

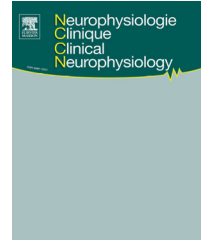


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REVIEW/MISE AU POINT

In the presence of others: Self-location, balance control and vestibular processing

Comment le contexte social influence la localisation de soi, la posture et le traitement de l'information vestibulaire



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Perspective taking;
Sensorimotor resonance;
Empathy;
Mirror neuron system

Summary The degree to which others in our environment influence sensorimotor processing has been a particular focus of cognitive neuroscience for the past two decades. This process of self-other resonance, or shared body representation, has only recently been extended to more global bodily processes such as self-location, self-motion perception, balance and perspective taking. In this review, we outline these previously overlooked areas of research to bridge the distinct field of social neuroscience with global self-perception, vestibular processing and postural control. Firstly, we outline research showing that the presence and movement of others can modulate two fundamental experiences of the self: self-location (the experience of where the self is located in space) and self-motion perception (the experience that oneself has moved or has been moved in space). Secondly, we outline recent research that has shown perturbations in balance control as a result of instability in others in our environment. Conversely to this, we also highlight studies in virtual reality demonstrating the potential benefits of the presence of others in our environment for those undergoing vestibular rehabilitation. Thirdly, we outline studies of first- and third-person perspective taking, which is the ability to have or take a visuo-spatial perspective within and out-with the confines of our own body. These studies demonstrate a contamination of perspective taking processes (i.e. automatic, implicit, third-person perspective taking) in the presence of others. This collection of research highlights

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MOTS CLÉS

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Système des neurones
miroirs

the importance of social cues in the more global processing of the self and its accompanying sensory inputs, particularly vestibular signals. Future research will need to better determine the mechanisms of self-other resonance within these processes, including the role of individual differences in the susceptibility to the influence of another.

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Résumé Cet article de synthèse résume les résultats des rares tentatives d'établir des ponts entre les neurosciences sociales et les études portant sur la localisation du soi, le contrôle postural et le traitement des informations vestibulaires. Premièrement, nous présentons des recherches montrant que l'observation d'autrui module deux expériences corporelles à la base de la conscience de soi : la localisation de soi, c'est-à-dire l'expérience d'où est localisé notre soi dans l'espace, et la perception de son propre déplacement dans l'espace. Par la suite, nous exposons des recherches récentes montrant que des instabilités posturales sont évoquées par l'observation des mouvements d'une tierce personne dans notre environnement. Ces données indiquent que le contrôle postural est sujet à des résonances sensori-motrices entre soi et autrui. Par conséquent, montrer des déplacements de corps humains dans des environnements virtuels serait efficace pour entraîner des patients lors de rééducations vestibulaires. Pour finir, nous rapportons des études sur la prise de perspective visuo-spatiale, c'est-à-dire la capacité à adopter une perspective centrée sur le corps (perspective en première personne) ou se situant hors des limites physiques du corps (perspective en troisième personne). Ces études suggèrent que la simple présence d'autrui évoque de façon automatique et implicite une prise de perspective en troisième personne, ce qui modifierait les traitements sensoriels au niveau du corps même de l'observateur. L'ensemble de ces études met en évidence l'importance des informations sociales dans le traitement plus global du soi et des entrées sensorielles qui le sous-tendent, en particulier celle des signaux sensoriels vestibulaires.

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Introduction

Human perception and action can be influenced by the observation of another person acting within our environment. Examples from daily life are numerous, ranging from irrepressible contagious yawning and itching to implicit mimicry of another's behavior [91,92]. Regarding the well-described "chameleon effect", experimental psychologists revealed that the mere observation of another person increases the chance of unconsciously mimicking their posture, gestures and facial expressions [22,58]. Of note, the overall influence that others exert on one's body perception and behavior is largely unconscious and uncontrollable. Surprisingly, studies of human balance abilities and vestibular perception have traditionally tested participants in well-controlled visual environments devoid of the depiction of human beings [66,114,27]. This accounts for the current lack of knowledge of how the presence of others influences spatial processing, vestibular processing and balance control. Only during the last few years have some theoretical (for recent accounts, see [68,61,62,25]) and experimental approaches ([26,78,117,118]) endeavored to merge procedures from social neuroscience, experimental psychology, and vestibular science.

Over the last twenty years, research in cognitive neuroscience has measured the degree to which sensorimotor processing is influenced by the observation of others, an effect referred to as "shared body representations" or "sensorimotor resonance" [24,116,49]. Motor resonance between the self and others can be seen when an observer

has their motor action execution facilitated by watching the same actions of another [31]. Sensory resonance between the self and others has been shown for tactile [116,110,111,21], nociceptive [113], and smell processing [128]. For example, participants instructed to detect touch applied to a given location of their own face were better able to do so when they simultaneously observed a face being touched at a similar anatomical location [110]. This facilitation was larger when participants observed their own face being touched as compared to someone else's face being touched. The mirror neuron system in the frontoparietal cortex [102,103,101,50] was proposed as the main neural basis of sensorimotor resonance between the self and others.

While sensorimotor resonance between the self and others has been extensively described for hand actions [31,50,16,121,122,88] and detection of tactile events on the face or hands [116,110,111,21], there are few descriptions of how it contributes to more global and coordinated bodily actions, such as balance control and sensory processing of whole-body vestibular signals. The present review article aims at establishing connections between the so far distinct fields of social neuroscience and the physiology of space perception, vestibular processing and postural control. In the first section, we summarize recent findings from cognitive neuroscience showing that self-identification with a visually presented human body modifies two crucial aspects of self-processing: self-location – the experience of where I am "located" in space, and self-orientation and perspective – the experience of how I am "oriented" within space and

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