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# Sensorimotor intentionality: The origins of intentionality in prospective agent action



Jonathan T. Delafield-Butt <sup>a,b,c,\*</sup>, Nivedita Gangopadhyay <sup>d</sup>

<sup>a</sup> Department of Psychology, University of Copenhagen, Denmark

<sup>b</sup> Institute for Advanced Studies in the Humanities & Perception Movement Action Research Consortium, University of Edinburgh, UK

<sup>c</sup> Faculty of Humanities & Social Sciences, University of Strathclyde, UK

<sup>d</sup> Center for Mind, Brain and Cognitive Evolution, Institut für Philosophie II, Ruhr Universität Bochum, Germany

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### ABSTRACT

Efficient prospective motor control, evident in human activity from birth, reveals an adaptive intentionality of a primary, pre-reflective, and pre-conceptual nature that we identify here as sensorimotor intentionality. We identify a structural continuity between the emergence of this earliest form of prospective movement and the structure of mental states as intentional or content-directed in more advanced forms. We base our proposal on motor control studies, from foetal observations through infancy. These studies reveal movements are guided by anticipations of future effects, even from before birth. This implies that these movements, even if they are simple and discrete, are the *actions* of an intentional agent. We develop this notion to present a theory of the developing organisation of a core feature of cognition as embodied agent action, from early single actions with proximal prospectivity to the complex serial ordering of actions into projects to reach distal goals. We claim the prospective structural continuity from early and simple actions to later complex projects of serially-ordered actions confirms the existence of an ontogenetically primary form of content-directedness that is a driver for learning and development. Its implications for understanding autism are discussed.

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\* Corresponding author. Address: Faculty of Humanities and Social Sciences, University of Strathclyde, St. James' Road, Glasgow G4 0LT, Scotland, UK.

E-mail address: [jonathan.delafeld-butt@strath.ac.uk](mailto:jonathan.delafeld-butt@strath.ac.uk) (J.T. Delafield-Butt).

## Introduction

Mental states, such as perceptions involving complex stimuli and memory, beliefs about a social and object world, and desires to engage with these worlds, are necessarily *about* something. They are 'content-directed' or 'intentional'. Intentionality as 'being about something' is a hallmark of mental phenomena (Brentano, 1874; Husserl, 1913; Merleau-Ponty, 1945; Searle, 1983).<sup>1</sup> It constitutes a core structure of mental states that requires investigation by an interdisciplinary study of the human mind. In his discussion of philosophical psychology Brentano (1874) reinvigorated the notion of intentionality as a core feature of mental states, "Every mental phenomena is characterised by... the intentional (or mental) inexistence of an object, and what we might call... reference to a content, direction toward an object... or immanent objectivity." (p. 88).

In this paper, we explore the origins of intentionality as 'being about something' in the development of motor control. We aim to demonstrate that understanding mental phenomena as intentional or referring to content must take into account the development of a pre-reflective bodily intentionality or goal-directedness, identified here as 'primary sensorimotor intentionality'. We draw on evidence from studies of the development of human movement to show that sensorimotor behaviour, even from before birth, incorporates an anticipatory structure engaged toward some future consequence, even though such action in early development is not necessarily conceptually or cognitively complex (Lee, 2005, 2009; Legrand, 2006; Trevarthen, 1984; von Hofsten, 2004, 2009).

We make two contributions to the interdisciplinary study of intentionality of mental states and the nature of sensorimotor actions. (i) We bring out the anticipatory, goal-directed nature of even the most primitive sensorimotor behaviours and show they are governed by a pre-reflective, pre-conceptual 'sensorimotor intentionality'. (ii) We trace the development of the intentional structure of mental states to development of motor control and thereby ground the study of intentional structure of mental states in the study of ontogenetically primary motor engagement.

Understanding of the role of action in constituting psychological states and in cognitive development has its origins in early psychological study by Baldwin (1895) and Piaget (1953, 1954). Their observations of infant limb movement identified an exploratory and sensation-seeking property of even basic actions essential for learning and cognitive development, establishing a non-trivial role of action in development currently widely discussed by a growing body of literature that crosses the disciplinary boundaries of developmental psychology, cognitive science, and philosophy (Clark, 1997; Gallagher, 2005; Gallese, 2005; Gangopadhyay, Madary, & Spicer, 2010; Grammont, Legrand, & Livet, 2010; Haggard, Rossetti, & Kawato, 2008; Hobson, 2002; Hurley, 1998; Jeannerod, 1997; Noë, 2004; Pezzulo, 2011; Pezzulo, Butz, Sigaud, & Baldassarre, 2008; Reddy, 2008; Reed, 1996; Shapiro, 2011; Thelen & Smith, 1994; Thompson, 2007; von Hofsten, 2004; Woodward & Needham, 2008). A major feature of this new body of work is the emerging approach of embodied cognition advanced in the last two decades to begin to replace a purely functionalist paradigm for the study of the human mind (Noë, 2004; Pezzulo & Castelfranchi, 2009; Sheets-Johnstone, 2011; Stewart, Gapenne, & Di Paolo, 2011; Thelen & Smith, 1994; Thompson, 2007; Varela, Thompson, & Rosch, 1991; von Hofsten, 2009).

However, more conceptual work is required to uncover the properties and aspects of embodiment which are of critical importance to a study of psychological and cognitive development as embodied phenomena. In particular, though embodied cognition approaches stress that cognition is an embodied *activity* (Noë, 2004; Pezzulo & Castelfranchi, 2009; Sheets-Johnstone, 2011; Thelen & Smith, 1994; Thompson, 2007; Varela et al., 1991; von Hofsten, 2009), and recent models have been proposed to explain motor dynamics and motor contribution to cognition (Pacherie, 2008; Pezzulo & Castelfranchi, 2009; Thelen & Smith, 1994; von Hofsten, 2004), little is discussed by way of fundamental bodily properties that are supposed to seal the gap between mental and physical agency into a unified account of cognition as embodied agent action.

<sup>1</sup> Metaphysical enquiry of the objects of mental states questions whether they are real existing objects in the physical world or whether they enjoy a special status beyond the subjective-objective world divide. This is the subject of long-standing philosophical debate. In this paper we focus on the object-directed nature of mental states and not on philosophical debates about the metaphysical status of mental state objects.

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