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MICHAEL TOMASELLO, *Becoming Human: A Theory of Ontogeny*, Cambridge, Massachusetts: The Belknap Press of Harvard University Press, 2019, xi + 379 pp., \$35.00 / £28.95 / €31.50

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In this book, Michael Tomasello proposes an overarching theoretical framework that organizes the research that he and his colleagues in the Department of Developmental and Comparative Psychology of the Max Planck Institute in Leipzig have carried out for the past 20 years. The book is recommended for students and academics working on the evolution of human cognition, especially those interested in the intersection between evolutionary developmental biology and developmental psychology.

The book consists of twelve chapters divided into four sections. The first section sets the goal of the book. Tomasello aims to provide what he calls a ‘neo-Vygotskian framework’ to explain the evolution and development of children’s psychological traits during the first six years of life that are unique within the ape lineage. These traits are grouped into cognitive and sociomoral categories. The second part of the book focuses on the ontogenetic pathways that lead to the distinctiveness of human cognition: social cognition, communication, cultural learning, and cooperative thinking. The third part of the book focuses on the distinctive ontogenetic pathways of human sociality: cooperation, prosociality, social norms, and moral identity. In the book’s concluding section, Tomasello frames the resulting theory as a neo-Vygotskian theory that focuses on shared agency.

Tomasello’s shared intentionality account is a Vygotskian theory to the extent that it focuses on uniquely human psychology, which it explains mainly in terms of the unique forms of sociocultural activity in which individuals engage over the life course. But the theory is neo-Vygotskian insofar as it uses an evolutionary approach to human ontogeny. Many species are biologically adapted in specific ways for engaging in their species-unique forms of social activity. In humans, these adaptations are culturally transmitted. Unlike Vygotsky, whose work focused on the process of cultural transmission and its effects on human psychology, this neo-Vygotskian theory takes a step back to look at the adaptations that facilitate the kind of social and mental coordination that facilitate human cultural adaptations. In this way, Tomasello builds not only on the work of classical developmental psychologists but also upon theoretical concepts from philosophy (joint agency, shared and collective intentionality) and evolutionary developmental biology (ontogenetic adaptations, ontogenetic pathways, developmental plasticity).

According to Tomasello, the last common ancestor of humans, bonobos, and chimpanzees was cognitively characterized by individual intentionality (e.g., “I want to forage for termites”), as opposed to shared intentionality. They were able to entertain abstract representations and simple inferences. In terms of their social capacities, they had prosocial tendencies for helping and sharing with others. Early humans were characterized by cognitive capacities for joint intentionality (e.g., “We want to hunt a stag”)—a basic form of shared

intentionality that enables humans to understand their partner's perspective in a joint activity and make recursive inferences about their mental states. From a sociomoral point of view, they developed a form of second-personal morality based on joint commitment towards shared activities and a sense of fairness that ensures one's partner's trust and sustained cooperation over time. Later in evolution, modern humans preserved these ancestral traits but were also selected to extend these capacities to a collective level by entertaining representations that go beyond an individual's perspective because of the need to apply them to a large pool of peers. These representations are then conceived as being somewhat objective, which in turn increased the epistemic demands on humans by creating standards of what is reasonable and justifiable. From a sociomoral perspective, this led to a form of group-minded morality characterized by explicit social norms.

Each of the above cognitive and sociomoral traits has a distinctive ontogenetic pathway. In Tomasello's view, explaining the evolution of these distinctive traits is explaining the evolution of their ontogenetic pathways. This is carried out by looking at how these ontogenetic trajectories are different from the ones we have observed in our closest living ape relatives. If we wish to explain how uniquely human psychology evolved, we must focus on how great ape ontogeny has been transformed into human ontogeny. Then, we need to pin down the key variables that make these pathways diverge from each other. These variables affect three kinds of developmental processes: maturational, experiential, and processes of executive self-regulation.

Maturational processes are those that canalize development such that development follows particular trajectories under different conditions. They make particular developmental pathways as well as their end-states robust. But no pathway is entirely fixed. Developmental processes are not completely deterministic—i.e., we cannot predict end-states with an absolute degree of confidence from initial conditions. The canalization of development is a compromise between robustness and plasticity, which facilitates evolution by supplying variation that can be accumulated over time. Developmental processes vary in the way they trade-off robustness and plasticity: some processes can be highly robust, while others can be highly plastic. While maturational variables tend to increase the robustness of the developmental process and their phenotypic outputs, organisms tend to differ in their individual experiences with their socio-ecological environment. This experiential component of development typically introduces noise that fosters individual variation. From the point of view of human psychological development, experiential processes are those that depend on environmental variables that affect the development of the organism through learning. However, it would be wrong to think that the experiential component of development is completely random. Local environments constrain, for instance, what we are able to learn via individual experience about local fauna. Learning can also be socially supervised. This is so because processes of executive self-regulation, such as attention, which shape learning trajectories, can be guided by others. It is certain that the development of some self-regulatory mechanisms can be highly robust, while the development of others can be very plastic such that they end up being mostly determined by subsequent learning. But, importantly, they do not neatly fall into the maturational or experiential categories.

Tomasello's idea of human uniqueness builds up on evolutionary continuity rather than on evolutionary discontinuity. Evolution produces diversity in living systems, including mental processes. These differences are not just a matter of dentition, cranial shape, or bipedal walking, but also mental functioning. None of these differences imply evolutionary discontinuity because humans did not actually split from any of the extant great apes (orangutans, gorillas,

chimpanzees, bonobos). We are different from extant great apes because some hominin ancestors of ours split from an ancestral hominin branch that in turn split from a hominid branch through a common ancestor that we share with great apes. Evolutionary continuity is further stressed in Tomasello's and similar approaches by focusing not only on processes of Darwinian natural selection but also on the production of variation over which natural selection operates. The evolutionary transition from ape-like psychology to human psychology is gradually shaped through small changes in developmental pathways via modifications of maturational, experiential, and executive self-regulatory processes.

The evolutionary baseline of the maturational component of our psychological development begins with general great ape cognitive and social ontogeny. Comparing human ontogeny with chimpanzee ontogeny is difficult. But Tomasello combines his and others' controlled experiments in captive and wild great apes, longitudinal studies, fieldwork and observational research to infer differences in developmental timing and overall ontogenetic trajectory. Children and apes differ in terms of their cognitive and sociomoral development but these differences are built upon shared ontogenetic processes that are latter transformed during evolution. This occurs because ape's mental development is plastic enough to provide selectable phenotypic variation. Tomasello argues, for instance, that social learning, imitation, communication are the domains whose development is most strongly affected by human interaction. This great plasticity provides the individual variability necessary for the evolution of human children's distinctive psychological development.

Building upon these shared and plastic ontogenetic pathways, intensive selection for increased cooperation in our lineage selected for evolutionarily novel capacities for joint intentionality, such as those for joint attention, declarative pointing, and forming joint goals. Selection for these capacities canalized their development by transforming our great ape maturational baseline. But maturation is only part of the story. As Tomasello points out, bipedal walking is a highly canalized human skill but it is also clear that we learn to walk. Experience matters in cognitive development. We learn to act jointly by doing things together. Furthermore, these capacities and the experiences that came with them transformed the process of executive regulation. Jointly attending to something means that I have to avoid distractions. I need to keep track of my partner's gaze if I am individually motivated to divert my attention from the desired area of common focus. If I am joining the goal of my partner to go on a foraging trip, there are things that I am expected to do and I should be committed to as a foraging partner. This leads to a particular form of self-regulation that is social and normative. This is what, in Tomasello's view, enables human children to internalize the perspectives and evaluations of others, and to create their own rational and moral identities. When acting together, we are accountable for both our actions and the shared, social mechanisms that should regulate those actions.

Tomasello's developmental approach then incorporates cross-cultural variation in the form of processes of socially induced executive self-regulation that affect children's psychology. Research in psychology has traditionally focused on populations living in Western, educated, industrialized, rich, and democratic countries—also now known as 'WEIRD' populations. Tomasello's book reflects a very welcome turn towards incorporating cross-cultural evidence, especially when considering the development of different aspects of social cognition such as fairness and other prosocial behaviors. He uses a wide range of evidence from correlational studies, cross-cultural investigation, and research with special populations to supplement the findings gathered through years of empirical research by his team in Leipzig.

Overall, the studies described in the book make a remarkable effort in avoiding artificial situations that could elicit unnatural behaviors in children. Experimental research often exchanges ecological validity for tighter control of potential confounds. But there is a good deal of ecological validity in most of the studies reviewed in the book as experimental procedures are mostly framed as child-friendly games. In some cases, this validity is culturally opaque and experimental results are further contextualized within the ethnographic literature. For example, experimental evidence suggests that toddlers from WEIRD populations collaborate with adult partners in similar ways as toddlers from small-scale, traditional societies (e.g., by spontaneously attempting to re-engage unresponsive partners in collaborative activities), even though ethnographic work indicates that children from small-scale, traditional societies typically have more experience collaborating with adults. This suggests that experience is not a decisive factor in influencing the developmental pathways of these aspects of children's collaborative behavior. This situation might be different when considering other key prosocial behaviors such as those related to resource distribution. Experimental evidence carried out by Tomasello and colleagues, for instance, suggests that 6-year-olds in small rural areas in Kenya are significantly less willing to take turns to access a monopolizable resource when compared to German subjects, suggesting that turn-taking is a culturally-dependent strategy.

All in all, the main contribution of the book is to place human psychological development, including those sociocultural factors that shape it, within the broad framework of evolutionary theory. As a whole, Tomasello's book offers an empirically rich view of human uniqueness that is not only informed by developmental psychology but also by cross-cultural and comparative research. *Becoming Human* is a theory of human origins, but it is first and foremost an attempt to understand the constant unfolding of our nature.