com/locate/ynimg
NeuroImage 31 (2006) 861 – 865

Neural correlates of culturally familiar brands of car manufacturers

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Received 8 October 2005; revised 2 December 2005; accepted 21 December 2005
Available online 17 February 2006

Brands have a high impact on people's economic decisions. People may prefer products of brands even among almost identical products. Brands can be defined as cultural-based symbols, which promise certain advantages of a product. Recent studies suggest that the prefrontal cortex may be crucial for the processing of brand knowledge. The aim of this study was to examine the neural correlates of culturally based brands. We confronted subjects with logos of car manufactures during an fMRI session and instructed them to imagine and use a car of these companies. As a control condition, we used graphically comparable logos of car manufacturers that were unfamiliar to the culture of the subjects participating in this study. If they did not know the logo of the brand, they were told to imagine and use a generic car. Results showed activation of a single region in the medial prefrontal cortex related to the logos of the culturally familiar brands. We discuss the results as self-relevant processing induced by the imagined use of cars of familiar brands and suggest that the prefrontal cortex plays a crucial role for processing culturally based brands.

Keywords: Medial prefrontal cortex; Somatic markers; Self-reflection; fMRI

Introduction

It is well established that people's economic decisions are not always based on rational behavior (Simon, 1957; Tversky and Kahneman, 1974; Kahneman, 2003). For example, brands may have a high impact on people's economic behavior: people may prefer products of certain brands even among almost identical products. Hence, trademarks without any material counter-values sometimes are traded for more money than the actual factories of these brands. Brands can be defined as culturally based symbols that promise certain advantages of a product to the customer.

In his somatic marker hypothesis, Damasio (1994, 1996) suggested that external or internal stimuli initiate a state that is associated with pleasurable or aversive somatic markers, which function to guide the person's behavior by biasing selections. Somatic markers might be crucial for decision-making even when there is no advantage or disadvantage associated with the response alternatives. Hence, unconscious hunches may be critical in decision-making (Bechara et al., 1997). We hypothesized that brands may function as those kinds of external stimuli and that the neural substrates of brands are involved in generating somatic markers.

Based on lesion studies, Damasio suggested that a network in the prefrontal cortex may be crucial in generating somatic markers (Bechara et al., 1994; Damasio, 1994, 1996). In particular, the ventromedial prefrontal cortex might play an important role in this theory, because this region seems to store information about past rewards and punishments (Damasio, 1996). Several studies support this view by linking the ventromedial prefrontal cortex to reward expectations (e.g., Watanabe, 1996; Knutson et al., 2003; O'Doherty et al., 2003; Paulus and Frank, 2003), and by demonstrating dense interactions with limbic structures in a variety of behavioral contexts (Pandya and Barnes, 1987; Price et al., 1996; Greene et al., 2001; Wagar and Thagard, 2004).

However, by showing neuronal correlates for culturally familiar drinks, McClure et al. (2004) suggested two separate brain systems involved in generating preferences, both situated in the prefrontal cortex: activity in the ventromedial prefrontal cortex predicts people's preferences when judgment decisions are based solely on sensory information, e.g., the taste of a favorite drink. In contrast, an active network including dorsolateral prefrontal cortex, hippocampi and midbrain accompanies subject's preference judgments when they are based at least in part on brand information. Hence, McClure et al. hypothesized two separate anatomical networks based on either sensory or cultural information that might bias preference judgments.

The aim of this study was to examine the neuronal correlates of brand knowledge. To this end, we employed an fMRI experiment that confronted subjects with logos of brands of car manufacturers.

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Available online on ScienceDirect (www.sciencedirect.com).

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doi:10.1016/j.neuroimage.2005.12.047

As a control condition, we used graphically comparable logos of car manufacturers that were unfamiliar to the culture of the participants. Subjects were instructed to imagine driving a car of the presented brand. If they did not know a brand they were told to imagine driving a generic car. We expected an active network including the prefrontal cortex when subjects are confronted with logos of culturally familiar car manufacturers.

Since somatic markers should be active before considering possible advantages or disadvantages of a decision, we did not create a forced-choice paradigm where subjects have to decide for one product in favor of another. Instead of these preference judgment tasks, we instructed the subjects to imagine a product of the brand and to use it. Since somatic markers are working as unconscious hunches, we expected the activation of these markers spontaneously and fast *before* subjects might be asked to perform a preference judgment task. Thus, an activation of the prefrontal cortex when seeing a strong familiar brand would not only suggest that this anatomical area is linked to the perception of this brand but also that the way how brands affect our behavior can be described with the idea of somatic markers according to the theory of Damasio (1994, 1996).

Materials and methods

Participants

Thirteen healthy volunteers (2 males) with a mean age of 27 years (SD 5.53, range 22–40 years) were recruited from the University of Magdeburg, Germany. All subjects were German. Informed consent was obtained from all subjects. The study adhered to the Declaration of Helsinki and was approved by the local human subjects committee. All subjects were right-handed (Edinburgh Handedness Inventory, Oldfield, 1971).

Procedure

Fourteen pictures of logos of car manufacturers were chosen for visual presentation. Seven logos represented familiar car manufacturers in Germany and Europe (Ferrari™, Volkswagen™, Opel™, Mercedes-Benz™, Rolls-Royce™, BMW™, Porsche™). Another seven logos were taken from car manufacturers from outside of Europe (Buick™, Saturn™, Holden™, Pontiac™, Lincoln™, Oldsmobile™, Acura™), which were unfamiliar to the culture of the subjects participating in this study. All logos were compatible regarding the size of the image (Fig. 1). Further, all logos contained the name of the brand. Although none of the unfamiliar car manufacturers sell their products or place advertisements in Europe, we cannot rule out that the subjects may have been more or less confronted with some of these logos (e.g., when traveling through other countries or when watching foreign movies). However, we assumed that the logos of the unfamiliar car manufacturers represented only mildly the concept of the brands compared to the strong brands of the familiar culture, which are present to the subjects of this study in everyday life (e.g., traffic, commercials, etc.). To ensure that the culturally unfamiliar brands were unfamiliar to the subjects of this study, we asked them to complete a questionnaire at the end of the experiment. They were asked if they know this brand very well or not at all. Subjects indicated their response on a six-point scale ranging from 'disagree completely' to 'agree strongly'.

Fig. 1. Examples of the presented stimuli. On the left side, an example of a culturally unfamiliar brand logo is shown; on the right side, a brand logo familiar to the culture of the subject is depicted.

The experiment consisted of three sessions of about 8 min duration each. Logos were presented sequentially in central vision on a computer monitor (against black background) each for a duration of 15 s followed by a fixation asterisk for 19 s. In each scanning session, subjects were presented with 14 logos (7 familiar and 7 unfamiliar, pseudorandomized over the three sessions). Prior to the experiment, subjects were instructed that they will see logos of familiar and unfamiliar car manufacturers and that they should imagine using and driving a product of the brand they see. If they would see a logo of a car manufacturer they did not know, they should imagine driving and using a generic car. During the presentation of the fixation cross, subjects were told to relax and stop performing the task.

fMRI data acquisition

Data were acquired with a 3 T Magnetom Trio Siemens scanner. T2*-weighted functional MR images were obtained using axially oriented echo-planar imaging (TR = 1.5 s, TE = 30 ms, flip angle = 75°, 26 slices, 5 mm thickness, resolution 3.5 × 3.5 × 5 mm). For each subject, data were acquired in three scanning sessions (functional runs). The first four volumes of each session were discarded to allow for T1 equilibration effects. For anatomical reference, a high-resolution T1-weighted anatomical image was obtained (3D-SPGR, TR = 24 ms, TE = 8 ms). Visual images were back-projected to a screen mounted on the head coil, thus subjects view the images through a mirror. Foam cushioning was placed tightly around the side of the head to minimize artifacts from head motion.

Data preprocessing and statistical analysis were carried out using SPM99 (Statistical Parametric Mapping, Wellcome Institute of Cognitive Neurology, London, UK). Individual functional images were realigned, slice-time corrected, normalized into a standard anatomical space (resulting in isotropic 3 mm voxels) and smoothed with a Gaussian kernel of 6 mm as described previously (Friston et al., 1995). The standard anatomical space was based on the ICBM 152 brain template (MNI, Montreal Neurological Institute). We used a block-design model with a boxcar regressor convoluted with the hemodynamic response function as the predictor to compare activity related to culturally familiar logos vs. culturally unfamiliar logos. High frequency noise was removed using a low pass filter (Gaussian kernel with 4.0 s FWHM) and low frequency drifts were removed via a high pass filter. Effects of the conditions for each subject were compared using linear contrast, resulting in a t statistic for each voxel. We carried out a group analysis on a second level using a whole brain random-effect analyses (one-sample t test). Only those regions that contain a minimum of five contiguous voxels thresholded at $P < 0.001$ (uncorrected for multiple comparisons) are considered as active.