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# The neural substrates of person comparison—An fMRI study

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**Person comparison is pervasive in social judgment and human decision making and yet its neural substrate is poorly explored. We measured brain activity when participants compared psychological (intelligence) and physical (height) characteristics of famous people and found activation of medial frontal, orbitofrontal and limbic areas and the temporoparietal junction. This network was largely driven by the psychological comparison, with activity being higher for intelligence than height comparison in several areas in medial prefrontal cortex, suggesting that their activation scales with the demand on person comparison. The person comparison network overlaps strikingly with that commonly described for classic theory of mind tasks. We interpret this overlap as indexing the use of perspective taking common to person comparison and theory of mind.**


## Introduction

In order to master the complexity of social interaction, people have to understand and predict the behavior of others. This requires trait judgments that are critically shaped by person comparisons (Dunning and Hayes, 1996; Higgins and Lurie, 1983). People's fundamental propensity to process social information comparatively has always played a prominent role in social psychology (Festinger, 1954; Higgins and Stangor, 1988). Particularly judgments about personal qualities often involve comparisons (Dunning and Hayes, 1996; Festinger, 1954; Mussweiler, 2003). Regardless of its remarkable psychological importance, little is known about the neural substrates of person comparison. This study was designed to fill this gap and delineate how, on a neural level, person comparisons differ from non-comparative person judgments.

Comparative social judgments may be supported by a generic network for comparative judgments as described for various categories of inanimate objects, involving mainly regions along the intraparietal sulcus (IPS) (Cohen-Kadosh et al., 2005; Pinel et al., 2004). Alternatively, the neural representation of comparative judgments may be organized along basic content domains into a social and non-social realm. We hypothesise that comparisons in the social realm are indeed a special case. When comparing people, particularly on psychological characteristics like intelligence, participants have to draw inferences about potentially intelligent beliefs, intentions, and attitudes of the two persons and take their perspective into account. That is, they try to understand other people's behavior in terms of their mental states — which is a specific human ability termed mentalizing or Theory of Mind (ToM) reasoning (Premack and Woodruff, 1978). Functional imaging research has helped identify a distributed neural system underlying ToM, including the right and left temporo-parietal junction (TPJ), the precuneus, right and left posterior superior temporal sulcus (pSTS) and the medial frontal cortex (MFC) (Brunet et al., 2000;

*Abbreviations:* APCC, anterior paracingulate cortex; arMFC, anterior portion of the rostral medial frontal cortex; BA, Brodmann area; BOLD, Blood Oxygen Level Dependent; prMFC, posterior portion of the rostral medial frontal cortex; FDR, false discovery rate; fMRI, functional magnetic resonance imaging; GLM, General Linear Model; GP, globus pallidus; IPL, inferior parietal lobule; ITI, inter trial interval; MFC, medial frontal cortex; OFC, orbitofrontal cortex; PCC, posterior cingulate cortex/precuneus; pH, posterior hippocampus; TPJ, temporo-parietal junction; TE, echo time; TR, repetition time; ROI, region of interest.

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Ciaramidaro et al., 2007; Frith and Frith, 2003, and 2006; Gallagher et al., 2000; Saxe and Kanwisher, 2003; Saxe and Wexler, 2005; Saxe, 2006).

In the present functional magnetic resonance imaging (fMRI) study, we contrasted comparative and non-comparative judgments about the same persons, and comparative judgments on psychological and physical dimensions. Participants were presented with names of two celebrities. In the non-comparative judgment, participants had to decide whether one of the two celebrities was a musician (or politician). The two comparative judgments were which of the two celebrities was more intelligent and which celebrity was taller. We hypothesized that in comparative person judgment, along with the activation of regions representing semantic person knowledge (Mason et al., 2004; Mitchell et al., 2002) comparison specific activity should be found. In addition, we expected ToM areas to be more activated during intelligence comparisons because comparison of psychological characteristics (intelligence) involves taking the person's own perspective into account. Our design thus entailed a comparison task with different degrees of perspective taking and a purely semantic non-comparative task as control condition. We did not try and include a control condition with a social but non-comparative task (e.g., how intelligent is X?), because comparisons are spontaneously engaged even if a person characteristic is judged without explicitly asking for comparison (Dunning and Hayes, 1996; Mussweiler et al., 2004).

## Materials and methods

### *Participants*

Previous research has demonstrated that the perceived height of another person depends on the participants' own height, leading to clear gender differences (Biernat et al., 1991). As a consequence, it is impossible to design stimulus material that is perceived similarly by male and female participants. Hence, fourteen healthy male, right-handed participants were recruited from an academic environment (mean age 27.93, SD 4.67). The Ethics Committee of the Medical School of the Johann Wolfgang Goethe University approved the study. Written informed consent was obtained from all participants prior to scanning.

### *Stimuli*

A set of 64 pairs of surnames of 47 celebrities served as stimulus material. The individual names had been tested for 100% familiarity on $N=20$ male students. Pairs of names were presented in white font (font: Arial, height: 4.6°) on a black background above and below the centre of the screen. The distance between centre of word and centre of screen was 4.4°. The four cue stimuli had the same colour and font size. Stimulus presentation and recording of response time was controlled by the Presentation 9.9 software

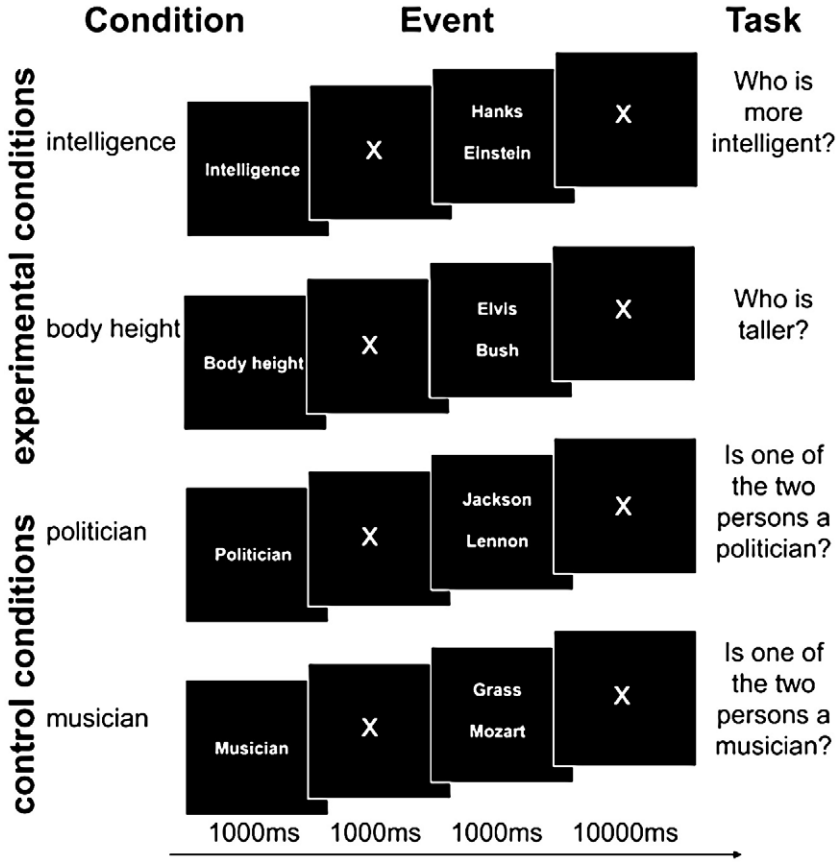


Fig. 1. Paradigm design. Four different tasks containing two experimental conditions (body height and intelligence comparison) and control condition (musician/politician). Each trial began with the presentation of a cue (1000 ms), followed by a fixation point (1000 ms) and a pair of stimuli (1000 ms). After 10 s (ITI) a new trial began. In the experimental conditions subjects had to decide which person, indicated by the names, was taller or more intelligent. In the control condition they had to decide whether a politician was present or whether a musician was present.