Rude - neutral - gentle: looking through the style of action

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Introduction

Rude- and neutral- and gentle- there is another fundamental aspect of an observed action: its dynamics. Action dynamics gives information on the temporal state of the agent and provides an appraisal of the affective and/or cognitive component underpinning the relation between the performing agent and the recipient. This aspect of action dynamics has been named by Stern vitality forms (Stern 2010). Vitality forms are composed by four basic components of movement: time profile, force, space and direction.

Aims

The present study consists of two functional magnetic resonance imaging (fMRI) experiments. The aim of Experiment 1 (Exp.1) was to confirm the location of the anatomical areas involved in vitality form processing described in Di Cesare et al. 2013. The aim of Experiment 2 (Exp.2) was to investigate whether the coding of vitality and velocity forms is characterized by distinct activation patterns.

Methods

Participants

16 right-handed subjects participated in Exp.1 and Exp.2.

Stimuli

In Exp.1 video-clips were presented to the participants showing two actors (1 male and 1 female) performing different actions using a hand: a cup (Figs.1AB); move a bottle; pass a ball; give a packet of crackers. All actions were executed using three different vitality forms: rude, neutral, gentle.

In Exp.2 video-clips were presented to the participants showing two male actors, only one of whom performed an action (more: a jar, a bottle, a can; see Fig.1CD) towards the observation of the other acting by his right hand. All actions were performed using three different vitality forms: gentle, neutral, rude.

Results

Experiment 1

Overall effect of “what” and “how” tasks

The observation of all video-clips vs. implicit baseline revealed a rather similar pattern of activations for both tasks (what and how). More specifically there was a significant activation of visual temporal area, posterior parietal lobe and cerebellum bilaterally, as well as of the left inferior frontal gyrus. Additional activations were found in the premotor cortex, particularly for the what-task (Fig.4).

Contrasts between “what” and “how” tasks

The contrast between tasks what vs. how revealed activations, in the posterior parietal cortex bilaterally, left premotor cortex and prefrontal cortex (Fig.5A). The opposite contrast (how vs. what), revealed specific activations in the dorsolateral insula bilaterally (Fig.5BC).

Experiment 2 - Univariate analysis

Overall effect of “vitality” and “velocity” tasks

In Exp.2, the observation of all video-clips vs. implicit baseline revealed a rather similar pattern of activations for both tasks (vitality and velocity).

More specifically observation of the video clips for each task vs. baseline revealed signal increase in visual occipito-temporal areas, parietal lobe, SMA, premotor and prefrontal cortex (Fig.1AB).

Additionally, insular activation was observed bilaterally.

Contrasts between “vitality” and “velocity” tasks

The direct contrast between vitality and velocity tasks revealed stronger activations, for vitality task, in the prefrontal lobe, with left prevalence and in the insula bilaterally (Fig.7AB).

Experiments 2 - Multivariate pattern recognition analysis

The univariate analysis carried out in Exp.2, contrasting vitality forms with velocity and the vitality-velocity task, revealed stronger activations, for vitality task, in the prefrontal lobe, with left prevalence and in the insula bilaterally (Fig.7AB).

The contrast between tasks what vs. how revealed activations, in the posterior parietal cortex bilaterally, left premotor cortex and prefrontal cortex (Fig.5A). The opposite contrast (how vs. what), revealed specific activations in the dorsolateral insula bilaterally (Fig.5BC).

Discussion

The vitality forms are an intrinsic property of the action that provides an appraisal of intersubjective relations allowing one to relate to and understand others. The present data show that recognition of vitality forms is mediated by a specific anatomical area involved in vitality form processing. The classification pattern analysis revealed that the classifier mean accuracy for the levels across 16 participants was, for the left and right insula respectively: 56.4% and 48.6%, for the contrast rude vs. neutral and medium and 56.7% and 55.7% for gentle vs. slow. In contrast, for the two control areas (CTRL 1, CTRL 2), the classifier mean accuracy across the same 16 participants was, for the left and right insula respectively: 56.4% and 48.6%, for the contrast rude vs. fast, 58.8% and 57.7% for the contrast neutral vs. medium and 56.3% and 56.6% for gentle vs. slow (Fig.8).

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Subsequently, group discriminative maps were inspected for consistency of spatial patterns across participants. Fig.9 shows the main pattern of discriminative maps clustered in the right insula (p<0.05 FDR corrected).

Figure 9: Discriminative maps of 50% of trials for each vitality form. The more discriminative for the peripersonal difference of “vitality” (rude) vs. (neutral, medium, gentle) vs. “velocity” (slow) was the left insula (p<0.05 FDR corrected) on the average across replication of 16 participants in Talairach coordinates.

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