Sangaralingam Ramesh

The Political Economy of Human Behaviour and Economic Development

Psychology and Economic Development

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For my father and my mother,
Nallathamby Sangaralingam and Pathmarani Sangaralingam,
Inuvil and Karinagar, Ceylon,
For their duty and for their courage.

Preface

The big emphasis in scholarly activity associated with contemporary Economics is the acquisition and the analysis of data using Machine Learning and Artificial Intelligence techniques to determine how people make decisions. However, this does not necessarily involve an analysis of the underlying sequential processes such as different parenting strategies, and cultural and economic environment that may impact on childhood and adult cognitive, social, and cultural development. It will be the study of the feedback mechanism between these factors and childhood and adolescent development which will allow for a better understanding of how decisions are made by adults and how these decisions may either positively or negatively impact on society. Moreover, the results of such an analysis will give policymakers robust information which can be used for the formulation of policies associated with government spending on helping families with childcare costs and the provision of education services for children from an exceedingly early age. Furthermore, policymakers can encourage the development and the implementation of specific and personalised curriculums and school activities which will better help children develop into mature and rational adults. Increased government expenditure in these areas will help improve equality in society and help reduce the social costs associated with crime and drug dependency. In addition, a qualitative analysis of the factors associated with human development and economic activity will help to better understand how and why such activity takes place. This may lead to overcoming the problems associated with the abstract results which are obtained from using mathematical models, constructed based on simplifying assumptions, to analyse a complex real

world. Moreover, while contemporary economic theory assumes that consumers maximise utility, it may be the case that consumers want to escape poverty and embrace prosperity. This may be the fundamental mechanism behind human behaviour which drives economic activity and not the maximisation of utility or rational choices. It may also be the case that this mechanism of human behaviour develops independently of the economic system in which individuals develop from birth, as infants, in childhood, into adolescence and into adulthood. For example, individuals born and brought up in former command economies (USSR, Central Europe, China, Vietnam) seek a better life in the developed economies of the West either through formal or informal migration. The same is true of people born and bred in developing economies. The former command economies (except China) and the developing economies lack the infrastructure, institutions, state of development, responsible governance, resources, systems of education, health, and freedoms to facilitate the flowering of economic prosperity. This would facilitate not only economic development but also the promotion of well-being. Lacking such economic development and well-being, individuals seek a better life by migrating from countries mired in poverty to countries relatively better off. In this case, the fundamental driving force behind human behaviour in the context of economic activity may not be the maximisation of utility or rational choice but the biological need to reproduce and to perpetuate the transmission of one's genes to subsequent generations. Following reproductive activities, the development of a human being begins from conception, in the womb, as an infant, as a child, as an adolescent and then into adulthood. The factors which affect each stage of this development will have an impact on the physical, physiological as well as the cognitive functioning of the adult who through their behaviour will take part in economic activity. Therefore, a better understanding of each stage of human development may lead to a better understanding of the nature of not only economic activity but also economic development. This is because economic activity may facilitate rising incomes and innovation (through greater competition). These changes will facilitate economic growth and then over time economic development. To optimise economic activity and economic development, the determination of the factors which optimise the development of human behaviour through its various stages will allow policymakers to develop and implement more effective social and economic programmes. This in turn will benefit the development of human society and help to sustain our civilisation.

This book is the author's fifth book and as such expands on the search for the roots of economic growth and economic development. This search emphasises the role of cognition and its development through the adult life cycle as being at the heart of human development. It is the development and growth of the latter which facilitates economic development and economic growth over time. The authors previous books include *China's Lesson's for India: Volume 1—The Political Economy of Development*, *China's Lessons for India : Volume 2—The Political Economy of Change*, *The Rise of Empires—The Political Economy of Innovation* and *China's Economic Rise—Lessons from Japan's Political Economy*.

London, UK Sangaralingam Ramesh

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CHAPTER 1

Introduction

China's economic rise has primarily been due to the incremental economic reforms instigated by the Chinese government since 1978 when the country began the transition from a centrally planned command economy to a mixed-market economy in which state intervention and free market forces co-exist. However, from a human perspective the key drivers of China's economic growth have been entrepreneurship and improvements in the possibilities for quality childcare due to the adoption of the one child policy in 1980. In the case of entrepreneurship, the government's economic and market reforms have allowed opportunity-based and necessity-based entrepreneurs to engage in economic activity by setting up businesses and fuelling China's economic phenomenal economic growth, which became more pronounced after China joined the World Trade Organization (WTO) in 2001. Moreover, improvements in the possibilities for childcare have been brought about by China's one child policy, which became a state-sanctioned policy in 1980 due to China's ever-growing population and fears that the country's economy would not be able to support it. The policy remained until 2015 and was quickly dismantled due to China's ever-shrinking population and fears that the slow growth in the population would reduce the workforce available to the economy and a reliance upon a smaller younger population to support a larger and growing elderly population. However, China's one child policy has facilitated the opportunity for the wider family to save and invest in the well-being and

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development of one child, the prince or the princess. The level of investment in the one child of the family would have led to higher levels of educational attainment and facilitated China's transition to some knowledge economy—perhaps matching if not surpassing the innovativeness enshrined in the US economy. Furthermore, in the case of China, entrepreneurship and the knowledge economy may be correlated because needs-based entrepreneurs make the money required to educate their children, whether in China or abroad. However, a negative impact of China's one child policy has perhaps been the growing selfishness of children brought up with the undivided attention of parents, the maternal and paternal set of grandparents as well as aunts and uncles. This selfishness may lead to a less caring and cohesive society in which the young no longer look after the well-being of elders and where divorce rates and levels of abuse soar.

The purpose of economic activity should be to facilitate human development. While the occurrence of this causation is in no doubt, what is in doubt is the mechanisms efficacy in ensuring that human development is spread evenly throughout the population. However, the problem with economic growth is that it usually facilitates human development amongst a small proportion of the population while inequality between the rich and the poor increases over time. This phenomenon is true within countries as well as between countries. The reasons as to why this phenomenon persists may be due to two factors. The first is the lack of quality of human development within and between countries. And the second is the efficacy of government policy in allowing for the factors requisite for quality human development to permeate and diffuse throughout society. The lack of quality human development and government policy may be entwined. For example, it has been found that if children and adolescents are given educational opportunities, they will be able to develop the characteristic of resilience, which will allow them to overcome adverse environments. As a result, they will be able to enter adulthood with better emotional stability and cognitive capabilities. These characteristics will in turn allow them to make better decisions. However, if a country spends a small proportion of its GDP on the public provision of education and/or if the quality of the educational services or in the school's infrastructure, then the impact on childhood development would be negative. Educational services may be represented by the quality of teaching, the developmental and learning opportunities a child receives and the quality of the relationship with the instructor/teacher. On the other hand, the schooling infrastructure may

be represented by the quality of the buildings, the availability of Wi-Fi, the availability of computing equipment as well as library resources. Nevertheless, the question also arises as to whether inequality would persist amongst peoples between and in countries even if government policies towards eradicating inequality and promoting quality human development were in place in the context of economic activity and economic growth. If inequality does persist, then the implication is that inequality may arise from human existence and economic activity due to differences in upbringing, cultural differences and economic circumstances. In this case, the aim of this volume is to evaluate whether differences in upbringing represent a source of persistent inequality in society. This may be evident from the fact that people who were born and grew up in a prosperous country struggle to achieve while those individuals who were born and grew up in a less prosperous developing country do well when they migrate to a prosperous country which has better physical (roads, railway networks etc.) and soft infrastructure (public educational system, public healthcare system, law and order). In this case, the objective of this volume is to determine how the policies of government should be focused to eradicate the emergence of such inequalities at source. If government policies are not so attuned to the reality of human development, then the implication would be that there will be increases in inequality because of economic growth. In other words, prosperity will become concentrated in the hands of the few and out of the grasp of the many. Furthermore, merely changing the focus of government policy from economic growth to quality of life may not have that much effect on eradicating inequality in society if inequality is so pervasive due to differences in upbringing. The best ways to bring up infants and enable their development through childhood into adolescence and beyond into adulthood in the best way possible to achieve optimal development is something that is neither taught nor learned. The implication is that some parents will achieve the right balance of strategies and use of resources in bringing up their children while other parents may not. The result of varying degrees of upbringing is that the development of individuals through infancy, childhood, adolescence and into adulthood will vary. This will be characterised by the development of differing levels of cognitive and non-cognitive skills.

The dynamism of technological innovation through the accumulation of wealth and human cognition co-exists with the constancy of the variation of human behaviour. Innovation can be driven by circumstance, necessity or opportunity though still dependent on human cognition. On

the other hand, variations in human behaviour may be dependent on the combined effects of genes, the environment and upbringing. In any case, new technological innovations are made, based on the foundations of previous innovations. However, the variability of human behaviour has stayed constant through the ages. For example, innovation took place when the round wheel replaced the square wheel in the times of ancient Sumeria. And in late eighteenth-century England, James Watt invented the steam engine. The round wheel and the steam engine were then integrated into the design of the railway engine, the movement of which was powered by the release of compressed steam. This enabled the transport of people and goods over long distances. However, the ability of an individual to kill another individual in anger has remained unchanged from the time of ancient Sumeria, to the seventeenth century AD, to the eighteenth century AD, remaining true in today's world. Therefore, while the capacity to innovate increases over time, the variability of human behaviour remains constant over the lifetimes of different individuals—although, as a result of ongoing evolution, there may be minor changes in the genes which are inherited from one generation to the next: typically, the genes which are passed from parent to child and not the same as those passed from grandparents to the parents. Individual lifetime experiences and environments will change an individual's transmissible genes in a different way. However, over the lifetime of an individual, the nature of behaviour will depend on the different life cycle stages, infant, child, adolescent and adult, and the environment associated with each.[1] Therefore, in the case of human behaviour, it is also important to consider the link between the person and the environment rather than that of the person in the environment.[2] This is because the nature of human behaviour depends on the environment. For example, the behaviour of someone constantly facing deadlines will be different from the behaviour of someone who has no deadlines to meet but instead has a carefree life. This is because someone who is constantly having to meet deadlines will always be under stress.[3] The person and the environment are a multi-dimensional phenomenon with specific dimensions contributing to the wider impact on human behaviour. In other

[1] Hutchison, E. (2019), Dimensions of Human Behaviour: Person and Environment, Sage Publications, Singapore.

[2] Ibid.

[3] Herbert, D., Coveney, J., Clarke, P., Graves, N., and Barnett, A. (2013), The impact of funding deadlines on personal workloads, stress and family relationships: a qualitative study of Australian Researchers, BMJ Open, Vol. 4, Issue 3.

words, analysing just one dimension will not be enough in understanding the wider impact.[4] A better understanding of human behaviour can be reached if it can be modelled as a multi-dimensional entity which integrates the systems associated with the biology, physiology and social aspects of every individual.[5] And, in the context of this integrated super-system, the most vital component, the co-ordinator in chief, is the brain.[6]

The Brain

The structure of the human brain is shown in Fig. 1.1. The shape of the brain is as such that the cerebrum, the easily recognisable wrinkled structure, represents three-quarters of the brain's volume.[7]

In turn the cerebrum itself is divided into two hemispheres which 'sit' on a thick stalk called the brain stem.[8] The two hemispheres are connected by the corpus callosum, a bridge of nerve fibres.[9] At the back of this structure, the main brain or cerebrum, is the protruding, cauliflower-shaped cerebellum or 'little brain'.[10] The cerebrospinal fluid (CSF) circulates the outer space of the brain as well as the spinal column.[11] The entire brain is constituted of billions of cells, supported by seven times more glial cells, each of which has thousands of connections to other brain cells.[12] The brain is the organ which co-ordinates our interaction with each other as well as with the world.[13] It also allows us to distinguish between 'self' and 'non-self'.[14] Each brain cell is like any other cell in the human body except its main purpose is communicating with other cells. In this case, each brain cell will receive an input signal through its soma end via dendrites.[15] The shape and the size of the dendritic trees will be different in different parts

[4] Hutchison, E. (2019), Dimensions of Human Behaviour: Person and Environment, Sage Publications, Singapore.

[5] Sapolsky, R. (2018), Behave: The Biology of Humans at Our Best and Worst, Penguin Books, New York.

[6] Ibid.

[7] Carter, R. (2019), The Brain Book, DK, London.

[8] Greenfield, S. (2014), The Human Brain: A Guided Tour, Weidenfeld & Nicolson.

[9] Carter, R. (2019), The Brain Book, DK, London.

[10] Greenfield, S. (2014), The Human Brain: A Guided Tour, Weidenfeld & Nicolson.

[11] Ibid.

[12] Dubin, M. (2002), How the Brain Works, Blackwell Sciences Inc, Oxford.

[13] Carter, R. (2019), The Brain Book, DK, London.

[14] Ibid.

[15] Ibid.

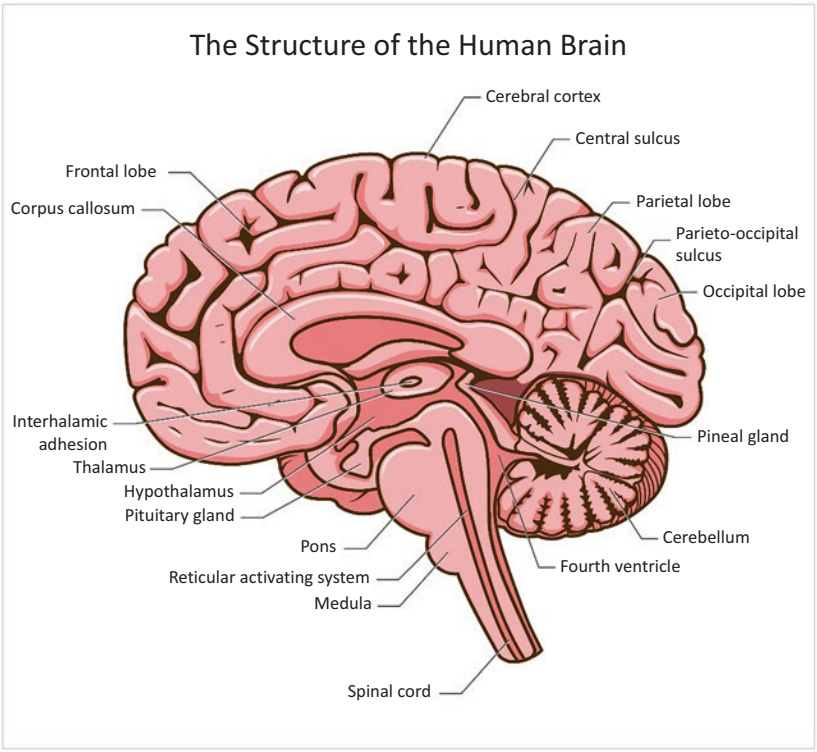

Fig. 1.1 The structure of the human brain

of the brain, as will the point of origin of the axon from each neuron.[16] The axons themselves end in a very large number of button-sized objects called boutons, which make contact with the dendrites of thousands of other neurons by forming synaptic points.[17] The signal then passes along the cell through the axon before exiting through terminals at the cell end, which form synapses with other brain cells.[18]

The higher-level mental functions occur in the cerebral cortex, and the lower-level brain functions such as those associated with the regulation of

[16] Ibid.
[17] Ibid.
[18] Ibid.

the heartbeat and breathing occur in the brainstem. Therefore, it is easy to see that the brain has a vertical zoning, with the level of cognition falling as one moves down the zone.[19] The inner brain also has a system of four interconnected ventricles. The two hemispheres of the cerebellum each have a ventricle; these are connected to a third ventricle in the mid-brain, which is linked to a fourth ventricle in the medulla and the pons.[20] The ventricles are filled with the CSF, which drains from the brain into the blood stream through the subarachnoid space.[21] The brain also houses 30 concentrations of neurons, called nuclei, which are paired left and right as the hemispheres are, which serve specific purposes.[22] However, the main nuclei in the human brain include the basal, the caudate, the subthalamic, the thalamus, the amygdala and the facial nucleus.[23] For cognition the most important of these nuclei are the caudate, the thalamus and the amygdala. It is these areas of the brain which are impacted upon by the external environment in which the embryo develops in its mother's womb or the child or the adolescent grows up in.

The caudate is responsible for processing feedback, the thalamus is a processing area for inputs and the amygdala is responsible for learning, memory and emotions. However, in the process of evolutionary development, other parts of the brain may have played a role. For example, the parieto-frontal 'mirror neuron' systems may have been important for language development in humans.[24] Moreover, the parietal and frontal connections of the brain may be where the action system is located.[25] In Macaque monkeys it has been observed that this area of the brain is modified when the monkeys are learning by trial and error to use sticks to reach fruit.[26] The innovative learning of the monkeys may suggest how human

[19] Ibid.

[20] Ibid.

[21] Ibid.

[22] Ibid.

[23] Ibid.

[24] Rizzolatti, G., and Buccino, G. (2005), The Mirror Neuron System and its Role in Imitation and Language, IN From Monkey Brain to Human Brain, A Fyssen Foundation Symposium (Ed), MIT Press, Cambridge, Massachusetts.

[25] Luppino, G. (2005), Organisation of the Posterior Parietal Lobe and of Parieto frontal Connections, IN From Monkey Brain to Human Brain, A Fyssen Foundation Symposium (Ed), MIT Press, Cambridge, Massachusetts.

[26] Iriki, A. (2005), A Prototype of Homo Faber: A Silent Precursor of Human Intelligence in the Tool Making Monkey Brain, IN From Monkey Brain to Human Brain, A Fyssen Foundation Symposium (Ed), MIT Press, Cambridge, Massachusetts.

evolution may also have followed the same pattern, with the results of such learning embedded in the human genetic code through gene expression.[27] The frontal lobes of the human brain have also been identified as the areas responsible for maintaining concentration. The stronger the ability to concentrate, the stronger will be the level of cognition.[28] This is because thoughts can be coherently organised, such that a consistent thought pattern will emerge. The frontal cortex is not only the slowest part of the brain to develop but also the part which reflects the ageing process first.[29]

The frontostriatal system of the brain encompasses both the neocortex and the basal ganglia.[30] The basal ganglia is further divided into the dorsal striatum and the ventral striatum, with the latter being smaller than the former.[31] The ventral striatum receives inputs from the orbital prefrontal cortex and is responsible for generating craving impulses.[32] While the orbital frontal cortex is associated with behaviours associated with compulsion, it is also an area of the brain which is important in terms of the transition from compulsive behaviours to goal-directed behaviours.[33] On the other hand, the posterior region of the frontal lobe provides inputs to the dorsal striatum.[34] This is divided into the caudate and the putamen.[35] The selection from a number of possible alternative strategies to determine a behaviour to achieve a specific objective is made possible by the caudate.[36] However, the putamen is responsible for behaviours associated with responses to stimuli and to learning by performing actions repeatedly.[37]

[27] Iriki, A. (2005), A Prototype of Homo Faber: A Silent Precursor of Human Intelligence in the Tool Making Monkey Brain, IN From Monkey Brain to Human Brain, A Fyssen Foundation Symposium (Ed), MIT Press, Cambridge, Massachusetts.

[28] Dempster, F. (1992), The Rise and Fall of the Inhibitory Mechanism: Toward a Unified Theory of Cognitive Development and Ageing, Developmental Review, 12, pp. 45-75.

[29] Ibid.

[30] Striedter, G. (2016), Neurobiology: A Functional Approach, Oxford University Press, Oxford.

[31] Ibid.

[32] Ibid.

[33] Brann, A. (2017), Neuroscience for Coaches: How to Use the Latest Insights for the Benefits of Your Clients, 2nd Edition, Kogan Page Limited, London.

[34] Striedter, G. (2016), Neurobiology: A Functional Approach, Oxford University Press, Oxford.

[35] Ibid.

[36] Grahn, J., Parkinson, J., and Owen, A. (2008), The Cognitive Functions of the Caudate Nucleus, Progress in Neurobiology, 86, pp. 141-155.

[37] Ibid.

The dorsal striatum and the ventral striatum 'feed' into the dorsal pallidum and into the ventral pallidum, respectively.[38] The respective parts of the pallidum then 'feed' into different regions of the thalamic nuclei.[39] In this case, the ventral pallidum-thalamus route leads to the anterior prefrontal cortex, but the dorsal pallidum-thalamus route leads to the frontal lobe posterior region.[40] The organisation of the brain with regard to the frontostriatal system leads to contextual behavioural selections and responses, especially with regard to the environment faced by children and adolescents.[41] While the psychological structures and the organisation of the brain are important for the development of cognitive and non-cognitive skills, theories of the mind allow for a better understanding of the emotional aspects of human behaviour.

Theories of the Mind

Theories of the Mind (ToM) relate to the concept that children can understand human behaviour by identifying their mental states as well as those of others.[42] Theories of the Mind (ToM) fall into two categories, 'theory theory'[43] and 'simulation theory'[44]. The 'theory theory' ToM is based on the notion that states of belief and the transition from one belief to another can be inferred or deduced from a set of rules and laws.[45] On the other hand, 'simulation theory' asserts that we infer or deduce the mental states of others based on a 'projection' of our own mental states.[46] From a wider perspective, a Theory of the Mind (ToM) considers whether mental states

[38] Striedter, G. (2016), Neurobiology: A Functional Approach, Oxford University Press, Oxford.

[39] Ibid.

[40] Ibid.

[41] Ibid.

[42] Premack, D., and Woodruff, G. (1978), Does the chimpanzee have a theory of mind? The Behavioral and Brain Sciences, 4, 515-526.

[43] Gopnik, A. (1993), How we know our minds: The illusion of first-person knowledge of intentionality, Behavioral and Brain Sciences, 16, pp. 1-14.

[44] Goldman, A. I. (2002), Simulation theory and mental concepts: IN Simulation and knowledge of Action, Dokic, J., and Proust, J. (Eds), John Benjamins, Amsterdam.

[45] Gordon, R. (1996), Radical Simulationism, IN Theories of theories of Mind, Carruthers, P., and Smith, P. (Ed), Cambridge University Press, Cambridge.

[46] Ibid.

are physical or non-physical.[47] From a narrower perspective, the ToM can be defined as an explanation of how mental reasoning processes develop and are used by individuals to think about and to predict other people's behaviour.[48] ToM therefore represents one's awareness of others as well as an awareness of one's self. Indeed, to predict others' behaviour there is a need for self-awareness. This necessitates a set of inherent beliefs and desires[49]—as well as emotions.[50] An analysis of human behaviour using a ToM approach is therefore more realistic but in sharp contrast with the approach taken by neoclassical economics. The analytical approach taken by the latter is very much dependent on the assumption of rationality. In other words, human decisions are based on pure logic and as such beliefs, desires or emotions have no impact on the choices which are made. In this case, in the context of the assumption of perfect knowledge, individuals are expected to continuously update probabilities associated with specific choices.[51]

There are two main reasons as to why ToM may be of general interest to scholars, with the findings of research being of specific interest to policymakers in government.[52] Firstly, ToM is an important aspect of cognitive development. And secondly, this cognitive development will lead to other developments. One important aspect of the study of and research into ToM is with regard to how children acquire their ToM skills.[53] At a generic level this could happen because of an interplay between genes and the environment.[54] However, with regard to policy formulation, it would be beneficial if this causal relationship could be broken down into its specific processes. For example, how is the cognitive development of children affected by experiences.[55] It is with regard to the conceptualisation of experience that ToMs differ.[56] However, it would be beneficial for

[47] Campbell, N. (2005), A Brief Introduction to the Philosophy of Mind, Broadview Press Ltd, Ontario, Canada.

[48] Doherty, M. (2009), Theory of Mind: How Children Understand Others Thoughts and Feelings, Psychology Press, Hove and New York.

[49] Ibid.

[50] Miller, S. (2016), Parenting and Theory of Mind, Oxford University Press, Oxford.

[51] Kuzmics, C. (2004), Stochastic Evolutionary Stability in Extensive Form Games of Perfect Information, Games and Economic Behavior, Vol. 48, Issue 2, pp. 321-336.

[52] Miller, S. (2016), Parenting and Theory of Mind, Oxford University Press, Oxford.

[53] Ibid.

[54] Ibid.

[55] Ibid.

[56] Miller, S. (2016), Parenting and Theory of Mind, Oxford University Press, Oxford.

policymakers to be able to understand and know what formative experiences beneficially develops cognitive abilities so that suitable policies can be developed for schools and for society in general.

There are four specific types of ToM.[57] These include modularity theories, Piagetian theories, matching theories and intersubjectivity theories. Modularity theories suggests that ToM is acquired as brain structures develop over time and individuals become conscious of themselves as well as of others.[58] On the other hand, the Piagetian theories associated with ToM suggest that one's view of oneself and of others develops over time on a subjective basis as opposed to an objective one.[59] But matching theories assert that causal reasoning and a recognition of ToM occurs not via the use of language but by observation.[60] Intersubjectivity theory relates to understanding ToM in the case of individuals with autism. In this case, the emphasis needs to be on understanding intersubjective engagement of the autistic child with other children as well as the extent of the empathy in them in the context of ToM.[61] Nevertheless, regardless of the number of ToMs, any ToM has several characteristic features.[62] Firstly, any theory of the mind recognises a psychological relationship between human agents and objects which may not be face to face but at a distance. Secondly, in any theory of the mind, there is the recognition of the equivalence of 'self' and 'other' with regard to the conceptualisation of psychological relationships. Thus, any theory which seeks to explain the development of ToM should be able to put forward an explanation which helps in achieving an understanding of these two features. And whereas ToM is normally thought about in the context of psychological states such as desire, belief and emotions, this could also be thought of in the context of psychological

[57] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

[58] Scholl, B., and Leslie, A. (2002), Modularity, Development and 'Theory of Mind', Mind & Language, Vol. 14, Issue 1, pp. 131-153.

[59] Perner, J., Stummer, S., Sprung, M., and Doherty, M. (2002), Theory of Mind find its Piagetian perspective: why alternative naming comes with understanding belief, Cognitive Development, Vol. 17, Issues 3-4, pp. 1451-1472.

[60] Varley, R., and Siegal, M. (2000), Evidence for Cognition without grammar from causal reasoning and 'theory of mind' in an agrammatic aphasic patient, Current Biology, Vol. 10, Issue 12, pp. 723-726.

[61] Dant, T. (2014), In Two Minds: Theory of Mind, Intersubjectivity, and autism, Theory and Psychology, https://doi.org/10.1177/0959354314556526

[62] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

states between 'agents' and 'objects'.[63] This relational construct exists simply because an agent may be in a specific psychological state which is held against an object. Furthermore, psychological relations consist not just of states such as desires, beliefs and emotions held against objects but also actions directed against objects.[64] The nature of psychological states is not directly observable and so presents observers with a challenge in understanding, explaining and justifying such states. Moreover, just because agents and objects may be observable, there is no guarantee that the psychological states of agents can be deciphered. It may also be the case that psychological relations may be associated with agents and objects in locations which are far apart. For example, Jim hates the university canteen because it is overcrowded at lunch time. In this case, Jim does not have to be in the canteen to hate it. He can hate it from a distance with the knowledge that at a specific time of the day, when he most needs to use it, it is crowded.

Modularity theories of ToM focus on stipulating the biological structures which are necessary for processing information in order to facilitate the development of human cognition.[65] Modularity theories assert that ToM development occurs due to embedded neural network mechanisms solely devoted to the emergence of reasoning.[66] In other words, the entire neural network may not be homogenous but specific parts or modules could be dedicated to different information processing requirements, which acting as a whole would facilitate cognitive development.[67] As the brain develops, specific modules could become activated over time. Furthermore, there may be a part of the brain dedicated to ToM such that it becomes active by the second year of the life of an individual.[68] And although experiences may trigger its development, the core structure of the brain responsible for its development will not have been changed.[69]

[63] Barresi, J., and Moore, C. (1996), Intentional Relations and Social Understanding, Behavioral and Brain Sciences, Vol. 19, Issue 1, pp. 107-122.

[64] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

[65] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

[66] Mahy, C., Moses, L., and Pfeifer, J. (2014), How and Where: Theory of Mind in the Brain, Developmental Cognitive Neuroscience, 9, pp. 68-81

[67] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

[68] Ibid.

[69] Ibid.

On the other hand, unlike modularity theories, mental file theory explains how children of approximately four years of age are able to pass the false belief test as well as are able to process identity statements.[70] It is at the age of 4/5 that children may be able to construe that a person's views about the world may be mistaken, in other words the recognition that a person may hold false beliefs.[71] Moreover, at the same time as the development of the ability to identify false beliefs, children are also able to play the alternative naming game.[72] For example, if someone identifies the picture of a rabbit as a rabbit, the child in response will call out bunny.[73] Another approach to a better understanding of ToM can be associated with Piagetian theories. These theories suggest that cognitive development, social awareness and an awareness of the minds of others emerges and develops due to the interaction between the infant and its social environment.[74] Over time, the interactions between the infant and its environment may allow for a growing awareness of the equivalence of 'self' and 'other'. As the awareness of the equivalence of 'self' and 'other' develops over time, so does the level of human cognition. Theories which seek to explain the development of ToM and cognition as the growing awareness of the equivalence of 'self' and 'other' over time are known as matching theories.[75] A rising awareness of the equivalence of 'self' and 'other' could occur over time through the infant's observation and recognition of events which result from their interactions with the immediate environment. As a result, the infant will develop an understanding of the 'self' and the 'other' and, as a result, over time will be able to exhibit different

[70] Perner, J., Mauer, M. C., & Hildenbrand, M. (2011). Identity: Key to children's understanding of belief. Science, 333(6041), 474–477. https://doi.org/10.1126/science.1201216

[71] Wilde-Astington, J., Pelletier, J., and Homer, B. (2002), Theory of Mind and epistemological development; the relation between children's second order false-belief understanding and their ability to reason evidence, New Ideas in Psychology, Vol. 20, Issues 2-5.

[72] Perner, J., & Leahy, B. (2016). Mental files in development: Dual naming, false belief, identity and intentionality. Review of Philosophy and Psychology, 7, 491–508. https://doi.org/10.1007/s13164-015-0235-6

[73] Perner, J., Stummer, S., Sprung, M., and Doherty, M. (2002), Theory of mind finds its Piagetian perspective; why alternative naming comes with understanding belief, Cognitive Development, Vol. 17, Issues 3-4, pages 1451-1472.

[74] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

[75] Moore, C. (2006), Theories of Mind in Infancy, British Journal of Developmental Psychology, 14, pp. 19-40.

psychological states with other objects.[76] However, the events in which 'self' and 'other' are matched must occur frequently as well as in a non-random fashion such that the infant will be able to intuitively understand the connection between the two.[77] Thus, on the whole, ToM asserts that there is a separation between 'self' and 'others', and in order to bridge this gap individuals need to simulate the minds of others.[78] It is this 'bridge' which contextualises the need for different theories to explain how the minds of others may be simulated by individuals. An alternative to a ToM explanation and understanding of the development of cognition can be based in the context of an intersubjectivity approach. This is specifically with regard to a process of social cognition and then individual cognition.[79] In other words, child and individual consciousness interacts with its socio-economic environment and at the same time remains malleable to change.[80] The intersubjectivity approach can be decomposed into primary, secondary and tertiary intersubjectivity. Primary intersubjectivity revolves around the evolving ability of infants to be able to discern the intention of others through the observation of their expressions and actions.[81] Thus, infants begin to develop an awareness of 'self' through the emotional communication and expression with parents and immediate family members.[82] Once a sense of 'self' has been developed by the infant at around the age of 1, abilities emerge such that infants realise that minds can be 'interfaced' by direct communication. It is this intentionality and directness of communication of the infant which denotes secondary

[76] Ibid.

[77] Ibid.

[78] Zlatev, J., Racine, T., Sinha, C., Itkonen, E. (2008), Intersubjectivity – What makes us human? IN The Shared Mind – Perspectives on Intersubjectivity, Zlatev, J., Racine, T., Sinha, C., Itkonen, E. (Eds), John Benjamins Publishing Company, Amsterdam.

[79] Ibid.

[80] Allen, M., and Williams, G. (2011), Consciousness, plasticity, and connectomics: the role of intersubjectivity in human cognition, Front. Psychol. https://doi.org/10.3389/fpsyg.2011.00020

[81] Gallagher, S., and Hutto, D. (2008), Understanding Others Through Primary Interaction and Narrative Practice, IN The Shared Mind – Perspectives on Intersubjectivity, Zlatev, J., Racine, T., Sinha, C., Itkonen, E. (Eds), John Benjamins Publishing Company, Amsterdam.

[82] Bard, K. (1998), Social-experiential Contributions to Imitation and Emotion in Chimpanzees, IN Intersubjective Communication and Emotion in Early Ontogeny, Braten, S. (Ed), Cambridge University Press, Cambridge.

intersubjectivity.[83] Language development occurs around the age of 2 and this facilitates communication in more advanced social contexts.[84] Tertiary intersubjectivity involves a growing awareness of third parties in the environment during the process of communication with other actions, which could be sideward glances at individuals standing nearby.[85]

A key question faced by researchers for decades is the role of language in the context of the development of ToM.[86] Indeed, some studies have found that the level of language ability of children is positively related to the level of mental reasoning ability.[87] More, specifically children's understanding of epistemic states is developed in response to being exposed to verbs and syntax which are representative of epistemic states.[88] The verbs which are linguistically expressive of epistemic states would be expressive of either 'belief' or 'knowledge' in some form.[89] In this case, epistemic states result from experiences, which give rise to knowledge, which may lead to belief formation. In this case, decisions may be made on the basis of beliefs, which may not be true and therefore not rational.[90] Furthermore, due to the fact that epistemic states are based on belief, they are unlikely to change when new facts emerge.[91] Nevertheless, it has been shown that

[83] Bretherton, I. (1992), Social Referencing, Intentional Communication and the Interfacing of Minds in Infancy, IN Social Referencing and the Social Construction of Reality in Infancy, Feinman, S. (Ed), Springer Science + Business Media, New York.

[84] Gallagher, S., and Hutto, D. (2008), Understanding Others Through Primary Interaction and Narrative Practice, IN The Shared Mind – Perspectives on Intersubjectivity, Zlatev, J., Racine, T., Sinha, C., Itkonen, E. (Eds), John Benjamins Publishing Company, Amsterdam.

[85] Linell, P. (2017), Intersubjectivity in Dialogue, IN The Routledge Handbook of Language and Dialogue, Weigand, E. (Ed), Routledge, New York.

[86] Juan, V., and Astington, J. (2017), Does Language Matter for Implicit Theory of Mind? The Effects of Epistemic Verb Training on Implicit and Explicit False-Belief Understanding, Cognitive Development, 41, 19-32.

[87] Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding, Child Development, 78(2), 622–646.

[88] Hale, C. M., & Tager-Flusberg, H. (2003). The influence of language on theory of mind: A training study. Developmental Science, 6(3), 346–359.

[89] Martinez-Navarro, B. (2017), Epistemic States of Convincement: A Conceptualisation from the Practice of Mathematicians and neurobiology, IN Understanding Emotions in Mathematical Thinking and Learning, Eligio, U. (Ed), Academic Press.

[90] Bochman, A. (2007), The Many Valued and Nonmonotonic Turn in Logic, Handbook of the History of Logic, Vol. 8, pp. 13-689.

[91] Ibid.

epistemic verb training produced significant effects on epistemic reasoning with regard to implicit measures of both true and false belief reasoning.[92] This is specifically in the case of children who received epistemic verb training, leading them to achieve a greater improvement in the proportion of correct fixations in the context of measures of false belief.[93] In the case of true belief reasoning, there were significant declines in the proportion of correct fixations between the pre- and the post-assessment periods.[94] These findings associated with the impact of epistemic (conditions required for the acquisition of knowledge) training on true/false belief reasoning throws into contradiction the forecasts related to working memory capacity. This is because training did not impose any additional burdens on the processing capacity of cognition.[95] Therefore, the concurrent development of cognitive ability and experience may directly affect the implicit processing of epistemic states.[96] The latter can be associated with propositions believed. For example, the proposition could be that the 'sun rises each morning'. Associated with this proposition would be the epistemic state of 'know' or 'believe'.

Socio-Economic Status, Family Processes and Human Development

Evolutionary psychologists seek to better understand how human beings function in the context of psychological mechanisms which have evolved over time.[97] It is the interaction of the individual's environment with these psychological mechanisms which facilitates survival through infancy, childhood and to adulthood. This process may suggest that natural selection has been active in early life to allow for its extension to later life.[98] However, at a deeper level in the context of evolutionary developmental psychology,

[92] Juan, V., and Astington, J. (2017), Does Language Matter for Implicit Theory of Mind? The Effects of Epistemic Verb training on Implicit and Explicit False-Belief Understanding, Cognitive Development, 41, 19-32.

[93] Ibid.

[94] Ibid.

[95] Ibid.

[96] Ibid.

[97] Bjorklund, D., and Pellegrini, A. (2000), Child Development and Evolutionary Psychology, Child Development, November/December 2000, Volume 71, Number 6, pp. 1687-1708.

[98] Ibid.

the process of human development involves the interaction of genetically wired reactions and adaptations to various levels of external stimuli. But these genetically wired reactions and adaptations will differ from individual to individual due to genetic variations. In this way some individuals are better able to adapt to their environment and survive, reproduce and pass genetic variations onto future generations—although a better understanding will be required of how long-evolved psychological mechanisms impact on the development of human behaviour.[99] If psychological mechanisms are equivalent to cognitive processes, then it is the interplay between these processes and the individual's physical and social environment which not only characterises the development but also typifies the extent of human behaviour. This would suggest that Darwin's Natural Selection is caused by the interplay between cognition and the environment.[100] Therefore, it must follow that the development of human cognition over time took place to facilitate the resolution of real-world problems.[101] Nevertheless, although cognition may be considered as a whole, different cognitive processes may have evolved in order to allow for adaptation to different environmental conditions.[102] These different cognitive processes may be compared to having a unique computer programming language but different algorithms performing different functions. In an analogous way the human brain facilitates the emergence of different cognitive processes to deal with different physical and social environmental situations. The specificity of the application of cognitive processes suggests that cognition may not be a tool which allows for general problem solving[103]—in which case there may be a constraint to the extent of learning,[104] although the level of the performance of cognition allows for the expected gain to be higher

[99] Ibid.

[100] Cosmides, L., & Tooby, J. (1987), From evolution to behavior: Evolutionary psychology as the missing link, IN The latest on the Best Essays on Evolution and Optimality, Dupre, J. (Ed), MIT Press, Cambridge, MA.

[101] Ibid.

[102] Ibid.

[103] Bjorklund, D., and Pellegrini, A. (2000), Child Development and Evolutionary Psychology, Child Development, November/December 2000, Volume 71, Number 6, pp. 1687-1708.

[104] Gelman, R., and Williams, E.M. (1998), Enabling Constraints for Cognitive Development and Learning: Domain-Specificity and Epigenesis, IN Handbook of Child Psychology: Vol. 2, Cognition, Perception and Language, Kuhn, D., and Siegler, R.S. (eds.), Wiley, New York.

than the level of mental effort expended.[105] But while the disconnect between cognition and general problem solving may be thought of as having a negative impact on human development, it may actually be beneficial by allowing learning to occur in smaller 'bytes', leading to the accumulation of knowledge gained through experience. Moreover, the ability to learn will be different according to the state of individual development. For example, a child may not be able to learn as much or to deal with situations as effectively as an adult would be able to. However, whether an adult or a child, it may be the case that different environmental experiences activate different genes, which leads to different behaviours.[106] But just as behaviours are shaped by the environment, behaviours will also shape the environment.[107] Furthermore, childhood experiences may impact on adult behaviour.[108] But the childhood environment may be different to the adult environment.[109] In this case, in contrast to adults and older children, younger children may be more biologically tuned to receiving specific stimuli during their phase of development.[110] Therefore, it would be worthwhile for governments to analyse the costs and the benefits associated with early childhood interventionist policies with regard to policy formulation.[111] On the whole, governments would have a better understanding in the formulation of public policy with the knowledge that the cognitive processes used by modern humans to adapt to their environments have changed little since the dawn of civilisation 10,000 years ago.[112] However, the problems faced by modern humans are very different from those faced by our ancestors centuries ago.

[105] Anderson, J. (1991), Is human cognition adaptive, Behavioural and Brain Sciences, 14, pp. 471-517.

[106] Bjorklund, D., and Pellegrini, A. (2000), Child Development and Evolutionary Psychology, Child Development, November/December 2000, Volume 71, Number 6, pp. 1687-1708.

[107] Ibid.

[108] Ibid.

[109] Ibid.

[110] Bjorklund, D. F. (1997), The Role of Maturity in Human Development, Psychological Bulletin, 122, pp. 153-169.

[111] Hyson, M.C., Hirsh-Pasek, K., and Rescorla, L. (1990), Academic Environments in Preschool: Challenges or Pressures? Early Education and Development, 1, pp. 401-423.

[112] Bjorklund, D., and Pellegrini, A. (2000), Child Development and Evolutionary Psychology, Child Development, November/December 2000, Volume 71, Number 6, pp. 1687-1708.

An understanding of the psychological transformation of a newborn baby through infancy, childhood and then to adolescence and adulthood, the first 20 years of life, has always been a challenge for psychologists.[113] This psychological transformation also embodies a cognitive transformation which is facilitated by the formation of a hierarchical set of skills.[114] The hierarchy is composed of ten levels grouped into three categories associated with specific skills, abstract, sensory-motor and representational skills.[115] Each skill can be characterised as an exchange between the individual and the environment.[116] Moreover, skills develop continuously through levels not stages, although individuals' skills categories may not be at the same level at a point in time.[117] The development of specific skills is entirely dependent on the environment, with the best-developed skills being those which have been induced most often by the environment.[118] However, the extent to which individual skills can be induced by the environment will depend on the state of development of the individual, which will in turn dictate the highest skill level which can be attained.[119] But as the individual passes from infancy to childhood to adolescence and thence to adulthood, the highest skill level attainable will also increase.[120] Environmental stimulation rather than the genetic makeup of the individual facilitates the myelination of nerves in the cortex of the brain.[121] At birth, the infant has limited motor functions but a functioning sensory system which enables it to feel pain, hunger and discomfort, allowing it to alert its parents through its cries. The myelination of nerves in the cortex of the brain of the infant occurs mostly in the first eight months of the infant's life, although the process of myelination could also extend into adulthood. The myelination of the nerves allows for the development of insulation, which will facilitate the efficient transmission of electrical

[113] Fischer, K. (1980), A Theory of Cognitive Development: The Control and Construction of Hierarchies of Skills, Psychological Review, Vol. 87, No. 6.

[114] Ibid.

[115] Ibid.

[116] Sameroff, A. (1975), Transactional models in early social relations. Human Development, 18, 65-79.

[117] Fischer, K. (1980), A Theory of Cognitive Development: The Control and Construction of Hierarchies of Skills, Psychological Review, Vol. 87, No. 6.

[118] Ibid.

[119] Ibid.

[120] Ibid.

[121] Fischer, K.W., and Lazerson, A. (1984), Human Development: From conception through adolescence, W.H. Freeman, New York.

impulses from neuron to neuron via axons. Therefore, the greater is the extent of the myelination of nerves in the cortex of the brain, the greater will be the motor development of the individual. This in turn will facilitate cognitive development.

An understanding of the factors responsible for the successive cognitive development of the child into adolescence and adulthood will also provide policymakers with insights into how public policy may be better formulated to prevent the occurrence of behavioural, psychological and health disorders later in life. The development of cognition through childhood, adolescence and adulthood is dependent not only on individual factors such as genes but also on the nature of the individual's environment. This is because the structural development of the nerve fibres in the cortex of the brain is not dependent on genes. However, their structural development is dependent on the stimulations the nerve fibres receive through the environment in which an individual inhabits.[122] In this case, the extent and the number of neuron connections will determine the individual's level of cognition and even reason. Cognition can be defined as the extent of individual control in each environmental context.[123] Effective cognitive development will allow individuals to make better decisions regarding their daily lives as well as with regard to the long term too. Addiction to drugs, tobacco and/or alcohol will denigrate optimal individual decision-making capacity. In such instances individuals may engage in risky and wasteful decision making, which may result in poor lifestyle choices. An example would include a poor diet, which would incur healthcare costs borne by society. Another example would be domestic violence, which would require the involvement of the social services departments of local governments. The social costs associated with drug addiction and domestic violence can be avoided if the effective cognitive development of children can be facilitated through government policy. Moreover, once an adult individual can make better decisions, then an environment will exist in which individuals can decide whether to have children, how many children to have and when to have them. Government policy focused on childhood development is important because historic studies have emphasised the positive link between bad homes/schools and the emergence of

[122] Fischer, K., and Lazerson, A. (1984), Human Development, From Conception through adolescence, W.H. Freeman & Co Ltd, New York.

[123] Catania, A. C. (1978), The psychology of learning: Some lessons from the Darwinian revolution, Annals of the New York Academy of Sciences, 309, 18-28.