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Towards an integration of evolutionary psychology and developmental science : new insights from evolutionary developmental biology

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SUMMARY AND DISCUSSION

The main aim of this dissertation was to show that evolutionary psychology can serve as a metatheory for psychology, but only if its scope is broadened to include theories and findings from evolutionary developmental biology. Evolutionary psychology is defined as ‘simply psychology that is informed by the additional knowledge that evolutionary biology has to offer, in the expectation that understanding the process that designed the human mind will advance the discovery of its architecture’ (Cosmides, Tooby, & Barkow, 1992, p. 3). It is claimed to be a metatheory for psychology, i.e., a theory that unites the different branches and minitheories in psychology (Buss, 1995). The main tenet of evolutionary psychology is that the human mind consists of a multitude of evolved domain-specific psychological mechanisms, also called modules. These modules arose through natural selection because they could solve recurrent survival- and reproduction-related problems in ancestral times (Tooby & Cosmides, 1992; Buss, 1995). This tenet has been called the *massive modularity thesis* (Sperber, 1994), and is part of the *Integrated Causal Model* (Tooby & Cosmides, 1992). Evolutionary psychology is based on neo-Darwinian evolutionary theory, which states that evolution can be explained by small genetic changes that lead to variation upon which natural selection can act.

Evolutionary developmental (evo-devo) biology is an approach that forges a synthesis between processes active during individual development and processes active on an evolutionary time scale. It tries to explain both *that* evolution occurs, and *how* it occurs. In order to know how evolution occurs, one has to study the origin of traits, which implies studying the development of traits (Hall & Olson, 2003; S.B. Carroll, 2005).

In chapter 2 I proclaimed that evolutionary psychology is a useful framework to derive new hypotheses and novel interpretations of data, but that this is not enough to ascribe to evolutionary psychology the status of a metatheory. Such a metatheory should contribute to the major issues in the field of psychology. These include the modularity of the mind, the nature-nurture debate, the question whether development occurs gradually or in stages, and the question how individual differences arise. In chapter 2, each of these issues was considered from the perspectives of evolutionary psychology and evo-devo

biology. It was concluded that the view of evolutionary psychology is quite limited in addressing the major issues, whereas models and empirical findings of evo-devo biology provide new insights in these issues.

This chapter was published in *Psychological Inquiry* (Ploeger, van der Maas, & Raijmakers, 2008a), a journal that invites commentaries to target articles. Consequently, this chapter elicited several interesting reactions. A first issue that had to be considered was the definition of evolutionary psychology. Duntley and Buss (2008) argued that evolutionary psychology is a very broad field, and that it should not be equated with the *Integrated Causal Model* as advocated by Tooby and Cosmides (1992). We argue that evolutionary psychology in general is more a collection of point of views, rather than a coherent theory (see Ploeger, van der Maas, & Raijmakers, 2008b, for an extensive reply to the commentaries that appeared in *Psychological Inquiry*). The *Integrated Causal Model* is a coherent theory, and its tenets can be judged on their metatheoretical status. Evolutionary psychology in general can not be judged in that way, because the field is too diverse.

The main issue was, of course, whether evolutionary psychology can serve as a metatheory for psychology. Unsurprisingly, Duntley and Buss (2008) did not agree with our conclusion that evolutionary psychology is limited as a metatheory (Buss (1995) was among the first to introduce evolutionary psychology as a metatheory). Duntley and Buss argued that evolutionary psychology unites the field of psychology with all the other life sciences, including biology, economics, political science, history, legal scholarship, and medicine. We agree with this, but this does not weaken our conclusion that evolutionary psychology is limited as a metatheory *for psychology*, as it does not contribute substantially to the major issues in psychology. Barrett (2008) argued that evolutionary psychology is a way of thinking, a set of heuristics for generating hypotheses to be tested empirically. We also agree with this, but we note that a heuristic is not the same as a metatheory; a metatheory can contribute to the major issues in a field, while a heuristic does not necessarily do so.

Another issue raised was whether evo-devo biology constitutes a paradigm shift (Barrett, 2008; Duntley & Buss, 2008). Is evo-devo biology really something new, compared to neo-Darwinian theory? As we argued in chapter 2, the evo-devo and the neo-Darwinian approach are complementary rather than antagonistic, so the term 'paradigm shift' is not a good description of the

novelty of the evo-devo approach. The main difference between the two approaches is that the neo-Darwinian approach emphasizes the process of natural selection, and the evo-devo approach the mechanism of generating new variation. So the difference lies in emphases, not in different views or inconsistent empirical findings. Evo-devo biologists consider themselves as neo-Darwinians, and neo-Darwinians easily accept the research findings of evo-devo biologists.

Another issue was the tenability of the massive modularity thesis. This thesis has evoked a large debate in the literature (for a review, see Barrett & Kurzban, 2006). Buunk and Park (2008) argued that not massive, but messy modularity is a better account of the human mind: ‘natural selection does not strive to “design” efficient solutions - it merely sifts out the most adequate (or the least bad) alternative, all the while tinkering with existing features’ (p. 23), and ‘the human mind is better conceptualized as a mixed bag of mutually linked mechanisms and traits that reflect compromise and imperfection’ (p. 25-26). Although we agree with this, evo-devo research has shown that we can predict the likelihood of more domain-specific or domain-general mechanisms, based on certain conditions in our environment (Griswold, 2006; Kauffman, 1993). Barrett (2008) argued that the massive modularity thesis does not exclude the possibility of the existence of domain-general mechanisms. However, evolutionary psychology as advocated by Tooby and Cosmides (1992) does not offer a theory that explains the existence of domain-general mechanisms. Evo-devo biology does offer this theory (Hansen, 2003; Hansen et al., 2003; Griswold, 2006; Kauffman, 1993).

A final issue was whether evo-devo biology generates new, empirically testable, hypotheses. In chapter 3, 4, and 5 I have shown that this is the case. In chapter 3 we proposed the hypothesis that the savant syndrome did not spread in the population because of a developmental constraint. A developmental constraint is a mechanism that limits the possibility of a phenotype to evolve. Biologists have shown that there exist developmental constraints as the result of the high interactivity among body parts in an early stage in embryological development, namely early organogenesis or the phylotypic stage. The interactivity during this stage involves all components of the embryo, and as a result mutations that affect one part of the embryo also affect other parts. We hypothesized that a mutation, which gives rise to the development of the positive aspects of the savant syndrome (e.g., an impressive memory capacity), will virtually always have a deleterious effect on the development of other phenotypic traits, (e.g.,

resulting in autism and/or impaired motor coordination). Thus, our hypothesis stated that the savant syndrome did not spread in the population, because of this developmental constraint. The finding that children with savant syndrome often have autism and physical anomalies, which are known to be established during early organogenesis, supports our hypothesis.

In chapter 4 we proposed the hypothesis that schizophrenia is the result of disturbances during early organogenesis. Evidence has shown that there is a significant association between the development of schizophrenia and brain defects, major and minor congenital anomalies, other medical comorbidities, prenatal infections, and maternal obstetric complications. These abnormalities are usually established during early organogenesis, suggesting that schizophrenia has its origins very early in embryological development.

In chapter 5 we showed that the same hypothesis can be applied to the development of autism. We reviewed the literature and found ample evidence for the hypothesis that autism is associated with errors during early embryogenesis, brain pathologies, major and minor structural anomalies, and various other medical conditions. In these chapters we have shown that insights from evolutionary developmental biology lead to new hypotheses for psychology.

I have written this dissertation with great pleasure. The broad field of evolutionary developmental biology has opened my eyes; evolutionary research has so much more to offer than the easily comprehensible theory of evolution by natural selection. In the future I hope to expand the evolutionary developmental biology framework for psychology. It is my greatest ambition to make theories and research findings of evolutionary developmental biology accessible to psychologists.