

An fMRI study of violations of social expectations: When people are not who we expect them to be

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ABSTRACT

The current study examines the effect of violations of social expectancies on the neural substrates of person perception. In an event-related fMRI experiment, participants were presented with the photographs of either Republican or Democrat politicians paired with either typical Republican or Democrat political views (e.g., “wants a smaller government” or “wants liberal supreme court judges”). Subjects were asked to form an impression of the targets using information about both their political affiliation and their political views. Of interest was the contrast between stereotypically congruent trials and stereotypically incongruent trials. The results reveal that brain regions previously involved in mentalizing (i.e., temporoparietal junction and medial prefrontal cortex) are preferentially recruited when viewing incongruent social targets.

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The ubiquitous use of social expectations when perceiving others is well established. Social cognitive investigations have repeatedly demonstrated how impression formation based on categories and stereotypes (i.e., information that is expected to describe social targets belonging to a specific social group) often takes precedence over construal based on individuating information (i.e., information that is specific to a social target) (Devine, 1989; Macrae and Bodenhausen, 2000). Nevertheless, social expectations are often violated during impression formation (Hamilton et al., 1989; Hastie and Kumar, 1979; Macrae et al., 1999; Sherman et al., 1998). As a consequence, we routinely are required to override our social expectations and instead create individuated impressions of others.

The implementation of such individuation processes following the violations of social expectations has been extensively documented (Brewer, 1988; Fiske and Neuberg, 1990; Macrae et al., 1999; Hastie and Kumar, 1979; Srull and Wyer, 1989). When individuated, social targets are construed as complex social agents with their personal constellation of beliefs, personality characteristics and intentions, as opposed to stereotypical members of a particular social group. Individuation, therefore, requires the attribution of unique characteristics, such as intentions and mental states, to social targets.

From a social cognitive perspective, studying violations of social expectations during impression formation has revealed many of the

requirements and consequences of flexibly construing others (Macrae and Bodenhausen, 2000; Smith, 1998). However, although fMRI has been utilized to explore the brain regions supporting categorical or stereotype-based responses (Mitchell et al., 2009; Wheeler and Fiske, 2005; Quadflieg et al., 2009; Richeson et al., 2003), few studies have investigated the perception of violations of social expectations using the same method.

Previous fMRI studies have examined the congruency of affective associations towards social targets (Harris and Fiske, 2009; Knutson et al., 2006; Westen et al., 2006) and, using electroencephalography (EEG), both regulation of racial bias and perceived violations of social expectations have been investigated (Amodio et al., 2004; Amodio et al., 2006). Furthermore, with the help of EEG, the neural operations underlying the processing of words or sentences that are either congruent or incongruent in terms of gender stereotypes have been studied (Osterhout et al., 1997; White et al., 2009). Nevertheless, the neural correlates of social cognitive processes recruited when pre-existing social expectations are violated during impression formation have yet to be investigated using fMRI (see Amodio and Lieberman, 2009; for a recent review of the literature). Accordingly, the current study aims to identify brain regions recruited by fundamental social cognitive processes during the perception of targets violating social expectation.

The medial prefrontal cortex (MPFC) and temporoparietal junction (TPJ) appear to be the central components of a constellation of brain regions supporting social cognition (Adolphs, 2009; Amodio and Frith, 2006; Decety and Lamm, 2007; Spreng et al., 2009). In particular, multiple lines of investigations suggest that these regions support

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processes enabling perceivers to perform, in one way or another, mental inferences about encountered individuals (Adolphs, 2009; Frith and Frith, 2006; Mitchell et al., 2006a; Saxe and Wexler, 2005; Spreng et al., 2009). Of particular relevance to the current investigation, tasks requiring the attribution of specific mental states or access to person-knowledge about social targets have been shown to recruit these brain regions (Cloutier et al., 2011; Frith and Frith, 2006; Spreng et al., 2009; Todorov et al., 2007). Following social cognitive theorization, such processes should be extremely useful when forming an impression tailored to an individual for which pre-existing expectations are not applicable (Brewer, 1988; Fiske and Neuberg, 1990; Macrae et al., 1999).

Accordingly, processes supported by the TPJ and MPFC are often mentioned as prime candidates to support the individuation of social targets (Amodio and Lieberman, 2009; Freeman et al., 2010; Harris and Fiske, 2007). It is therefore surprising that little research has been done to test this possibility. Motivating the current study is the hypothesis that these brain regions will be preferentially engaged during the perception of incongruent social targets. When perceiving violations of social expectations, both the MPFC and TPJ are expected to support mental inferences necessary to form individuated impressions of the social targets.

To explore this possibility, the current study used an event-related fMRI design to identify brain regions underlying the processing of socially incongruent social targets. To this end, participants were presented with photographs of unknown politicians, assigned to either the Democrat or Republican parties, who endorsed either typically Democrat or Republican views (Fig. 1). Of particular interest were the brain regions preferentially engaged when perceivers were presented with incongruent trials (i.e., Democrats endorsing typical Republican views and Republicans endorsing typical Democrat views). Crucially, because the congruent Republican views were also incongruent Democrat views and vice-versa, all the information conferred by the faces and sentences (i.e., the political views) contributed equally to congruent and incongruent trials across participants.

Methods

Participants

Twenty participants were recruited from the local MIT community. Of these twenty participants, two were excluded from subsequent analyses (the first subject excluded reported discomfort during the scan and difficulty performing the task, while the second subject was the only one to report identification with the Republican party). The remaining eighteen were between the ages of 19 and 30 years (9 male, mean age = 20.7 years), reported no significant abnormal neurological history and had normal or corrected-to-normal visual

acuity. Sixteen participants were right-handed as measured by the Edinburgh Handedness Inventory (Oldfield, 1971). Participants were paid for their participation and gave informed consent in accordance with the guidelines set by the Committee on the Use of Humans as Experimental Subjects at MIT.

Material and pre-rating task

In a pilot study, participants (N = 24) rated a list of sentences created to represent either typical Democrat (i.e., *prioritizes environmental policies*) or Republican views (i.e., *wants to privatize Social Security*). As a group, the participants considered themselves affiliated with the Democrat party (M = 2.7; s.d. = 1: on a 7 point scale with 1 = "Extremely Democrat" to 7 = "Extremely Republican") and as having liberal views (M = 2.8; s.d. = 1: on a 7 point scale with 1 = "Extremely liberal" to 7 = "Extremely conservative"). Their task was to rate how "stereotypically Democrat or Republican" they believed the views described by sentences were on 7 point scale, 1 = "Very stereotypically Democrat" to 7 = "Very stereotypically Republican". From this pilot study, we identified two lists of sentences (typical Democrat views: mean (s.d.) = 2.25 (0.39); typical Republican views: mean (s.d.) = 4.33 (0.30)) that were subsequently used in the functional imaging task. Because the sentences were created and rated by individuals identifying themselves mostly as Democrats, the resulting sentences can be construed to represent typical Democrat or Republican views from the perspective of Democrat individuals.

Functional imaging task and procedure

During the fMRI experiment, participants formed impressions of either Democrat or Republican politicians (80 unique targets were created using photographs of unknown politicians paired with background colors ascribed to each political party) paired with either typical Democrat or Republican political views (40 sentences of each type of view were paired with politicians of each political affiliation) (Fig. 1). Each face was presented twice with two unique sentences of the same condition. This resulted in 40 unique congruent-Democrat trials, 40 unique incongruent-Democrat trials, 40 unique congruent-Republican trials and 40 unique incongruent-Republican trials. Each trial consisted of a photograph of an unknown politician with a colored background (indicating a political affiliation) paired with a sentence describing a political view and was presented for 3500 ms. Following each stimulus presentation, a fixation cross was presented for 500 ms. Null events consisting of a fixation cross for 2000 ms were pseudorandomly interspersed to introduce jitter into the fMRI time-series to create ITIs of either 500 ms, 2500 ms, 4500 ms or 6500 ms. Participants were instructed to form impressions of the politicians based on the information available to them (i.e., the portrait, the party affiliation associated with the background color and the political views represented by the sentence). The pictures were gray-scaled photographs of unfamiliar politicians used in a previous study. These pictures were presented in the center of the screen at a size of 100–128 pixels wide by 150 pixels tall. The photographs and the color backgrounds were counterbalanced across participants to ensure that they would be equally represented in each trial type. Participants took part in practice trials prior to the fMRI session to ensure that they would efficiently associate the background color with the appropriate political affiliations.

Following previous fMRI investigations using impression formation instructions, participants were simply asked to press response buttons held in both hands once they felt they completed the task. The behavioral response was requested mainly to ensure that participants were paying attention to the task and participants were therefore not asked to perform their response as quickly as possible.

Importantly, the information communicated by the faces and the sentences was counterbalanced across participants to ensure they

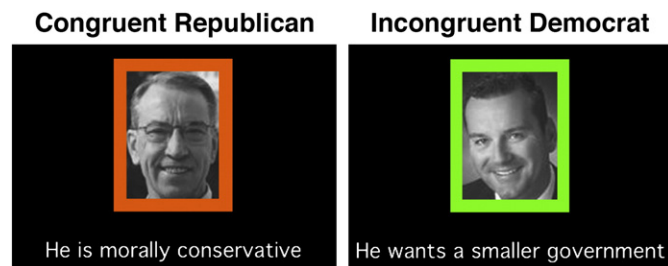


Fig. 1. Figures displaying an example of a stereotypically congruent trial (left) and an example of a stereotypically incongruent trial (right). In these trials, orange was predetermined to signify that a target was a Republican and green to signify that the target was a Democrat.

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