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New Ideas in Psychology 26 (2008) 143–145

NEW IDEAS IN PSYCHOLOGY

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Editorial

Dynamics and Psychology

The first 40 years or so of the cognitive revolution in psychology were dominated by information processing theories. Even "non-classical" models, such as connectionist networks, still regarded cognition as essentially information processing. More recently, however, the hegemony of computationalism has given way to a diversity of theoretical approaches. Among the most promising of these is dynamicism, the view that cognitive processes are best modelled as dynamical systems rather than as information processing systems.

The properties of dynamic systems are uniquely suited to modelling psychological and neurophysiological systems. Brain activity and behaviour both happen in time, and temporality is an essential property of dynamic systems. Moreover, the time scales are nested: social interactions, which may last hours or longer, include individual behaviours, such as language, which occur over the course of seconds to minutes. Behaviours are driven by cognitive mechanisms like memory and categorization, which operate on sub-second time scales. These cognitive mechanisms are implemented in the brain, where neurons operate on a time scale of milliseconds. Both brain and behaviour often exhibit nonlinearity. These systems are also often coupled, both with each other and with the environment. The structure of the system at any point in time is an equilibrium of stability and change. Dynamic explanations account for precisely these phenomena: temporality, nested time scales and coupled, nonlinear interactions, and equilibrium between flexibility and stability, in the short and the long run.

In the present issue, we have collected together representative examples of the best psychological work being done from a dynamical systems perspective across a wide range of research topics. The volume focuses on theoretical issues (temporality, complexity) and on results in development and language, as well as on modelling and experimental results related to higher-level cognitive capacities and deficits, including vision, memory, social cognition, mental illness and psychotherapy. Altogether, the special issue constitutes a powerful claim for the relevance of dynamicism to contemporary psychology:

Grush (2008) highlights the psychological relevance of time and elaborates on a model that puts dynamics at centre stage in behaviour and perception, as framed in the temporal dimension.

Chialvo (2008) focuses on the key notions of emergence and criticality. He presents the emergence of collective behaviour in social insects as a model to help us understand the mechanisms that underlie the emergence of complexity in self-organizing dynamical systems more generally, and the brain in particular.

0732-118X/$ - see front matter
doi:10.1016/j.newideapsych.2008.02.001

Colunga and Smith (2008) put forward a model of learning that accounts for the generalization of nouns by children. The model nicely illustrates the integration of flexibility and stability as different time scales bear on the task. Colunga and Smith's focus on flexibility and individual differences fits together nicely with the following two pieces.

First, Rączaszek-Leonardi and Kelso (2008) address the challenge of how a dynamicist approach can deal with the symbolic aspects of natural language, which usually have been the ones that attracted attention. The coupled dynamic systems approach suggests the need to pay attention to the different time scales at which language unfolds and reject the synchronic assumption of symbolism.

Second, Tuller, Jantzen, and Jirsa (2008) address the perception of new speech sounds as an example of category learning. In line with previous articles, this research reports the relationship between initial conditions and individual differences, as well as the process of reconfiguring discriminative abilities.

Next, Johnson, Spencer, and Schöner (2008) introduce the dynamic field approach, a theoretical framework that has been successfully exploited in the explanation of motor control and development, in order to study the dynamics of visual cognition. In their paper, change detection and the 'binding problem,' among other central issues in the vision literature, are addressed in terms of attractors, bifurcations, instabilities, and related dynamical systems concepts.

Chartier, Renaud, and Boukadoum's article (2008) focuses on modelling memory with nonlinear dynamic artificial neural networks. The relation between artificial neural networks and dynamical systems is a topic that has received much attention. This study throws light upon the sort of constraints that a dynamic approach can take in modelling dynamic psychological properties.

Focusing on the study of social cognition, Di Paolo, Rohde, and Iizuka (2008) study the dynamics that underlie interpersonal interactions by means of evolutionary robotics simulations. In their view, social interactions can be accounted for dynamically by shifting from an individualistic framework to an interactive one, where global collective dynamics are characterized by processes of reciprocal causality.

The last two contributions show the relevance of the dynamicist perspective in psychotherapy.

According to Doba, Nandrino, Lesne, Humez, and Pezard (2008), dynamicist ideas provide a useful resource for finding better diagnostic evidence for anorexia, by studying the dynamic patterns in the discourse of patients. In particular, they study the autobiographical speech of anorexic adolescents to find patterns different from those in the speech of normal adolescents.

Finally, Villmann, Liebers, Bergmann, Gumz, and Geyer (2008) try to understand pyschotherapeutic change as a dynamical, nonlinear phenomenon, which is tracked through psychophysiological records.

The diversity of topics and approaches in this special issue highlights the vibrancy of dynamical research in psychology today. One of the great benefits of the dynamical approach is the natural integration of different temporal and spatial scales. That breadth is evidenced here in the range of phenomena under consideration—everything from the level of the individual neuron through individual behaviour, all the way to social interactions.

We hope that this issue will serve as a landmark in the development of dynamical theories in psychology, both in the present and in the future. In the present, we hope that researchers working in different areas will gain a broader perspective on the variety of

dynamical work underway. In the future, we hope that the field will be able to look back on this issue as the beginning of an effort to unify psychological science, to integrate different time scales, different phenomena, and different approaches under a common dynamicist explanatory framework.

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