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Multimodal dynamics of coordination,
or Michael Turvey and psychology according to engineers (not only for engineers). Excerpts[46]

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Abstract

A major part of Michael T. Turvey's contribution to ecological psychology are reflections on the coordination of movement, in particular with regard to the environment. This suggestion plays an important role in the beginning of the debate on motor control, whose today's meaning is far broader than the original one, including the field of cognitive science. An overview of the progress of the debate has been presented, from the beginning to the present day, with an indication towards its diversity and the role of what Michael T. Turvey suggested 30 years ago.

Keywords: Michael T. Turvey; ecological psychology; coordination of movement; motor control; dynamics and self-organizing systems theory; MOSAIC, joint action.

A natural point of reference for Michael Turvey's body of work, especially keeping in mind the entire period of his academic activity, is ecological psychology. In a chapter on ecological psychology he co-wrote with Michael J. Richardson, Kevin Shockley, Brett R. Fajen and Michael A. Riley for *Handbook of Cognitive Science. An Embodied Approach*, Turvey treated the subject in view of six rules: 1) the proper unit of analysis is the organism-environment system; 2) environmental reality should be defined on an ecological scale; 3) behaviour is emergent and self-organized 4) perception and actions are continuous and cyclic; 5) information is specificational and 6) perception is of affordances. Within this set of rules, the rules 3 & 4 seem especially interesting, as while they retain a basic relationship with ecological psychology, they point to a connection with the concept of Bernstein, to whose body of work Turvey attached particular signi-

[46] Excerpts from the entire Polish version (Komendziński 2012).

ficance. This paradigm is connected with the concept of coordination. Bernstein's model evokes another notion important in this context, a notion whose weight I would like to point out, namely, anticipation.

We can refer to five main routes of development characteristic for that time: 1) towards a extension of synergetic modeling (identification of new parameters of control); 2) towards connecting levels of analysis; 3) towards temporal patterning and variability of rhythmic coordination; 4) towards a network of oscillators for perceptive and motor synchronization of complex musical rhythms; and 5) towards synergy as spinal modules or pattern generators with a point attractor or limited cycle dynamics. These two decades of development constitute search within the theory of metastability, and thus, a departure from multistabilities discovered at various levels (see Dagmar Sternad).

At the end of the previous decade (in 1998 and 1999), there appeared works authored by Daniel Wolpert and Matsuo Kawato, which suggested a modular approach that would refer to internal model for motor control. A developed model of motor control, known as MOSAIC (Modular Selection and Identification for Control) was presented by Haruno, Wolpert and Kawato in the article "MOSAIC Model for Sensorimotor Learning and Control" in 2001. In the same year, Wolpert together with Randall Flanagan present in *Current Biology* the work "Motor Prediction." Motor prediction is one of the problems very interesting for us in the context of reflection over coordination and motor control (prediction, applying the model to social interactions).

In the last decade, in the context of discoveries within neuroscience, the possibility of monitoring of brain activity by the means of modern tools and an especially fast development of the concept of embodied cognition, there has been developing research on joint action. According to what the titles of works published by Gunther Knoblich, Natalie Sebanz and their collaborators claim, coordination is therein transferred to whole bodies. These texts show that our minds are to a large degree joint with motility and the body on the one hand, while our bodies become harmonized with other bodies. We achieve simultaneously the embodied and the social dimension of joint action. In this case, coordination begins to have its social dimension. Starting with Michael Turvey three decades ago, the research conducted within the paradigm of behavioral dynamics of coordination is an important component of the joint action perspective, at least within the scope of time coordination. The ecological perspective, represented by Turvey, meets studies over cooperation conducted within joint action. Coordination of movement ceases to be simply a way of organizing movement, human motility becomes an experience. In further research over coordination it turns out that humans not only coordinate their movements with the rhythms coming from the environment, but, importantly, they do not do this within one modality, but, rather, in a multimodal way.

The research of this kind is important for situations from our everyday life, as it allows us to understand what coordinating movement with visual and auditory rhythms of the environment consists in. This allows for a transition from the issue of motor coordination in the perspective of its dynamic interpretation to another question of current importance, that is sensory multimodality and intermodal integration.

As a conclusion of this route of development of the notion of motor coordination in the perspective of the theory of dynamic systems we may take a look at a chapter from the book *Progress in Motor Control* (2008, edited by Sternad), written by Michael Turvey and Sergio Fonseca, entitled “Nature of Motor Control: Perspectives and Issues”. This chapter points to four approaches which the authors see as their sources of inspiration: neuroanatomy, robotics, self-organization and ecological reality. This suggestion should be analyzed more carefully, due to the fact that, as Nigel Stepp, Anthony Chemero, and our main character, Michael T. Turvey, demonstrate in the article “Philosophy for the Rest of Cognitive Science”, it is a proposition of a paradigm for cognitive sciences, and especially for the integration of cognitive sciences within the scope designated by the research in the perspective of the theory of dynamic systems, the concept of motor ontrol and the complementary account of embodied cognition, and particularly in the context of anticipation and prediction. This may be the future of cognitive sciences, the road towards which was indicated over 30 years ago by Michael T. Turvey, as based on the earlier indications by Bernstein and Gibson.

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