



The neural bases underlying social risk perception in purchase decisions



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ABSTRACT

Social considerations significantly influence daily purchase decisions, and the perception of social risk (i.e., the anticipated disapproval of others) is crucial in dissuading consumers from making purchases. However, the neural basis for consumers' perception of social risk remains undiscovered, and this novel study clarifies the relevant neural processes. A total of 26 volunteers were scanned while they evaluated purchase intention of products (purchase intention task) and their anticipation of others' disapproval for possessing a product (social risk task), using functional magnetic resonance imaging (fMRI). The fMRI data from the purchase intention task was used to identify the brain region associated with perception of social risk during purchase decision making by using subjective social risk ratings for a parametric modulation analysis. Furthermore, we aimed to explore if there was a difference between participants' purchase decisions and their explicit evaluations of social risk, with reference to the neural activity associated with social risk perception. For this, subjective social risk ratings were used for a parametric modulation analysis on fMRI data from the social risk task. Analysis of the purchase intention task revealed a significant positive correlation between ratings of social risk and activity in the anterior insula, an area of the brain that is known as part of the emotion-related network. Analysis of the social risk task revealed a significant positive correlation between ratings of social risk and activity in the temporal parietal junction and the medial prefrontal cortex, which are known as theory-of-mind regions. Our results suggest that the anterior insula processes consumers' social risk implicitly to prompt consumers not to buy socially unacceptable products, whereas ToM-related regions process such risk explicitly in considering the anticipated disapproval of others. These findings may prove helpful in understanding the mental processes involved in purchase decisions.

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Introduction

Traditional economics has focused on how to maximize people's desire. According to the traditional view, people make economic decisions, such as purchase decision – the most fundamental economic decision in daily life – on the basis of their personal preferences. Neuroscience studies have revealed the neural circuits of personal preferences. For example, the dopamine (DA) network is believed to be critical for regulating personal preferences (Knutson et al., 2007).

Abbreviations: fMRI, functional magnetic resonance imaging; ToM, theory of mind; mPFC, medial prefrontal cortex; TPJ, temporal parietal junction; MNI, Montreal Neurological Institute; RT, response time; OFC, orbitofrontal cortex; BOLD, blood oxygenation level-dependent; S, social risk; PI, purchase intention.

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However, contrary to the traditional economics view, human beings are naturally able to inhibit personal preference in economic decisions (Henrich et al., 2001). This is how human society is able to maintain public order, social norms, and morals (Elster, 1989). For example, the process of purchase decision making is affected by subjective or social norms, i.e., consumers' perceptions of what other people approve of (Berns et al., 2010; Childers and Rao, 1992; Lascu and Zinkhan, 1999; Mason et al., 2009; Peter and Olson, 1996; Wänke, 2009). More specifically, fearing criticism from family or friends, consumers might stop buying a preferred product (Rook and Fisher, 1995), particularly products that might be considered controversial (e.g., those made of alligator skin) (Xu et al., 2004).

These previous studies indicate that purchase decisions are not always regulated by personal preference (i.e., DA network activity) alone; instead, perceptions of social risk, which, in this study, is defined as the anticipated disapproval of others, influence purchase decisions independent of personal preference. However, no studies have identified

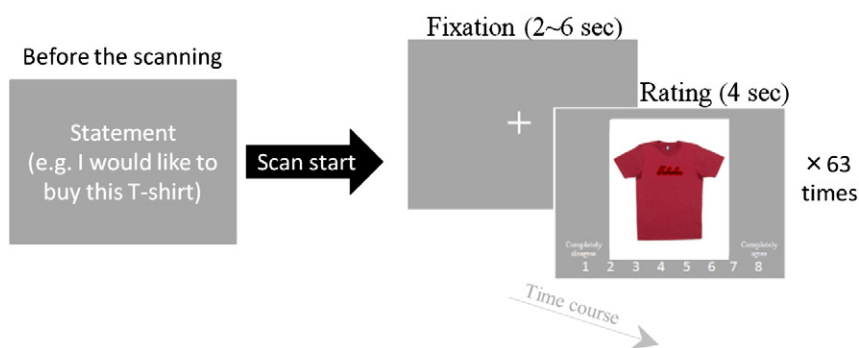


Fig. 1. Task. Subjects viewed the images of T-shirts and rated each of them from a 1–8 levels, from completely disagree (level 1) to completely agree (level 8). This rating was based on image brightness, purchase intention, social risk, and preferences. A statement corresponding to each session was displayed once before the scanning in each session.

the psychological and neural bases of social risk perceptions regarding purchase decision making. Therefore, in this study, we aimed to clarify the neural basis of social risk perception during purchase decisions.

Neuroimaging studies have identified various brain structures that are involved in ensuring compliance with social and moral norms. These neural substrates are mainly located in two regions of the brain. The first comprises the theory of mind (ToM)-related regions, such as the medial prefrontal cortex (mPFC) and temporal parietal junction (TPJ) (Lieberman, 2007; Saxe and Kanwisher, 2003). The second comprises emotion-related regions, such as the anterior insula (Craig, 2009; Harenski and Hamann, 2006; Kurth et al., 2010; Montague and Lohrenz, 2007), amygdala (Adolphs et al., 1994, 1998; Buckholz and Marois, 2012), and lateral orbitofrontal cortex (OFC) (Spitzer et al., 2007).

We assume that, in ordinary cases, social risk is dominantly processed implicitly and emotionally in purchase decision making to make consumer behavior efficient. Otherwise, individuals would have to explicitly think about the opinions of others before any purchase by using a ToM-related neural process. Therefore, we expect that our social risk perception during purchase decisions will be related to social-emotional related regions of the brain (Kurth et al., 2010). To verify this, firstly, we will investigate the neural basis of social risk perception during purchase decision making, and secondly, we will focus on the differences in brain activity between explicit and implicit evaluations of social risk, i.e., purchase decision making.

Taking these points together, we formulated the following two hypotheses:

H1. Consumers' social risk perceptions in purchase decisions are processed in the social-emotional regions of the brain.

H2. The neural basis of social risk perception during purchase decision making is different from that of the explicit evaluation of social risk.

Methods

Overview

Our fMRI experiment was governed by two criteria. First, the object stimulating a neural response should be a product that consumers can or do refuse to purchase because of social pressure. To satisfy the first condition, following Izuma and Adolphs (2013), we selected T-shirts as the stimulus because T-shirts can feature designs that trigger the perception of social risk. Second, the analyses should be performed on fMRI data acquired during the purchase intention rating to assure that observed brain activity relates specifically to purchase decisions. To satisfy the second condition, we recorded blood oxygenation level-dependent (BOLD) contrast fMRI data during subjects' rating of purchase intention for our main analysis. This common method to make subjects deliberate purchases is taken from consumer behavior

studies (Haugtvedt et al., 2008; Peter and Olson, 1996; Robertson and Kassirjian, 1990).

Our fMRI studies extended over four sequenced rating sessions: (1) product brightness rating, (2) purchase intention rating, (3) social risk rating, and (4) product preference rating. The order of sessions (3) and (4) was counterbalanced among subjects. The brightness judgment task functioned as a control to elicit neural activity (fMRI signals) related to motor and simple cognitive processes as a result of button pressing common to all subsequent experimental tasks. This task was performed before subjects were informed of the purchase intention, product preference, and social risk sessions, with the assurance that neural patterns would not be influenced by purchase deliberation. In addition, we conducted a purchase intention rating session before the social risk and preference sessions to assure that the neural process and ratings of purchase intention would not be biased by the social risk and preference ratings.

Participants

Observing the Declaration of Helsinki (1991), we obtained written informed consent from participants before the study. The Tohoku University School of Medicine Ethics Committee approved the study protocol. A total of 30 healthy, right-handed individuals (17 male, 13 female) participated in the fMRI experiment. Their mean age was 20.87 years (19–24 years). Handedness was evaluated using the Edinburgh Handedness Inventory (Oldfield, 1971). Four participants' data were excluded because of greater than two millimeter movements and response rates below 90% during the fMRI task. The mean age of the 26 remaining subjects was 20.92 years (19–24 years). All subjects had normal or corrected-to-normal vision and no history of neurological or psychiatric illness.

Stimuli

A total of 63 photos of T-shirts chosen from one online vendor (<http://www.graniph.com/>) were used as the stimuli to control for price, style, brand, and quality. We conducted a preliminary experiment to select T-shirts that elicited a range of social risk ratings to assure the collection of a sufficient number from each subgroup for statistical analysis. This preliminary experiment involved 10 healthy university students who did not participate in the fMRI experiment. Before the purchase intention session, we instructed the participants that all T-shirts were of identical price, brand, and quality to exclude these as confounding factors as preferences.

Experimental tasks

Participants completed a practice trial immediately before the fMRI sessions, after which they entered the MRI scanner. All the images of

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