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Distinct neural correlates of social categories and personality traits ☆

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ABSTRACT

Does the processing of social category-related versus trait-related information generate a different pattern of brain activation? In this fMRI study, we compared the processing of behaviors performed by a member of a social category versus an individual, both possessing similar personality traits. Based on previous behavioral studies we predicted that the processing of social category-related information would recruit more activation in brain areas related to mentalizing than individual trait-related information. Participants read sentences describing behaviors performed by a member of a social category (of which the stereotype involves a given trait) or by an individual possessing the same trait. These behavioral sentences varied on both valence (positive versus negative) and consistency (consistent versus inconsistent) with regard to the social category or trait. The results revealed that social category-related behavioral information showed more activation in mentalizing areas (medial prefrontal cortex, anterior temporal lobe, bilateral temporo-parietal junction, posterior cingulate cortex) than trait-related information. This increased activation is interpreted in terms of the impact of autobiographical memories, greater variance among members of social categories than individual traits, a higher construal level (i.e., abstractness), and larger perceived group size. Additionally, inconsistent as opposed to consistent information showed more activation in the right temporo-parietal junction and left lingual gyrus.

Distinct neural correlates of social categories and personality traits

In a world of continuously increasing complexity, assigning individuals to different categories has become vital to allow flexible maneuvering through our social environment. In the present study we focus on two fundamental types of social constructs – social categories and personality traits – which have generated ample research over the past decades (Andersen et al., 1990; Brewer, 1996; Contreras et al., 2012; Fiske and Neuberg, 1990; Hamilton and Sherman, 1996; Macrae et al., 1994; Mitchell et al., 2009; Winter and Uleman, 1984). Social categories are groups of people that carry a socially shared label, and tend to be characterized by specific features like occupations and belief systems, while personality traits are concepts used to describe the essential qualities of individuals, often inferred from specific behavior (Andersen and Klatzky, 1987).

Theories like the Continuum Model (Fiske et al., 1999), the Dual-Process model of Impression formation (Brewer et al., 1999), the Parallel Distribution Satisfaction model of person perception (Kunda and Thagard, 1996), and even Social Identity Theory (Tajfel, 1981), pay special attention to the way social categories influence impression formation and updating on other persons. Several studies have repeatedly demonstrated that knowledge of social categories and their stereotypical characteristics often have more impact on impressions about other persons than individual trait knowledge (Bodenhausen et al., 1999). In contrast to the wealth of theories and research in the behavioral literature on the role of social categories and personality traits during impression formation (Andersen et al., 1990; Hamilton and Sherman, 1996; Kunda and Thagard, 1996; Fiske and Neuberg, 1990; Brewer, 1988), direct comparisons between these two types of constructs are, to the best of our knowledge, much less investigated in current social neuroscientific research. Some studies have touched upon related topics, such as the difference between categorization and individuating processes in the brain (Mason & Macrae, 2004), stereotypical judgments (Quadflieg et al., 2009), trait and evaluative representations during stereotype judgments (Gilbert et al., 2012), and inferring mental states from groups (Contreras et al., 2013).

In line with this earlier work, the aim of this study is to investigate directly the differences and similarities in brain activations during the processing of behavioral descriptions of individuals in the context of social categories and personality traits. We use behavioral theories about these issues to make predictions about activation patterns in the human brain.

Differences between social categories and traits

Social categories and traits appear to share a similar function, as both social constructs provide information which allows us to predict future

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behavior of a target person, as well as to coordinate our own behavior, cognition and affect towards targets of specific categories (e.g. thieves) or personality types (e.g. dishonest people) (Fiske et al., 1999; Bodenhausen et al., 1999). As the example demonstrates, social categories and individuals may even share common traits, such as dishonesty. Nevertheless, social categories and traits also differ with regard to some specific characteristics.

It is evident that social categories refer to group-membership while traits suggest individual attributes. Andersen et al. (1990) further pointed out that social categories tend to be more idiosyncratic and specific, and hence more informative and imaginable than personality traits. Social categories and traits also differ with regard to abstraction, and here Andersen et al. (1990) offered two possible options. On the one hand, social categories can be viewed as concrete and specific categories (e.g., nurses) that are subordinate in a hierarchical relationship to traits, which are more general and abstract (e.g., caring). On the other hand, social categories are often considered as an organizing entity of group members (e.g., nurses), combining different traits (e.g., caring) as well as other types of individual information like physical attributes (e.g., dressed in white) or demographic characteristics (e.g., women). In this sense, traits are basic and concrete, and subordinate to more general social categories (Andersen et al., 1990; Macrae et al., 1994). The latter view corresponds to a narrow definition of personality traits, in which traits only convey the behavior they summarize (Andersen et al., 1990) and a broader definition of social categories as a more complex concept that involves a higher level of abstractness, also termed *level of construal* (Trope and Liberman, 2010).

A crucial question is, do these differences play a role in how social categories and traits are used in impression formation? As noted earlier, behavioral research has repeatedly demonstrated that knowledge of social categories and their stereotypical trait characteristics have more impact on impression formation than individual trait knowledge (Bodenhausen et al., 1999; Fiske et al., 1999). In a study directly comparing social categories and traits, Andersen et al. (1990) documented that social categories are more influential than traits. These authors presented behavioral descriptions of a person who was depicted by either a social category (e.g., politician) or a trait (e.g., daring) and performed a mundane act (e.g. The politician/The daring type *opened the drawer*) or experienced a common state (e.g. The politician/The daring type *felt a draft*). Participants had to judge whether the target person was likely to exhibit such behavior or experience such a state. The results revealed that when judging the likelihood of the behavior or state, the response was faster following social categories compared to traits, indicating that social categories function as a more efficient prime than traits. Social categories also appeared to provide a memory advantage over traits in a cued recall task, where the presented behaviors or states served as cues. These results were interpreted as indicating that social categories are more accessible and semantically richer than traits, encompassing traits as one of the many features that make up a single social category (Macrae et al., 1994).

Neurophysiological findings on social categories and traits

Recent event-related-potential (ERP) studies support the greater influence of social categories during impression formation, in particular with respect to processing speed. The results indicate a very rapid detection of race and gender from visual information (Ofan et al., 2011; White et al., 2009). In contrast, personality traits which are usually inferred from verbal behavioral descriptions tend to require more time (Van Duynslaeger et al., 2007; Baetens et al., 2011).

Neuroimaging studies focused on the brain areas involved in impression formation, using verbal descriptions of trait-implying behaviors (Ma et al., 2012; Mende-Siedlecki et al., 2012) or a stereotype (political affiliation of the protagonist, see Cloutier et al., 2011), revealed substantial overlap for trait and stereotypical processing in a number of brain areas belonging to the *mentalizing* network. This network is involved in the understanding of other person's behavior as driven by internal mental states like thoughts, emotions and beliefs (Van Overwalle, 2009; Spreng et al., 2008). It encompasses various medial areas including the medial prefrontal cortex (mPFC), posterior cingulate cortex, and precuneus, as well as areas in the lateral temporal lobe, including the temporo-parietal junction (TPJ), posterior superior temporal sulcus (pSTS), and anterior temporal lobe (aTL). This social mentalizing network shows considerable overlap with other networks that share similar functionalities, such as the default-network (Raichle et al., 2001; Spreng et al., 2008), the autobiographical memory network (Svoboda et al., 2006), the evaluative network (Legrand and Ruby, 2009) and the task-negative network (Fox et al., 2005; see Spreng, 2012 for a discussion on this classification).

Beyond the processing of individual mental states, activation in the mentalizing network has also been observed when making judgments about social groups, such as about their typical characteristics and features (Contreras et al., 2012; Mitchell et al., 2009; Quadflieg et al., 2009), social identity (Volz et al., 2009), ingroup loyalty (Baumgartner et al., 2012), social interaction (Lahnakoski et al., 2012), group-based emotional responses (Harris et al., 2007), and when making evaluative and trait judgments related to group stereotypes (Gilbert et al., 2012).

However, given the lack of direct comparisons in previous neuroimaging research, it is still unclear whether the mentalizing system is more strongly involved in the processing of behavioral information with respect to social categories or individual traits. In line with behavioral research reviewed earlier, there are several arguments supporting the prediction that processing information about groups as opposed to individuals recruits more activity in the mentalizing network.

First, social categories appear to be more influential in the process of impression formation. Upon activation they provide a wealthier source of information than personality traits, which aids in interpreting behaviors. The processing of social categories may facilitate the retrieval of multiple autobiographical memories of individual contacts with category members, leading to increased accessibility of typical group exemplars as opposed to a single individual. Such elaborate processing of autobiographical memories may lead to increased activation in areas associated with the mentalizing system (Holland et al., 2011). Second, social categories have more variability and complexity than individuals. They have higher idiosyncratic, specific and complex representations, due to the higher number of individuals involved and the sometimes broad social categories they represent (e.g., woman). This higher complexity and variability may demand a higher level of information processing, leading to increased activation of the mentalizing network (Meyer et al., 2012; Mitchell, 2010). Lastly, social categories reflect a higher level of abstractness or construal (Trope and Liberman, 2010). Recent imaging research demonstrated that increasing the level of construal (e.g., by focusing on trait versus visual characteristics of a person) increases the activation of the mentalizing network, and the mPFC in particular (Baetens et al., 2014). Based on a similar logic, we might expect an increase of activation when moving the level of abstractness from traits to social categories.

The present research

In the present study, we explore how social categories and traits have a differential impact on the processing of behavioral descriptions. We briefly presented a personality trait (e.g. friendly) or social category (e.g. nurse) that implied the same trait, and then provided behavioral sentences that were either consistent or inconsistent with the social category or trait. Participants were requested to judge to what extent the behavior was applicable to the social category or individual trait. Pilot testing ensured that the behavioral descriptions were on average equally applicable in relation to the social category or the individual trait, and the analyses further controlled for remaining differences in applicability.