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## WHY DYNAMICS? BECAUSE IT TACKLES REAL ISSUES.

For many years, in fact since the inception of cognitive science, the framework of a *representational* theory of mind has provided conceptual support to research on the question of cognition, tractable under the information-processing approach. The level of description opened by the concept of information processing is still the decisive notion for most of cognitive science because the relevant disciplines of the hard sciences—for instance AI, neural networks, and cognitive psychology—mostly operate on this conceptual level. Put in a more concrete fashion, one tries to analyze mind and cognition as a complex information-processing event in the brain. This would then also have to be applied to singular elements of the experiential space, such as for instance, to the phenomenal self or to qualia.

Recently, however, a flood of completely new concepts, many of which are often very hard to understand, have been introduced by numerous researchers who take an interdisciplinary opening of a science of mind seriously. These are concepts such as activation vectors, non-linear effects and measures, trajectories through neural spaces, attractors, neural binding and temporal coding. This colorful and contingent list could easily be continued. They all can be arranged under one big, encompassing umbrella: that of *dynamics* as the central frame, highlighted by the contributions of Part I of this volume. Not representational models with symbolic contents, but active agents with dynamical architectures are considered. This shift in perspective is, no doubt, the most important transformation that cognitive science has witnessed. It is here to stay, as attested to by the contents of Part I of this volume, along with a growing literature on the subject.

Why should this dynamical turn be so significant? I would say because it tackles two really hard issues: the alternative to representations, and the causal level of a cognitive subject. Let me address these two issues separately.

First, dynamical approaches are essential because they free us from the straight-jacket of a representational mind by postulating, instead, mind as an emergent phenomena which is anchored in its *immediate coping* with its world. For a cognitive agent conceived as a dynamical network, coupling with the world will create regularities, which are, de facto, the objects that populate its world. This is the central idea of an *embodied*, situated or enactive cognitive science. This epistemic shift, made largely possible by the technical tools of dynamical systems, cannot be underestimated, and we are far from having extracted all its consequences. One of the most dramatic examples of this impact are the new schools of artificial intelligence based on autonomous agents, as seen in the papers in Part III of this volume. The very use of the word ‘autonomous’ already is a giveaway that these are not representational, but actively presentational machines.

The second central aspect introduced by dynamics is the new status given to the cognitive *agent*. In fact, if the proper level of analysis of cognition is as an emerging

property from dynamical principles, a separate question is its causal efficacy. Can a mental subject actually bear effectively on the elements and properties that are needed to give rise to it? This issue is particularly important in psychology for it defines the status of the 'self', the level required by psychologically motivated questions. As several contributions in Part II of this volume show, an emergent cognitive agent is intrinsically endowed with the capacity to affect the levels of constitutive elements. This is simply due to the fact that the cognitive subject as a global emergent level acts directly as a constraint on the local level. We are landed with a *double* causality across levels, effective passages between the local and the global. Epistemically this solves the old quandary concerning the apparently epiphenomenal status of the subject, and illuminates a host of phenomena in psychology from emotions to somatisation.

Although much more must be achieved before we arrive at a mature dynamical cognitive science and psychology, this volume adds significant steps. It is now time to turn to these voices.

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Francisco J. Varela