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Athlete or athletic? Limited differential brain activation in person descriptions using nouns or adjectives ☆

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ABSTRACT

Do differences between the syntactic categories of nouns and adjectives for describing persons translate into different patterns of brain activation? In this fMRI study, we compared reading person and object descriptions denoted by nouns or adjectives. Previous behavioral studies found that nouns, describing the more abstract construct of social categories, compared to adjectives, describing the more concrete construct of personality traits, have an impact on the inferences made about a person. Additionally, previous neuroimaging findings suggest that abstract constructs recruit a different pattern of brain activation, compared to more concrete constructs. Participants read sentences describing a protagonist by means of a noun or an adjective, as well as sentences describing objects through a noun or an adjective. The results revealed that reading nouns as opposed to adjectives showed increased activation in the left lingual gyrus for persons, and additionally in the right lingual gyrus for objects. The results indicate that there are limited differences in the processing of nouns and adjectives when describing persons.

1. Introduction

Do you prefer being described as an *athlete* or *athletic*, as an *entrepreneur* or *entrepreneurial*, as an *enthusiast* or *enthusiastic*? Not only the content of the language we use to describe and represent others appears to be important, also the linguistic characteristics of that description appear to be of great importance. In his highly influential work on prejudice, Allport singled out nouns as the syntactic category which plays a key role in reflection, recall, identification and action related to generalizations about our social environment (Allport, 1979). This linguistic form is typically used when describing social categories and stereotypes. Social categories refer to groups of people who are denominated by a socially shared label and are characterized by specific features like occupations and belief systems (Andersen & Klatzky, 1987), while stereotypes refer to the accumulated knowledge and beliefs observes have about social categories (McGarty, 2002; Tajfel, 1981). Social categories, like *African Americans*, as well as stereotypes about them (e.g. *athletic*) allow us to cognitively, affectively and behaviorally organize our social environment, as well as predict possible behavior of its protagonists (Allport, 1979; Fisk & Neuberg, 1990).

When forming an impression of another person, we often categorize them by means of these social categories using nouns (e.g., athletes), rather than individuating them by referring to their personality traits using adjectives (e.g., athletic), which denote essential qualities of people, often inferred from specific behavior (Andersen & Klatzky, 1987; Bodenhausen, Macrae, & Sherman, 1999a; Bodenhausen, Macrae, & Sherman, 1999b). Even though both social categories and traits have received ample attention in research on impression formation, the impact of nouns and adjectives as syntactic categories for representing groups versus individuals has been lacking in social neuroscientific research. The current study attempts to answer the question whether the differential use and impact of nouns and adjectives in person perception is reflected in distinct neural correlates in the brain.

1.1. Nouns vs. adjectives in person perception

Through the representation of social categories, nouns are related to group membership, compared to the more individual oriented traits. Social categories represent a more complex cluster of information than traits do. Despite their complexity, a noun describing a social category appears to be more imaginable and

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Table 1
Contrasts for syntactical type and person/object.

Comparison and anatomical area	x	y	z	Voxels	max F/T	
Noun person > Adjective person						
Left lingual gyrus	−10	−78	0	55	5.97	**
Adjective person > Noun person						
		–				
Noun object > Adjective object						
Left lingual gyrus	−12	−78	−2	148	6.65	***
	−8	−82	4		6.54	***
Right lingual gyrus	14	−78	2	35	5.81	**
Adjective object > Noun object						
		–				
Conjunction of each of the four conditions > baseline						
Left lingual gyrus	−34	−82	−4	302	8.61	***
	−22	−94	−6		6.69	***
Right lingual gyrus	22	−88	−2	138	6.17	***
	34	−86	−4		5.58	**
Noun > baseline						
Left inferior frontal gyrus (pars Triangularis)	−46	28	18	30	5.27	*
	−46	18	24		5.04	*
Left inferior frontal gyrus (pars Opercularis)	−38	8	24	82	5.64	**
	−48	4	54	313	5.33	**
Left postcentral gyrus	−52	−8	46		6.68	***
Left SMA	−4	0	60	137	6.72	***
Left middle temporal gyrus	−62	−36	2	11	5.17	*
Left inferior parietal lobule	−24	−66	44	72	5.64	**
Left superior parietal lobule	−28	−72	52	72	5.15	*
Left inferior occipital gyrus	−38	−74	−6	1110	∞	***
Left middle occipital gyrus	−36	−82	−4		12.37	***
Left inferior occipital gyrus	−22	−94	−6		∞	***
Right inferior occipital gyrus	40	−82	−8	439	5.94	***
	34	−86	−4		6.83	***
Right lingual gyrus	24	−90	−2		7.61	***
Adjective > baseline						
Left inferior frontal gyrus (pars Triangularis)	−46	28	18	16	5.29	*
	−44	10	28	61	5.15	*
Left inferior frontal gyrus (pars Opercularis)	−38	6	24		5.46	**
Left SMA	−4	0	60	56	5.73	**
Left postcentral gyrus	−52	−8	48	58	5.55	**
Left inferior parietal lobule	−24	−66	44	13	5.30	**
Left inferior occipital gyrus	−38	−74	−6	1180	∞	***
Left middle occipital gyrus	−36	−82	−4		12.58	***
Left inferior occipital gyrus	−22	−94	−6		∞	***
Right inferior occipital gyrus	40	−76	−10	443	5.49	**
	34	−86	−4		7.11	***
Right lingual gyrus	24	−90	−2		∞	***
Person > object						
		–				
Object > person						
Left inferior frontal gyrus (pars Orbitalis)	−44	40	−12	62	6.68	***
	−50	34	−14		5.46	*

Note: x, y, and z = Montreal Neurological Institute coordinates of the peak values in the left–right, posterior–anterior, and inferior–superior axes respectively; t = t-score of the peak values. Whole brain analysis with $p < 0.05$ (FWE-corrected) and cluster extent >10 voxels; listed are clusters and peak coordinates that are significant at $p < 0.05$, FWE-corrected.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$ (FWE-corrected).

idiosyncratic than an adjective describing a personality trait, making nouns more salient in our memory (Andersen, Klatzky, & Murray, 1990). Social categories and traits also differ with regard to their level of abstraction, with social categories being more multileveled and complex concepts that involves a higher level of abstractness, also termed *level of construal*, while traits only convey the concrete, less abstract behavior they summarize (Andersen et al., 1990; Macrae, Milne, & Bodenhausen, 1994; Trope & Liberman, 2010). Level of abstractness plays an important role in the Linguistic Category Model (LCM). This model divides our language about interpersonal communication into five different categories of interpersonal terms, organized by increasing level of abstraction moving away from concrete event descriptions towards abstract stable characteristics of an individual (see Semin, 2009, for review). The first four levels of this model describe interpersonal actions through verbs, while the highest level of abstraction in this model is reserved for adjectives, yet nouns are not accounted for in this model (Semin, 2009).

Even though the distinction between nouns and adjectives has primarily received attention in the context of the social categories and the traits they represent, the linguistic difference itself has not completely been neglected in behavioral research. Recent findings suggest that nouns have more inductive potential compared to adjectives. Nouns describing social categories trigger more stereotypical inferences, inhibit counterstereotypical inferences, and allow stronger inferences about a target which are more persistent and less affected by situational constraints (Carnaghi et al., 2008). In contrast to nouns, adjectives do not form a universal word class as they do not appear in every language (Dixon, 1982).

1.2. Neuroscientific findings

Neuroimaging studies on social categories and personality traits have revealed the involvement of a network of brain regions related to mentalizing, that is, the perception of other person's behavior as driven by internal mental states like thoughts, emotions, beliefs, personality traits, and social categories (Cloutier, Gabrieli, O'Young, & Ambady, 2011; Ma et al., 2012; Mende-Siedlecki, Cai, & Todorov, 2012; Spreng, Mar, & Kim, 2009; Van Overwalle, 2009). The mentalizing network consists of various areas along the medial axis including the medial prefrontal cortex (mPFC), posterior cingulate cortex (PCC), and precuneus, as well as lateral areas including the temporo-parietal junction (TPJ), posterior superior temporal sulcus (pSTS), and anterior temporal lobe (aTL) (Van Overwalle, 2009; Van Overwalle & Baetens, 2009).

Previous studies have suggested that activation in this network may not be exclusively related to social reasoning, but might involve the construal level at which data is processed (Baetens, Ma, Steen, & Van Overwalle, 2013; Gilead, Liberman, & Maril, 2013; Grossman et al., 2002). Grossman et al. (2002) presented nouns varying in level of abstraction and participants indicated the pleasantness of these nouns. The authors found that abstract nouns showed more activation in the mPFC, TPJ and inferior frontal gyrus in the left hemisphere than concrete nouns (Grossman et al., 2002). More recently, Baetens et al. (2013) provided pictures of people displaying everyday behavior or of objects. In this study, participants had to generate a personality trait or object category to induce high construal reasoning, or they had to visually describe the pictures in order to induce low construal reasoning. The authors found that the mentalizing network, including the mPFC, TPJ, precuneus and PCC, was engaged during reasoning at a high construal level with substantial overlap between persons and objects (Baetens et al., 2013). In a study applying a similar logic, Gilead et al. (2013) asked participants to indicate 'why' a person performed a certain activity to induce high construal reasoning, while participants had to explain 'how' a certain activity is performed to induce low construal reasoning. They compared this to reasoning about objects at different construal levels by asking them to generate superordinate categories (high construal) or subordinate exemplars (low construal) for the same objects. The results only partly replicated the previous studies (Baetens et al.,