Schema Mechanisms as an Attempt to Implement Genetic Epistemology

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Abstract. We review schema mechanisms as they have been used to account for a *genetic* or *constructivist* theory of learning.

Keywords: Schema mechanism · Genetic epistemology · Constructivist learning.

1 Introduction

2 Genetic epistemology

The notion of *sensori-motor scheme* proposed by Piaget [10]. Related to constructivist epistemology by [5].

Piaget's genetic epistemology : "Knowledge does not originally arise either from a subject conscious of itself or from objects already constituted (from the subject's point of view) that would impose themselves on the subject. Knowledge results from interactions occurring halfway between the subject and the objects, and thus involving both, but due to a complete un-differentiation and not from exchanges between distinct forms.

If, at the beginning, there is neither a subject, in the epistemic sense of the term, nor objects, conceived as such, nor, above all, invariant instruments of exchange, then the initial problem of knowledge will be to construct such mediators. Starting from the contact zone between one's own body and the objects, these mediators will progressively engage more deeply in both complementary directions toward the exterior and the interior. It is from this dual progressive construction that the joint elaboration of both the subject and the objects depends.

The initial instrument of exchange is not perception, as rationalists too easily conceded to empiricism, but rather action itself, with its much greater plasticity. Certainly, perceptions play an essential role, but they partly depend on action as a whole, and some perceptual mechanisms that one might have thought to be innate or very primitive only emerge at a certain level of object construction." (translated from [9], p14-15)

Guerin and McKenzie [6] proposed the graphical representation in Fig. 1.

Ziemke [12] examined how these views apply to robotics.

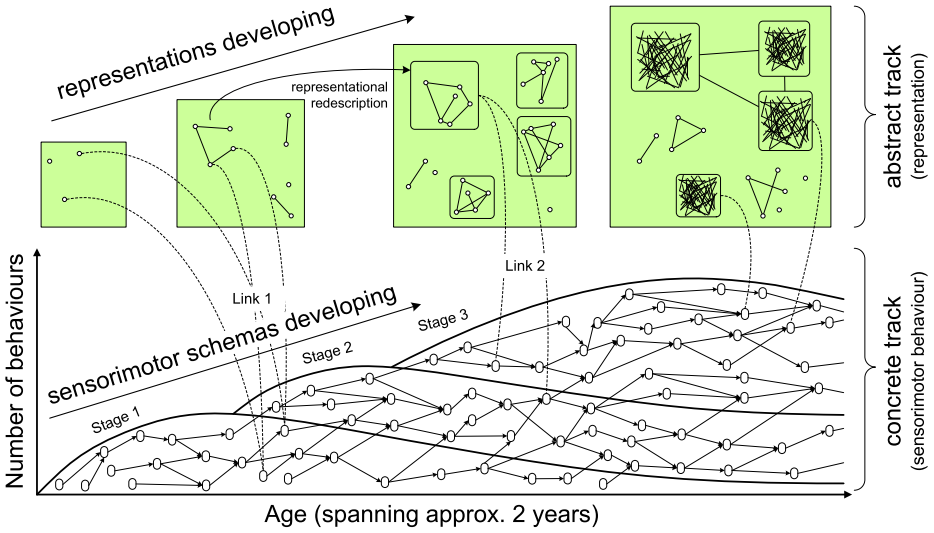

Fig. 1. Conceptual diagram of infant development from [6] Fig. 1. The lower (concrete) track shows a directed acyclic graph of sensorimotor schemas. A node represents a newly created schema. An edge has the meaning "is a necessary precursor". Stage 1: behaviors without objects. Stage 2: behaviors with single objects. Stage 3: object-object behaviors. The schemas now involve relationship among objects, and locations and transforms within space. The higher (abstract) track represents representations of objects by schemas and physical properties influencing their interactions.

3 Schema mechanisms

Drescher [3] proposed the foundational schema mechanism by modeling schemas as depicted in Fig. 2.

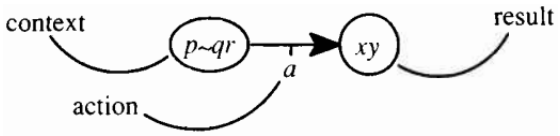

Fig. 2. Schema from [3] Fig. 3.2. The schema noted $p{\sim}qr/a/xy$ asserts that if action a is taken in the context where p is true, q is false, and r is true then the resulting conditions x and y will be true.

Bettoni has criticized this model in stating that "Drescher's Constructivism is not Piaget's Constructivism, mainly because of its tacit acceptance of *cognitive dogmatism*" ([1], p. 6). He describes cognitive dogmatism as taking for granted that "patterns and structures of objects, attributes, relations, etc. [...] be as much as possible true copies of 'original' objects, attributes, relations etc. in the world" ([1], p. 1).

[3] [2] [4] [8] [7] [11]

4 Conclusion

The problem of abstraction.

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