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NEUROSCIENCE AND PATHOLOGY OF IMAGING AGING BRAIN

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Project Title: Neuroscience and Pathology of imaging Aging brain .

Description/Goals of Project

This Article aims to investigate the cognitive process and the neural basis of action processing and, in particular, of gesture elaboration. The topic has been dealt with in clinical and neuro imaging studies, and the functional role of the fronto-temporo-parietal regions, with a particular focus on the motor and premotor areas. The first chapter presents a critical revision of neuroimaging findings on the neural basis of gesture processing, with the aim of verifying whether different neural structures are involved in processing various kinds of gestures and with specific reference to the distinction between meaningless (MLG) and meaningful gestures (MFG). The review also proposes an attempt at reconciling cognitive models with available neuroimaging data, and serves as the starting point for further clinical investigation. In the second chapter, the role of the supplementary motor area (SMA) - the major target of basal ganglia output - in the control of voluntary movement was investigated in a functional MRI study on a patient with Tourette syndrome. The topic of the voluntary control of action has been discussed from a different clinical perspective in the third chapter, by means of a study on the automatic-voluntary dissociation (AVD) in patients affected by disorders of gesture processing (limb apraxia); apraxic patients usually perform the same gestures better in a naturalistic context than upon an examiner's request. The comprehension of the cognitive mechanisms underlying this phenomenon in single patients can provide further information about how the fronto-temporo-parietal network interacts with environment in gesture planning. Finally, in the fourth chapter, the activity of the primary motor area (MI) has been addressed in relation of the embodiment theory by means of a Transcranial Magnetic Stimulation (TMS) study, in which the effects of action observation and action sentence comprehension on the activity of the motor system in different ways have been compared.

Hypotheses;

The present work aimed at investigating the cognitive process related to action processing and his neural basis. This topic has been dealt in different ways, devoted to clarifying this complex motor behavior. In the first chapter we verify whether recent functional imaging studies support the view that different neural structures are specialized in processing different kinds of gestures. The reviewed papers, have shown that MFG shares most neural bases with MLG but also involves the activation of additional neural structures. Moreover, among MFG specific areas, most cerebral regions were activated only in TG processing, while no brain region was specifically activated by SG processing. No brain region has been consistently demonstrated to be MLG specific; however, several regions that are activated bilaterally in MFG processing appear to be activated predominantly on the right side during MLG processing. Moreover we have tried to interpret our results in relation of cognitive models of apraxia with the aim of contribute to resolve some controversial aspects. In particular, the controversial distinction between two cognitive components specifically responsible for skilled action recognition and production (the so-called input and output praxicons) is not supported by present findings. In fact, no areas have been found to be activated specifically for MFG observation and recognition. In agreement with Peigneux et al. (2004), our data support the idea that one single system (the so-called “praxicon”) is actually responsible for representing, and holding in long-term memory, sequences of skilled movements. This cognitive component, therefore, appears to be organized according to the general “mirror” principle: more specifically, the left anterior IPS, could be the neural basis of the praxicon since it is specialized in representing skilled actions, including actual or pantomimed tool use and, possibly, purported tool use. Moreover, our review has demonstrated that imitation of novel or familiar gestures may proceed through the activation of the same pathway, and that additional cortical regions are specifically involved in MFG processing.

The core of this system is represented by a distributed frontoparietal mirror circuit (including the Broca’s area and vPM, the anterior and the superior parietal regions). Gesture representations computed by the fronto-parietal mirror circuit would feed, for the actual production of selected movements, frontal areas, namely dPM, SMA and MI, specifically involved in motor integration and execution. The role of the SMA in the control of voluntary movement was investigated in a functional MRI study on a patient with Tourette syndrome (second chapter). This study confirms that the SMA and primary sensorimotor area are hierarchically complementary to each other in the programming and execution of voluntary movements. The increased SMA activation in TS patients may reflect the use of more cerebral cortex to perform a voluntary motor task as a result of the additional effort required to suppress tic activity. The absence of tics during either movement, which rendered the fMRI examination possible, may be related to constrained pre-programming activity modulated by the SMA. In the third chapter, the topic of the voluntary control of action has been discussed in relation with the automatic-voluntary dissociation. Our study showed that AVD can be observed in patients affected by clinically relevant limb apraxia, documenting that gesture reproduction in artificial context may substantially different from spontaneouslyevoked motor activity. Therefore the context can provide strong facilitatory cues for the retrieval of adequate motor patterns, more than the single tools.

In this sense the whole seems to be more than the sum of its parts. Since we have demonstrate that even the same gesture, evoked by the very same tool, can be produced correctly

or not depending on the kind of context, we have suggested that facilitatory “natural” conditions may have a crucial influence in determining motor behavior. It has been maintained that, although examiner’s requirements came from the external world and are mediated via the senses, i.e. seem to be bottom-up, yet they provide a model the subjects have to comply with, i.e. are top-down. Finally, in the fourth chapter, the activity of the primary motor area (MI) has been addressed in relation of the embodiment theory. Whereas studies of action observation has been shown to increase primary motor cortex excitability in an effector (or goal-based) manner, contrasting effects are found during action-based linguistic processing. Our preliminary results showed a higher modulation of the activity of the hand MI during processing both picture and sentences for the hand actions compared other stimulus types. Moreover while pictures observation showed a motor cortex excitability more similar to that one induced during the baseline, actionrelated sentence comprehension has produced a progressive decrease in motor cortex excitability activity along the TMS timings.

My Role:

The ongoing assessment plan for the Neuroscience major will focus on the following three **fundamental questions:**

(1) What do we need to describe cognitive process and the neural basis of action processing and, in particular, of gesture elaboration and how I able to do, and what perspectives should acquire as output?

(2) What evidence is need for clinical and neuro imaging studies, and the functional role of the fronto-temporo-parietal regions, with a particular focus on the motor and premotor in areas of the Neuroscience which acquiring the intended knowledge, skills, and perspectives in field?

(3) How is this evidence used for ongoing improvements in student learning? More specifically, our assessment project:

Research Techniques

As I have already been trained on the techniques I will use Transcranial magnetic stimulation (TMS) study, in which the effects of action observation and action sentence comprehension on the activity of the motor system in different ways have been compared.

Status of Project I worked with Rukhsana yasmeen year to perform work that led to a Bs English thesis((Cognitive Poetics) . This project is a related of that work. I have recently begun working again and expect to continue to do so over the course of the summer in order to produce a publication describing my investigation.

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References

1) Brown, Rebecca C.; Lockwood, Alan H.; Sonawane, Babasaheb R. (8 January 2017).
2) Peters, R (8 January 2017). "Ageing and the brain"
3) Mather, Mara (5 October 2015). "The Affective Neuroscience of Aging"
4) LeMay, Marjorie (1984). "Radiologic Changes of the Aging Brain and Skull"
5) Kelly, K. M.; Nadon, N. L.; Morrison, J. H.; Thibault, O.; Barnes, C. A.; Blalock, E. M. (1 January 2006). "The neurobiology of aging"
6) Kumar, Ashok; Foster, Thomas C. (1 January 2007). "Neurophysiology of Old Neurons and Synapses"
7) Peters, R (8 January 2017). "Ageing and the brain"
8) Reuter-Lorenz, Patricia A.; Park, Denise C. (8 January 2017). "Human Neuroscience and the Aging Mind: A New Look at Old Problems
9) Kaszniak, Alfred W.; Menchola, Marisa (1 January 2012). "Behavioral neuroscience of emotion in aging"
10) Stanton, Biba R. (1 February 2011). "The neurology of old age"