Growing minds from a different seed : how focusing on the basis of behavior induces a radically different theory of cognition

Martin Flament Fultot,[1]

Abstract. Despite a growing influence of ideas stemming from embodied and enactive cognition, mainstream cognitive science keeps conceiving the role of the nervous system over the body as one of control. This notion–derived mainly from engineering–attempts to model the body as a system of actuators, and the nervous system as a computing machine which plans and sends commands to the actuators. Important challenges to such a view have been raised continuously for several decades now. Among these challenges, some are addressed either to the vision of the body as purely passive and obedient or to the nervous system as a computing machine. For instance the properties of muscles are completely different from the properties of electric actuators and they are very difficult to command following a typical computational approach. To compensate for this, mainstream cognitive science is forced to bet even harder on the cognitive capabilities of the nervous system. It has been justly said that mainstream cognitive science sees animal bodies as poorly designed robots with powerful computers on their shoulders

Nevertheless, some efforts have been made in order to adapt the main models of mainstream cognitive science to such challenges. However, it can be argued that the mismatch between the way the controller is supposed to be–i.e. like a computer–and how inadequate actual animal bodies seem for being controlled through computational means, requires a lot more than simple tweaks to the model (e.g., adding probabilities, noise or a discrete amount of "off loading" computational burden into the body and environment, etc.). In particular, complex animal bodies resist computational control approaches because of their many degrees of freedom, which has been called the problem of redundancy : the same behavioral outcome can be reached through an open ended amount of combinations of muscular activity. Since this problem arises at the very basis of behavior–i.e. muscular contraction–mainstream cognitive science has been historically crippled in its attempt to apply computational, problem-solving inspired tools to the production of behavioral models. Thus, I claim that any theory that is constructed from its inception with the problem of redundancy as the main *explanandum* will have *ipso facto* a decisive epistemic advantage over current computational cognitive theories.

In this talk I will focus on the Equilibrium Point Hypothesis and its extension into the theory of coordinative structures or synergies. I will show that, muscular control being a so called "low-level" task notwithstanding, in order to account for it these theories need to depart so radically from mainstream models of cognition that it no longer seems possible to reconcile them. In particular, control is not achieved through the communication of command signals, nor any representational vehicle, but through the modulation of self-sustaining patterns. I further speculate on how this shift from the idea of control through information towards the idea of coordination through modulation can be extended to the whole functioning of the nervous system at every scale. I will argue that such a scenario can actually account for an important amount of properties that have been acknowledged as the core *explananda* of cognitive science and philosophy but which have nonetheless puzzled scientists and philosophers until now, e.g. the intentionality of perception and the faculty of anticipation.

Finally I will reflect on how the shift in focus from traditional questions in cognitive science to the actually more pressing issues of motor coordination is to be accredited for facilitating the emergence of theories that hold a better promise of explaining, on the long run, "higher level" cognitive phenomena than the very theories that were forged to deal first and foremost with those phenomena.

REFERENCES

[1] Paris Sorbonne University/SND/CNRS, email: martin.flament-fultot@paris-sorbonne.fr