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A Broad Overview

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Endorsements

Benedikter, Giordano, and Shook provide an accessible, timely, and engaging introduction to the main challenges of neuroscience and neurotechnology for individuals and society. It is impressively wide-ranging, insightfully examining philosophical, cultural, political, and economic dimensions of brain science. An especially fascinating aspect of the book is discussion of the implications of bioenhancement for transhumanism and how it could influence how we define who we are.

Walter Glannon, Professor Emeritus of Philosophy, University of Calgary

This book provides an excellent survey about the challenging 'Neuro-World'. It reflects the different perspectives which are relevant for modern societies. It is full of information to gather additional knowledge on an international and interdisciplinary level.

Prof. Dr. Ernst Pöppel, Professor of Medical Psychology (em.), Ludwig Maximilian University (LMU) Munich

This engaging and highly accessible book offers an excellent short introduction to the powerful impact of neuroscience and neurotechnology upon modern societies. Covering a broad range of issues and perspectives from neuroscience, social science, philosophy, and ethics, it is eminently suitable for teaching and provides a thought-provoking basis for further discussions.

Kathinka Evers, Professor of Philosophy, senior researcher in philosophy at the Centre for Research Ethics & Bioethics (CRB) at Uppsala University and Professor ad honorem at the Universidad Central de Chile

Contents

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Chapter 1
Introduction: Neuroscience, Neuroculture, Neuroethics: What, Why, and Whereto?

Abstract This chapter provides a basic introduction to the concepts and practices of neuroscience, neuroculture, and neuroethics. It discusses where they stand, why they are so prominently on the rise, and what their perspectives are.

Keywords Neuroscience · Neuroculture · Neuroethics

What are *Neuroscience*, *Neuroculture,* and *Neuroethics*? How are they interrelated in our time? How are they impacting human life-worlds? And how will they do so over the coming years?

Neuroscience is a field of interdisciplinary research and knowledge that is transforming the image of the human being, including its self-conception. Its application as *Neurotechnology* is advancing at a pace and breadth that is certain to incur effects both within medicine and psychology, as well as in communication, artificial intelligence (AI), politics, business, military, and entertainment realms and in society at large. Future experts such as Markku Wilenius predict the next Kondratieff cycle (i.e., the next big historic leap in the relationship between the human being and technology) after the current rise of intelligent technologies such as AI, ChatGPT, and blockchain an even farther-reaching global "bioeconomy era" of "living systems technologies" starting around the mid of the century, which will be centered around the merger if biotechnology, the brain sciences at-large and biocomputing (including particularly neuromorphic software) (sixth Kondratieff cycle 2050–2100).[1] This cycle could even start earlier, as the signs are on the wall already today and emerging everywhere in the forms of new and interdisciplinary neuro-applications. Blurred distinctions between treatment, enablement, and enhancement of the human body, and opportunities for multiple domains of use, as well as the potential for misuse all incur legal, moral, and ethical issues.

Lead authors: Roland Benedikter and James Giordano

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[1]Wilenius, M.: Patterns of the Future: Understanding the Next Wave of Global Change. World Scientific Publishers 2017. Cf. M. Wilenius and S. Kurki: Surfing the sixth wave. Exploring the next 40 years of global change. Finland Futures Research Centre, University of Turku 2012.

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This is why *Neurophilosophy* has become a crucial field in the contemporary ethical debate. Neurotechnological inventions and applications such as brain–machine interfaces, brain–computer interfaces, and—since 2019—even brain–brain interfaces are spreading out to all and every field of contemporary life and are becoming part of daily culture, although on different levels and to different extents, and with a vast variety of effects.

Equally important, neurotechnology today is in the process of incepting a global *Neuroculture* by modifying the human being into an organism in biological, psychological, and social transition: by creating the neurotechnological "transhuman." Questions abound. Under the influence of the neurosciences, is it still meaningful to think and speak in terms of classical binary "categories" of analysis, such as the "human" versus the "non-human" or the "natural" versus the "technological"? Neurotechnology and the capabilities for human–technology convergence it affords pose genuine challenges to long-held core concepts of modern human societies, for example, of what "individuality," "self-reliance," and "freedom" mean in a neurophysiological view, and what "a good life" may be. Neuroscience may contribute to conceptual changes for the ontological status of "immaterial" personhood and self as related to the "material" body. In general, findings of neuroscience question the bases of culturally accepted self-image(s) of the human being—be it those of the enlightenment, the humanistic, or those spiritual and mythical. In many ways, neuroscience and its deriving technologies are becoming tools that influence how humans think about themselves and their futures, as thus an increasingly potent "contextual" cultural force.

Neuroethics, in response, is the attempt to deal with the resulting scientific, metaphysical, social, and political questions and consequences in a responsible, pondered, rational, and (as far as possible) integrative way.

All three dimensions: *Neuroscience*, *Neuroculture,* and *Neuroethics* are closely interwoven and reinforce each other. At the same time, they are often in contradiction and create a dialectical process that exhibits a high degree of dynamics.

Addressing the resulting rapid—and in many aspects still wide open—development of the field, this book poses three main questions.

How to keep ethical pace with the current "deep" cultural transformations evoked by neuroscience and neurotechnology in the form of a rising neuroculture?

What to expect of their impact on human futures, i.e., how lives are lived, how humans conceive themselves, and how societies may evolve?

What can be the role of neuroethics in finding a "good" way to steer the overall global development of human-technology convergence between different civilizational, political, and social interests and strategies, worldviews, and goals?

Despite all differences in the evaluation of the sometimes overwhelming techno-human developments particularly of the past decade, one thing is for sure: We must now address the possible trajectories, implications, and consequences of the emerging global "neurocultures," so as to remain aware of, and prepared for, the possibilities, potential, and problems that lie ahead, and establish meaningful ethical discourse toward the address, guidance, and governance of the ongoing transformation. To contribute to a timely philosophy and value debate on transformation technologies means to discuss new "human technologies" from the view of philosophical and ethical considerations of their impact particularly on the human self-image. This must include the fact that neuroscience, neurotechnology, and neuroethics are now rising to stand at the forefront and to become core aspects of the contemporary techno-revolution, featuring an increasing variety of derivatives such as neuromorphic software, biocomputing, AI, human–machine convergence, whole brain emulation, and so on.

Recent scientific inquiry has dug into the bases, extent, and complexities of neuroscience and neurotechnology research and application in multinational settings in a variety of social, political, and cultural fields. Over the past decade, amidst ongoing global transitions, the resulting "neurocultures" have been seeded and fertilized, and their emerging conditions, attractors, and constraints have been established. As we have seen for years now, the effects of neuro on culture, and culture on neuro have been and will be evermore reciprocal. This prompts the need for

Illustrating these realities;

Defining the specific issues generated;

Addressing the meanings, implications, challenges, and opportunities posed by these realities and issues;

Explicating extant capabilities and limitations of ethico-legal and social tools that could be employed to engage these challenges and opportunities; and.

Discussing ways that existent ethico-legal and social tools need to be revisited, revised, and in some instances, replaced or at least reinforced by new principles.

These requests are in the meantime getting heightened attention, and there has been growing interest in "a more globally inclusive and relevant neuroethics."[2] Focusing on that vital issue, this book addresses the central question: What will be the impact of *neuroscience, neurocultures,* and *neuroethics* on human futures? Answers have to authentically reflect the neuro-technological potentials; and thus more effectively, efficiently, and genuinely afford means to further progress their intended guidance and governance in use.

Further questions follow. How might neuroscience, neurotechnology, and neurocultures affect or alter the self-image of the human being, the contexts of societies, and our understanding of politics, economics, and culture?

For example, we have clear evidence that neuro-cultural technologies such as "ideal affect match"—a technique mirroring brain processes of empathy and sharing—influence behavior beyond traditional culture and thus appear to be in the process of creating a new global "trans-cultural civilization" on their own.[3] Will this development contribute to trans-nationally shared social and individual progress in a sustainable, open, and participatory way? Are there new fields of scientific inquiry arising?

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[2] Palk, A.: Towards a More Globally Inclusive and Relevant Neuroethics. In: C. Jones et al. (eds.): Challenges in Medical Ethics: The South African Context. Stellenbosch: African Sun Media, 2022, pp. 157–182.

[3] Park, B. et al.: Neurocultural evidence that ideal affect match promotes giving. In: Social Cognitive and Affective Neuroscience 12(7) (July 2017): pp. 1083–1096.

A second illustration arrives with the "neurocultural theory of emotions"[4] which investigates how and to what extent the self-perception of the human being, including its interpretation of such private and intimate aspects like its own emotions, may be altered by increasingly trans-culturally influential neuroscience. A partial field of this investigation is the practical search for the computerization of feelings and emotions, as carried out, for example, by Jonathan Gratch at the University of Southern California who wants to "build machines that understand and shape human emotions"[5] and Rosalind Picard at the MIT who sees "Affective Computing" as one of the main future challenges of human-machine convergence.[6] Evidently, such novel areas of inquiry are raising important ethical questions on the future of humanity's self-conception as such techno-civilizational influence levels up to a global scale.

Third, the topic of "neuromorphic" technology is constantly increasing in importance on an ever-broader instrumental level—as seen, for example, in the long-term technology outlook index published by the European Union (EU) in January 2023 in the framework of the EU's "2023 Forward Look." Among the areas the EU identified as critical for developed societies' future were neuromorphic software and computing, bio-computing, natural language processing and speech technology, and bio-machine interfaces, with most if not all of them deriving directly or indirectly from brain research and neurotechnology applications.[7] Similarly, the OECD in its Global Scenarios 2035 Report "explored three scenarios—Multitrack World, Virtual Worlds, and Vulnerable World—and their possible implications for the future of global collaboration," stressing out that neuromorphic technologies in the broad sense could contribute to "emerging changes and trends that could affect the world in unpredictable ways over the next fifteen years."[8] In its OECD Science, Technology, and Innovation Outlook 2023, the OECD stressed that for such emerging trends that will create hyper-complex intelligence networks, new forms of governance must be invented which will transcend most known models.[9] This also

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[4] Leys, R.: Paul Ekman's Neurocultural Theory of the Emotions. In: R. Leys: The Ascent of Affect: Genealogy and Critique. Chicago: University of Chicago Press, 2017.

[5] Jonathan Gratch's research at the University of Southern California: https://people.ict.usc.edu/~gratch/

[6] Picard, R.: Affective Computing: Challenges. In: International Journal of Human-Computer Studies 59 (2003), pp. 55–64, https://affect.media.mit.edu/pdfs/03.picard.pdf. Cf. R. Benedikter: Digitalisierung der Gefühle? [Digitalization of emotions?] In: Telepolis (2 April 2018), https://www.telepolis.de/features/Digitalisierung-der-Gefuehle-4000478.html?seite=all

[7] Council of the European Union, Analysis and Research Team (ART): EU Forward Look 2023, January 2023, https://www.consilium.europa.eu/media/61563/forward-look-2023-external_final.pdf, pp. 14ff.

[8] Cass-Beggs, D., Markle, A., et al. (OECD Strategic Foresight Unit): Global Scenarios 2035: Exploring implications for the future of global collaboration and the future of the OECD, OECD Paris 2021, https://search.oecd.org/economy/global-scenarios-2035-df7ebc33-en.htm

[9] OECD Committee for Scientific and Technological Policy (CSTP): OECD Science, Technology and Innovation Outlook 2023: Enabling Transitions in Times of Disruption, OECD Paris 2023, https://www.oecd.org/sti/oecd-science-technology-and-innovation-outlook-25186167.htm

remains valid for ambitious research ideas such as the "Whole Brain Emulation" project initiated at the Future of Humanity Institute (FHI) at Oxford University in 2007 which aims at artificially imitating the complexity of a natural brain, with all deriving options of techno-social hyperintelligence-applications.[10] Furthermore, given the meteoric rise of new, also partially neuro-research originating "intelligent" technologies such as Chat GPT, a fervent debate has started of whether human brains are still "more intelligent" that the most advanced AI, with the answer given that the advantage of the human brain lies in its natural adaptability due to its changing physical shape that makes it more efficient in mastering complexity and fundamental systemic and structural change than AI.[11] Thus, while new technologies are increasingly driven by neuroscientific research and its applications, there is a new intellectual, cultural, and social debate about how the brain and, with it neuroscience and neuroethics, could and perhaps should defend the differences between the human brain and advanced technologies.

In the framework of such rapid ascent to civilizational factors, neuroresearch, neuroscience, and neurotechnology could be promotors of values such as individuality, freedom, and human dignity in an age where globalized technology merges with the human body, particularly with the human brain. However, non-democratic regimes such as China form their authoritarian alliances to compete with the values of the international democratic order, thus creating "two competing globalizations instead of one," not least by using new, invasive human technologies for surveillance and oppression.[12] In the meanwhile, in the open societies of the West, will neuroscience and neurotechnology evolve into another rapidly expanding domain of cutting-edge technology that will be wedded to commercialism without appropriate recognition for the deep-reaching anthropological, philosophical, political, and ideological dimensions implicit in their development and use? Sufficient attention must be focused on the ongoing profound political and business influences upon the human–technological global civilization that is emerging.

To date, such issues have been infrequently posed by politics, the media, and the public. This is in part due to the still relative novelty of the field, in part to its extraordinary inter- and trans-disciplinary complexity, and in part to the dissonance between the pace of scientific and technologic advancement and the ethical systems and socio-philosophical approaches that have been developed to assess and resolve issues and debates generated by the impact of more traditional, disciplinary science upon society in the past—and not for the new neurocultures.

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[10] Sandberg, A. and Bostrom, N.: Whole Brain Emulation: A Roadmap (2008). In: Oxford University FHI, Technical Report 2008–3#, https://www.fhi.ox.ac.uk/brain-emulation-roadmap-report.pdf

[11] BBC: ChatGPT, Why we are still smarter than machines. BBC (29 March 2023), https://www.bbc.com/reel/video/p0fc9tlx/chatgpt-why-we-re-still-smarter-than-machines and https://www.youtube.com/watch?v=NR1Tvxaiu2Y.

[12] Benedikter, R.: The New Global Direction: From "One Globalization" to "Two Globalizations"? Russia's War in Ukraine in Global Perspective. In: In: New Global Studies 17(1) (2023), pp. 71–104, doi: https://doi.org/10.1515/ngs-2022-0038

While approaching these questions, one far-reaching matter cannot be avoided: What role can *neuroethics* play more specifically in the framework of the emerging global "neuroculture"? Can there be *one* integrative, unifying neuroethics, or will there be *many* neuroethics as multi-disciplinary as the scientific disciplines involved in contemporary neuroscientific research and neurotechnological application?[13]

Perhaps there could be a confluence of different disciplinary values, or perhaps there will be fights among opposed approaches by different worldviews. We are already witnessing such ideological disputes like those now raging about neuroscientific and neurotechnological research between "humanists," i.e., those who want to preserve the human being as we know it by rejecting new technologies, and "trans-humanists", i.e., those who want to reach out beyond the present human condition by pursuing technology to overcome the known human being by merging technology and the human body towards something unprecedented in history. Neuroscience cannot avoid pondering whether a new neuroethics can develop in actu alongside scientific progress, or whether outdated principles and "traditional" ideals dictate the fields of the new neurotechnologies.[14]

This and similar questions are becoming more urgent, as neuroculture is not any longer understood solely as the emergent globe-spanning sector of neuroscience but is also affecting the knowledge of and research on a variety of socio-political fields of increasing importance, such as apparently quite distant fields of migration. For example, the investigation of "neuro-culture interaction in specific brain regions of immigrants as an effect of historical and contemporary exposure from majority cultures"[15] promises to provide new insight into the more profound patterns of difference, diversity, and integration.

As a consequence of this and the related, more generalizing human rights debate which is also intensifying in times of a post-pandemic era of new wars (such as Russia's Ukraine war that started in February 2022), the debate about "neurorights" as a "new human right" has been conceived as one of the eminent topics on the table with regard to both the future of global rights and the concept of humanism, modernization, and humanization.[16] It goes without saying that as always at historical turning points, such a debate about new human—and other—rights is profoundly related to background philosophical considerations that ponder the pros and cons of new intellectual situations and prospects. Thus, it does not come as a surprise

[13] Consult: Emerging Issues Task Force of the International Neuroethics Society: Neuroethics at 15: The Current and Future Environment for Neuroethics. In: AJOB Neuroscience 10(3) (2019), pp. 104–110, https://doi.org/10.1080/21507740.2019.1632958

[14] See Roskies, A.: Neuroethics. In: E. N. Zalta (ed.): The Stanford Encyclopedia of Philosophy (3 March 2021), https://plato.stanford.edu/entries/neuroethics/

[15] Jusoff, N. et al.: Neuro-Culture Interaction in Specific Brain Region of Immigrants: The Effect of Historical and Current Exposure from the Majority Culture. In: ASM Science Journal 14 (2021), https://www.akademisains.gov.my/asmsj/article/neuro-culture-interaction-in-specific-brain-region-of-immigrants-the-effect-of-historical-and-current-exposure-from-the-majority-culture/

[16] Hertz, N.: Do we Need New Human Rights? A Reconsideration of the Right to Freedom of Thought. In: Neuroethics 16(5) (2023), article 5, https://doi.org/10.1007/s12152-022-09511-0.

that, related to neurorights, there is also an intense debate also about the need for a "neurophilosophy" whose desirable and non-desirable facets are currently discussed controversially, including the debate about its potential reductive (or even reductionist) versus non-reductive forms when it comes to the future of the human self-concept, that is, to the question what a human being is, and what it is not.[17]

Overall, the contemporary focus on neuroculture as related to neuroethics is a result of the increasing number, bandwidth, and intellectual variety of technical, moral, and ethical debates about the creation of neuroculture(s) as an effect of rapidly advancing neuroscientific expansion and insight. Importantly, most of these debates focus on neuroethics as becoming one of the important facets of neuroscience understood as a practical impact factor within society.[18] The relation between neuroscience and neuroethics has in the meantime been widely acknowledged as a crucial aspect of "anticipating the future"[19] in the sense of "considering ethics now before radically new brain technologies get away from us."[20] Further than that, it is also considered a new field of philosophical-intellectual investigation on its own, promising potential new research options into the riddle of the human being and its specific forms of consciousness that could alter many pillars of what has been taken as self-explaining or granted, making neuroethics a potentially revolutionary speculative-empirical field. Last but not least, over the coming years, this field will increasingly include border areas to human consciousness such as the rising "ethics of conscious artificial brains" at the intersection between the human brain and AI[21]—thus contributing to understanding the future of human-machine *interaction* which is rapidly turning into human–machine *convergence*. All this is the reason why neuroethics is regarded as one of the most critically positioned and discipline-wise most universally intertwined fields of ethics of our time.[22]

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[17] Klar, P.: What is Neurophilosophy: Do we need a non-reductive form? In: Synthese 199 (2021), pp. 2701–2725, https://doi.org/10.1007/s11229-020-02907-6

[18] Dana Foundation: Neuroethics: A Focus on Neuroscience Within Society (16 March 2022), https://dana.org/article/what-is-neuroethics/

[19] Illes, J. (ed.): Neuroethics: Anticipating the Future, Oxford University Press, Oxford 2017.

[20] Maynard, A.: Considering ethics now before radically new brain technologies get away from us. In: The Conversation (14 September 2016), https://theconversation.com/considering-ethics-now-before-radically-new-brain-technologies-get-away-from-us-65215

[21] Neuroscience News: The Ethics of Research on Conscious Artificial Brains (18 February 2022), https://neurosciencenews.com/brain-organoid-consciousness-20089/

[22] Johnson, L. S. M. et al. (eds.): The Routledge Handbook of Neuroethics, Routledge, New York 2017.

Chapter 2
Neuro-*Futures*: Programs and Impacts of Neuroscience and Neurotechnology

Abstract This chapter describes and discusses the most important programs and visions of the field of neuroresearch and neuroscience developed over the past decades. Some have materialized, others have not, and the question is why, and what this means in the outlook.

Keyword Development programs in neuroscience and neuroethics

In the first instance, *neuroscience* is the empirical and quantitative study of the human brain, the spinal cord, and the entire nervous system. *Neurotechnology*, then, is the application of the findings of neuroscience about the nature of intelligence, consciousness (including sub- and unconsciousness), and self-agency to different socio-technological sectors, including their use for economic purposes. With regard to the future, neuroscience and neurotechnology are regarded as crucial forces of progress and economic expansion. Some think of them as the future biggest players in the health care and education sectors and the military; others think of their impact as more subtle by influencing the whole of culture and civilization through modifying the self-image of humans and their societies.

In reviewing their current state of affairs, including their social status and outlook, the joint purview of neuroscience and neurotechnology must be assessed in their intersection with the bases for the senses of self, individuality, and personhood and must consider how they operate practically in a variety of societal areas and technological fields. Those fields now include devices such as brain implants, neurosensors, brain–machine interfaces (BMIs), and brain–computer interfaces (BCIs) which consist of connections between brain functioning and computing, that is, between neuronal tissue and chip technology. In addition, since February 2019, the new and contested field of brain–brain interfaces (BBIs) is rapidly gaining traction, particularly in autocratic societies such as China, but there have been also

Lead authors: Roland Benedikter and James Giordano

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predecessors in the West.[1] China in the meantime regularly uses neuro-reading devices such as brain-hats—that is, wearable electroencephalographic brain scanners—to scan people's minds for control and optimization.[2] The Western alliance NATO has to some extent responded to this development by implementing its "Cognitive Warfare" program in 2023 which is dedicated to "strengthening and defending the mind."[3] The aim is to develop a "Cognitive Warfare Concept" until 2024.[4] As Johns Hopkins University and Imperial College London explained,

> In cognitive warfare, the human mind becomes the battlefield. The aim is to change not only what people think, but how they think and act. Waged successfully, it shapes and influences individual and group beliefs and behaviours to favour an aggressor's tactical or strategic objectives. In its extreme form, it has the potential to fracture and fragment an entire society, so that it no longer has the collective will to resist an adversary's intentions. An opponent could conceivably subdue a society without resorting to outright force or coercion… The aims of cognitive warfare can be limited, with short time horizons. Or they can be strategic, with campaigns launched over the course of decades. A single campaign could focus on the limited aim of preventing a military manoeuver from taking place as planned, or to force the alteration of a specific public policy. Several successive campaigns could be launched with the long-term objective of disrupting entire societies or alliances, by seeding

[1] Zhang, S., Yuan, S., et al.: Human Mind Control of Rat Cyborg's Continuous Locomotion with Wireless Brain-to-Brain Interface. In: Nature Scientific Reports 9 (4 February 2019), article 1321, https://www.nature.com/articles/s41598-018-36885-0. Cf. Yoo S.-S. et al.: Non-Invasive Brain-to-Brain Interface (BBI): Establishing Functional Links between Two Brains. In: PLOS One (3 April 2013), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0060410; and Anthony, S.: Harvard creates brain-to-brain interface, allows humans to control other animals with thoughts alone. In: Extremetech (31 July 2013), https://www.extremetech.com/extreme/162678-harvard-creates-brain-to-brain-interface-allows-humans-to-control-other-animals-with-thoughts-alone.Cf. Benedikter, R.: Künstliche Intelligenz und Neurowissenschaften. Futuristische Entwicklungen: Brain-Brain-Interfaces. St. Augustin und Berlin 2019, https://www.kas.de/web/auslandsinformationen/analysen-und-argumente/detail/-/content/kuenstliche-intelligenz-und-neurowissenschaften and https://www.kas.de/documents/252038/4521287/K%C3%BCnstliche+Intelligenz+und+Neurowissenschaften.pdf/63fcf974-2757-565f-dd48-8273fcced23c?version=1.0&t=1575898258780

[2] Chen, S.: 'Forget the Facebook leak': China is mining data directly from workers' brains on an industrial scale. In: South China Morning Post (29 April 2018), https://www.scmp.com/news/china/society/article/2143899/forget-facebook-leak-china-mining-data-directly-workers-brains. See also: Winick, E.: With brain-scanning hats, China signals it has no interest in workers' privacy. In: MIT Technology Review (30 April 2018), https://www.technologyreview.com/2018/04/30/143155/with-brain-scanning-hats-china-signals-it-has-no-interest-in-workers-privacy/. Cf. Cole, S.: China Claims It's Scanning Workers' Brainwaves to Increase Efficiency and Profits. In: Vice (1 May 2018), https://www.vice.com/en/article/8xkymg/china-brain-wave-hats-helmets-productivity and

[3] NATO Allied Command Transformation: Cognitive Warfare: Strengthening and Defending the Mind (5 April 2023, https://www.act.nato.int/article/cognitive-warfare-strengthening-and-defending-the-mind/

[4] Stato Maggiore della Difesa della Repubblica Italiana: Cognitive Warfare: La competizione nella dimensione cognitiva, Edizione 2023, https://www.difesa.it/SMD_/Staff/Sottocapo/UGID/Dottrina/Documents/Cognitive_Warfare_Ed.2023.pdf

doubts about governance, subverting democratic processes, triggering civil disturbances, or instigating separatist movements.[5]

Side by side with these interest-driven socio-political and geo-strategic applications which are just one example of the growing global strategic role and importance of neurotechnology, an even vaster variety of civil and civic application devices deriving from neuroscience and neurotechnology exist now or a coming into existence, for example, in the field of advanced prosthetics and healthcare-related disease detection and scanning routines which promise to revolutionize the medical field and its related self-concept and philosophy.[6] These applications are used reliably and intensely, rapidly spreading out from research centers and laboratories into everyday life. Their advances come with potentials of innovation so broad, multi-dimensional, and multi-applicable, that they could revolutionize modern life like few other technological fields.

Given the numerous factors and facets in play, the structure of tentative priorities leads us to undertake *three* initial steps. We *first* sketch what is going on in the field; *second*, we posit some basic questions that the international political and knowledge community must address and further elucidate in the coming years; and *third*, we outline some perspectives that may help us to better investigate what the future may bring.

2.1 Neuroscience and Neurotechnology, a Rather Recent Success Story

The outstanding place of neuroscience and neurotechnology in today's social, economic, and political development is due to three main factors:

- First, the study of how consciousness works in the human brain holds in principle unlimited potential for discovery and learning about basic mechanisms of intelligence and consciousness (since a couple of years also including artificial intelligence). The results can be useful in every imaginable field of application,

[5] Johns Hopkins University and Imperial College London: Countering cognitive warfare: awareness and resilience. In: NATO Review: Opinion, Analysis and Debate of Security Issues (20 May 2021), https://www.nato.int/docu/review/articles/2021/05/20/countering-cognitive-warfare-awareness-and-resilience/index.html

[6] Giordano, J. and Benedikter, R.: An Early - And Necessary - Flight of the Owl of Minerva: Neuroscience, Neurotechnology, Human Socio-Cultural Boundaries, and the Importance of Neuro-Ethics. In: Journal of Evolution and Technology 22(1) (December 2011), pp. 110–115, https://philpapers.org/rec/GIOAE. Cf. Giordano, J., Benedikter, R., and Kohls, N. B.: Neuroscience and the importance of a Neurobioethics: A reflection upon Fritz Jahr. In A. Muzur & H.-M. Sass (eds.): Fritz Jahr and the Foundations of Integrative Bioethics. Münster and Berlin: LIT Verlag 2012, pp. 267–280.

including most technologically (and that means: economically) relevant fields of the present and foreseeable future.[7]

- Second, neuroscience and neurotechnology hold unprecedented potentials of what is called "translational potential," that is, they point toward a new level of inter- and trans-disciplinary permeability and fluidity between different sectors of scientific insight that over time could revolutionize scientific inquiry as we know it.[8]
- Third, society is increasingly shaped by technological innovations that rely on a unifying trend toward *greater intelligence*. Information-age societies utilize smarter machines, procedures, and cybernetics in every and each sector, mostly interconnected through artificial intelligence services that try to mimic brain processes. Brain and mind research, in the broad sense, become crucial factors here for a vast variety of progressive applications.[9]

The current explosion of the overall importance of neuroscience, neurotechnology, and neuroethics on a global level is based not only on traditional lines of scientific and economic progress alone but also on a recent wave of interest, investment, and popularity. Until the first years of this century, progress in neuroscience has occurred in relatively silent yet steady and robust incremental steps. The past 20 years have borne witness to an accelerated pace of neuroscientific advancement, mainly due to two developments: first, the expansion of knowledge within its constituent disciplines, especially anatomy, physiology, pharmacology, radiology, and neuroimaging, and, second, the conjunction of new disciplines within the natural and physical sciences, mainly among genetics, nanoscience and cyberscience, as well as in the social sciences and humanities, for example, of anthropology, sociology, philosophy, and ethics under a broadening rubric.

During the years 2005–2015, the overall investment volume in neuroscience and the related neurotechnology industry increased at high growth rates. The global "neurotech market" was valued at around 26.2 billion USD in 2021 and is estimated to reach nearly 40 billion by 2030.[10] In the coming years, these numbers could rise not linearly, but exponentially. The global central nervous system treatment market has been projected to increase from $89.02 billion in 2021 to $166.53 billion in

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[7] British Neuroscience Association: Neuroscience, Science of the Brain. An Introduction for Young Students, Liverpool 2003, https://www.bna.org.uk/static/uploads/resources/BNA_English.pdf

[8] Davies, C., Hamilton, O., Hooley, M., Ritakari, T. E., Stevenson, A. J., and Wheater, E. (2020). Translational neuroscience: the state of the nation. In: Brain Communications 2(1) (April 2020), article fcaa038, https://academic.oup.com/braincomms/article/2/1/fcaa038/5816591

[9] Flavián, C. and Casaló, L.: Artificial intelligence in services: Current trends, benefits and challenges. In: The Service Industries Journal 41 (2021), pp. 853–859.

[10] Custom Market Insights: Neuroscience Market Size, Share, Growth Analysis Report. Global Industry Overview, Statistical Data, Competitive Intelligence, Trends, Outlook, and Forecast 2022–2030, July 2022, https://www.custommarketinsights.com/press-releases/global-neuroscience-market/

2028 worldwide, with an average combined growth rate of 9.4% per year.[11] This dramatic growth is due to changes in the aging pyramid, increasing wealth in developing countries, new global players like China or India investing in the field, and demographic shifts.

Additionally, brain science and the resulting neurotechnological applications are regarded as increasingly critical to the national security of both Western and non-Western nations, with viable applications in the health, safety, and performance improvement of military personnel, intelligence augmentation, and neurologically focused weapon systems. The U.S. Department of Defense and other national security agencies were investing heavily in neurotechnology research by 2010, and that trend toward expanded engagement and funding of neurotechnology for the use of deterrence and defense is expected to continue throughout the coming years.[12] Among the issues "aimed at expanding the frontiers of the field and enabling powerful, new capabilities"[13] are as follows:

- The Electrical Prescriptions (ElectRx) program that aims to help the human body heal itself through neuromodulation of organ functions using ultraminiaturized devices, approximately the size of individual nerve fibers, which could be delivered through minimally invasive injection;
- The HAPTIX program that aims to create fully implantable, modular, and reconfigurable neural-interface microsystems that communicate wirelessly with external modules, such as a prosthesis interface link, to deliver naturalistic sensations to amputees;
- The Neural Engineering System Design (NESD) program that aims to develop an implantable neural interface able to provide unprecedented signal resolution and data-transfer bandwidth between the brain and the digital world;
- The Neuro-FAST program that seeks to enable unprecedented visualization and decoding of brain activity to better characterize and mitigate threats to the human brain, as well as facilitate the development of brain-in-the-loop systems to accelerate and improve functional behaviors. The program has developed CLARITY, a revolutionary tissue-preservation method, and builds off recent discoveries in genetics, optical recordings, and BCIs;
- The Next-Generation Nonsurgical Neurotechnology (N^3) program that aims to develop a safe, portable neural interface system capable of reading from and writing to multiple points in the brain at once. Whereas the most advanced existing neurotechnology requires surgical implantation of electrodes, N^3 is pursuing

[11] Fortune Business Insights: Central Nervous System Treatment Market (2022), https://www.fortunebusinessinsights.com/central-nervous-system-treatment-market-103973

[12] DARPA and the Brain Initiative (2022): https://www.darpa.mil/program/our-research/darpa-and-the-brain-initiative. See also J. Sanchez and R. Miranda: Taking Neurotechnology into New Territory. In: DefenseMediaNetwork (14 March 2019) at https://www.defensemedianetwork.com/stories/taking-neurotechnology-new-territory/3/

[13] DARPA and the Brain Initiative (2022), loc cit.

high-resolution technology that works without the requirement for surgery so that it can be used by able-bodied people.

- The Reliable Neural-Interface Technology (RE-NET) program that was archived in the meantime sought to develop the technologies needed to reliably extract information from the nervous system, and to do so at a scale and rate necessary to control complex machines, such as high-performance prosthetic limbs;
- The Restoring Active Memory (RAM) program that aims to develop and test a wireless, fully implantable neural-interface medical device for human clinical use. The device would facilitate the formation of new memories and retrieval of existing ones in individuals who have lost these capacities as a result of traumatic brain injury or neurological disease;
- The Restoring Active Memory—Replay (RAM Replay) program that will investigate the role of neural "replay" in the formation and recall of memory, with the goal of helping individuals better remember specific episodic events and learned skills. The program aims to develop novel and rigorous computational methods to help investigators determine not only which brain components matter in memory formation and recall but also how much they matter;
- The Revolutionizing Prosthetics program that aims to continue increasing the functionality of DARPA-developed arm systems to benefit Service members and others who have lost upper limbs. The dexterous hand capabilities developed under the program have already been applied to small robotic systems used to manipulate unexploded ordnance, reducing the risk of limb loss among Soldiers;
- The System-Based Neurotechnology for Emerging Therapies (SUBNETS) program that seeks to create implanted, closed-loop diagnostic and therapeutic systems for treating neuropsychological illnesses;
- The Targeted Neuroplasticity Training (TNT) program that seeks to advance the pace and effectiveness of cognitive skills training through the precise activation of peripheral nerves that can in turn promote and strengthen neuronal connections in the brain. TNT will pursue the development of a platform technology to enhance learning of a wide range of cognitive skills, with a goal of reducing the cost and duration of the Defense Department's extensive training regimen, while improving outcomes.[14]

Programs like these have led to an interweaving of the military-industrial complex and civilian (among others academic) groups dedicated to neuroscientific projects, prompting discourse and debate within both the scholarly community and the public, as well as in the realms of international law and politics about the further path to take.

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[14] Ibid.

2.2 Toward a "Brain Race"?

Two overarching "grand challenge" projects during the 2010s have promoted long-term oriented "grand design" civil neuroscientific research: the BRAIN initiative of the U.S. and the Human Brain Project of the European Union. As a result, there has been a shift toward an ever-broader neuroscience agenda conducted in the public contexts of these leading global players with billions of taxpayer money which has attracted increasing amounts of private capital into the sector. The BRAIN initiative in the United States in 2013 was provided with around 200 million in the first phase.[15] As the Obama administration who launched the project wrote on the occasion,

> The BRAIN Initiative has the potential to do for neuroscience what the Human Genome Project did for genomics by supporting the development and application of innovative technologies that can create a dynamic understanding of brain function. It aims to help researchers uncover the mysteries of brain disorders, such as Alzheimer's and Parkinson's diseases, depression, and traumatic brain injury (TBI). The initiative will accelerate the development and application of new technologies that will enable researchers to produce dynamic pictures of the brain that show how individual brain cells and complex neural circuits interact at the speed of thought. These technologies will open new doors to explore how the brain records, processes, uses, stores, and retrieves vast quantities of information, and shed light on the complex links between brain function and behavior.[16]

Furthermore, the then White House stated:

> In the last decade, scientists have made a number of landmark discoveries that now create the opportunity to unlock the mysteries of the brain—including the sequencing of the human genome, the development of new tools for mapping neuronal connections, the increasing resolution of imaging technologies, the maturation of nanoscience, and the rise of biological engineering. These breakthroughs have paved the way for unprecedented collaboration and discovery across scientific fields. For instance, by combining advanced genetic and optical techniques, scientists can now use pulses of light to determine how specific cell activities in the brain affect behavior. Similarly, through the integration of neuroscience and physics, researchers can now use high-resolution imaging technologies to observe how the brain is structurally and functionally connected in living humans. While these technological innovations have contributed substantially to our expanding knowledge of the brain, significant breakthroughs in how we treat neurological and psychiatric disease will require a new generation of tools to enable researchers to record signals from brain cells in much greater numbers and at even faster speeds. That's where the BRAIN Initiative comes in.[17]

[15] The White House Washington DC: BRAIN Initiative. President Obama is calling on the science community to join him in pursuing a grand challenge: Brain Research Through Advancing Innovative Neurotechnologies (BRAIN) (2 April 2013), https://obamawhitehouse.archives.gov/BRAIN.

[16] Ibid.

[17] Ibid.

The Human Brain Project of the European Commission since 2012 was financed with an investment of more than 1.4 billion.[18] It connects 16 countries, more than 500 researchers, and 123 institutions in cooperation with the Switzerland-based "The Blue Brain Project" of the Ecole Polytechnique Federale de Lausanne (EPFL) and the Swiss government.[19] The Blue Brain project is dedicated "to build biologically detailed digital reconstructions and simulations of the mouse brain"[20] for the anticipation of human-centered research. As its founders write, the Blue Brain project aims at establishing

> Simulation neuroscience as a complementary approach alongside experimental, theoretical and clinical neuroscience to understanding the brain, by building the world's first biologically detailed digital reconstructions and simulations of the mouse brain. The supercomputer-based simulations and reconstructions built by Blue Brain offer a radically new approach for understanding the multi-level structure and function of the brain.[21]

The brain research initiatives of several participating countries began to coordinate their activities and enact a joint research governance structure in 2017.[22] As the EU Commission wrote in its description of the project,

> The Human Brain Project aims to put in place a cutting-edge research infrastructure that will allow scientific and industrial researchers to advance our knowledge in the fields of neuroscience, computing, and brain-related medicine.[23]

The "focus areas" of the EU's Human Brain Project in 2023 were as follows:

- Connectivity and Dysconnectivity of the Brain: Developing personalized network models and relevant clinical applications to better understand brain behavior.
- Consciousness and Cognition: Developing a multi-scale understanding of physiological, drug-induced, and pathological brain states and how they can support consciousness and cognition.
- Brain-Inspired Cognitive Architectures: Improving our understanding of how brain networks enable visuo-motor and cognitive functions, such as dexterous manipulation, spatial navigation, and relational reasoning.
- Data and Knowledge: The EBRAINS Data and Knowledge Services increase the efficiency and productivity in research by making data discoverable and reusable.
- Brain Atlases: Brain atlases provide spatial reference systems for neuroscience that allow navigation, characterization, and analysis of information based on anatomical location.

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[18] The Human Brain Project of the European Commission (2013–2023): https://www.humanbrainproject.eu/en/

[19] The Blue Brain Project of EPFL: https://www.epfl.ch/research/domains/bluebrain/ (2023).

[20] Ibid.

[21] Ibid.

[22] Adams, A., et al.: International brain initiative: An innovative framework for coordinated global brain research efforts. In: Neuron 105(2) (2022), pp. 212–216.

[23] The Human Brain Project of the European Commission (2013–2023): https://www.humanbrainproject.eu/en/ (2023).

- Simulations: Integrated workflows for model creation, simulation and validation, data analysis and visualization, and covering and connecting the different levels of description ranging from molecular and subcellular, to cellular, network, and whole brain levels.
- Medical Data Analysis: Helping clinicians, clinical scientists, and clinical data scientists who aim to adopt advanced analytics for diagnosis and research in clinics.
- Neurorobotics Platform: The service for embodied simulation developed by the Human Brain Project, now offered by EBRAINS.
- Computing and Storage: The High-Performance Computing, Cloud Computing, Storage, and Network Services of the Fenix infrastructure are integrated into EBRAINS. They are complemented by additional services, for example, for data transfer and infrastructure monitoring.
- Neuromorphic Computing: The neuromorphic computing systems SpiNNaker (1 mio core ARM processor system) and BrainScaleS (physical analog neuromorphic system) are available through EBRAINS.[24]

In all this, the shared EU research platform EBRAINS serves as A facilitator of exchange between the single actors and participants. It aims at building "a shared digital brain research infrastructure for the EU,"[25] stating

> EBRAINS provides digital tools and services which can be used to address challenges in brain research and brain-inspired technology development. Its components are designed with, by, and for researchers. The tools assist scientists to collect, analyze, share, and integrate brain data, and to perform modelling and simulation of brain function. EBRAINS' goal is to accelerate the effort to understand human brain function and disease.[26]

The two macro-"signal projects" of the USA and the EU have been meant not only to carry out cutting-edge research from an applied perspective but also to serve as examples for the global community in order to pave the way to a greater wave of transnational public investments. Both projects build upon tools-to-theory-to-tools heuristics to prompt translational outcomes of brain research in medicine, public life, and national security and defense applications. Both of them rely on the exploration of the brain by the use of hyper-speed supercomputers and complex data processing devices which simulate the activity of single neurons, as well as clusters of neurons, and aim ultimately to be able to simulate the brain as such. As the then director of the EU's Human Brain Project, Henry Markram, declared,

> It's going to be … a Noah's archive of the mind. It's like a telescope that can span all the way across the universe of the brain from the micro to the macro level.[27]

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[24] Ibid.

[25] EBRAINS Platform: https://ebrains.eu/about/ (2023).

[26] Ibid.

[27] Honigsbaum, M.: Human Brain Project: Henry Markram plans to spend €1bn building a perfect model of the human brain. In: The Observer (15 October 2013), https://www.theguardian.com/science/2013/oct/15/human-brain-project-henry-markram. In the meantime, Paweł Świeboda has taken over as the director of both the EU's Human Brain Project and EBRAINS.

The respective efforts and, more importantly, the scientific and political aspirations intertwined with them are in the meantime reaching new levels, if compared with the situation of just a decade ago, pointing toward a fast-paced development. Yet as early as in 2013, the development took a promising direction:

> When Markram first unveiled his idea at a conference in Oxford, few of his peers took him seriously. The brain was too complex, they said, and in any case there was no computer fast enough [to simulate it]. Even when he presented a more detailed plan at a scientific meeting …, showing how the requisite computer power would be available by 2020, many neuroscientists continued to insist it could not be done and dismissed his claims as hype.
>
> Today, thanks to the largesse of the European Union, which awarded Makram $1.4 billion in 2012 to make his dream a reality, many of those naysayers are being forced to take him seriously. The gift, which comes on top of a state-of-the-art IBM Blue Gene computer from the Swiss government, makes Markram's unit at the Swiss Federal Institute of Technology in Lausanne the biggest dog on the neuro block. It also gives Markram a head-start on brain-mapping projects in Japan and the US, where Barack Obama [was] hoping to persuade Congress to award $3bn to a similar initiative called BRAIN.
>
> The timing of Obama's initiative and the EU's award, the [by then] largest in its history, has led to talk of an international 'brain race.' But Markram argues that a better parallel is the Human Genome project. Just as the decade-long effort to map the 3.3 billion base pairs that make up the 23 chromosomes in the human genome required close co-ordination between scientists worldwide, so Markram argues mapping the human brain in all its neural complexity will take a similarly co-operative international research effort.[28]

Similarly, but with a slightly different, more applied business and military focus, former U.S. president Barack Obama officially declared the goals of the then-new U.S. BRAIN initiative in April 2013:

> Every dollar we spent to map the human genome has returned $140 to our economy—$1 of investment, $140 in return. [We] are here to announce the next great American project, and that's what we're calling the BRAIN Initiative.
>
> As humans, we can identify galaxies light years away, we can study particles smaller than an atom. But we still haven't unlocked the mystery of the three pounds of matter that sits between our ears. But today, scientists possess the capability to study individual neurons and figure out the main functions of certain areas of the brain. But a human brain contains almost 100 billion neurons making trillions of connections. So as a result, we're still unable to cure diseases like Alzheimer's or autism, or fully reverse the effects of a stroke. And the most powerful computer in the world isn't nearly as intuitive as the one we're born with.
>
> So there is this enormous mystery waiting to be unlocked, and the BRAIN Initiative [aims at changing] that by giving scientists the tools they need to get a dynamic picture of the brain in action and better understand how we think and how we learn and how we remember. And that knowledge could be—will be—transformative.
>
> In the budget …, I propose a significant investment by the National Institutes of Health, the Defense Advanced Research Projects Agency, and the National Science Foundation to help get this project off the ground. I'm directing my bioethics commission to make sure all of the research is being done in a responsible way. And we're also partnering with the pri-

[28] Honigsbaum, M.: Human Brain Project, loc cit.

> vate sector, including leading companies and foundations and research institutions, to tap the nation’s brightest minds to help us reach our goal.[29]

Accordingly, at the official presentation of the BRAIN initiative at the White House in Washington DC, it was said that

> the BRAIN initiative is a bold new research effort to revolutionize our understanding of the human mind and uncover new ways to treat, prevent, and cure brain disorders like schizophrenia, autism, epilepsy, and traumatic brain injury. The BRAIN Initiative—short for *Brain Research through Advancing Innovative Neurotechnologies*—builds on the President’s … call for historic investments in research and development to fuel the innovation, job creation, and economic growth that together create a thriving middle class. The Initiative promises to accelerate the invention of new technologies that will help researchers produce real-time pictures of complex neural circuits and visualize the rapid-fire interactions of cells that occur at the speed of thought. Such cutting-edge capabilities, applied to both simple and complex systems, will open new doors to understanding how brain function is linked to human behavior and learning, and the mechanisms of brain disease.
>
> In his remarks, the President highlighted the BRAIN Initiative as one of the Administration’s ‘Grand Challenges’—ambitious but achievable goals that require advances in science and technology to accomplish … Grand Challenges of the 21st century—(are) challenges that can create the jobs and industries of the future while improving lives.[30]

Similar enterprises involving multi-billion-dollar worth of scientific projects have been targeting the interface between industry, commerce, health, and the military to serve as an orientation for the economic-scientific avant-garde sector of neuroscience in the more strict sense, and its applications in neurotechnology.

The overall picture manifests that an outstanding importance is currently given to neuroscience and neurotechnology by governments and institutions on both sides of the Atlantic. Both pillars of global open societies and democracies: the U.S. and the European Union see the sector as a crucial innovation field to foster interdisciplinary research and technology with benefits for the inventiveness and competitiveness of the greater whole of the respective research industries and economies and their standing in the international community.

As an effect, the strengthening of further investment and cooperation in these fields are broadening the agendas of global research by broadening systematic institutional and governmental exchange as well as by involving private–public partnerships.

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[29] Obama, B.: Remarks by the President on the BRAIN Initiative and American Innovation. In: The White House Office of the Press Secretary (2 April 2013), http://www.whitehouse.gov/the-press-office/2013/04/02/remarks-president-brain-initiative-and-american-innovation

[30] Collins, F. and Prabhakar, A.: BRAIN Initiative Challenges Researchers to Unlock Mysteries of Human Mind. In: The White House blog (2 April 2013), http://www.whitehouse.gov/blog/2013/04/02/brain-initiative-challenges-researchers-unlock-mysteries-human-mind. See also Shen, H.: Neurotechnology: BRAIN storm. In: Nature 503 (6 November 2013), pp. 26–28, https://doi.org/10.1038/503026a

2.3 The West Is Going Ahead, But What About "the Others"?

If Western powers are pursuing neuroscience and neurotechnology with such eager ambitions both with regard to the benefit of their economies and populations and their standing among their peers on an international and global level, other, non-Western powers are not sleeping. Powers such as China, India, Russia, and Brazil have been seriously—and with large public investments—entering the field since the early 2000s.[31] They are increasing investment and research dedicated to neuroscience and neurotechnology by inaugurating new research centers, seeking cooperation with Western institutions, and developing their own, partly public, partly classified agendas involving mainly medicine, human enhancement, and the military.[32] As a U.S. National Research Council (NRC) report stated already in 2008,

> Experts say the global neuroscience race has heated up, with about 500 global companies trying to develop brain-targeting drugs and devices. Like biotechnology, neuroscience and neurotechnology—the engineering of devices and drugs targeting the brain and nervous system—have therapeutic and military uses. Officials with the Pentagon's Defense Advanced Research Projects Agency DARPA talk of next-generation wish lists that include pills that decrease fear or enhance cognition in soldiers and devices that connect human thoughts with devices such as prosthetic limbs and unmanned aircraft.
>
> Meanwhile, such nations as India, Brazil, China and Iran are increasing their capabilities in fields related to neuroscience—a fact that worries U.S. intelligence officials concerned with threats involving 'neuroweapons' that act on the brain and nervous system. The report says that China 'is fast becoming an international superpower and a haven for biotechnology research,' in part because of relatively inexpensive labor and biotechnological expertise in universities and companies. It also cites a Chinese strategy paper saying that [China's] People's Liberation Army is trying to 'make major breakthroughs in some basic, pioneering and technological fields of strategic importance.'[33]

In the wake of titular projects from the preceding "Decade of the Brain" (1990–99)[34] launched by former U.S. president George Herbert Walker Bush to the groundswell of research, development, and applications of neuroscience and its technologies (neuroS/T) fostered by multi-national projects of the past 20 years, the remaining 2020s will be an even more potent and portentous decade for advancing an

[31] Hearn, K.: Iran, China make neuroscience advances. In: The Washington Post (2 October 2008), http://www.washingtontimes.com/news/2008/oct/02/neuroscience-wake-up-call/?page=all http://www.qaas.zju.edu.cn/ziint/. See also Gray, N. and Haihong, Y.: Amazing changes in Chinese neuroscience over the past decade. In: actionpotential: neuroscience@nature (17 March 2008), http://blogs.nature.com/actionpotential/2008/03/haihong_ye_chinese_neuroscience.html

[32] Shook, J. and Giordano, J.: All Ethics is Global: New Neuroethics in a Multipolar and Multicultural World. In: Benedikter, R., Gruber, M. and Kofler, I. (eds.): Re-Globalization: New Frontiers of Political, Economic and Social Globalization, London and New York: Routledge 2022, pp. 106–116.

[33] Hearn, K.: Iran, China make neuroscience advances, loc cit.

[34] Goldstein, M.: The Decade of the Brain. In: Neurology 40(2) (1990), https://doi.org/10.1212/WNL.40.2.321

understanding—and capabilities to affect—the brain and its functions. Initiatives based in China[35] and Japan[36] (Okano et al. 2015), just to mention a few, are incorporating opportunities to reflectively consider the impacts of investigations and achievements in brain science research.

Summing up the state of things, the UK's Regulatory Horizons Council released its 2022 report on the global scale of neurotechnology invention and innovation:

> Neurotechnology is predicted to become a significant market with the potential to generate substantial economic benefits, valued at US$17.1 billion globally by 2026, with the largest segments being neuromodulation, neuroprosthetics and neurosensing. Growth potential is also reflected in the number of patents being filed. An Organization for Economic Co-operation and Development (OECD) 2019 report found that more than 16,000 patents had been filed between 2008 and 2016 in health-related neurotechnologies across 10 key worldwide priority filing locations, with a significant upwards trend. The growth of the sector is currently driven by both private and public investment. The scale of government investment in neurotechnology can be difficult to ascertain. The Council is aware of significant government-driven investment in the United States, European Union, China, South Korea, Australia, Japan and Canada, with the US being the largest investor in absolute terms. There is also increasing evidence of private investment in neurotechnology. The *Crunchbase* database lists 757 neurotechnology start-ups, companies and organizations at the time of writing, compared to the 400 listed in 2019.[37]

As the report stressed out, the field of neuroethics will depend on the politics and ambitions of new corporate and government actors at the interface between big business, medicine, brain science, and technological human futures in general.

2.4 Investments of Scientific, Medical, and Military Industries

Overlooking these developments, neuroscience, neurotechnology, and neuroethics, the latter as their overarching legitimating—and therefore, where needed, self-critical—discourse pattern, are all three, without doubt, becoming core players at the interface of crucial industries both scientifically and businesswise. More than that, they are becoming centerpieces of a variety of national and international policy strategies involving multiple fields of foresight, forecast, and planning of all the most influential nations and institutions.

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[35] Poo, M. M., et al.: China's Brain Project: Basic neuroscience, brain diseases, and brain-inspired computing. In: Neuron 92 (2016), pp. 591–596.

[36] Okano, H., et al.: Brain/MINDS: brain-mapping project in Japan. Philosophical Transactions of the Royal Society B: Biological Sciences 370(1668)(2015), p. 20140310, https://doi.org/10.1098/rstb.2014.0310

[37] The UK Regulatory Horizons Council: Neurotechnology Regulation, November 2022, accessible at https://www.gov.uk/government/publications/regulatory-horizons-council-the-regulation-of-neurotechnology

The future is predictable, despite the impact of recent major global ruptures such as the COVID-19 pandemic and Russia's Ukraine invasion which have temporarily slowed down the progress in the field. New methods for the simulation and representation of the self, consciousness, and human intelligence in the medical, social, and military milieus will offer both benefits and profits along with hazards, burdens, and risks. Employing "big science" approaches to address so-called "grand challenges" connected with the human brain and the effects that such advances may exert upon communities can powerfully impact society at large and international politics and policy. Such impacts still remain a wide open and insufficiently addressed—and inadequately covered by media—the topic of public discussion.[38] That deficit is even worse among non-Western and non-democratic nations around the world, where debate and knowledge about neurotechnology-driven transformation is scarce or non-existent.

Nevertheless, the rapid rise of neuroscience and neurotechnology to becoming global actors is not due to the particular role or engagement of any single sector alone, but rather to the extraordinary participation of, and cooperation between, broad and diverse fields of modern societies. Among them are such different (and partly conflicting) sectors like the medical, entertainment, and military industries. New neuroscientific investigations and their technological outcomes and applications are triggering more and more waves of innovation-oriented investment. Neurotechnology has aroused many ambivalent feelings since it has interwoven hopes for with fears of "deep transformation."

It is not by accident that two more or less simultaneous *Nuffield Council on Bioethics* reports from a bit more than a decade ago, "Human Bodies: Donation for Medicine and Research"[39] and "Solidarity: Reflections on an emerging concept in bioethics,"[40] as well as successive reports, already noticed concordantly that neurotechnology and its side sectors were advancing exponentially and simultaneously on a variety of fields. Importantly, although the *Human Genome Project* is still often mentioned as "the" example of how the new field may (and according to some actors perhaps should) develop, neuroscience and neurotechnology are novel fields per se *not* identical to biotechnology. On the contrary, they are (although part of the overall sector) rising actors on their own right:

> Unlike the field of biotechnology, which concerns itself with pharmacological and genetic engineering efforts to understand and control DNA, genetic material, and other complex biological molecules, neurotechnology is concerned with electronic and engineering methods of understanding and controlling the nervous system function. Some of the very early

[38] Lanzilao, E., Shook, J. R., Newman, R., and Giordano, J. (2013): Advancing Neuroscience on the twenty-first-Century World Stage: The Need for and a Proposed Structure of an Internationally Relevant Neuroethics. In: Ethics in Biology, Engineering and Medicine 4(3) (2013): 211–229.

[39] The Nuffield Council on Bioethics: Human Bodies: Donation for Medicine and Research. Report, London 2011, http://www.nuffieldbioethics.org/sites/default/files/Donation_full_report.pdf

[40] The Nuffield Council on Bioethics: Solidarity: Reflections on an emerging concept in bioethics. Report, London 2011, http://www.nuffieldbioethics.org/sites/default/files/NCOB_Solidarity_report_FINAL.pdf.

> firms in the neurotechnology field have scored great success building devices that restore hearing to deaf people, restore arm and hand function to quadriplegics, and accomplish a host of other feats using techniques of functional electrical stimulation of the human body …
>
> Government and private research funding in this area will lead to one of the great spinoffs of our time as biomedical engineers apply their knowledge and experience building devices that sense and stimulate the human nervous system and interface with non-human systems such as computers, training systems, and virtual reality.
>
> Moreover, much of the risk in financing technology development in this field will be borne by government and private medical institutions who do not necessarily have the same expectations as the venture capital community.[41]

The fact that some of the world's leading powers are increasingly seeing neurotechnology, and in particular BCIs and BMIs, as decisive pillars for the future of defense is an important driving force for the growth of public investments in the sector. While the militarily standard-setting power USA invested around $500 million in neurotechnology and its derivatives in 2009, already in 2012, the estimated amount reached $3 billion—and that trend has continued since to display further rapid growth. The U.S. 2023 Military Science and Technology budget amounted to $130 billion for Research, Development, Test, and Evaluation (RDT&E), a 16% increase compared with 2022, with "the portion for science and technology including $16.5 billion,"[42] a 12% increase compared with 2022.[43] The development is similar in China and Russia, despite differences in their overall military spending and technological readiness. Gaps may be closing fast, although non-transparency about real spending by non-democratic actors cannot be discounted. Military interest in new technologies related to the brain is a trend-setter for many other fields, including economic, political, and administrative sectors.

Overall, neuroscience and neurotechnology have the potential, willingly or unwillingly, to contribute to incept weapons of the future by introducing a new kind of weaponry unknown in traditional history:

> The weapons that humanity has used until now have all been kinetic tools of waging war starting from spears and arrows up to high-precision munitions, electronic warfare and stealth technology. But in a quite foreseeable future, a completely new physical principle of waging combat action will be applied. The systems fall under the category of non-lethal weapons, but their … potential may by far exceed any conventional capability we have ever seen.
>
> Dozens of years of brain research start to result in advanced discoveries to be put to practical use, advances that open the door to 'neuroweapons'—for example virus-transported molecules to addle the brain. Nowadays neuroscience is rapidly advancing encompassing a wide range of use and technologies. In the not-too-distant future the battlefields will be shaped by advances in neuroscience focused for military purposes, where the technologies called BCIs could link human brains with computer programs. For instance, analysts with a brain chip could quickly sift through huge amounts of intelligence data, and

[41] Ibid.

[42] Carberry, S.: 2023 Science, Technology Budget a Mixed Bag. In: National Defense Magazine 31 May 2022), https://www.nationaldefensemagazine.org/articles/2022/5/31/2023-science-technology-budget-a-mixed-bag

[43] Ibid.

> fighter pilots merged with computer search algorithms could (more) rapidly lock onto enemy targets.[44]

Without doubt, globally leading powers jealously imitate each other, trying to catch up with perceived leaders to be close to the forefront of the respective fields:

> Neuroscience and brain-related research is something (for example) the United States military invests in. The Defense Advanced Research Projects Agency (DARPA) lists several neuroscience-related projects on its website, including 'Accelerated Learning,' 'Neurotechnology for Intelligence Analysts' and 'Cognitive Technology Threat' … The US … Air Force also studies the ways to enhance airmen's performance, while degrading the mental states of their enemies. In November 2009 the Air Force Research Laboratory … came out with a call for proposals that examine 'Advances in Bioscience for Airmen Performance.' It [was] a six-year, $49 million effort to deploy neuroscience and biotechnology in the service of warfare. The announcement states the Air Force seeks 'radically new military capabilities that improve warfighter performance and combat effectiveness.' The goal is technologies that can read airmen's minds and then manipulate them 'to anticipate, find, fix, track, identify, and characterize human intent and physiological status anywhere and at anytime.'[45]

On the contrary, it is obvious that the potentials of such military applications of neuroscience and neurotechnology are among the motors pushing toward a new, comprehensive form of neuro-logistics, that could revolutionize mobility, transport, and interchange of services and goods.

As a consequence, forecasts and reports (particularly in the Anglo-American sphere including its avant-garde military sectors) strenuously attempt to anticipate the most pressing questions related to this development, in order to sketch a first blueprint of international ethical standards on the field:

> Experts … discuss four types of technology valuable for national security: nano-neuroscience, pharmaceuticals, neuro-imaging and cyber-neurosystems. They provide examples, such as nanomachines that modify the brain's functioning to enhance the performance of troops, mind-reading by means of neuro-imaging and devices that would increase a person's brainpower by linking it to a computer. Other contributors also describe BMIs, which could wire a human into a computer network. They could be used to control advanced weapons systems directly from the mind, or for training and supplementing the abilities of intelligence analysts. It's emphasized that [there is] already developing technology that would allow intelligence personnel to sift through images at unprecedented speeds. The neuropharmacological drugs could be used in combat to paralyze or make enemy troops incapable for agile operational activities … There are other sorts of psychopharmacological manipulation that could be used to boost servicemen performance, allowing them to remain vigilant without sleep, [and] enhance their perceptual powers.[46]

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[44] Akulov, A.: Neuroscience and the Weapons of the Future. In: Strategic Culture Foundation (a Moscow-based think tank), (4 December 2012), www.strategic-culture.org/news/2012. Accessed at https://web.archive.org/web/20121105224957/http://www.strategic-culture.org/news/2012/04/12/neuroscience-and-the-weapons-of-future.html

[45] Ibid.

[46] Ibid.

Not to forget, the field of neuroscience is also becoming a prominent actor both in the strategic foresight and in the practical application of analyses of and findings on rapidly changing contextual environments:

> In February 2012 the UK Royal Society published the Neuroscience, Conflict and Security report. The wide-ranging document … notes that the most consequential developments will be found in the area of neural interfacing and the efforts to bring the human nervous system and computing machines under a single informational architecture. One of the options presupposes that a human brain may be harnessed within fire control systems to perform cognitive tasks before these even become conscious to them.[47]

The questions with regard to such practical application of neuroscientific research onto the military field are without doubt many, and they are less about efficiency but more about principal ethical considerations to be reconciled with the needs of defending democracy and freedom in a hyper-technological world where authoritarian powers are rising not least due to increasing interdependency and interconnectedness.

Such questions are ultimately also diplomatic. Joint efforts to limit neurotechnological applications in warfare and defense among global powers evoked in international meetings and negotiations must be sincere. Alternatively, competition and mutual mistrust might prevail, over agendas to create strategic surprise, advantage, or even predominance. Given that public policy issues, including the policies of copyrights and patent ownership, are pursued "aggressively"[48] and in grand style by lobby organizations such as the *Neurotechnology Industry Organization* (NIO) which assembles more than 100 organizations under a joint umbrella,[49] with similar trends toward systematic lobbying underway in China and Russia, it remains insecure whether traditional diplomacy alone can on the long run outweigh globally interconnected business, industry, and enterprise interests. Most probably, the addition of economic diplomacy[50] and science diplomacy[51] will be needed.

47 Akulov, A.: Neuroscience and the Weapons of the Future, loc cit.

48 Cf. the activities and publications of the Neurotechnology Industry Organization (NIO), a San Francisco and Washington D.C.-based lobby organization: http://www.neurotechindustry.org/home.html and http://www.neurotechindustry.org/publicpolicy/nnti.html

49 Ibid.

50 Diplomacy.eu: Economic diplomacy, n.d., https://www.diplomacy.edu/topics/economic-diplomacy/

51 European Union External Action (EUEA): What is Science Diplomacy? (16 March 2022), https://www.eeas.europa.eu/eeas/what-science-diplomacy_en

2.5 The Need for In-Depth Assessment and Future-Oriented Regulation

All this comes with an increased need for in-depth assessment and future-oriented regulation. As the United Nation's educational, scientific, and cultural organization UNESCO assessed as early as 1984, biotechnologies, including neuroscience and its derivatives in the form of neurotechnologies, present deep-reaching "challenges and promises" alike.[52] While according to the most important global bodies such as UNESCO and OECD the chances and advantages prevail, the risks cannot be underestimated. In March 2023, at an OECD Paris presentation about the future relationship of advanced technology and mankind, the biggest impact technology of open outcome mentioned was "neuroscience" since, according to the OECD foresight experts, in conjunction with artificial intelligence, it could profoundly modify both the science-based self-image and the socio-political realities of the human being thus impacting most other relevant sectors of interconnected technologies and their cultural use. As the OECD wrote already in 2019, because of this fundamental role, there is an increasing "need for an international standard for responsible innovation in neurotechnology."[53] In detail, the OECD Legal Instruments Commission in 2019 stated that

> Novel neurotechnology offers significant potential for the promotion of health, well-being, and economic growth. Mental health is an increasingly important public health concern in OECD Member countries and beyond. Mental and neurological disorders (e.g. Alzheimer's disease and other dementias) cause great human suffering and are increasingly recognised as major causes of death and disability worldwide. They often remain untreated and impose significant economic and social welfare costs, elevating their importance to the highest national and international policy levels. Neurotechnology is redefining what is possible in terms of monitoring and intervention in clinical and non-clinical settings, with great promise for improving mental health, well-being and productivity. Spearheaded by large national and international flagship initiatives in brain science and fuelled by a clear medical need, research both in the public and private sector has made considerable advances.[54]

In particular, the OECD mentioned that the

> convergence between neuroscience, engineering, digitalisation, and artificial intelligence (AI) is becoming a key driver of innovation and will disrupt existing practices as well as traditional boundaries between medical therapies and consumer markets. At the same time, neurotechnology raises a range of unique ethical, legal, and societal questions that potential business models will have to address. These questions include issues of (brain) data privacy, the prospects of human enhancement, the regulation and marketing of direct-to-consumer

[52] Sasson, A.: Biotechnologies: Challenges and Promises. UNESCO Paris Publications 1984, online at: https://unesdoc.unesco.org/ark:/48223/pf0000055004?posInSet=19&queryId=95062a59-c379-447f-a71e-d00a3ca5ec62

[53] OECD Legal Instruments: Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD Legal 0457, adopted on 11/12/2019, Paris 2019, to be found online at: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0457

[54] Ibid.

devices, the vulnerability of cognitive patterns for commercial or political manipulation, and further inequalities in use and access.[55]

According to the OECD, this is why

> Governance issues surrounding neurotechnology affect the entire innovation pipeline, from fundamental brain research, cognitive neuroscience, and other brain-inspired sciences to questions of commercialisation and marketing. In order to respond to these issues, the OECD, through its Working Party on Biotechnology, Nanotechnology and Converging Technologies (BNCT), has been pursuing a five-year project focusing on developing a set of principles for responsible innovation in neurotechnology. These aim to assist governments and innovators in addressing and anticipating the governance challenges raised by mental and neurological disorders and novel neurotechnologies.[56]

As a consequence, there has been a growing call for Anticipatory Innovation Governance (AIG)[57] requested by an increasing number of actors, including, more in specific, for anticipatory neurotechnology innovation governance.[58] This is why the OECD, in exchange with its 38 single member states and the United Nations, as well as with their sub-bodies and -committees, between 2015 and 2019 conducted the project "Neurotechnology and Society."[59] As a result, the OECD in 2019, building on extensive studies since 2017,[60]

> has adopted a Recommendation on Responsible Innovation in Neurotechnology that embodies nine principles focusing on (1) promoting responsible innovation; (2) prioritising safety assessment; (3) promoting inclusivity; (4) fostering scientific collaboration; (5) enabling societal deliberation; (6) enabling capacity of oversight and advisory bodies; (7) safeguarding personal brain data and other information; (8) promoting cultures of stewardship and trust across the public and private sector; and (9) anticipating and monitoring potential unintended use and/or misuse.[61]

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[55] Ibid.

[56] Ibid.

[57] Tonurist, P. and Hanson, A.: Anticipatory Innovation Governance. Shaping the future through proactive policy-making. OECD Working Papers on Public Governance No. 44, OECD Publications, Paris 2020, to be found online at: https://www.oecd.org/science/anticipatory-innovation-governance-cce14d80-en.htm

[58] Nelson, J. P. et al.: Amplifying the Call for Anticipatory Governance. In: The American Journal of Bioethics 22(1) (2022), pp. 48–50, doi: 10.1080/15265161.2021.2001109, to be found online at: https://par.nsf.gov/servlets/purl/10344096

[59] OECD Legal Instruments: Recommendation of the Council on Responsible Innovation in Neurotechnology, loc cit.

[60] Among them are: OECD: Neurotechnology and society: Strengthening responsible innovation in brain science. OECD Science, Technology and Industry Policy Papers, No. 46, OECD Publishing, Paris 2017; Garden, H. and Winickoff, D.: Issues in neurotechnology governance. OECD Science, Technology and Industry Working Papers, 2018/11, OECD Publishing Paris 2018; and Garden, H. et al.: Responsible innovation in neurotechnology enterprises. OECD Science, Technology and Industry Working Papers, No. 2019/05, OECD Publishing, Paris 2019.

[61] OECD/OPSI (Observatory of Public Sector Innovation): Anticipatory Innovation Governance: What it is, how it works, and why we need it more than ever before. OECD-OPSI, Paris 2020, online at: https://oecd-opsi.org/wp-content/uploads/2020/11/AnticipatoryInnovationGovernance-

As the OECD wrote in its deriving outlook in 2019,

> The implementation of [this] recommendation will be supported by the development of practical tools and guidance. A collection of examples of best practices and lessons learned in the field of neurotechnology and other emerging technologies will be developed to assist adherents in the project of implementation. In addition, the [specialized OECD committees] will serve as a forum for exchanging information on neurotechnology policy and experiences with the implementation of the recommendation and foster multi-stakeholder and interdisciplinary dialogue on innovation in neurotechnology.[62]

This announced work on assessing regulatory options for both the next years and the more distant future is ongoing. It is made more difficult by the macro-split of the international community into the new competition of two global ideological blocs: the alliance of democracies versus the alliance of autocracies which pursue "two different and competing globalizations."[63] Both blocs are fighting for technological supremacy and control of respective basic resources—such as mirrored by, to mention just one example, China's 2023 decision to "tightening controls over exports of two key materials used to make computer chips. From [August 2023], special licenses will be needed to export gallium and germanium from China, which is the world's biggest producer of the metals … China's Ministry of Commerce said the restrictions were needed to safeguard national security and interests."[64] This and similar de-globalization and re-nationalization efforts are crucially important also for the ongoing re-nationalization of neurotechnologies, including the rapidly multiplying technological applications of brain research in the new generation of bio- and neuromorphic computers.

Note-Nov2020.pdf, pp. 68. Cf. OECD/OPIS: Anticipatory Innovation Governance News, https://oecd-opsi.org/work-areas/anticipatory-innovation/

[62] OECD Legal Instruments: Recommendation of the Council on Responsible Innovation in Neurotechnology, loc cit.

[63] Cf. more in detail Benedikter, R.: The New Global Direction: From "One Globalization" to "Two Globalizations"? Russia's War in Ukraine in Global Perspective. In: New Global Studies 17(1) (2023), pp. 71–104, doi: https://doi.org/10.1515/ngs-2022-0038

[64] Liang, A. and Sherman, N.: China curbs exports of key computer chips materials. In: BBC News (4 July 2023), https://www.bbc.com/news/business-66093114

Chapter 3
Neuroenhancement: Brain–Computer Interfaces (BCIs) and Their Applications

Abstract This chapter provides an impression of applications in the field of the so-called "New Human Technologies (NHT)." It addresses Brain–Computer Interfaces (BCIs) and their use and explains what neuroenhancement is and could become.

Keywords New human technologies · Brain · Computer interfaces · Neuroenhancement

The capabilities afforded by neuroscience and neurotechnology are applicable to an increasingly broad palette of propositions—and uses—given that the efforts toward their employment in research and practices are becoming ever more multi-national in engagement and effects. In the main, the general trend reflects a focus on developing and employing various iterations of brain–machine interfaces (BMIs) to assess, access, and affect the structures and functions (viz., cognition, emotion, and behaviors) of the brain and nervous system.

As mentioned, BMIs today are an expanding presence in varied domains of everyday life: in medicine, education, occupational settings, and entertainment, which each and all show present promise and near-future potential to modify human (and other organisms') abilities in and across scales that range from the cellular to the social and from the individual to the global. We may be at the beginnings of an age of human–technology hybridization and the enmeshing of boundaries between the human and the non-human. In our time, the borders of the possible often challenge the borders of the ethical, which implies that the neurosciences cannot avoid conversations with the rising field of neuroethics.

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3.1 Medicine

Perhaps the most obvious applications for BMIs are in clinical research and therapeutics. Apparent benefits to employing neuroscience and technologies, in general, and iterations of BMIs, more specifically, are directed toward improving the assessment and treatment of neurological and psychiatric disorders and conditions. The medical neuroscience and technology market is already significant and continues to grow as a result of innovations and products from several nations' large-scale initiatives in brain science.

The reasoning behind these investments is obvious. The US-based market research organization *NeuroInsights* estimated that the annual economic cost of neuropsychiatric disorders in the USA amounted to more than US$1.4 trillion already in 2012[1], and the European Brain Council and the UK's *Nuffield Council on Bioethics* have estimated that European incurred costs of these conditions are in excess of €800 billion in 2012.[2] The Information Technology and Innovation Foundation (ITIF) indicated in 2016 that "brain disorders and diseases cost the U.S. economy US$ 1.5 trillion per year, which was 8.8 percent of the Gross Domestic Product (GDP)."[3] According to the Foundation, in 2016 "50 million American adults—28.8 percent of the adult population—experienced a brain disease or disorder", including mild symptoms.[4] Regarding Europe, estimates arrived at 17% of the population to be affected by mental disorders (MDs) per year in 2020.[5] In 2020, experts estimated the average international cost of a patient with neurological disorders at over US$ 10,000 per year.[6] In 2022, experts wrote that

[1] NeuroInsights: The Neurotechnology Industry 2012 Report, San Francisco 2012, p. 35, http://www.neuroinsights.com/marketreports.html#!exhibitors/c1iz5. Cf. Society for Neuroeconomics: 16th annual meeting, October 5–7, 2018, https://neuroeconomics.org/wp-content/uploads/2018/10/SNE-program-oct2018-110-web.pdf

[2] Nuffield Council on Bioethics: Novel Neurotechnologies: Intervening in the Brain, London 2013, p. 46, http://www.nuffieldbioethics.org/sites/default/files/Novel_neurotechnologies_report_PDF_web_0.pdf

[3] Information Technology and Innovation Foundation (ITIF): Brain Disorders and Diseases Cost U.S. Economy $1.5 Trillion, Underscoring Scale of Opportunity for Greater Research and Innovative New Treatments to Improve Health and Drive Prosperity, ITIF Study Finds (11 July 2016), https://itif.org/publications/2016/07/11/brain-disorders-and-diseases-cost-us-economy-15-trillion-underscoring-scale/

[4] Ibid.

[5] Laszewska, A., Wancata, J., Jahn, R., et al.: The excess economic burden of mental disorders: findings from a cross-sectional prevalence survey in Austria. In: The European Journal of Health Economics 21 (2020), pp. 1075–1089, https://doi.org/10.1007/s10198-020-01200-0 and https://link.springer.com/article/10.1007/s10198-020-01200-0

[6] Christensen, M. K., et al.: The cost of mental disorders: a systematic review. In: Epidemiology and Psychiatric Sciences (18 August 2020), https://www.cambridge.org/core/journals/epidemiology-and-psychiatric-sciences/article/cost-of-mental-disorders-a-systematic-review/3AF132DC8AF734F6B6D63807FA160848

> We estimate that 418 million disability-adjusted life years (DALYs) could be attributable to mental disorders in 2019 (16% of global DALYs)—a more than three-fold increase compared to conventional estimates. The economic value associated with this burden is estimated at about US$ 5 trillion. At a regional level, the losses could account for between 4% of gross domestic product in Eastern sub-Saharan Africa and 8% in High-income North America.[7]

In May 2022, the White House of US President Joe Biden came to similar numbers indicating a strong increase of MDs during the COVID-19 pandemic and therefore made the issue of "the economic burden of unmet mental health needs" a priority.[8] In October 2018, the Lancet Commission estimated that "the global mental health crisis could cost the world US$ 16 trillion by 2030."[9] In comparison, the American Cancer Society reported that the annual total expenses related to cancer in the USA were approximately US$ 183 billion in 2015, with the projection of incrementing up to US$ 246 billion by 2030.[10] As early as 2001, the World Health Organization (WHO) had estimated that the costs for diagnosing and caring for brain-related illnesses, including psychiatric disorders, would represent one of the highest economic factions of all treatment expenses worldwide by 2025 and would most likely become, after heart-disease, the second-most important cause of the loss of lifetime quality years (i.e., disability-adjusted life years, DALY) for both males and females.[11]

As a consequence, medical technologies will be increasingly used to repair the effects of injury and disease as well as the consequences of congenital, developmental, or age-related changes to neuro-cognitive functions. Among these technologies, are most recently the promises of BMIs. Yet while economic and feasibility considerations prevail, at what point might the costs and burdens of intervening with brain injury and disease be ethically addressed? If "treatment" is defined as those means rendered to mitigate, correct, or compensate for some pathology, then where on the relative spectrum of BMIs-related intervention does "preventive care" fall? To what

[7] Arias, D., Saxena, S. and Verguet, S.: Quantifying the global burden of mental disorders and their economic value. In: The Lancet 54 (101675) (December 2022), https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(22)00405-9/fulltext

[8] The White House: Reducing the Economic Burden of Unmet Mental Health Needs (31 May 2022), https://www.whitehouse.gov/cea/written-materials/2022/05/31/reducing-the-economic-burden-of-unmet-mental-health-needs/

[9] Kelland, K.: Mental health crisis could cost the world $16 trillion by 2030. In: Reuters (10 October 2018), https://www.reuters.com/article/us-health-mental-global/mental-health-crisis-could-cost-the-world-16-trillion-by-2030-idUSKCN1MJ2QN. Cf. London, E. and Varnum, P.: Why this is the year we must take action on mental health. In: World Economic Forum (2 January 2019), https://www.weforum.org/agenda/2019/01/lets-make-2019-the-year-we-take-action-on-mental-health/

[10] Cancer Action Network of the American Cancer Society: The Costs of Cancer, 2020 edition, https://www.fightcancer.org/sites/default/files/National%20Documents/Costs-of-Cancer-2020-10222020.pdf. Cf. the slightly higher numbers in: National Cancer Institute (NIH): Cancer Trends Progress Report: Financial Burden of Cancer Care, April 2022, https://progressreport.cancer.gov/after/economic_burden

[11] World Health Organization: The World Health Report 2001: Mental Health: New Understanding, New Hope. New York 2001, p. 30, http://www.who.int/whr/2001/en/whr01_en.pdf

extent are preventive mediations—for example, to confer or sustain resistance, resilience, and recovery—considered to be "entablements" fortifying the system's capacities to effectively perform some functions? Or might remediations go so far as to be labeled as bodily "enhancements" rather than just therapies?

3.2 Human Enhancement

Human enhancement involves the attempt to "improve" the bodily structure and mental functions.

through engagement with tools and techniques so as to afford increased survival and flourishing and encourage a better quality of life. Defining and classifying enhancements could be construed along an interactive continuum of health, occupational protection, and embellishment (i.e., HOPE), wherein maintaining health involves increasing both protective as well as performance aspects of specified activities and dedicated tasks of daily living.

Each and all of these dimensions to "improving life" may involve some type and level of enhancement. As stated as early as in a 2009 report of the European Union's Human Brain Project,

> The umbrella term 'human enhancement' refers to a wide range of existing, emerging and visionary technologies, including pharmaceutical products: neuro-implants that provide replacement sight or other artificial senses, drugs that boost brain power, human germline engineering and existing reproductive technologies, nutritional supplements, new brain stimulation technologies to alleviate suffering and control mood, gene doping in sports, cosmetic surgery, growth hormones for children of short stature, anti-ageing medication, and highly sophisticated prosthetic applications that may provide specialized sensory input or mechanical output. All these technologies signal the blurring of boundaries between restorative therapy and interventions that aim to bring about improvements extending beyond such therapy. As most of them stem from the medical realm, they can boost societal tendencies of medicalization when increasingly used to treat non-pathological conditions.[12]

Both the intended benefit and possible and potential burdens, risks, and harms incurred by the varied uses of such technologies must be considered and neuroethically addressed. While regard for balancing the benefits and risks of an intervention is axiomatic to medical practice, such deliberation is equally, or at least equivalently critical (in the most literal sense, as affording critique to decisions of use or non-use) when "human enhancement" is sought and employed without explicit, medical "need":

> (We can define) human enhancement, for heuristic and politically pragmatic reasons, as any 'modification aimed at improving individual human performance and brought about by

[12] Coenen, C., Schuijff, M., Smits, M., et al.: Human Enhancement. Brussels: Studies of the European Parliament, Science and Technology Options Assessment (STOA) 2009, online at: http://www.europarl.europa.eu/RegData/etudes/etudes/join/2009/417483/IPOL-JOIN_ET%282009%29417483_EN.pdf

> science-based or technology-based interventions in the human body' … We view human enhancement primarily as offering a specific perspective on developments in science, technology, medicine and society. The effects of human enhancement technologies (HET) can be either long term or even permanent (as in the case of genetic enhancements), or temporary (such as improved concentration levels brought about by drugs). The aim may be to improve our natural abilities (for example by making us stronger or happier) or to give us characteristics or abilities that no human being has ever possessed before, such as full night vision, or even extra senses.[13]

The fact that such options are currently available at all will certainly prompt consideration, if not articulation of very different (and diverse) uses, so as to reflect the variety of groups' perspectives, interests, values, and ideologies, which may not always be in consensus. At present, the European Union viewpoint regards these technologies as novel societal developments destined to change aspects of daily life, in ways that civic institutions are not yet prepared to address or direct:

> To a certain extent, human enhancement technologies (HET) are already being developed and used today. They potentially have a huge impact on society, but the main questions relate to the health care systems that are regulated on the micro-level … Given the European [Union] Internal Market (especially the free movement of people and the freedom to provide services) and the new directive on cross-border health care that is being prepared, this means that the national health care systems will be put under pressure to allow what is allowed elsewhere, or that people will travel to another country to be 'treated' or 'enhanced.' This will force up health care systems costs. It also puts strains on solidarity if such 'treatments' or 'enhancements' are only accessible for the rich. Moreover, the European Union is already funding a lot of research on potential HET, some of which could lead to undesirable consequences. Such research and development should not be uncritically funded, and the role of far-reaching promises and expectations, which have created a kind of vicious circle in research policy, should be discussed more intensively. Guidelines and criteria are needed on what to fund and what not. Research proposals need to serve socially desirable goals, and this also requires… broad deliberation and reflection on the regulation of possible HET and on the fundamental normative and societal aspects. At the moment, however, we do not even have a clear picture of how (to) think about 'human enhancement.'[14]

The discourse, consideration, concerns, and debates regarding BMIs and HET are similar in the USA and among open democracies of much of Asia and the Pacific Rim. However, the details of such concerns, and thus, resulting constraints and permissiveness in research and uses and practice differ. Therefore, while it could be argued that any and all such current and proposed investigations and uses of BMIs and HET are intended for, and oriented toward some definable "good," it becomes important to ask "what good(s) exactly; for whom; and to what effect?" To reiterate the longstanding moral query, *cui bono; qui malo*?—whose good, whose harm?[15]

As a case in point, let us provide an example of BMI/HET research and use in military and intelligence contexts. While many of the issues regarding the military medical use of these tools and methods are similar if not identical to those focal to

[13] Ibid.

[14] Ibid.

[15] Desai, P., Shook, J. R., Giordano, J.: Addressing and managing systemic benefit, burden, and risk of emerging neurotechnology. In: AJOB-Neuroscience 12(4)(2021), pp. 8–11.

civilian contexts, the implications of "preventive military occupational medical employment" of BMIs and HET evoke notions of creating "super-soldiers" and "super-spooks" (i.e., intelligence operators). Furthermore, optimizing the performance of key occupational personnel, although pioneered in military and intelligence contexts, surely has relevance to and applications in other professions, as well. These innovations may be equivalently instrumental to advancing national interests and leverage in the emerging global neurobioeconomy.[16]

In general, multi-national defense institutions and industries are devoting greater and greater resources and effort to the neuro-cognitive sciences. In addition to focusing on augmenting the neuro-cognitive and behavioral performance of personnel, there is ongoing consideration of, and interest in weaponizing neuroscience and its technologies as means of "contending against others" in ways that more precisely disrupt adversaries' desire or ability to fight.[17] As stated in a 2020 Pentagon report, the neuro-cognitive sciences afford possibilities toward "quicker, shorter, deadlier and more exact"[18] warfare.

In accordance with the maxim of "creating and preventing strategic surprise," the US Defense Advanced Research Projects Agency (DARPA) is working to develop neuroscientific applications, including BMIs, to instill some element of "strategic surprise"[19] (viz., to favor the security of global democracies), while preventing such surprises from peer-competitors or adversaries (e.g., authoritarian regimes or terrorists who could utilize these new technologies for disruptive if not destructive ends). Hence, it is not a question of "if" such developments will be engaged in military and intelligence operations, but rather when, by whom, to what extent, and to what effects. Neuroethics will be a key dialogue partner in conversations about whether nations on the twenty-first-century global stage can be prepared for—and responsive to—such ambiguous real-world uses.[20]

[16] DeFranco, J. P., Rhemann, M., and Giordano, J.: The emerging neurobioeconomy: Implications for national security. In: Health Security 18(4) (2020), pp. 66–80.

[17] DeFranco, J. P., DiEuliis, D., and Giordano, J.: Redefining neuroweapons: Emerging capabilities in neuroscience and neurotechnology. In: PRISM 8(3)(2019), pp. 48–63.

[18] United States Department of Defense: Joint Vision 2020. Washington 2000, http://www.fs.fed.us/fire/doctrine/genesis_and_evolution/source_materials/joint_vision_2020.pdf

[19] DARPA - Creating and Preventing Strategic Surprise: http://www.darpa.mil/default.aspx

[20] DeFranco, J. P., DiEuliis, D., Bremseth, L. R., Snow, J. J., and Giordano J.: Emerging technologies for disruptive effects in non-kinetic engagements. In: HDIAC Currents 6(2)(2019), pp. 49–54. Cf. Giordano, J.: Battlescape brain: Engaging neuroscience in defense operations. In: HDIAC Journal 3(4)(2017), pp. 13–16; Giordano, J. and Wurzman, R.: Neurotechnology as weapons in national intelligence and defense. In: Synesis: A Journal of Science, Technology, Ethics and Policy 2 (2011), pp. 138–151; and Giordano, J., Forsythe, C., and Olds, J.: Neuroscience, neurotechnology and national security: The need for preparedness and an ethics of responsible action. In: AJOB-Neuroscience 1(2) (2010), pp. 1–3.

3.3 No Boundaries for Futuristic Research: Assessing the Brain in Space

This is shown by a variety of examples. In fact, in the meantime, multi-dimensional neuronal research is multiplying and differentiating beyond most expectations on a much broader and bolder level than ever imagined. Decisively, it is even moving beyond earth. For example, as Vey Law reports, in the expectation that humanity will soon restart space travel on a more extended level and colonize the surrounding extraterrestrial space by routine space travel, there are new, long-term oriented research approaches on how the brain and new environments of humanity could mutually affect each other, such as the one on "the effects of space travel on the brain." As Vey describes it,

> How does weightlessness in space affect the brain changes and activity adaptations after return to Earth? Scientists from the University of Antwerp and the University of Liège have conducted a study on the impact of weightlessness on the brain. The study has revealed that the brain changes and adapts to weightlessness, essential for astronauts staying in space for extended periods. The results have also shown that some brain activity changes remain even after the astronaut returns to Earth … Adapting to weightlessness is a significant challenge for astronauts, as their bodies and brains are accustomed to living in a gravity-driven environment … The brain also has to work differently in a weightless environment, as it no longer has gravity to help orient the body and coordinate movements. This can result in disorientation, spatial confusion, and even motion sickness. The BRAIN-DTI project is focused on understanding how the brain adapts to these changes and how it can be trained to function optimally in space, which is essential for planning long-duration missions and ensuring the well-being of astronauts.[21]

It is quite exciting what the studies on the brains of 14 astronauts found, particularly with regard to the announcements of investors such as Elon Musk that humanity will soon become a "multi-planet species"[22]:

> They found that functional connectivity, which is a marker of how activity in some brain areas is correlated with the activity in others, changes in specific regions after spaceflight. The altered connectivity patterns were observed in regions that support integrating different types of information, rather than dealing with only one type each time, such as visual, auditory, or movement information. These findings suggest that extended periods in space may affect the brain's ability to process and integrate sensory information … The finding that some changes in brain communication patterns remained even after the astronaut's return to Earth is significant. It suggests that the brain has undergone long-term adaptation to the weightlessness environment, and the learning effect may have occurred as the astronaut adjusted to the new surroundings. This finding … also raises questions about the potential

[21] Law, V.: The effects of space travel on the brain. In: The Academic (7 March 2023), https://theacademic.com/space-travel-on-the-brain/. Cf. the original research behind this report from S. Jillings, E. Pechenkova, E. Tomilovskaya, et al.: Prolonged microgravity induces reversible and persistent changes on human cerebral connectivity. In: *Communications Biology*, *6*(1)/2023, 46, https://doi.org/10.1038/s42003-022-04382-w

[22] WION: Eyeing Mars, Elon Musk wants humans to be 'multi-planet species', WION (24 April 2021), https://www.wionews.com/technology/eyeing-mars-elon-musk-wants-humans-to-be-multi-planet-species-379777

long-term effects of space travel on the brain and whether these changes could impact an astronaut's health or cognitive abilities in the long run … By mapping the changes in brain function using neuroimaging techniques, future astronauts can be better prepared for space travel challenges and potentially even monitor their brain characteristics to ensure their well-being during and after missions … Further research is required to investigate the exact behavioural consequences of these brain communication changes, whether longer time spent in outer space might influence these observations, and whether brain characteristics may help select future astronauts or monitor them during and after space travel.[23]

The most interesting question in the long-term perspective nevertheless might be whether the brain could also acquire new "connectivities" and capabilities under new conditions such as the surrounding space, to which extent these could become collective or species-characteristic, and whether this in the overall dimension could lead to "progress" of cognitive, functional, or even intelligence patterns in the future in the sense of neuronal and thus human evolution. Another question is to which extent such effects could be both influenced, mitigated, steered, or even "harvested" for the individual and collective good by the combination of the respective research with brain–machine, brain–computer, brain–brain, or brain–artificial intelligence interfaces which could not only help measure the effects more in detail but also help "contextualize" them in broader networks for civilizational use.

3.4 Educational Aspects

The use of the growing new options of insight into the brain and its potential for human–technological interconnectivity is taking quite different directions. Unlike the USA, China, and Russia, the EU remains dedicated to not actively pursuing the use of neuroscience and technology in military and strategic intelligence agendas. Instead, the EU has directed the majority of its public investments toward civilian applications, inclusive of educational pursuits, which could indeed be construed as "human enhancement." There is a growing body of literature about a variety of BMI-based approaches, including neurofeedback, transcranial electrical stimulation (tES) and magnetic stimulation, and vagal nerve modulation. Another form of neuromodulation that has transitioned from clinical to consumer market availability is electroencephalography (EEG), permitting the regulation of levels of cortical activity in order to promote thought processes conducive to learning. These neurotechnologies can be used to improve attention, focus, working memory, and other factors conducive to learning, and aspects of intellectual and artistic creativity.[24]

[23] Law, V.: The effects of space travel on the brain, loc. cit.

[24] Weinberger A. B., Cortes R. A., Green A. E., and Giordano J.: Neuroethical and social implications of using transcranial electrical stimulation to augment creative cognition. In: Creativity Research Journal 30(3) (2018), pp. 249–255. Cf. Giordano, J., Bikson, M., Kappenman E. S., et al.: Mechanisms and effects of transcranial direct current stimulation. In: Dose-Response 1–22 (2017); Plischke, H., Du Rousseau, D., and Giordano, J.: EEG-based neurofeedback: The promise of neurotechnology and need for neuroethically-informed guidelines and policies. In: J Ethics in

Many experimental neurotechnologies are today available for approved human subject research, and educational and creativity research studies are employing these tools to investigate and modulate cognitive activity and learning performance under various conditions and settings.[25] Additionally, there is an expanding market of direct-to-consumer neurotechnologies that combine some form of EEG sensing with both forms of relatively easily employable neuroimaging (e.g., functional near-infrared spectroscopy), and low-output neuromodulation modalities (e.g., low output tES) for use in educational contexts.[26]

In these ways, there is building interest in, and trends toward *neuro-education*—or "Brain-based Learning"[27] as a tool for educational enhancement. Praise and criticism of these methods have been somewhat equivocal. Because of—or perhaps despite—such developments, there are voiced concerns in public and professional communities about the meanings, implications, and values fostered by these broadening uses of neurotechnology. As neuroscientist Steven Rose has noted in the early stages of this development:

> Neuroscientists—and neuroscience—are on a roll … For it is true that this is an amazing time for brain research, with extraordinary new techniques capable of probing the living brain at all levels, from the movement of ions across synaptic membranes to the engagement of giant ensembles of neurons in accomplishing tasks such as plotting the route from home to work or recalling the face of someone you love. But with these successes has come a certain arrogance. 'You are your brain,' claims one Nobelist; another states: 'You are nothing but a bunch of neurons.' Mind, consciousness and 'free will' collapse; they are merely [seen as] the epiphenomena of brain processes, a 'user illusion'. And so the onward march of neuroscience offers to illuminate and transform other previously independent social and cultural studies.[28]

Hence, there is a blossoming sphere of "neuro-" worldviews, explanations, and intentions which encourages neuroenhancement on all levels rather than constructively accompanying and productively criticizing it. As Rose has stated:

> We are entering the hybrid world of neurodisciplines: neuroeconomics, neuromarketing, neuroaesthetics … Some of these are perhaps best seen as mere intellectual bubbles, memorably captured in Raymond Tallis' phrase 'neuromania.' But some—above all neurolaw

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Biology, Engineering & Medicine 2(3) (2011), pp. 221–232; Giordano, J. and DuRousseau, D.: Toward right and good use of brain-machine interfacing neurotechnologies: Ethical issues and implications for guidelines and policy. In: Cognitive Technology 15(2) (2011), pp. 5–10.; and Gini, A., Rossi, J., and Giordano, J.: Considering enhancement and treatment: On the need to regard contingency and develop dialectic evaluation. In: AJOB-Neuroscience 1(1)(2010), pp. 25–27.

[25] Davidescu, I. et al.: Neuroscience Research in the Classroom Portable Brain Technologies in Education Research. In: Educational Researcher 50(9)(2021), pp. 649–656. Whitman, G., and Kelleher, I.: Neuroteach: Brain Science and the Future of Education. Lanham, Md: Rowman and Littlefield 2016.

[26] Uchitel, J., Vidal-Rosas, E. E., Cooper, R. J., and Zhao, H.: Wearable, Integrated EEG–fNIRS Technologies: A Review. In: Sensors 21(18)(2021), article 6106, doi: 10.3390/s21186106.

[27] Rose. S.: Beware 'brain-based learning'. Enthusiasm for 'neuroeducation' risks blinding people to its potentially limited efficacy. In: Times Higher Education (12 December 2013), http://www.timeshighereducation.co.uk/features/beware-brain-based-learning/2009703.article

[28] Ibid.

(this field, growing in the US, explores the argument of diminished responsibility for a crime because 'my brain made me do it'), and neuroeducation—need to be taken more seriously, because their claims have practical consequences.[29]

Physician-philosopher Raymond Tallis famously criticized an irrationally broad "culturalization" of neuroscience and neurotechnology from early on, calling it "neurotrash." Parry has accurately described Tallis's critique of "bastardized" neuroscientific information and unbridled advocacy of its tools in contemporary popular culture:

> Tallis … demolishe(d) two 'pillars of unwisdom.' The first, 'neuromania,' is the notion that to understand people you must peer into the 'intracranial darkness' of their skulls with brain-scanning technology. The second, 'Darwinitis,' is the idea that Charles Darwin's evolutionary theory can explain not just the origin of the human species but also the nature of human behavior and institutions … Those trends, as Tallis sees them, are like 'intellectual illnesses' metastasizing from academic labs into popular culture. He sees the symptoms in neuro-economic thinkers who explain our susceptibility to subprime mortgages by describing how our brains evolved to favor short-term rewards. He sees them in philosophers who claim that our primate minds admire paintings of landscapes that would have supported hunting and gathering. He sees it in neurotheologians who preach that 'God is a tingle in the God spot in the brain.'[30]

The popularization, and misrepresentation, of neuroscientific research may indeed lead to reductionisms, exaggerations, and distortions also with regard to neuroenhancement. Hence, the critique that "neuroscience overstepping its bounds"[31] is acknowledged by most neuroscientists and neurophilosophers (including the authors of this book) because the overwhelming majority of the neuroscientific community is conscious of the limits of current tools and techniques, contexts of research, and clinical findings and prudently cautious about the relative value of neuroscientific enhancement technologies and knowledge. Moreover, there is general appreciation within the neurocognitive scientific community for the fundamental differences between "qualitative" phenomenal events obtained through first-person subjective experience and the "objective" self as defined and described by the natural sciences through experimental analyses of the brain and its functions.[32] That difference further enables pragmatic acknowledgment of domains of similarity and distinction between the descriptive approaches of the social sciences and humanities and the empirical methods of the natural sciences. Indeed, we posit that one would be hard-pressed to find a neuroscientist who would not agree that both approaches are needed, at least to some degree, given the complexity of the "reality processing" of

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[29] Ibid.

[30] Parry, M.: Raymond Tallis Takes Out the "Neurotrash." In: The Chronicle of Higher Education (9 October 2011), http://chronicle.com/article/Raymond-Tallis-Takes-Out-the/129279/

[31] Cf. Parry, M.: AfterWord: Has Neuroscience Overstepped Its Bounds? In: The Chronicle of Higher Education (17 October 2013), http://chronicle.com/blogs/afterword/2011/10/17/has-neuroscience-overstepped-its-bounds/

[32] Giordano J., Rossi P. J., Benedikter R.: Addressing the quantitative and qualitative: A view to complementarity—from the synaptic to the social. In: Open Journal of Philosophy 3(4) (2013), pp. 1–5.

subjective–objective consciousness. In support of this view, we argue that the viewpoints of the brain sciences, social sciences, and humanities cannot and should not be reduced to, or replaced by the other, but rather should be regarded—and utilized—in complementarity. That is what, for example, German brain researcher Wolf Singer holds, a natural scientist who experimented with psychological access to consciousness through practicing meditation.[33]

Assuming the application of such a complementarity stance, what then is so problematic about neuroeducation via neuroenhancement? Might such a discipline and its practices provide an opportunity to overcome simple reductionism and to instantiate a "neuropragmatic" approach to understanding and accessing the brain in order to affect the mind in ways that are cognizant and respectful of current capabilities and limitations of the neurocognitive sciences? Taken as this construct, could neuroeducation not be the exact opposite of "misrepresentative" pop-cultural trash, or even its antidote? And if there are new possibilities to link brains to machines, should not these be fully exploited to optimize personalized, more precision-based methods of teaching and learning that are intentionally oriented to the best interests of the learner?

We are not against the experiment, at least in principle, but also acknowledge possible ethico-legal and social problems such as inequitable provision of resources and methods; widening the schism between the neuro-capabilized haves and the non-neuroeducated have-nots; and, in these ways, creating social dissonances, inclusive of the type fictionalized in Daniel H. Wilson's 2012 novel, *Amped*. While we appreciate the specific benefits of neuroeducation, we acknowledge its risks, and with Steven Rose, we also caution against the tendency toward simple reductive physicalism:

> It is easy to see why the prospect of neuroeducation, or brain-based learning, might excite schoolteachers anxious to do the best for their students and to find ways of anchoring their teaching and learning strategies into the best that science can offer. The seductive appeal of those ubiquitous … color images of the brain, showing the regions that 'light up' when solving a math problem or learning a new language, cannot be denied. They seem to offer a certainty that mere psychological or educational insights cannot. So it is unsurprising that neuroeducation is becoming a growth industry (a Google search [already in 2013] record[ed] 50,900 hits for 'neuroeducation' and 250,000 for 'brain-based learning'). Parents and teachers alike are targeted. Television advertisements hymn the merits of 'brain gyms' and offer exercises to activate 'brain buttons' to enhance blood flow to the brain. At least in the UK, unlike in the US, the adverts don't yet include the direct current electrodes (transcranial direct current stimulators, TCDS) that, placed across the skull, are supposed to improve learning and memory. Nonetheless you can buy them on the internet, along with off-label 'cognitive enhancers' such as Ritalin, originally prescribed for attention deficit hyperactivity disorder but now widely used by students revising for exams … Different teaching strategies are proposed for 'left-brain' and 'right-brain' learners, those whose learning is more language-based versus those who are more visual … Neuroscientists are rightly critical of many of these claims; a Royal Society report in 2011 (*Brain Waves Module 2,*

[33] Schnabel, U.: Der Hirnforscher Wolf Singer über den "Weg zu sich selbst". Ein Gespräch über Erfahrungen bei der Meditation und die Neurobiologie des Religiösen. In: Die Zeit (23 October 2008).

Neuroscience: Implications for Education and Lifelong Learning) described them as 'neuromyths.'[34]

Rose has been also correct in speculating that things could get worse when it comes to experiments to define how to concretely implement these myths in schools, with real children:

> Consider the recommendations with which the [UK's] Royal Society's report on the implications of neuroscience for education and lifelong learning conclude: a strong plea for neuroscience to inform teaching strategies … Neuroscience, it proposes, should be used as a tool in educational policy, informing teacher training and adaptive learning technology. And the foreword to a new book, *Educational Neuroscience*, imagines a future in which parents take their 10-month-old daughter for an educational check-up by measuring her brain's electrical activity, and determine whether she will be able to learn Chinese by imaging her response to Mandarin phonemes, with a robot teacher to coach her. Functional magnetic resonance imaging could be used to help to 'close the achievement gap between Asian and Western children'…, while studying the 'brain mechanisms of experts' may determine if a given teaching method is establishing 'genuine expertise.'
>
> Are such proposals, well meaning though they are, realistic or even desirable? This is not to deny that those studying cognitive psychology and child development have useful things to say about optimal learning strategies and the normal sequence in which children develop competences in contemporary Western culture. Just as was Alfred Binet's intention in developing IQ tests a century ago, such research can help to identify children with specific learning difficulties, from dyslexia to dyscalculia, and to devise strategies to help them improve. But unless she is teaching biology, is it important for a teacher to know her hippocampus from her amygdala, both brain structures involved in certain forms of learning? Brain imaging has apparently shown that the ventrolateral prefrontal cortex lights up when adolescent girls experience social exclusion, but does this provide guidance as to how the youngsters might be helped? Unless of course, as in the futurologist's dream, it is to be by direct intervention into the brain.[35]

These are questions that should be posed and addressed if there is genuine consideration of employing the neurocognitive sciences via neuroenhancement techniques to advance more inclusive and balanced educational approaches.[36] The importance of education for all fields and sectors of society requires prudent caution (and the establishment of supportive civic institutions, practices, and guidance) to evaluate and mitigate both idiosyncratic and systemic risks in the application of these new technologies.[37] This is particularly urgent when the latter is physically

[34] Rose, S.: Beware 'brain-based learning,' loc cit.

[35] Ibid.

[36] Baker, D. L. and Leonard, B.: Neuroethics and Higher Education. In: Neuroethics in Higher Education Policy. New York: Palgrave Macmillan 2017, pp. 1–17.

[37] Desai P., Shook J. R., Giordano J.: Addressing and managing systemic benefit, burden, and risk of emerging neurotechnology. In: AJOB-Neuroscience 12(4)(2021), pp. 8–11. Giordano J.: Toward an operational neuroethical risk analysis and mitigation paradigm for emerging neuroscience and technology (neuroS/T). In: Experimental Neurology 287(4) (2017), pp. 492–495. Giordano J.: Conditions for consent to the use of neurotechnology: A preparatory neuroethical approach to risk assessment and reduction. In: AJOB-Neuroscience 6(4) (2015): 12–14. Giordano J.: A preparatory neuroethical approach to assessing developments in neurotechnology. In: AMA Journal of Ethics 17(1) (2015), pp. 56–61.

invasive into the human body and particularly when these bodies (and brains) are those of children.[38] Ideological, technological, and logical fallacies inherent to the new "neuromythology" are evident with ongoing discourses and debates about potential uses for BMIs in the educational sector. Some fundamentally dogmatic precepts are bound to be revealed:

> There's another problem, a manifestation of the common tendency among neuroscientists to commit what philosophers call the mereological fallacy, which broadly means ascribing the properties of the whole—in neuroscience terms, the living, conscious human being—to a part of that whole, i.e. the brain. Thus, an accessible and widely read introduction to the brain and its study … is called *The Learning Brain: Lessons for Education*, and its chapter heads include 'the mathematical brain' and 'the literate brain'. Common usage, but … it isn't brains that learn, are mathematical or literate; it is their owners who use their brains to learn, do math or whatever. This is more than a semantic quibble, because such titles reflect the way that neuroscientists tend to think and encourage others to think likewise. Furthermore, the emphases that are developed from this way of thinking …, risk confounding teaching with learning. By instrumentalizing teaching instruments, by focusing on the brain and not the child or student, these advocates seem oblivious to the fact that both teaching and learning are not timeless and isolated activities but in their very essence socio-culturally embedded.[39]

Despite these sound cautionings from non-reductive neuroscience and neurophilosophy, neuromyths are proliferating within discussions of education.[40] It has been popularly imagined, and marketed, that the best neurotechnologies for improving cognitive abilities would not necessitate rigorous learning regimes or perhaps any conscious effort whatsoever but be rather a mechanical and automatic tool. Little about developmental psychology, cognitive science, or neurology supports this fantasy. Studies have shown that certain neurotechnological and neuropharmacological approaches can be used to modulate the information acquisition and motor performance curves to facilitate greater time and effort-efficient cognitive and behavioral learning. All the same, there is no neurological or psychological evidence to support the notion that BMIs, HET, or psychoactive drugs will soon serve as magical brain hacks for infusing genuine intellect, creativity, or skill. Novel modes of neuromodulation may work by altering the activity of certain nodes, networks, and/or regions of the brain, but robust acquisition and maintenance of knowledge and skill that directly affect performance metrics still require individual human practice. Integrating new patterns of BMI-induced alterations of functional activity into meaningful cognitive or behavioral outputs cannot be avoided. Performance metrics

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[38] IEEE SA - IEEE 2089–2021 Standard: IEEE Standard for an Age Appropriate Digital Services Framework Based on the 5Rights Principles for Children (14 March 2022), https://standards.ieee.org/ieee/2089/7633/. See also Li, L.: BrainCo's FOCUS Headband: Brain Scan or Brain Scam? In: Digital Innovation and Transformation (3 December 2019), https://digital.hbs.edu/platform-digit/submission/braincos-focus-headband-brain-scan-or-brain-scam/

[39] Rose, S.: Beware 'brain-based learning,' loc cit.

[40] Liu, L: Orwellian Nonsense or Innovation in the Classroom? In: EE Times Asia (5 November 2019), https://www.eetasia.com/orwellian-nonsense-or-innovation-in-the-classroom/

are always required in order to substantiate that a particular neuro-intervention actually works as intended and designed.

Neurologically, information processing serves cognitive performance, which is nested within learning experiences, for the various social purposes of education. Each involves and implies the other. Hereafter, learning and education shall be taken as synonymous, so that the actual neuroscientific opportunities to enhance both can be the focus. Working knowledge of human capacities and interactions can surely benefit many aspects of learning and education, such as assessment, intervention, and training. Improved learning, guided by insights into teaching pedagogy, modalities, and learning readiness, can be expected from the careful design, implementation, and evaluation of neurotechnologies. The experience of learning through thinking, practicing, and testing can be supported by targeted brain assessments and modulations. At the neurological level, neuroscience and neurotechnologies are uncovering a vast realm of incredibly complex regional architectures associated with cognitive functioning and mental acuity.

Nevertheless, a general warning about prevalent assumptions is also appropriate here. The strengthening of a singular neurocognitive operation, no matter how important it appears, will not necessarily yield guaranteed results for lasting learning. Similarly, it must not be assumed that focusing on the mental skills of a learner in isolation is the same thing as delivering a robust educational experience. There are learners and teachers; learning methods and achievements; and, finally, there are knowledgeable individuals contributing to social practices and enterprises.[41] Data and static metrics, whether about neural stimulations or test grades, are never the whole story. Therefore, rather than simply referring to "cognitive enhancement" in a context-free manner, neuroeducation should distinguish brain *modifications*, cognitive *improvements*, learning *performance*, and educational *enhancement* from each other. None of them are guaranteed goods in some context-free manner; brain architecture is far too complex for simplistic assumptions.

Safety, efficacy, and ultimately real-world effectiveness (inclusive of cost-effective efficiency) are essential to any authentic attempt at benefit, burden, and risk assessment of current and emerging neurotechnologies being considered for any modification or improvement of cognitive and behavioral performance.[42] Such risk assessment and mitigation imperatives are somewhat more important for neurotechnology than for pharmacologic agents used toward performance optimization, given that drugs can be withdrawn, while direct technologically-induced modification of brain node and network functions, regardless of how apparently

[41] Davidesco, I., Matuk, C., Bevilacqua, D., Poeppel, D., & Dikker, S.: Neuroscience research in the classroom: Portable brain Technologies in Education Research. In: Educational Researcher, 50(9) (2021), pp. 649–656.

[42] Shook, J. R., Giordano, J.: Toward a new neuroethics in a multipolar and multicultural world. In: Global-e 13 (2020), article 56, https://globalejournal.org/global-e/august-2020/toward-new-neuroethics-multipolar-and-multicultural-world. Cf: Giordano, J.: Toward an operational neuroethical risk analysis and mitigation paradigm for emerging neuroscience and technology (neuroS/T). In: Experimental Neurology 287(4) (2017), pp. 492–495.

acute and "non-invasive," can nonetheless induce durable, if not irreversible changes to neural network architectures and activity patterns. To be clear, any modifications of neurological functioning can just as easily diminish as embellish cognitive ability, and a cognitive improvement in one kind of task could impede or erode other abilities. Certain sorts of cognitive improvements may or may not contribute to the sort of learning needed in an individual's setting or environment.[43] Nothing could properly be regarded as educational for people in their actual lives unless and until any and all such complications are empirically examined and evaluated or at the very least considered and prepared for.[44]

In our view, concerns about neurotechnology that does not work performance-wise are secondary, compared with neurotechnology that only *appears* to modify learning, which represents a far greater problem. The primary ethical priorities when considering the use or non-use of neurotechnology—for education, or arguably any purpose that will influence the individual and collective good—are to define and prevent, or at least mitigate, unhelpful or unworkable consequences. Thus, both individual and collective benefits, burdens, and harms must be anticipatorily identified and addressed in ways that are viable, valid, and thus of real value within both limited (i.e., community) as well as more generalized and perhaps generalizable (i.e., cosmopolitan) contexts of use-in-application.[45] While easily stated, the task of developing and articulating this cosmopolitan-communitarian ethical approach is considerable and is—and should remain—an ongoing process reflective of and responsive to changing realities of (1) technological development and capability and (2) the needs, values, and influences of socio-cultural aspects relevant to employing (or not employing) neuro-enhancing tools and methods.

3.5 Entertainment

Last but certainly not least, it should be noted that BMIs are increasingly being utilized, and offered directly to consumers, for lifestyle and entertainment (e.g., media and gaming) purposes. For example, wireless electrode-bonnets or "brain

[43] Shook J. R., Giordano J.: Neuroethics beyond normal. Performance enablement and self-transformative technologies. In: Cambridge Quarterly of Health Care Ethics 25 (2016): 121–140.

[44] Schmied, A., Sashank V., and Dubinsky, J. M.: Acceptability of Neuroscientific Interventions in Education. In: Science and Engineering Ethics 27(4) (2021), pp. 1–27.

[45] Shook J. R. and Giordano J.: A principled, cosmopolitan neuroethics: Considerations for international relevance. In: Philosophy, Ethics, and Humanities in Medicine 9 (2014), article 1. Cf. Lanzilao E., Shook, J. R., Benedikter R., Giordano J.: Advancing neuroscience on the twenty-first century world stage: The need for—and proposed structure of—an internationally relevant neuroethics. In: Ethics in Biology Engineering and Medicine 4(3) (2013), pp. 211–229.

wave sensors" are becoming more available. Emotiv BCIs[46] or Neurosky BCIs[47] allow unskilled persons, including children, to exercise "mind control" of a computer-related device. The iterative development of "open BMIs," for example, freeware variations of BMIs, may allow a ten times faster wireless EEG connection than with a smartphone or tablet.[48] One of the leading companies in this area is *Cognionics* which specializes in "brain products," that is, so-called State-of-the-Art dry EEG Headsets.[49]

Overall, the viability and use of BMIs are gaining traction in the computer gameplay industry, wherein market presence dominates the current global entertainment sector. This growing market space reflects the popularity of the core feature of computer gaming—that is, interactivity.[50] High profits garnered from applications of BMIs to the entertainment industry have long been expected.[51] Gaming systems such as *Oculus Rift* and a growing number of similar approaches allow users to immerse and interact within three-dimensional environments on novel experiential levels.[52] As Lev Grossman has noted,

> the *Oculus Rift* is the first visual medium that doesn't have a frame around it … When you're in the Rift you *become* the camera. You control the point of view with your body, the way you would in reality … [making you] a floating, disembodied spirit. And yet it's convincing. It's visceral. There's a name for it in the industry, this deep and abiding conviction that you're somewhere else: *presence* … To fool the brain into thinking it's somewhere else, the headset has to put out 75 frames per second on bright, high-definition OLED displays of the kind used in smartphones. A gyroscopic sensor tracks any tiny rotation your head makes so the view can change accordingly … The first time I tried the Rift …, my brain started looking for the edge of the image—but it didn't come … That's when my brain admitted defeat. It surrendered to the illusion that it was in another world.[53]

Given these current trends in the field, there is a high probability that next-generation BMI systems will merge easy-to-wear neurosensing and modulating devices with computational and other machine systems in ways that afford direct, remote, and real-time bi-directional interactions of human neurocognitive and

46 Emotiv Enterprises: http://emotiv.com/

47 Neurosky Enterprises—Brain Wave Sensors for Every Body: http://www.neurosky.com/Products/MindWaveMobile.aspx

48 Murphy, J. and Russomanno, C.: Open BCI: An Open Source Brain-Computer Interface For Makers. In: Kickstarter (10 December 2015), http://www.kickstarter.com/projects/openbci/openbci-an-open-source-brain-computer-interface-fo

49 Cognionics Enterprises: https://www.cgxsystems.com/

50 Cucuel, Q.: The Video Game Industry: Explaining the Emergence of New Markets. In: Otago Management Graduate Review (September 2011), http://www.business.otago.ac.nz/mgmt/research/omgr/2011/11cucuel.pdf

51 Scott, J. A., and Sims, M.: Acceleration of therapeutic use of brain computer interfaces by development for gaming. In: Zihan Ly, Houbing Song (eds.): International Conference on Intelligent Technologies for Interactive Entertainment. 13th EAI International Conference, INTETAIN 2021, Virtual Event, December 3–4, 2021. Springer, Cham 2021, pp. 267–281.

52 Grossman, L.: Head Trip. A 19-year-old hacker set out to invent a gaming headset. He ended up reviving a dead technology and creating an idea worth $2 billion. In: Time Magazine (7 April 2014), pp. 30–35.

53 Grossman, Ibid.

machine elements. An example of the current and near-term state of the science and engineering is DARPA's Next-Generation Nonsurgical Neurotechnology Project.[54]

These domains and applications of BMIs and HET are not mutually exclusive. The multiplicity of uses reflects the changing dynamics of the respective roles of governmentally funded research and engagements of science and technology, as well as the academic, industrial-commercial, and public communities of the private sector. When coupled with an increasingly integrative scientific convergent orientation,[55] these dynamics accelerate the pace and scope of neurotechnology research, development, testing, and evaluation. Ultimately, they advance the technological readiness level of both individual tools and systems of tools, viable for varied real-world uses. As we and others have acknowledged, such practical deployments of neuroenhancement tools in the broadest sense incur ethical, legal, and socio-cultural issues that require analysis and attempts at resolution, or at minimum, realistic readiness for their occurrence and manifest effects in and across each and all of their domains and dimensions of influence.[56]

[54] Sarma, G.: Next-Generation Nonsurgical Neurotechnology. In: DARPA, n. d., https://www.darpa.mil/program/next-generation-nonsurgical-neurotechnology

[55] Giordano, J.: Integrative convergence in neuroscience: trajectories, problems and the need for a progressive neurobioethics. In: Vaseashta A., Braman E., Sussman, P. (eds.): Technological Innovation in Sensing and Detecting Chemical, Biological, Radiological, Nuclear Threats and Ecological Terrorism. NATO Science for Peace and Security Series, NY: Springer 2012.

[56] Cf. Giordano, J. and Shook, J. R.: Neuroethics: What it is, does—and should do. In: Health Care Ethics USA 9(2) (2018), pp. 15–19; Shook, J. R. and Giordano, J.: Neuroethical engagement on interdisciplinary and international scales. In: Racine, E., Aspler, J. (eds.): Debates About Neuroethics. NY: Springer 2017, pp. 225–246.; Giordano, J.: Respice finem: Historicity, heuristics and guidance of science and technology on the twenty-first century world stage. In: Synesis: A Journal of Science, Technology, Ethics and Policy 4 (2013): E1–4; and Giordano, J.: Keeping science and technology education In-STEP with the realities of the world stage: Inculcating responsibility for the power of STEM. In: Synesis: A Journal of Science, Technology, Ethics and Policy 3(1) (2012): G1–5.

Chapter 4
Neuro-*Ethics*: Holism, Preparedness, and Precautions

Abstract The rising field of neuroethics is about combining a holistic approach with preparedness and precautions against the misuse of neurotechnologies. This chapter describes what neuroethics is, what it aims to achieve, and why it must be a trans-systemic and international endeavor.

Keywords Neuroethics · International agreements · Common sense · Policy

4.1 New Ethical Issues

The rise of neuroscience and neurotechnology, with their integrations and exponential gains in efficiency, investment, applications, and side products, is birthing counter-movements embedded into an anti-technology movement worldwide. This opposition bears similarities to, and connections with, the earlier techno-skepticism, particularly in Central European post-World War II philosophy[1] and anti-biotech movements active in Western societies since the 1990s.[2]

Nevertheless, these movements remain a minority and are barely incident on the overall trend; nor it is expected they will become more potent in the near future. More importantly, while some of them claim to be "ethical correctives" to the

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[1] Borowski, A.: Philosopher of the Apocalypse. From the ashes of the Second World War, Günther Anders forecast a new catastrophe: technology would overwhelm its creators. In: Aeon, 17 May 2022, https://aeon.co/essays/gunther-anders-a-forgotten-prophet-for-the-21st-century. Cf. Torres, E. P.: The ethics of human extinction. Why would it be so bad if our species came to an end? It is a question that reveals our latent values and hidden fears. In: Aeon (20 February 2023), https://aeon.co/essays/what-are-the-moral-implications-of-humanity-going-extinct

[2] Seifert, F.: Anti-Biotech Movements in the European Union. In: Cornell University Institute for the Social Sciences (1 November 2013), http://socialsciences.cornell.edu/event/anti-biotech-movents-in-eu/

J. Giordano et al., *Neuroscience, Neuroculture, and Neuroethics*, SpringerBriefs in Political Science, https://doi.org/10.1007/978-3-031-74024-4_4

potential overuse and implicit dangers of neurotechnology, they have not contributed much to the creation of an international, relevant, rational, and comprehensive neuroethics able to provide orientation and to establish accepted standards of how to proceed.

Overall, the present picture shows that while there are both ideological pro- and contra-movements for and against the rapidly expanding application of neuroscience and neurotechnology to all and every crucial field of technology and society, there seems to be a lack of integrative, pondered, and rational positions in between them—that is, between those euphoric about the trend and those shocked by it and between those who more or less favor it unconditionally (the modernists or "enhancement optimists") and those who fear the worst for the human being as a consequence of the fusion of human consciousness with machines and technology (the apocalyptics or "bionaturalists"). As a result, there are "third-way" intermediate movements based on a belief in progress and a devotion to caution, rationality, enlightenment, and pluralism. This third way encourages open debate about which developments are desirable and which may become dangerous, at a time when public debates are needed in order to engage civil society and broaden the spectrum of ideas and options.

As a European Union Parliament report on "Human Enhancement" rightly stated as early as 2005,

> ... the (development) shows a Janus face: on the one hand, there are a range of technoscientific developments, and of social and individual demands and desires that often appear in themselves to be highly relevant from an ethical or political point of view, yet also interact in a way that can be said to amount to a tendency towards an 'enhancement society'. On the other hand, the convergence of technologies and of the related visions of human enhancement is actively driven forward by a number of social groups and networks in science, technology and research policy, among them a couple of key players in these fields. Faced with the often highly visionary and strongly ideological character of the debate ..., one must strive for a balance between advancing a rational discussion through critical analysis of the relevant visions and normative stances, and taking a close look at the diversity of ... their actual social, technological and political significance.[3]

In fact,

> If one takes a closer look at certain segments of the discourse ... (e.g. ... mood enhancement by means of brain implants) and the involved technologies, it becomes obvious that these diverse cases all share certain characteristics. They all relate, for example, to ideas that push back the boundaries of medical and scientific research. All the research on which these technologies are based stretches the known limitations of the scientific disciplines. Furthermore, novel applications for new technologies can be developed for derivative purposes other than those for which the technology was originally designed. Moreover, many have the potential to increase the incidence of currently illegal practices, and all raise questions of distributive justice now or in the future. They often throw up questions about fundamental cultural values and tend to challenge our view of what it means to be human. More pressing are concerns regarding the costs of the technologies in question, the unin-

[3] European Parliament Directorate General for Internal Policies, Department A: Economic and Scientific Policy, Science and Technology Options Assessment (STOA): Human Enhancement Study (IP/A/STOA/FWC/2005–28/SC35, 41 & 45), May 2009, pp. 6–8.

tended (side-) effects, the desirability of the social changes they will precede, and the acceptability of medical tourism benefitting from highly specialized medical or enhancement tourism.[4]

The evident fragmentation within the neurosciences and the still-uncertain role of ethics challenge any proposed answers.

4.2 Two Main Challenges

Are contemporary neurosciences and neurotechnology a seemingly never-ending success story of progress and innovation, as it may seem to the outside observer? In many ways, yes. As the international organization *Neurotech Reports* has stated, with regard to the larger growth fields: neuromodulation, neurosensing, neurorehabilitation, and neuroprosthetics,

> Neurotech Reports projects that the overall worldwide market for neurotechnology products will be $9.8 billion in 2022 and will reach $17.1 billion in 2026. ... Neurotechnology has grown and matured as an industry as a result of advances in several fields of science and technology, including neuroscience, electrical stimulation, biomaterials, and microelectronics.[5]

However, outstanding success is not the whole story, nor is it the whole truth. With light, there comes shadow, and neuroscience and neurotechnology are no exceptions. Among the many challenges and problems to address are two in particular: one *technical* problem and one *principal* challenge.

The *technical* problem may be easier to solve. It consists of the still existing competition, instead of cooperation, between different disciplines, resulting in a disciplinary fragmentation of the neurosciences instead of systematic inter- and trans-disciplinarity. This fragmentation reflects the past, not the future of the field and its impact on the future of science in general:

> The problem … is that neuroscience (is) hopelessly fragmented. Each year sees the publication of about 100,000 papers, but neuroscientists are so specialized they have trouble understanding each other. We know a lot about the organization and interaction of individual neurons, and there have been countless studies using functional magnetic resonance imaging (fMRI) of brain regions at the scale of tens of millions of neurons, but we have little information about the scales in between. Nor do we have an integrated understanding of how events at the level of genes, proteins and synapses cascade through the brain to produce behavior and cognition. Using conventional approaches, it takes 20,000 experiments to map a neural circuit. Yet, in all, the brain contains 86 billion neurons. On top of that, to fully understand the operation of every synapse and how they interact with neurons in other parts of the neo-cortex, scientists would need to trace all of the 100 trillion connections between them—something that is impossible to do experimentally.[6]

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[4] Ibid.

[5] "The Market for Neurotechnology: 2022–2026, A Market Research Report from Neurotech Reports," https://www.neurotechreports.com/pages/execsum.html. Accessed 1 January 2023.

[6] Honigsbaum, M.: Human Brain Project, loc cit.

It results that an increased level of cooperation between different sciences, in particular computational, biological, and neuro-engineering, is needed, and thus a more serious, consequential, and maybe even aggressive kind of transgression of disciplinary boundaries—as it will be the future of most other avant-gardist, relevant fields of knowledge: "What neuroscience needs is diversity and a multiplicity of approaches by creative young researchers ..."[7]

But so far, part of this endeavor remains almost equally one-sided as traditional science used to be. It is, as in the case of both the U.S. government *BRAIN project* and the *Human Brain Project* of the EU, indeed mainly the belief in the abilities of computing technology to reveal new insights into the brain. The driving dogma teaches the view that technology can lead to deciphering the biggest mystery of humanity in order to lead to more advanced technologies and more competitive economies. That conviction is driving the mainstream of current neuroscience, not (yet) the (much more needed and far-reaching) belief in a broad inter- and transdisciplinary conjunction of technology, computing, medicine, and the social sciences, including anthropology, philosophy, metaphysics, and ethics. While many leaders of "grand challenge" signal projects, without doubt, believe "in the need for teamwork (that) is rooted in (the) conviction that only neuroscience is capable of solving the deeper mysteries of how the electrical signals zinging between neurons produce consciousness"[8] and that as a consequence "we're going to have to work in teams, in swarms,"[9] the reality is still about "swarms" (a rather impersonal term) composed by bio-technologists, "neuromorphic engineers,"[10] and computing specialists—not (also) by ethicists, philosophers, and anthropologists, who are in most cases still left out of the future discourse. And this fragmented reality to a greater part of the current neurosciences is not what a truly integrative approach requires.

That trend toward applied biotechnology without much theory, without much ethics, and without much interdisciplinarity presents the overarching problem presented by neuroscience. Attendant to that trend are serious concerns about the practical, political, and social implementation of neurotechnologies and the unavoidable explicit (outspoken) and implicit (tacit) ethics to follow.

4.3 Great Expectations: Entrepreneurial Boldness or Ethical Caution?

Another inbuilt dialectics in the sector today is that between boldness and caution. It reflects the impact—both legitimate and useful—of the different lead principles of business and ethics, which are by their very nature difficult to reconcile.

[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] Ibid.

Interestingly, U.S. President Barack Obama, according to his speeches about the brain sciences, clearly seems to favor boldness for the sake of "innovation" and the economy:

> Think about what we could do once we do crack (the) code (of the brain). Imagine if no family had to feel helpless watching a loved one disappear behind the mask of Parkinson's or struggle in the grip of epilepsy. Imagine if we could reverse traumatic brain injury or PTSD for our veterans who are coming home. Imagine if someone with a prosthetic limb can now play the piano or throw a baseball as well as anybody else, because the wiring from the brain to that prosthetic is direct and triggered by what's already happening in the patient's mind. What if computers could respond to our thoughts or our language barriers could come tumbling down ... That's the future we're imagining. That's what we're hoping for. That's why the BRAIN Initiative is so absolutely important. And that's why it's so important that we think about basic research generally as a driver of growth ... We have a chance to improve the lives of not just millions, but billions of people on this planet through the research that's done in this BRAIN Initiative alone.[11]

It was no accident that in a particularly suggestive conclusion, Obama emotionally stated, what a good part of the current "neuroscience-is-valuable-if-it-leads-to-applications-of-neurotechnology" trend is about not missing an opportunity by "taking some risks."

> I don't want our children or grandchildren to look back on this day and wish we had done more to keep America at the cutting edge. I want them to look back and be proud that we took some risks, that we seized this opportunity. That's what the ... story is about. That's who we are. That's why this BRAIN Initiative is so important. And if we keep taking bold steps like the one we're talking about to learn about the brain, then I'm confident America will continue to lead the world in the next frontiers of human understanding. And all of you are going to help us get there.[12]

Of course, in principle (and substance), Obama was (though perhaps unwillingly) talking about neuroscience in general, not just about the BRAIN Initiative of the USA, thus initiating a political mainstream discourse worldwide on the issue. Indeed, most of his colleagues in major nations of the world would actively echo his words, although the respective goals of Germany, the UK, China, Russia, or India certainly differ when it comes to concrete policies and applications.

In the view of many neuroscientists of today around the world, when it comes to "neuropolitics," the importance of "catching the opportunity" for economic growth and wealth seems to be more important than the growth of knowledge as such and, in many ways, more important than ethical considerations. In current mainstream rhetoric about neuroscience, neuroethics is not entirely missing. However, the concern is about the size of the role and importance of neuroethics compared with the role of neuroeconomics and neuropolitics. Will the role of ethics be only secondary for the sake of technological progress?

Western nations are without doubt leading the efforts to establish an international ethical discourse on the applications of neuroscience and neurotechnology. President

[11] Obama, B.: Remarks by the President on the BRAIN Initiative and American Innovation, loc cit.

[12] Ibid.

Obama in an exemplary way made it one priority of the BRAIN Initiative (and other programs), at least rhetorically. He thus paved the way for neuroethics to find their right place within the current rapid development of the sector and to find it as soon as possible.

On the contrary, Obama's statements, indeed representative of most other Western politicians (not to speak of non-democratic leaders), also mirrored agendas often labeled as "transhumanist." The director of Oxford's *Future of Humanity Institute*, Nick Bostrom, a co-founder of the global "transhumanist" movement, is an outspoken representative favoring the "super-human" through merging technology with the human body. One of his impressive poems expressed his hopes on the primacy of feasibility over ethics for the sake of the future with these words:

> On the bank at the end
> Of what was there before us
> Gazing over to the other side
> On what we can become
> Veiled in the mist of naïve speculation
> We are busy here preparing
> Rafts to carry us across
> Before the light goes out leaving us
> In the eternal night of could-have-been.[13]

We think that a perspective like Bostrom's is significant and somewhat legitimate. However, we do not think that this is the whole story and maybe not even the main story to be told.

Neuroscientific debates often reveal a polarized framework or rather two opposite camps: the transhumanists and the bioconservatives. For the agents of the first group, the engineered humans are an expression of the transformative essence of human nature and its transcendental aspirations. The second group emphasizes the (imperfect) givenness of human nature with its genesis and demise within a certain time horizon. How might it be possible to integrate both viewpoints for a discourse about the status of the human condition? Neuroethics is hence drawn into debates over who gets to decide human futures, for individuals, and for societies. What do imagined transhumanist futures tell us about our human necessities and desires to transcend biological, psychological, and cognitive limitations? For many transhumanists, the right to use enhancement technologies—such as neural prostheses, brain-enhancing and mood-altering psychopharmaceuticals, and so on—is an extension of individual freedom, choice, and self-determination.

Perhaps human enhancement serves as a liberating force for self-empowerment. Fantasies of enhancement may be driven by less rationalized urges as well. The consciousness about our own mortality and the incomprehensibility of the (so far) unavoidable death inspires fear, which is at the core of all human angst. The body's limitations, the finite span between birth and death, and the attitude one should take toward finitude have been issues for religious contemplation as well as scientific

[13] Bostrom, N.: Poem. In: Nick Bostrom's Homepage, http://www.nickbostrom.com/, 21 March 2014.

inquiry. Whether in the hands of the optimists or the conservatives, neuroethics will be positioned as an ethical and quasi-religious judge about these questions. Neuroethics will also play a political role, examining political scenarios of technologically enhanced "posthumans"—who will have manipulated their biological, neurological, and psychological constraints—motivated by quite different goals and self-interests than unenhanced "bio-humans"?

Humanistic and transhumanist opinions should be openly debated in front of the major policy decision-makers rather than fighting hidden behind the curtains of research programs. To what extent do global decision-makers understand what the respective ideologies imply for the future—not only of neuroscience and neuroethics but also of a broad array of aspects and dimensions of the future of technologically advanced societies? The future of the public and whole populations is at stake, including the self-image of humanity, and our human hopes for a desirable society and a "good life."

4.4 The "Decade of the Mind" Project

An attempt toward an ethical and inclusive approach may be inspired by nation-level investment. It is worthwhile to note here that ethics do not need to be parochial or to judgmentally critique all practical decisions. Ethics intends to be realistic about the pros and cons of decisions made in these fields, so important for the whole of society. Ethics ponders possibilities and risks in a sober way in order to form balanced decisions about issues of progress and innovation. This should happen through the inclusion of contextual political issues such as social psychology, the history of ideas, philosophy, and cultural studies to investigate overall questions about the impact of new scientific fields like neuroscience on all nations and the planet.[14]

One of the main attempts toward an ethical, inclusive, and *at the same time* business-ripe approach was the "Decade of the Mind" (DoM) project in the USA that started in May 2007.[15] Then, a group of leading cognitive investigators met at George Mason University's Krasnow Institute for Advanced Study to consider the state of what many consider the most important unsolved scientific question of our time: how does the activity of human brains produce the collection of phenomena that we call "mind"? And how is, in turn, the "mind" building the brain?

The result of their meeting was a *manifesto* that advocated for a "Decade of the Mind," with a concomitant federal investment of $4 billion over 10 years. The scale of the project was a bit larger than that of the Human Genome Project. The project was meant to look at defined goals: to heal the mind, enrich the mind, model the

[14] Goodin, R. E. and Tilly, C. (eds.): The Oxford Handbook of Contextual Political Analysis, Oxford University Press 2006.

[15] Albus, J. S., Bekey, G. A., Holland J. H., et al.: A proposal for a Decade of the Mind. In: Science 317(5843)(2007), p. 1321.

mind, and understand the mind. The endpoint, however, was in understanding the *mind–brain–spirit–Geist* complex. Simply put, DoM wanted to understand the process by which neural activity, mind (as defined by complex behaviors, higher cognition, and consciousness), self, spirit, and *Geist* work together to produce what we call the "existent I" or the "ontological self."

What Happened?

The DoM project, while not gaining traction in the USA, has remained a moderately successful enterprise in Germany and Singapore (and thus in effect, the Pacific Rim). There are a number of reasons why DoM failed in the USA, namely, that it lacked the large-scale constituency of both the neuroscientific community and the ardent backing of key players within the governmental infrastructure to sustain its political and economic viability within the first-term agenda of the Obama administration. Other programs (namely, the efforts that ultimately became the Affordable Care Act) superseded the precedence of DoM as a politically supported enterprise.[16]

However, when taken together with calls for a U.S. National Neurotechnology Initiative and ongoing recognition of neuroscience and neurotechnology as significant forces of economic leverage, that initial momentum of DoM can be seen as instrumental, at least in part, to the formulation and enactment of the mentioned European Union's *Human Brain Project*, and the *Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative* in the United States.

The intent and potential for the benefit of such trajectories of brain science are obvious. Yet, there are mounting concerns about the possible burdens, risks, and harms that could be incurred through unanticipated consequences of nascent science and bioengineering, as well as inapt use or frank misuse of neuroscience and its technologies for nefarious purposes.[17]

Certainly, these concerns have been expressed by the community of scholars within the discipline of neuroethics; yet, these anticipations of negatively valent application or effect are also recognized by the U.S. government. President Barack Obama tasked the *Presidential Commission for the Study of Bioethical Issues* in 2013 to address these issues and develop a programmatic approach to address, discourse, and resolution of the ethico-legal and social questions and problems generated by the research and translation to be fostered by and within the BRAIN initiative. In the wake of DoM, DARPA also established a neuroethics study group (comprised of non-military scholars in neuroscience, neuroethics, and law) to address key issues arising in and from the conduct of neuroscientific research and

[16] Giordano, J. and Benedikter, R.: Neurotechnology, culture and the need for a cosmopolitan neuroethics. In: J. Giordano (ed.): Neurotechnology: Premises, Potential and Problems. Boca Raton: CRC Press, pp. 233–242.

[17] Giordano, J. and Benedikter, R.: An early - and necessary - flight of the Owl of Minerva: Neuroscience, neurotechnology, human socio-cultural boundaries, and the importance of neuroethics. In: Journal for Evolution and Technology 22(1) (2012), pp. 14–25.

neurotechnology use as relevant to a mission of international relations, along with national security, intelligence, and defense. Of interest is that DARPA’s neuroscience and neurotechnology research portfolio is not classified and is focused primarily on the translation of neuroscientific and neurotechnological development into applications that can be utilized in medical, public, as well as military-operational spheres.

The research intended by DoM has hence been “underway” for a long time by now. It is recognized to be consistent with, and supportive of, directions and goals of a specific programmatic agenda, and as such are then further supported and developed. We view DoM as a seed from which has fortified investments and commitments to the brain sciences and their social influence and effect. Yet, as with any new growth, careful pruning will be just as important as cultivation, if the outcomes and products to be developed and harvested are to benefit the overall public good.

4.5 Toward “Hacking” Brains?

The new “brain-penetrative” BCI technology may have undesired side effects. As Peter V. Milo reports:

> It sounds like something out of the movie ‘Johnny Mnemonic,’ but scientists have successfully been able to ‘hack’ a brain with a device that’s easily available on the open market. Researchers from the University of California and University of Oxford in Geneva figured out a way to pluck sensitive information from a person’s head, such as PIN numbers and bank information. The scientists took an off-the-shelf Emotiv brain-computer interface, a device that costs around US$200, which allows users to interact with their computers by thought. The scientists then sat their subjects in front of a computer screen and showed them images of banks, people, and PIN numbers. They then tracked the readings coming off of the brain, specifically the P300 signal. The P300 signal is typically given off when a person recognizes something meaningful, such as someone or something they interact with on a regular basis. Scientists that conducted the experiment found they could reduce the randomness of the images by 15 to 40 percent, giving them a better chance of guessing the correct answer. Another interesting facet about the experiments is how the P300 signal could be read for lie detection. (The scientists) state that ‘the P300 can be used as a discriminative feature in detecting whether or not the relevant information is stored in the subject’s memory.’ For this reason, a … P300 has a promising use within interrogation protocols that enable detection of potential criminal details ‘held by the suspect,’ the researchers said. However, scientists say ‘this way of lie detection is vulnerable to specific countermeasures,’ but not as many compared to a traditional lie detector. This could only be the beginning of a new form of fraud. Scientists say that a person with their guard lowered could be ‘easily engaged into mind games that camouflage the interrogation of the user and make them more cooperative.’ Also, much like other household electronics, ‘the ever increasing quality of devices, success rates of attacks will likely improve.’[18]

[18] Milo, P. V.: Scientists Successfully ‘Hack’ Brain To Obtain Private Data. In: CBS Seattle, (25 August 2012), http://seattle.cbslocal.com/2012/08/25/scientists-successfully-hack-brain-to-obtain-private-data/

As a consequence, there are talks about a "brain fingerprint" by enterprises like *NoLieMRI*, which is specialized in the discovery of lies and betrayal in brain and spinal cord mechanisms. New smartphones with new identification technologies and other devices of daily use can and will play a role here, and what that means for the chances and risks of open societies around the globe, has to be seen.

4.6 Neuroscience and Neurotechnology

Contemporary cultural forces are modifying the underlying philosophies of open societies. Overlooking these phenomena, the contemporary outreach of neuroscientific and neurotechnological advancement is not limited to their domains of specialization in the strict sense. More than that, neuroscience and neurotechnology are affecting public life through an ever-increasing proliferation of "neurocentric" images and ideas and by the means of an increasing civilizational and cultural reliance upon neuroscientifically-based explanations for much of human behavior.

In light of this, neuroscience and neurotechnology must be seen not only as economic and political, but also viewed increasingly as potent cultural, civilizational, and social forces. In which sense exactly? There are multiple aspects to consider in this regard.

First of all, if we sum up what we have seen neuroscience and neurotechnology today are challenging older theses about the structure and function of nervous systems, the physiological basis of consciousness, and the nature of the *body–brain–mind–self* relationship. Given its new and in many ways impressive explanations of the origins and mechanisms of the conscious and subconscious self, neuroscience and neurotechnology prompt re-examination of traditional concepts of personhood, which forms the basis of the modern, open democratic social sphere and its self-interpretation.

Second, as we have seen contemporary neuroscience also questions traditional socially defined ontologies of what a "good life" is, fundamental social values, conventions, norms, and morals, as well as the ethical responsibilities relevant to constructs of individual and social "good" in both Western and non-Western hemispheres. While "closed" and authoritarian societies are less concerned, since they do not base their value systems and their structural organization on such terms as free will or human dignity, open societies may transform if basic terms and definitions of personhood, individuality, and self-reliance are modified by neuroscientific findings not embedded into a comprehensive, overarching and publicly accepted neuroethics.

Third, neuroscientific developments are getting translated not only into medical contexts but also into much broader social contexts with growing speed and innovative impetus, thus dramatically shortening the incubation phases of public opinion.

That speed is rendering rational deliberations more complex, if not difficult compared with former times of slower biotechnological progress.[19]

4.7 Pressing Questions

These developments give rise to a number of pressing questions. Are strivings toward "liberation technologies"[20] such as neurotechnology that promises "progress" with regard to the human brain, mind, and body, fundamental to human nature as an iterative engagement of biological, social, and machine use? Or do such activities portend a "transhumanist" trajectory that uses neuroscience to engineer a novel being that is distinct from extant concepts of humanity?

Irrespective of whether inherent to human nature or representative of a trend toward some trans-human design, might neuroscience (and neurotechnology) afford, and perhaps enable, a more inclusive idea (and ideal) of the human being, that overcomes biological (e.g., gender, ethnic, race-related) and cultural distinctions by revealing a common basis of consciousness, self, and personality, and in this way advance social reality? Or will neuroscience expose the human being as "merely" another social animal among other species of social animals, and in so doing diminish or dispel anthropocentric notions of commonality, freedom, equality, brotherhood, pluralism, and personal dignity?

Can neuroscience and its technological products benefit the greater social good by creating a new, more cohesive vision of humans, humanity, and perhaps other sentient creatures that reconciles long-held distinctions between mankind, nature, organic and inorganic beings, and the nature of life on appropriate, but conjoining levels of differentiation? Or will it separate these ontologically different realms further?

How—and in what ways and directions—will neurotechnology compel change in the construct, scope, and conduct of medicine as profession, practice, and commercial enterprise within a technophilic and market-driven world culture?

Last but not least, how might the trajectories of neuroscience and neurotechnology evoke positive or negative outcomes for the open societies of the coming decades?

These questions and many more reflect the promises, challenges, as well as problems that can and will be generated at the intersection of neuroscience, neurotechnology, and society. Studies of the brain–mind continuum have historically been driven by strivings to address perennial philosophical questions about the nature of the human being and the so-called human condition. Today, in actuality, the scope and tenor of science and technology are frequently influenced by the social climates

[19] Giordano, J. and Gordijn, B. (eds): Scientific and Philosophical Perspectives in Neuroethics. Cambridge University Press 2010.

[20] Cf. The Stanford Program on Liberation Technology, Freeman Spogli Institute for International Studies, Stanford University: http://liberationtechnology.stanford.edu/

fostered by wealth inequality, market, and political imperatives that are often disconnected from—if not discordant with—such philosophical and humanitarian considerations and concerns. That will be the case with neuroscience and neurotechnology too.

Moreover, any use of neuroscientifically-based outcomes must acknowledge that the foundational "hard problem" of how "mind" occurs in brain and self remains unresolved.[21] Thus neurocentric constructs of consciousness, self, morality, and the nature of society itself must be viewed as speculative, and as such, may be subject to misapprehension, misconstruction, and misuse under various social agendas.[22]

How then are we to navigate a path forward, while recognizing the power of neuroscience and neurotechnology to affect, and be affected by, the social sphere, and at the same time acknowledge the limitations of both neuroscience, neurotechnology, and the social settings in which they may be employed?

4.8 Technological Versus Socio-political and Anthropological Progress?

The problems of the relation between brain sciences and society can be seen as a *raison d'etre* for neuroscience and neurotechnology to probe ever-deeper into the nature of the brain–mind complex, the "essence" of the human being as an individual and social creature, the human predicament, and our social capabilities and limitations. That "Janus face" presented by the new science that requests a new neuroethics is now needed more than ever before.

But there is a *caveat*: The pace and extent of scientific and technological advancement characteristically exceeds that of social progress and social responsibility. Thus, it is vital to (1) appreciate the social implications and manifestations that any and all of these discoveries may incur; (2) assess what systems and methods of social responsibility might be available to address such issues, questions, and problems; and (3) recognize whether it might be necessary to develop newer ethical constructs, systems, and approaches to more effectively deal with the exigencies generated by the social impacts of cutting edge neuroscientific products.

At the fore is the need to consider what other problems might arise as the "hard problems" of neuroscience are approached, answered, or remain unresolved.

Indeed, it is the "hard problems" of neuroscience[23] that are the focus of the DoM project in support of cooperative, multi-national efforts to bridge neuroscientific and neurotechnological advancement to social progress. After a period of

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[21] Pinker, S.: The Brain: The mystery of consciousness. In: Time (29 January 2007), http://content.time.com/time/magazine/article/0,9171,1580394,00.html

[22] Giordano, J. and Olds, J.: On the interfluence of neuroscience, neuroethics, legal and social issues. The need for NELSI. In: American Journal of Bioethics and Neuroscience 1(4)(2010), pp. 12–14.

[23] Pinker, S.: The Brain: The Mystery of Consciousness, loc cit.

stagnation, the DoM project should now be revived (although probably in updated ways) since it aspires to:

1. Gain more thorough insight into the brain–mind relationship, the nature of consciousness, the self, and the implications of this knowledge for understanding socio-political and social interaction;
2. Develop new technologies to further this understanding;
3. Use these technologies and techniques to address the neuro-psychiatric basis of disease, human action, and social behavior;
4. Develop programs that are based upon the most current understanding of the body–brain–mind–self complex, so as to utilize neuroscience and neurotechnology to advance cutting-edge research as well as public educational methods;
5. Inculcate public awareness of neuroscientific developments so as to allow realistic perception of the groundswell of new information, knowledge, and capability.

Numerous challenges crucial for the future of society lie at the interface of neuroscience, neurotechnology, and its potentially inbuilt ethics. Despite this, a vanishing small percentage of the U.S. Federal scientific budget has been so far allocated to explicitly addressing ethical, anthropological, and socio-legal issues engendered by research and its translation into clinical care and public use. As we and other colleagues in the respective sciences maintain, the speed and possible directions of neuroscientific advancement necessitate a system of ethics that:

(a) reflects the rapidly expanding epistemological capital of neuroscience and (b) responds to the social repercussions that may result from this novel transdisciplinary and integrative knowledge.

4.9 Neuroethics: Closing the Gap Between Technological and Societal Dimensions

The nascent, but expanding field of *neuroethics* is meant to meet this challenge. By definition, neuroethics is dedicated to addressing the ethical, legal, and social issues arising in and from neuroscientific research and its applications in the public domain[24], as well as studying the putative neurological substrates and mechanisms of moral cognition, interpersonal, and social relations (i.e., "neuromorality"[25]).

In the conjunction of these two trajectories, neuroethics might offer a form of contemporary, trans-cultural meta-ethics that allows insight into the ways in which moral decisions are individually and socially made and evaluated. It thus could provide a mirror with which to reflect upon, assess, and guide the conduct of neuroscience—as a research endeavor, a set of clinically relevant techniques, and as a

[24] Roskies, A.: Neuroethics for the new millennium. In: Neuron 35 (2002), pp. 21–23.

[25] Giordano, J. and Gordijn, B. (eds): Scientific and Philosophical Perspectives in Neuroethics, loc cit.

growing cultural influence upon society. Neuroethics, understood as an equally socio-political and cultural endeavor as it is a medical and economic enterprise, thus may become one core field of trans-disciplinarily conceived political studies of the coming years.

The validity (and value) of neuroethics is and will be predicated upon its embrace of an iteratively wider vision of the human being and humanity. We also argue that neuroethics must apply an integrative, trans-cultural bio-psychosocial model of consciousness and self that acknowledges how organisms are reciprocally interactive with their environment, that is, the dimensions of "social design" in the broad sense. Simply put, neuroethics must appreciate and constructively criticize how neuroscience has affected, and will continue to impact, the ways that humans create biological and social identity, and are nested, vested, and function within society and culture, today and tomorrow.[26]

As a form of ethics, neuroethics employs ethical methods of analysis and action and focuses these within the inter-disciplinarity of bioethics.[27] Yet, neuroethics must be flexible to incorporate a growing and shifting fund of knowledge—and technological capability—that is not tethered to dogmatic ideas about the human being and human nature but rather is free to develop an innovative concept of the human in society.

Moreover, a meaningful neuroethics may need to transcend older, more traditional ethical concepts and systems, so as to embrace new ideas and methods that better enable analyses of novel situations of the human being generated by the effects of neuroscience in society.[28] This situates neuroethics to engage issues ranging from the philosophical to the juridical. And, if politics in open societies can be defined as the permanent, never-ending translation of social practices into binding juridical arrangements, neuroethics must certainly be considered as an increasingly important influence upon political endeavors.

Eventually, this brings us back to neuroethics as neuromorality and prompts questions about how constructs of good are formulated, perceived, and decided upon and whether, and in which ways exactly, neuroscience and neurotechnology could change given social ideas, ontologies, and ideals.

4.10 The Challenge Ahead

Summing up, the challenge before neuroscience and neuroethics as fields in evolution is to be pragmatic, self-reflective, and integrative at the same time with regard to crucial problems and expectations of our time—both politically,

[26] Racine, E.: Pragmatic Neuroethics. Cambridge, MA: MIT Press 2010.

[27] Levy, N.: Neuroethics: A new way of doing ethics. In: American Journal of Bioethics and Neuroscience 2(2)(2011), pp. 3–9.

[28] Giordano, J.: Neuroethics: Traditions, tasks and value. In: The Human Prospect 1(1)(2011), pp. 1–6.

anthropologically, and culturally. Programs of neuroscience and neuroethics education must be international, multi-cultural, and multi-disciplinary so as to liberate its activities and perspectives from the restrictions of anachronism and dogma and sharpen the acuity of viewpoints. There is a need—and perhaps urgency—for well-established programs of neuroethics impregnated with the critical, even "deconstructive" tools of the contemporary social sciences given:

- The rapid growth and often provocative, if not contentious nature of neuroscientific achievement and applications;
- The tendency of "post-modern" civilization to exercise technology as demiurge;
- The occurrence of unforeseen or irretrievable consequences resulting from the cavalier use of the neuroscientific tools and techniques at our current and future disposal.

It is our hope that neuroethics—as a discipline and as a set of practices at the crossroads between medicine, business, military, politics, the social in general, and ethics in particular—will provide an innovative system for reflection, analysis, and preparedness for the imminent neurocentric future. To be sure, this is a field that is gaining rapid intellectual and practical maturity[29], and none too soon, as neuroscience and neurotechnology continue to proverbially "push the envelope" of knowledge that will be enacted on the global stage.[30]

Looking ahead, we can anticipate probable outer and inner transitions for globalization through the rise of "neuroculture" in the years to come. Surveying today's interface between the transition of the global imaginary through the change of basic concepts of what is human and what is society by the hands of brain and consciousness research, we can foresee that it will be most probably exactly these dimensions that may co-shape the future of globalization. This is because the different dimensions of neurotechnological transformation present features that are in large parts complimentary to each other, and which seem to continuously strengthen and empower each other. For example, neurotechnology, high-performance biocomputer technology, and the rapid exchange of large amounts of data and information over time and space on the internet are becoming an indivisible unity, particularly with regard to the development of a computer- and information-based brain science that operates with BCIs. Thus, it seems that only if seen in their (sometimes contradictory, sometimes homogenous) relationship and mutual interdependence, the inner and outer dimensions of the current transition: technological progress and the

[29] Giordano, J., Benedikter, R., and Boswell, M.: Pain Medicine, Biotechnology and Market Effects: Tools, Tekne, and Moral Responsibility. In: Journal of Ethics in Biology, Engineering and Medicine 1(2)(2010), pp. 135–142. Cf. Giordano, J.: Neuroethics: coming of age and facing the future. In: J. Giordano and B. Gordijn (eds.): Scientific and Philosophical Perspectives in Neuroethics, loc. cit.

[30] Benedikter, R., Giordano, J., and Hutchison, P.: Culture, Sustainability and Medicine in the 21st Century. Re-grounding the Focus of Medicine Amidst the Current "Global Systemic Shift" and the Forces of the Market: Elements for a Contemporary Social Philosophy of Medicine. In: International Journal of Politics, Culture and Society 23(1)(2010), pp. 29–41.

change in the self-image of the human being may be appropriately discerned and analyzed; as well as the resulting overall trajectory.

What is our outlook? In the present age which is increasingly characterized by a potentially fundamental change to the self-images of the human being and society under the impact of neurotechnology, “neuroelectronics,”[31] and “transhumanism,”[32] we live through a period where ethics and politics seem to be groping into the dark of an uncharted territory.[33] And so do most branches of philosophy and the social sciences. The uncertainty now prevailing in the cultural debate on the perspectives opened up by neuroscientific advancements is because the combination of the outer and the inner dimensions of the described transition is, as always in the case of complex issues of modernity, not simply the sum of its parts, but seems in the process of creating its own patterns and laws of development. If this is the case, it will produce its unavoidable pros and cons; and it may raise hopes as well as fears of the unknown.

Some contemporary critics are skeptical toward the future of humanity as a “humanistic” and rational endeavor. They think that humanism is arriving at its endpoint, where brain tissues, computer chips, and neuroelectronic impulses become more important for explaining individual and social behavior than the classical “enlightened mind” or the “beautiful soul” of the Western tradition. Techno-pioneers, such as Bill Joy, even expected that “the future doesn’t need us (as humans)” anymore,[34] because, as he states, we are losing ourselves in that dilemma between the Scylla of new, body-penetrative media like BCIs and the Charybdis of neurotechnology, both featuring their own challenges of getting into questions and issues too complex to handle.

At the same time, there is a growing number of enthusiasts who seem to expect the exact opposite: not less than miracles of liberation and cognition allegedly implicit in the new scientific brands. And there are some (self-proclaimed) “techno-fundamentalists” like Kevin Warwick to declare that the new technologies pave us the way to becoming cyborgs within just a couple of decades and that this is (in their view) the only desirable way toward progress for the human race.[35]

To us, most of these seem rather irrational fears and hopes of poor relevance. We believe with regard to the future of neuroscience and neuroethics, we need to be neither pessimists nor optimists: neither apocalyptic nor enthusiastic in addressing

[31] Keiper, A.: The Age of Neuroelectronics. In: The New Atlantis 11 (2006), pp. 4–41, https://www.thenewatlantis.com/publications/the-age-of-neuroelectronics

[32] Fukuyama, F.: Our Posthuman Future: Consequences of the Biotechnology Revolution. New York 2002. Cf. the response of N. Bostrom: Transhumanism: The World’s most dangerous idea? Oxford University 2004, https://nickbostrom.com/papers/dangerous

[33] Bostrom, N.: Technological Revolutions: Ethics and Politics in the Dark. Oxford University 2006, http://www.nickbostrom.com/revolutions.pdf

[34] Joy, B.: Why the Future doesn’t need us. In: Wired (April 2000), https://www.wired.com/2000/04/joy-2/

[35] Warwick, K.: The Matrix—our future? Reading University 2003, http://www.ironworksforum.com/forum/showthread.php?t=39603

the new constellation. Instead, we need more balanced, pondered, and rational approaches that do not underestimate the risks but do not also exaggerate the fears.

In our view, the reality of the conjunction between the outer and the inner dimensions of neuroscientific and neurotechnological transformation in our time is in large parts still to be understood, and we hold this as a topic worth every effort. What we know so far is not much. But one thing is certain: neuroscience, neurotechnology, and neuroethics are crucial for the future of globalization and the concept of humanity.[36]

[36] Bostrom, N.: The Future of Humanity, Oxford University 2007, http://www.nickbostrom.com/papers/future.pdf

Chapter 5
Neuropolitics: New Frontiers for Policy and Strategy

Abstract Contemporary neuropolitics opens new frontiers for policy and strategy due to the unprecedented bandwidth of actual and potential applications and directions of development. This chapter describes what neuropolitics is and where it might be going from here.

Keywords Neuropolitics · Policy · Ideology · Realism · Idealism

Current advancements in neuroscience and neurotechnology are generating new domains of economic potential, military power, and cultural transformation. The "neuro" preface has come to denote the use of neuroscience and its technologies to both assess and control the neuro-cognitive basis of various aspects of human endeavor—including the functions and aims of institutions like those in the medical field, scientific investigation, and applied social policy. Neuroscience may also anticipate changes in social relations and in the self-image of the human being. And as far as neuroscience and neurotechnology are inevitably used by groups of people working in different contexts and striving toward different goals partly opposed to each other, they are not and will never be free of ideology.

Rubrics of "neuroeconomics," "neurolaw," "neuroweaponry," or "neuroecology" are reflective of an ever-expanding, transnational cultural reliance upon neuroscience and neurotechnology to define and affect the human condition on a global level. It is inevitable that these developments touch politics at their core and its reality, thus giving birth to the new field of "neuropolitics." Interrelated with each other and with the future of global politics like few other emerging fields, the new "neuropolitics" poses both unprecedented opportunities and challenges for leadership. Neuroscience and neurotechnology contain historically unprecedented potentials of transformation that can stir up political emotions like few other contemporary fields

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of innovation and thus may unfold populistic energies able to mobilize new social movements.[1]

In light of this, the threefold question is: What can, and what will be a pondered, integrative, and rational "neuropolitics" that evades radicalization and fosters responsibility, and who is going to shape it? What will be the main new frontiers for policy and strategy that may open up with the rise of neuroscience and neurotechnology? And how could neuropolitics and neuroethics be conceived as interdependent, if not as a unity *per definitionem*?

5.1 A Complex Issue

Neuropolitics is, like many other branches interconnected with neuroscience and neurotechnology, a field in open development. Therefore, the term "neuropolitics" is overused in both descriptive and normative meanings across current debates. While some opinion leaders want the term to denote the attempt to inform, improve, or even manipulate traditional politics through the findings of neuroscience as a tool for enhancing the quality and expanding the extension of power and influence,[2] others understand it as the embodiment of every social information and influence on the brain, and the respective—conscious and unconscious—reaction which is considered a form of action based on a choice, and thus political in its nature.[3] A third group wants "neuropolitics" to denote the inclination of a person toward a political stripe, political ideology, or even a political party allegedly due to the functioning of his or her brain,[4] asking:

> Is there a capitalist part of the brain? Is there a conservative part of the brain? ... The implications become clear when you think of the … work that suggests that political persuasion may have less to do with experience (culture, upbringing, social and economic factors) and more to do with biology. (But) this is simply an erroneous conclusion, as the neuroscience data cannot separate correlation from causality ... Recent books … advocate the use of brain imaging in detecting criminals. (As an effect), some people will need to be taken off the streets on the basis of their fMRIs for a longer time, even a lifetime … We should impose lying-free zones by scanning people in areas where the powers that be may want to 'enforce the truth' ... Another voice … critical of the social implications (is that which) views the

[1] Dunagan, J., Grove, J., and Halbert, D.: The Neuropolitics of Brain Science and Its Implications for Human Enhancement and Intellectual Property Law. Philosophies 5(4) (2020): article 33, pp. 1–15. https://www.mdpi.com/2409-9287/5/4/33

[2] Fowler, J., and Schreiber, D.: Biology, Politics, and the Emerging Science of Human Nature. In: Science 322(5903) (2008), pp. 912–914.

[3] Connolly, W. E.: Neuropolitics. Thinking, Culture, Speed. University of Minnesota Press 2002.

[4] Call, R.: Neuropolitics: Brain Studies that differentiate political party preference. In: OpEdNews.com (29 March 2013), http://www.opednews.com/articles/Transcript-Neuropolitics-by-Rob-Kall-130329-707.html. Cf. Kanai, R. et al.: Political Orientations Are Correlated with Brain Structure in Young Adults. In: Current Biology 21(8)(2011), pp. 677–680.

> modern neurosciences as to a large part reinforcing gender stereotypes by locating them in biology rather than in processes of socialization.[5]

Untouched by such and similar critique, some repeat the notion that "the left brain is conservative, the right brain is liberal." Better research has been found that,

> on average, conservatives show more structured and persistent cognitive styles, whereas liberals are more responsive to informational complexity, ambiguity and novelty. We tested the hypothesis that these profiles relate to differences in general neurocognitive functioning using event-related potentials, and found that greater liberalism was associated with stronger conflict-related anterior cingulate activity, suggesting greater neurocognitive sensitivity to cues for altering a habitual response pattern.[6]

While many of these interpretations and usages of the term "neuropolitics" are consciously experimental, occur in their own right, and in principle cover legitimate fields of investigation and critique connected with recent development, the main use of the term in our view remains twofold:

> Neuropolitics embraces the politics of neuroscience and neurotechnology, that is, the policies and strategies of how to further evolve these fields and include them in the best possible way in the overall social process;
>
> Neuropolitics deals with neuroscience and neurotechnology in the international context of global political competition, international law, and ethics.[7]

It is in our view in particular these last two points that any strategy of applied policy dealing with the term "neuropolitics" will have to consider.

Political leaders will need to consider the impending economic dimension of the rapidly multiplying technologies related to the nervous system, brain, and consciousness in general. Rightly or not, this field of research is becoming particularly significant in times of economic change, especially for the West. The financial crises and subsequent debt crises that have impacted the democracies of the West between 2007 and 2023 have weakened the credibility of its economics, including the potential of its scientific innovation policies.[8] This prompts a re-examination of venues for fiscal investment, and consideration of how such investments will yield long-term and multi-focal benefits in global markets.

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[5] Libcom.org: Neuropolitics, neuroeconomics, neuroethics... neurobabble: thoughts on 'Neuromania' (3 January 2012), http://libcom.org/blog/neuropolitics-neuroeconomics-neuroethics-neurobabble-thoughts-ineuromania-limits-brain-scie

[6] Amodio, D., Jost, J., et al.: Neurocognitive correlates of liberalism and conservatism. In: Nature Neuroscience 10(11)(2007), pp. 1246–1247, http://www.nature.com/neuro/journal/v10/n10/abs/nn1979.html. Haidt, J.: *The righteous mind: Why good people are divided by politics and religion*. New York, Vintage, 2012.

[7] Shook, J. R. and Giordano, J.: A principled and cosmopolitan neuroethics: Considerations for international relevance. In: *Philosophy, Ethics, and Humanities in Medicine* 9 (2014), article 1, http://www.peh-med.com/content/9/1/1

[8] Kugler, J., and Zak, P. J.: Trust, cooperation, and conflict: Neuropolitics and international relations. In: Advancing interdisciplinary approaches to international relations, pp. 83–114. Palgrave Macmillan, Cham, 2017.

On the contrary, political strategies on both national and international levels are well aware that neurotechnology can be viewed as an avant-garde science located at the intersection of biological and technological research and hence at the leading edge of future technology that will merge the "organic" and the machine, thus forcing political parties and actors to choose between different options: embracing the new "neuroculture" or rejecting them, or finding intermediate ways, according not least to the preference of the respective voters. Although profoundly provocative (and often contradictory) in its implications, like most other future technologies, neurotechnology will be increasingly used to leverage economic influence on the world stage through a variety of applications and thus become a more and more important "contextual" political force.[9]

5.2 Quality of Life as a Political Factor

This is the case not least because access and control of consciousness foster tremendous potential to leverage political and socio-cultural effects and will enable significant economic power in the coming decades. For example, neurotechnological approaches such as brain implants, novel psychotropic drugs, and human–machine interfaces can be used to treat neuropsychiatric disorders cognition, emotions, and behaviors of both individuals and groups as part of a new technological toolset that can be utilized in business applications. As the respective technology will be able to modify the mind, or at least the mental state of the individual as well as his or her behavior, both use and misuse become political issues of the highest relevance.

Furthermore, the employment of neurotechnologies in healthcare creates a hugely opportunistic environment for biotechnology companies and investment firms to evoke change in the scope and nature of medical care, healthcare economics, and the social milieu. All national and international health policies and strategies around the globe will be massively affected by this development. Indeed, it is estimated that over US$5 trillion (Euro€3.7 trillion) will be devoted to the medical use of biotechnology in the next 10 years, creating a fertile playground for new health policies. By affording the capability to improve the quality of life (both directly and indirectly), such technologies also affect the socio-political stability of human ecology in a number of ways. While neurotechnology can rightly be viewed as providing a means to enhance medical care and human performance, it is important to bear in mind that these effects are elicited within the market environment of contemporary societies—and thus benefits are also political, achieved by neuroscience and neurotechnology companies which increasingly rely on lobbying organizations and in part contribute to finance politics, as well as by the national economies that profit from their revenues.

[9] Goodin, R. E. and Tilly, C. (eds): The Oxford Handbook of Contextual Political Analysis, Oxford University Press 2006.

Seen in a pragmatic manner, these developments suggest that "neuropolitics" in the broad sense will be an emerging field of the future, particularly in the most advanced national economies. Whether we like it or not, whether we reject the respective moral and social implications or welcome them, neuropolitics is here. Whether we fear for the future of humanity or embrace an age of "trans-humanism," the issue must be considered and debated by political leaders and governments, with acknowledgment of the implications of these developments, the individuals and groups affected, and the perspectives and values involved. This prompts the question of whether Western democracies are prepared for such discourse, to which extent they are, and how much and how fast they are ready to face the challenges posed by the rapid advancements.

The power dimension, in the more strict sense fostered by neuroscience and neurotechnology, must also be considered. Although reliant in part upon economics, it transcends simple economic considerations and domestic party politics. The latest financial crises have compromised part of the USA's and Europe's domestic and foreign power arrangements: namely, in the case of the USA, the attempt to lead increasingly through civilian power instead of military supremacy,[10] and in the case of Europe, basic approaches and strategies like multi-statism, ordo-liberalism, welfare state, low military profile, political power through pluralistic and inclusive dialogue, and through binding international law. In the changing political constellation today, neurotechnology is becoming a crucial international political factor in a broader sense than before, because it is related, among other fields, to the future of information, surveillance, and warfare.

5.3 Neuropolitics Embedded in Concepts of Modernity

We arrive at the human question in the philosophical and ethical sense, as reflective of, and inherited by, the Western concept of modernity, which stands at the very origin of its democratic political systems in the form of enlightenment and humanism. The question of what the human being is, and what it may become, will be increasingly and unavoidably connected with the development, control, and implementation of neurotechnology. How far will the current models of the human being and its self-interpretation shift, change, or be undermined by the influence of new technologies that are directed at, and affect, the brain and consciousness? And what will be the consequence for the systems and institutions of the West?

This is not just a question to be situated within the framework of medical translations of neuroscientific and neurotechnological research and the commercial sectors that support it, but rather one that affects and reinforces a much broader trend that is moving toward a transnational "neurocivilization"—that is, a civilization in which

[10] Clinton, H. R.: Leading Through Civilian Power. Redefining American Diplomacy and Development. In: Foreign Affairs (November/December 2010), http://www.foreignaffairs.com/articles/66799/hillary-rodham-clinton/leading-through-civilian-power

a multitude of technologies related to the brain and consciousness will dominate notions of progress, enlightenment, and modernity.

Like any form of science and technology, neuroscience and neurotechnology can be used to effect good and harm. And while the tendency to use science and technology inaptly or toward malevolent ends is certainly not new, the extent and profundity of what neuroscientific information implies (i.e., about the nature of the mind, self-control, identity, and morality) mandate thorough political review and discernment.

In effect, the West should do much more. The West should act in its own interest, in the interest of global politics, and in the interest of international mediations and reconciliations. Toward such ends, the USA and Europe must take ardent strides to foster discussion about the global trends in neurotechnological development and use by co-creating a more cosmopolitan, if not worldly rather than simply "Western" discourse. In striving for such discourse, it will be crucial to recognize that the philosophico-political traditions, ethics, ideals, needs, desires, and practices of Western societies—in particular, the history of political ideas of Europe and the USA—may not be sufficiently relevant or applicable to the ways that avant-garde enterprises such as neurotechnologies are studied, developed, and used in non-Western nations.

That means that differing cultural traditions, values, and practices must be regarded and responded to if tensions and conflicts are to be avoided. Technological and economic capabilities increasingly engender credibility and clout at international bargaining tables. The social and professional values of non-Western countries that are gaining momentum in neuro-biotechnological research and production will become ever more prominent and therefore necessary to acknowledge.

However, that should not hinder the West in putting forward its own socio-political and humanitarian agenda. In this light, it is essential to re-iterate that science and technology are human endeavors that are enacted in the sphere of human society. Without doubt, the shifting architectonics of neurotechnological capability are affecting the philosophical and ethical *zeitgeist* that characterizes the current "global systemic shift" and its manifest effects. Thus, the pace and extent of neuroscientific and technological advancement necessitate an equivalently strong dedication to studies and applications of the policies, strategies, and laws that govern research and applications of neuroscientific knowledge in domains of healthcare, public life, and national security by re-assessing and, if necessary, affirming and strengthening humanitarian (if not humanistic) ideals.

5.4 Non-Western Concepts

Because neurotechnology will so deeply influence questions about human nature and action which since the eighteenth century have been mainly related to European and Western ideals, and which have provoked increasing tensions about the power of cultural and ethical egoism since the second half of the twentieth century, a particularly high level of scrutiny is needed when looking to, and relying upon, neuroscience and neurotechnology, both for determination of internationally binding ethico-legal judgments and to describe, predict, or control human behavior.

Taken together, these dimensions will hopefully induce Western leaders to realize that the multi-disciplinary and multi-level discussion needed about the impact of neurotechnology on contemporary globalized societies is no longer merely a case of "Eurocentrism" or of "The West against the rest" when considering the calculus of capability, political influence, and power leveraged through neurotechnology. Rather, the current palette of neuroscientific and technological development instantiates a need for both finely- and coarsely-grained analyses of the political, ethical, and legal changes that will occur as non-Western countries—such as China and India, which have historically had different constructs of human rights standards and the protection of individuality as a good in itself—are becoming scientific, technologic, and economic influences upon world politics, economies, and public life.

5.5 What To Do

The Western political leadership has yet to address these "deep" questions appropriately—both separately and in their inter-relatedness. It will have to develop an integrative neuropolitics which the West still has not. Such issues will be an important part of the global future, politically, economically, and ideologically. Europe and the USA must recognize the rapid development and use of neurotechnology and the variety of new fields of application and transformation generated in the mid- to long term by neurotechnological tools and the capabilities they yield.

Neuroethics, brought forward as a new, transnational strategy for the ethical development of neurotechnological innovation—that is, as a form of neuroecology—could be the embodiment of rational and pondered neuropolitics. It will be in any case instrumental to developing political, economic, and military relationships not only in and for Europe and the USA but on a global level. As such, it can constitute an important part of the West's renewal of "soft power" on the world stage.

Neurotechnology is, and remains, a field in evolution. And neuropolitics will be as well. The questions generated by neuroscience and neurotechnology are complex—and more numerous than the certainties achieved thus far. The common ground of these questions is not whether deep-reaching scientific and technological shifts will occur and have political consequences, but rather when, and to what extent. The overarching question is how, and in which ways, these shifts will be expressed by and affect global political forces.

Without doubt, a number of countries that do not strictly adhere to the Nuremberg Code, that is, the set of research principles for human experimentation established as a consequence of the trial against medical doctors of the Nazi regime in 1947, or to the subsequent, more elaborated declarations of Geneva (1948) and Helsinki (1964) can, and likely will, generate products and devices capable of affecting the human predicament or condition, for example, by providing treatments for medical disorders or performance enhancement, and in this way incur significant economic power in global markets.

How will such developments in non-Western, partly authoritarian, and non-democratic countries be addressed and handled by the West? Could some uniform regulations for research and use be viable? And if so, by which mechanisms might these codes be developed and articulated? Should some form of "moral interventionism" be adopted to uphold and enforce particular European and Western ethical standards like human rights and human dignity upon the conduct of non-Western science and technology? Or should we posture toward more of an isolationist stance? And, in the event, how would Western nations then maneuver neuro- and biotechnological efforts to retain a presence on the global technological and economic map? Are the new, "hyper-technological" trends fostering a unification of pan-Western ideals and values—or rather a new separatism and competitiveness between the two sides of the Atlantic that will evoke what French philosopher Michel Foucault referred to as highly controversial policies of "biopower" by engaging what might be regarded as "neuropower"?

Summing up so far, it is exactly the scientific-to-social-to-political span of neuroscientific and technological effects that necessitates a stronger political and leadership focus of the West. Western democracy is rightly considered to be one of the most sophisticated (and certainly also one of the most complex) political arrangements of social and cultural differentiation in the world. Thus, the West will be intensely questioned about its stand toward neuroethics in the coming decade—probably much more than in past years, and more than non-Western or even authoritarian nations.

As a new, "proto-political" discipline, neuroethics entails and obtains two main traditions. The first is focused on the nature and patterns of human cognition, needs, and resource utilization in moral, ethical, and social decision-making. This approach is important to appreciate the ways that bio-psychosocial (including cultural) differences are manifest. Yet, insight and understanding of such substrates and mechanisms are not sufficient to foster inclusive political perspectives. Therefore, it will be necessary to engage this knowledge both in the tradition of the analyses of problems borne of humanistic, rational, and enlightened progress and in the development of recommendations and guidelines that direct the scope and tenor of current neuroscientific research and applications worldwide.

With the difficult questions connected to the current rise of neuroscience and neurotechnology, one thing is clear: Any meaningful attempt at neuroethical analyses and action must be based upon a more cosmopolitan outlook and stance that seeks to bring differing viewpoints to the discourse, and that is not necessarily wedded to a particular theory or system, but instead is in principle open to all political, economic and social actors, relative to the circumstances, benefits, burdens and harms that are in play and at stake. That is what we call a progressive stance.

The sheer fact that profound questions must be posed and answered (at some point) by Western leaders demonstrates that neurotechnology is becoming one contemporary vehicle (among others) of a potentially new form of cosmopolitics. As philosopher Fritz Jahr noted around a century ago, new science and technology unavoidably add to the palette of philosophy, ethics, economy, culture, and politics alike.[11] They require new forms of ethical reflection and revised concepts of policy. Given the growing reciprocal relationship of politics, knowledge, technology, economics, and culture, in order to maintain humanistic leadership and influence on the global stage, it will be necessary to develop guidelines, policies, and laws that appropriately reflect avant-garde scientific advancements and aptly direct, if not govern, the use and manifestations of neuroscience and neurotechnology in inclusive ways.

5.6 Neuropolitics, the Under-Addressed Challenge?

Neuropolitics—and indivisible from it, neuroethics—remain critical for considering under-addressed challenges. As we approach the frontier realms of science, we encounter new possibilities that require us to deal with the contingencies arising not only from what is yet unknown but what may ultimately remain unknowable. What we need is a politics of science to address and unify domains of metaphysics, epistemology, anthropology, and ethics, and a political paradigm for precautionary progress that involves a pragmatically balanced optimism grounded in proactive responsibility. That includes, as Eric Parens has rightly underscored,

> issues surrounding definitions of normality, and how these constructs can affect the way in which we treat those who fall outside of the artificial, and sometimes arbitrary, distinctions and boundaries drawn while describing what is acceptable or desirable.[12]

It is exactly this what has to be called "politics."

Overall, contemporary neuropolitics must recognize that the status quo *is* progress. Progress cannot be impeded, nor will it be reversed. The goal, therefore, is to recognize our responsibility to engage the profound ethical, social, and legal implications of the truths we may seek about the brain and mind through our use of technology and acknowledge its potential uses as well as misuses in both neuroscience and society. To do so will require that we identify the policy gaps in knowledge and safety, analyze how such gaps can incur burdens, threats, and risks, and work to ensure that precaution is taken so as not to be exclusory of technology, but to advance with humanitarian concern and prudence.

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[11] Benedikter, R., Giordano, J., and Kohls, N. B.: Neuroscience and the Importance of Neurobioethics: A Reflection Upon Fritz Jahr. In: A. Muzur and H.-M. Sass (eds.): Fritz Jahr and the Foundations of Global Bioethics. The Future of Integrative Bioethics. LIT publishers Berlin 2012, pp. 267–280.

[12] In Palchik, G.: Conference Report: Technology, Neuroscience & the Nature of Being: Considerations of Meaning, Morality and Transcendence. Part I: The Paradox of Neurotechnology, Georgetown University, Interdisciplinary Program in Neuroscience, 8 May 2009, p. 3 and 9.

Chapter 6
Neuro*civics*: Are Civic Institutions Ready for Moral Bioenhancement?

Abstract The approach of neurocivics posits the question of whether civic institutions are ready for moral bio-enhancement. This chapter introduces the term and practice of neurocivics and draws the perspectives.

Keywords Neurocivics · Civil society · Democratic institutions

6.1 Civil Enhancement

Positive assessments of moral enhancement too often isolate intuitive notions about its benefits apart from the relevance of surrounding society or civic institutions. If moral bioenhancement should benefit both oneself and others, it cannot be conducted apart from the enhancement of local social conditions, or the preparedness of civic institutions. Neither of those considerations has been adequately incorporated into typical neuroethical assessments of ambitious plans for moral bioenhancement. Enhancing a person to be far less aggressive and violent than an average person, what we label as "civil enhancement," seems to be quite moral, yet its real-world social consequences are hardly predictable. A hypothetical case about how the criminal justice system would treat an offender who already received civil enhancement serves to illustrate how civic institutions are unprepared for moral enhancement.

Speculations about if and how modifications of genotype and/or phenotype could help someone be more moral have stimulated philosophical, scientific, sociological, and political discussion and debate. Studies of putative neurological structures and functions involved in moral cognition and behavior have become part of the field known as neuroethics.[1] Importantly, the discipline also addresses the questions and

Lead authors: Roland Benedikter and James Giordano

[1] Glannon, W.: The evolution of neuroethics. In: *Debates on Neuroethics*, ed. E. Racine and John Aspler, Berlin Springer 2017, pp. 19–44.

J. Giordano et al., *Neuroscience, Neuroculture, and Neuroethics*, SpringerBriefs in Political Science, https://doi.org/10.1007/978-3-031-74024-4_6

problematic issues arising from the broader implications of neuroscientific research and potential neurotechnological applications. However, if moral bioenhancement should benefit both oneself and others, then we argue that it cannot be conducted apart from the enhancement of local social conditions or the preparedness of civic institutions. Often, such considerations have not been adequately incorporated within typical neuroethical assessments of ambitious plans for moral bioenhancement.

People lacking in morality might look like a problem needing a technological solution. Some neuroethical assessments of moral enhancement hardly go beyond saying, “It’s moral, so it has to be good for you and everyone too,” as if adjusting a person’s moral capacity always bears intrinsic worth. Other kinds of cognitive enhancement have been treated in a similarly simplistic manner.[2] We insist that cognitive enhancement is unrealizable without due regard for the real-world contexts in which cognitive abilities contribute to measurable performance improvements.[3]

6.2 Moral Improvement

Three different ideas about moral improvement compete for attention in people’s minds when they hear about “moral enhancement.” The first idea is to instill some degree of moral capacity and responsibility in someone who has never had it, which is better labeled as “moral habilitation.” (And restoring lost moral capacity would hence be “moral rehabilitation.”) The second idea occurs if enhancement is taken to mean an improvement of already-existing moral capacity toward society’s standards of good moral conduct. This idea of enhancement as “moral normalization” is probably what first comes to mind and initially earns approval because that goal is already the aim of morality itself: each person behaves in accordance with moral standards that everyone is expected to follow. Finally, the third idea of enhancement is an improvement above regular requirements of common morality, which might be called “surpassing enhancement.” This third idea has received the most attention in academic discussions, yet it is more difficult to analyze and less straightforward to justify.[4] Only surpassing enhancement is the topic of this discussion.

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[2] An overview of perspectives on cognitive enhancement is provided by Jotterand, F., and Dubljević, V. eds. *Cognitive Enhancement. Ethical and Policy Implications in International Perspectives*. Oxford: Oxford University Press, 2016.

[3] Shook, J. R., and Giordano, J. Defining contexts of cognitive (performance) enhancements: neuroethical considerations, and implications for policy, in *Cognitive Enhancement: Ethical and Policy Implications in International Perspectives*, eds. F. Jotterand and V. Dubljević, Oxford: Oxford University Press, 2016, pp. 76–98.

[4] Shook, J. R., and Giordano, J. Moral enhancement? Acknowledging limitations of neurotechnology and morality. *AJOB-Neuroscience* 7 (2016), pp. 118–120. https://doi.org/10.1080/21507740.2016.1188178. Shook, J. R., and Giordano, J. Neuroethics beyond normal. Performance enable-

Another distinction is also crucial. The label of "moral bioenhancement" applies to technological interventions employed for directly controlling some aspect of human neuro-cognitive functioning that is viewed as instrumental to moral thought and/or behavior. Such technologies are new; controlling human behaviors is not. Although specialized social means, such as education and law, can be improved by technology, they are not essentially invasive or reconstructive (unless they resort to such things as bioenhancement). Only impactful events in the local environs of a person (e.g., hearing a narrative, suffering a punishment, receiving a reward, and so on) are involved with mundane means of socialization, correction, and so forth. Any lasting change to one's behaviors and habits is accompanied by some redistribution or reorganization of neurological activity. The distinction between "bioenhancement" and "enviroenhancement" is instead based on the nature of the method. Technology also permits a third category, "selection-enhancement," when an embryo or fetus is chosen for birth because it meets pre-set genetic or developmental criteria. We shall not consider selection enhancement here.

There is a deep connection between utilizing bioenhancement and enviroenhancement to foster morality, not as regards their role as distinctive means, but rather with the realization of their common end. That connection is revealed through a pragmatic assessment of the conditions needed for their moral effectiveness. Allowing that dichotomy to stand unchallenged would permit assessments of bioenhancement to proceed in an unrealistic manner and potentially arrive at rashly optimistic judgments.

In order to justify labeling an adjustment to human abilities as a "moral enhancement," a framework of prior judgments must be premised.

First, it will be important to define what is meant by "morality." Clearly, this opens broad and deep discourse, if not debate. What emerges from such discourse is that society establishes what is considered (at any given time) to be "moral." Thus, moral cognitions and actions are internal processes that occur in and reflect external contexts.[5] Second, criteria must be applied for empirically confirming when a physiological/neurological intervention shifts personal conduct in a desired moral direction.[6] Third, distinguishing episodic from enduring adjustments is necessary. An episodic adjustment made as situations arise is moral in a limited sense (e.g., "he did a morally good deed"), while an enduring adjustment, such as a non-reversible alteration of the brain or a genetically engineered modification, would be moral in a broader sense (e.g., "she is a more moral person").

Additionally, expectations should be established about what may constitute good outcomes for morally enhanced people as they function in a society in which most

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ment and self-transformative technologies. *Cambridge Quarterly of Health Care Ethics* 25(2016), pp. 121–140. https://doi.org/10.1017/S0963180115000377

[5] Giordano, J., Becker, K., and Shook, J. R. On the "neuroscience of ethics"—approaching the neuroethical literature as a rational discourse on putative neural processes of moral cognition and behavior. *Journal of Neurology and Neuromedicine* 1(6) (2016), pp. 32–36.

[6] Shook, J. R. My brain made me moral: moral performance enhancement for realists. *Neuroethics* 9 (2016), pp. 199–211. https://doi.org/10.1007/s12152-016-9270-y

people are not morally altered. A further layer of envisioned prospects for morally-enhanced people as they interact with important civic institutions, especially law enforcement and governing agencies, should also be evaluated. The final section of this paper offers a hypothetical example illustrating why the civic practicality of a moral enhancement cannot be taken for granted.

In what follows we shall only consider surpassing and enduring moral enhancements, which include genetically engineered modifications for above-average moral conduct. Anything called a "moral enhancement" should at least deliver something that anyone could verify and want for themselves. What do people realistically expect from so much more morality? For example, is it more moral to be less selfish? If an alteration is supposed to keep one's overall selfishness at a lower level, for example, what specific course of conduct during a salary negotiation, or a dispute between parents, would count to prove its effectiveness? Hence, what percentage wage increase shall the less-selfish female employee accept from her male supervisor? How many household duties should the less-selfish parent take over from the other parent?

Such practical scenarios should make readers feel uncertain and perhaps a bit uncomfortable. In the real world, each person wants *other* people to act less selfishly towards them, while acting as self-interested as one already happens to be. If morality involves some sacrifice, who shall be among the first?

6.3 Who Gets Moral Enhancement?

There will not be a realistic way to simultaneously enhance millions or billions of people or to control all social interactions to guarantee universally fair results. (That is why fanciful moral utopias are barely distinguishable from totalitarianisms.) A realistic framework allows (and accepts) that moral enhancers will not be uniform in either distribution or manifestation, given that: (a) the large majority of social interactions would involve at most one morally enhanced individual and (b) morally enhanced people would probably not see similar consequences of their engagements within social groups.

Unrealistic frameworks, by contrast, isolate one "obvious" moral virtue—altruism or empathy are frequently selected, for example—and then presume that such a good thing must always be good no matter the circumstances. By that framework, there is no conceivable harm simply from living a more altruistic life, since human nature is meant to be, and deserves to be, more kind and generous. Only the technological means of achieving that end, and not the moral end itself, needs to be scrutinized.[7] Objections raised against these assumptions are occasionally heard, and we

[7] DeGrazia, D.: Ethical reflections on genetic enhancement with the aim of enlarging altruism. *Health Care Analysis* 24 (2016), pp. 180–195. https://doi.org/10.1007/s10728-015-0303-1

agree with concerns that large-scale and long-term social dynamics should be empirically investigated rather than reflectively intuited.

It should be first noted that morality is not necessarily contrary to self-interest.[1] Most moral deeds can be beneficial to all parties, as the practices of cooperativeness, trustworthiness, civility, and so on are conducive to everyone's welfare. The question is not whether conducting oneself in accordance with common moral standards is beneficial. When enhancement asks for above-average moral behavior, we question how uncommon morality would fare in the real world of ordinary moral expectations.

If this issue is to be treated as an empirical matter, any intuitive generalization about above-average moral people is probably unsound. What could be reliably predicted from dramatically enhancing the morality of any randomly chosen person somewhere in the world today? It seems quite dubious that being more moral than average could ensure that one's status, income, relationships, or life prospects are affected in some predictable way, much less re-directed in the same way as other morally enhanced individuals. None of these framing presumptions, common to positive assessments of moral enhancement, can be trusted:

> The overall welfare of a person can be predictably increased by morally enhancing that person.
>
> Social affairs within a group can be reliably improved with the moral enhancement of even a few individuals.
>
> The overall welfare of a group can be predictably increased by a moral enhancement to a portion of its members.
>
> The improvement of social relations within the group can be reliably accomplished by selecting a moral rule that an individual can follow and enhancing many individuals into conformity with that rule.

These tenets are unreliable because the intuitive calculations behind them take morality to be isolable and individualizable. That permits speculation to imagine that morality's goodness must aggregate to improve society no matter what else may be happening. Concepts about morality in their abstract purity are poor guides when compared with the collective experiences of an entire society.

That said, which behavioral modifications already regarded as moral would actually be conducive to widely welcomed social benefits? Taking morality to be as social as the general welfare it is supposed to yield and evaluating changes to people's morality in terms of empirically confirmable results for society open the entry to the field of *social ethics*. Connecting public morals to social welfare and civic improvement is an approach to social theory inherited from Cicero, Seneca, and Plutarch, and pursued by Western political thinkers, both liberal and conservative, from medieval times to the twentieth century. Eastern philosophy is also replete with this kind of moral and social theorizing. Even modern libertarians, opposed to government encroachment upon private liberties, argue that freer citizens are the kind of virtuous citizens who are essential to a good society. However, this is not without contention; one needs only to recall Mandeville's *Fable of the Bees* for a poetic illustration of problems that can arise when attempting to mitigate "private vices for public benefit."[8]

However, given that humans are social animals, the capacity to behave morally enables engagement with productive social relationships and institutions. Just as public morals are evidently tied to social welfare, it is difficult to deny the social nature of individual well-being.

The overall connection is becoming clear: the relationship between one's individual well-being and one's moral conduct with others is mediated by environing social conditions.

6.4 The Sociality of Morality

How one's morality affects oneself, as well as others, depends on the social contexts making behavior meaningful, effective, and productive. For social ethics, improving individuals morally is foremost about the social contexts in which conduct occurs. Morality is not simply about what a person prefers to do; how a person *can* behave is largely dependent on environing obstacles or opportunities. This is as true of morality as it already is for any desirable improvement of personal conduct. Enhancing what people can do has little to do with them individually; empowerment requires social opportunity. This approach has been defended by Laura Cabrera:

> Under such a perspective, human enhancement focus shifts from changing the biological reality of individuals, to addressing environmental factors that undermine the optimal performance of individuals or that can foster wellness. Such a human enhancement perspective would be consistent with a population health approach, as it pursues more equitable and accessible interventions, on the path to addressing social inequality. Human enhancement does not need to be only about high-technological interventions for a selected group of individuals; rather, it should be a continuous project aiming to include everyone and maximize the public benefit.[9]

For example, if recycling cans and bottles is a good thing to do, few people could actually do this until a recycling industry is assembled and public infrastructure is in place to allow many people to easily recycle some of their household garbage. Asking "Who is a good recycling person?" makes no sense until many people can recycle when they want to; motivating people to be good recyclers is pointless until society provides for recycling. In general, for social ethics, the right social context allows good deeds to happen, which in turn benefit society. Adjusting social

[8] Physician-philosopher Bernard Mandeville's poem "The Grumbling Hive, or Knaves Turn'd Honest," included in his 1724 book *The Fable of the Bees: Private Vice; Publick Benefits*, explored the respective roles and proper balancing of personal moral conduct and public economic and social gain.

[9] Cabrera, L. Y. (2017). Reframing human enhancement: a population health perspective. *Frontiers in Sociology* 2:4. https://doi.org/10.3389/fsoc.2017.00004

conditions where people are expected to act morally is far more intelligent and productive for social welfare than just making some people decide to behave better. Philosophically stated, “ought” implies “can”: when and where people are to do what they *ought*, conditions are to be arranged so they *can*.

Social conditions cannot be left out of account; they shape morality as much as morality guides society. Unless it is supposed that one’s morality is uncorrelated with one’s overall well-being, or it is imagined that one’s well-being is achievable no matter what society is like, how a society functions largely explains the moral capacities of its members.

What does this perspective from social ethics imply for any practical mode of moral enhancement? We offer two initial recommendations. First, to re-iterate, a sharp dichotomy between moral bioenhancement and moral enviroenhancement is unsound in both concept and practice. Effective and large-scale bioenhancement should include enviroenhancement in tandem as a unified strategy. Moral bioenhancement pursued without due regard for appropriate moral enviroenhancement may satisfy purely conceptual notions about individualized morality, but it will not satisfy real-world plans for human welfare. Second, moral enviroenhancement should only be pursued while anticipating how established social institutions should adjust in order to appropriately deal with morally enhanced individuals. This recommendation is especially the case for enduring moral enhancements. The final portion of our essay enlarges upon this thesis.

Moral bioenhancements that afford enduring effect in order to produce above-average cooperativeness and congeniality (and below-average tendencies towards conflict and aggression) may be labeled as “civil enhancers.” By definition, a functional civil enhancer would yield a large and reliable reduction in a person’s behaviors that could be threatening to other people or would initiate and escalate violence. We are not talking about moral rehabilitation or normalization, which at most improves morality up to society-wide standards. Civil enhancement produces people who are morally abnormal, by being much less likely than the average person to ever engage in threatening or aggressive behavior.

6.5 Civil Enhancement and Law

What would happen if civil enhancement were enacted while leaving civic institutions unaltered? Let us consider a specific example: how might a civic institution, such as a society’s legal system, handle issues of criminal intent and responsibility for persons modified by civil enhancement? Setting aside the ethical issues attached to the idea of mandatory neurotechnological treatment of offenders, we simply try to predict the fate of a hypothetical person already civilly enhanced for whatever reason.

Consider this imaginary legal case: A hypothetical person P was provided with a civil enhancer CE, which dramatically reduces the likelihood of choosing to indulge in aggressive or abusive conduct. P has been using CE as supervised by a competent clinician. On a certain day, P is arrested for getting into a violent fight and is accused of instigating the violence. The legal defense for P argues during the trial that, in light of conflicting witnesses and ambiguous evidence about who started the violence (e.g., no video surveillance), the additional fact that P was properly using the CE should be admitted as evidence tending to show that P was probably not the instigator. After all, as the legal defense would point out, surely, the purpose of a reliable CE is to reduce criminal intent and hence to reduce the chances of criminal responsibility.

Our questions about this hypothetical situation ensue. Should P's use of CE be admitted as evidence under such circumstances? If admitted, how should the evidence be presented/explained to the jury? Are any special jury instructions needed for their deliberations? And if P is convicted on some charge, should the same evidence be available for sentencing deliberations? How should P's use of CE affect sentencing, if at all? Three basic options seem available. Option (A): P is *less* blameworthy since P is less responsible for bad behavior, which was not sufficiently moderated by the weak CE (and thus, P is entitled to, and perhaps also requires, a stronger CE). Option (B): P is *equally* blameworthy as anyone, for P is just as responsible for intentional conduct, regardless of enhancement (and P needs a stronger CE, too). Option (C): P is *more* blameworthy since P is more responsible for bad behavior, which was caused by P's deeper viciousness despite the use of the CE (and therefore P is sentenced to use a stronger CE as well).

Additional questions arise. Could contemporary law and legal theory determine a ranking of A, B, and C? Is there any amount of possible neurological information to directly determine whether A, B, or C is the correct option? These questions, and the premises upon which they are based, are not esoteric but rather are becoming ever more realistic as the law seeks to engage the brain sciences. To be sure, some neurological determination would be convenient, but it turns out that neuroscience alone cannot yet provide such information, or accomplish such a normative task.[10] Perhaps neuroethics can proactively develop answers by working in tandem with the other disciplines already mentioned. In the meantime, needless to say, the civic institutions for law, criminal justice, and corrections are at present unprepared for these kinds of issues.

One additional question can be asked to narrow the issue to genetic/developmental means to accomplish moral bioenhancement. If P had received this reliable CE treatment during conception or gestation, should this person be treated differently (option A or C) from other people who never had any form of CE? We leave the reader to their own thoughts about possible answers and their implications, for both this particular issue and the overall trajectory and consequences of bioenhancement in society.

[10] Shats, K., Brindley, T., and Giordano, J.: Don't ask a neuroscientist about phases of the moon: applying appropriate evidence law to the use of neuroscience in the courtroom. *Cambridge Quarterly of Health Care Ethics* 25 (2016), pp. 712–725. https://doi.org/10.1017/S0963180116000438

Chapter 7
Neuro*economics*: Understanding the Future Socio-economic Sphere

Abstract Neuroeconomics might change the crucial field of economics profoundly over the coming decades. This chapter introduces the term and explains the most important features of the nascent practices related to it.

Keywords Neuroeconomics · Political economy · Social economy

Neuroeconomics is an emerging contemporary approach to economic theory and practice. In many ways, it can be regarded as a new, multi- and inter-disciplinary orientation to economic thinking. It interweaves the current international renewal of the economic sciences, in particular the "new experimentalism" requested by many leading economists and economic leaders. This novelty is a consequence of recent economic and financial crises, and the most recent technological advances in brain research, ecology, and environmentalism. As well, the field integrates aspects of business leadership, social anthropology, and trans-culturalism.[1]

Given that rapid progress in neuroscience and neurotechnology may profoundly modify globalized human culture (and perhaps human behavior, if not identity), neuroeconomics can be considered an experimental field that is closely related to the most *avant-garde* developments in the applied sciences. Thus, it has the potential to become an important pillar of a broader and more differentiated post-crisis economic theory. That theory would look beyond neoliberal reductionisms, oriented toward multi-dimensionality, the integration of different scientific insights, sustainability, and an applied and more realistic humanism.

Nevertheless, the further development of neuroeconomics is open, and thus success and fertility of the new field are not guaranteed.

Lead authors: Roland Benedikter and James Giordano

[1] Reuter, Martin, and Christian Montag, eds.: *Neuroeconomics*. Springer Berlin Heidelberg, 2016.

J. Giordano et al., *Neuroscience, Neuroculture, and Neuroethics*, SpringerBriefs in Political Science, https://doi.org/10.1007/978-3-031-74024-4_7

7.1 The Renewal of Economic Thinking

Modern economics can be sketched as a fourfold endeavor, which can be defined as the mechanisms and systems of selection, use, and practical administration of (a) resources by (b) human beings (c) within an environment (d) through labor and its respective organization. These four dimensions constitute specific social mechanisms that then generate variable collective meso-habits or "cultures." In the era of globalized modern technology, these factors are closely related to and interwoven with each other, probably more so than in any previous epoch of human history.

Traditional economic theory has been focused on the first and fourth dimensions, namely: (1) on the extraction and exploitation of resources, with the leading resources changing over time, and currently shifting from oil to renewable energies and precious metals, thus changing a whole cultural history of oil addiction and its widely ramified effects, and (2) on the social and political effects of labor organization as it has existed since the industrial revolution.

Fundamentally, the majority of economic theories of the past 300 years have concentrated on the mechanisms, laws, and "meso-cultures" of these two dimensions and their complex interrelation, including the early liberal and capitalistic approaches as well as their apparent historical antipodes, the Marxist theories, and movements. As both of these were of bourgeois eighteenth- and nineteenth-century origin, they tended to neglect anthropological and environmental issues in their attempts to understand the basis and activities of how the modern economy creates societies with respective cultural and political identities. A notable exception is the early writings of the young, still Hegelian Karl Marx, which have a strong anthropological, although over-idealistic flavor, for example, his famous essay "Let us suppose that we had carried out production as human beings" from his book "Comments on James Mill" of 1844, which like most of his work of the period concentrated upon themes of alienation.[2]

By contrast, current economic theory has assumed a trajectory that expands the older, "classical" two-fold approach towards a new (at least) fourfold one. This expansion was borne out of necessity because of recurring crises between 2007 and 2023, and it manifests potentially far-reaching consequences.

Most initiatives toward a more inclusive economic theory attempt to actively bridge insights from the economic sciences, the social sciences, the humanities, and (increasingly albeit somewhat incipient) the natural sciences, with particular emphasis upon neuro-cognitive studies. Observe an illustration with Oxford University's Skoll Centre for Social Entrepreneurship.[3] Given that economic actions are, objectively speaking, exerted by biological organisms embedded within their

[2] Marx, K.: If We Had Produced As Human Beings, in Comments on James Mill's Elements of Political Economy (1844). In: J. Elster (ed.): Karl Marx: A Reader. New York: Cambridge University Press 1986, pp. 31–35.

[3] Skoll Centre for Social Entrepreneurship at Oxford University: http://www.sbs.ox.ac.uk/centres/skoll/Pages/default.aspx

environment, that is, within a systemic relationship that unavoidably constitutes an ecology, it becomes critical for any contemporary economic theory to understand how humans intuit ecological circumstances to allocate resources that are necessary or desirable for both individual and social flourishing. This becomes particularly important in times of the global environmental crisis, growing overconsumption and overpopulation, global cultural assimilation, and the need for new resource efficiency.[4]

One innovative goal within the current post-crisis "renewal of economic thinking" sought by leading economists is to replace aspects of the often reductionist neoliberal theorems with a more thorough address and elucidation of the neuropsychological bases of human decision-making relevant to the acquisition and use of environmental resources.[5] In recognition of the bio-psycho-social realities of human beings and human interactions, any meaningful attempt at such an approach must include anthropological, environmental, and socio-cultural dimensions. That multi-dimensionality and inter-disciplinarity experimentally broaden the limits of old-style economic thinking. Therefore, the need to consider how neural substrates and mechanisms contribute to decision-making becomes evident—leading to the development of the interdisciplinary field of neuroeconomics.[6]

7.2 A (Very) Short History of Neuroeconomics

The field originated as early as the 1970s when economic models began to merge with ideas from psychology and social anthropology to form behavioral economics.[7] By the 2000s, the obvious limitations, if not flaws, of neoclassical economics dictated the development of a more comprehensive approach that could account for bio-psychosocial variables operative in oftentimes non-rational decisions and actions toward acquiring and distributing limited resources.[8]

Currently, neuroeconomics can be considered to be a growing, but still experimental, pre-normative and descriptive discipline, and as a set of practices that engage neuroscientific approaches to assess and inform assumptions about

[4] Sawe, Nik. "Using neuroeconomics to understand environmental valuation." *Ecological Economics* 135 (2017): 1–9.

[5] Cf. the exemplary exercise in interdisciplinarity, including the economic sphere, in A. Gehlen: Man: His Nature and Place in the World. New York: Columbia University Press 1988.

[6] Konovalov, A. and Krajbich, I.. "Over a decade of neuroeconomics: What have we learned?." *Organizational Research Methods* 22(1)(2019), pp. 148–173.

[7] Kenning, P. and Plassman, H.: Neuroeconomics: An overview from an economic perspective. In: Brain Research Bulletin 67(5)(15 November 2005), pp. 343–354.

[8] Surgrue, L. P., Corrado, G. S., et al.: Choosing the Greater of Two Goods: Neural Currencies for Valuation and Decision Making. In: Nature Reviews Neuroscience 6(5) (2005), pp. 363–375.

economic decision-making.[9] In this way, neuroeconomic analyses may be able to contribute to, and compensate for limitations of neoclassical theory, and may be an additional source of current and future value in defining, guiding, and perhaps predicting economic activities in the social sphere.

Yet, the science is nascent, and the social milieu is large. Thus, we must ask: In which sense? And how, exactly?

7.3 The Neo-Classical View of Rational Decision-Making

Rational choice theory, a cornerstone of neoclassical economics, remains a fundamental tool for describing how decisions *ought* to be made. This approach is based upon a view of the human as "*homo economicus*": a "rational, self-interest guided, unemotional utility maximizer."[10]

However, theoretically, rational behavior does not always occur. Therefore, while humans can be perceived as *homo economicus* under particular conditions, these certainly are not universal. Indeed, the assumptions of neoclassical economics do not obtain the irrationality and emotionality of real human actors. In discussing these issues, Daniel Kahneman states that "most judgments … and choices are made intuitively."[11] Decisions are rarely made in a "deep" contemplative manner as suggested by Smithian theory. The fact is that the role of emotions in making judgments and decisions is conspicuously absent in the *homo economicus* approach. As Kahneman notes, "a theory of choice that … ignores feelings … is not only descriptively unrealistic, it also leads to prescriptions that do not maximize the utility of outcomes."[12]

This means that neoclassical theory remains lacking when describing actual human behavior. Hence, any conclusions based upon such a theory are sometimes erroneous. This notion is further supported by the fact that emotions are frequently unconscious, yet can strongly influence direct behavior. In other words, some judgments based on emotions arising from previous experiences are not able to be rationalized because they are not apparent to the decision-maker. However, these judgments affect expectancy and trust and ultimately influence utility evaluation and economic behavior.

Therefore, a more realistic and integrative model that accounts for biological, psychological, social, and cultural aspects of human experience (all of which are

[9] Glimcher, P. W. et al.: Neuroeconomics: Decision making and the brain. Second edition. London: Academic Press 2014. See also M. Reuter and C. Montag, eds., Studies in Neuroscience, Psychology and Behavioral Economics. Berlin: Springer, 2016.

[10] Berns, G. S. et al.: A shocking experiment: new evidence on probability weighting and common ratio violations. In: Judgment & Decision Making 2 (2007), pp. 234–242.

[11] Kahneman, D.: Maps of Bounded Rationality: Psychology for Behavioral Economics. In: The American Economic Review 93(5) (2003), pp. 1449–1475.

[12] Ibid.

partly conscious, and partly unconscious in structure and pattern) has been proposed by Cañadas and Giordano.[13] In this model, biological elements include predispositions, tendencies, and substrates of consciousness that establish mechanisms and baselines in decision-making. The psychological element reveals positive and negative neuro-cognitive and emotional responses to both the biological and environmental condition, and the socio-cultural element entails "effects incurred by factors of the external environment"[14] which include the artificial "second natural habitat" of human beings which is culture.[15]

This model regards epistemological, anthropological, and ethical components and has been posited to yield a more comprehensive view of human economic behavior. It integrates three fields previously sometimes neglected into one comprehensive unity:

1. The *epistemological* component, derived from viable aspects of both neoclassical and post-neoclassical theory, serves to provide a working foundation upon which to ground practical applications of knowledge.
2. The *bio-anthropological* element defines ways that such knowledge is employed within the context of human actions and interests.
3. The *ethical* aspect strives to address and assess formulations of the societal, economic, and cultural benefits produced by resource-based decisions and practices in accordance with the bio-psychosocial aspects of the human condition.[16]

The need to understand neurobiological substrates, and how these affect—and are affected by—psychosocial and cultural factors operative in shaping economic expectancy, trust, and decision-making thereby becomes significant, and of major socio-economic importance.

7.4 "Expected Value" as a Decision-Making Algorithm

The economical "expected value" (EV) describes the tendency of any rational being to take a certain action based on its probable outcomes.[17] This occurs in accordance with the equation:

[13] Cañadas, A. and Giordano, J.: A Philosophically-based Biopsychosocial Model of Economics: Evolutionary Perspectives of Human Resource Utilization and the Need for an Integrative, Multidisciplinary Approach to Economics. In: The International Journal of Interdisciplinary Social Sciences 5(8)(2010), pp. 53–68.

[14] Ibid.

[15] Gehlen, A.: Man: His Nature and Place in the World, loc cit.

[16] Ibid.

[17] Cf. Cañadas, A. and Giordano, J.: A Philosophically-based Biopsychosocial Model of Economics, loc cit.

$$EV(A) = P(O_1) * G(O_1) + \ldots + P(O_n) * G(O_n).$$

Here, the expected value action *A* is equal to the summation of the probability of an outcome $P(O_n)$ times its value, or gain $G(O_n)$, for all possible *n* outcomes.

"Expected value" is a means with which to examine possible courses of actions and choose the best suitable actions. It provides a decision-making algorithm. Although descriptive, the "Expected value" algorithm fails to define *how* decision-making might occur in practical reality. While the science about what is guiding our actions in the complex interaction between brain, culture, and social reality remains somewhat immature, a theoretical construct of economic decision-making has been offered by Sugrue and colleagues.[18] According to their model, decisions consist of (a) "value transformation," or the processing of environmental input into a meaningful interpretation; (b) "decision transformation," or a deliberation on available data or interpretations; and (c) "action implementation," or the pre-motor signals attributed to the choice made.

According to Sugrue, a "sensory transformation operates on primary input to generate a higher order representation of stimulus." Then, "a decision transformation maps this sensory representation to the probability of alternative responses." At the last stage, action implementation reduces the "probabilistic representation to a discrete plan for motor action."[19] Expected value occurs at the level of decision transformation, where values are weighted and probabilities are formed.

Sugrue and coworkers describe an "actor-critic conceptual framework for simple value-based decisions." In the actor, sensory input and physiological needs first interact to produce a "common reward currency" that "identifies rewards in the ... environment" and provides input for later stages of decision formation. The input is then "transformed into a higher-order representation of the value of different stimuli" and then processed by the critic component of the scheme to "select actions that maximize rewards in response to specific sensory cues."[20] The prediction-error signal cycle of the scheme operates to distinguish disparities between expectations and experiences of reward. Subsequent decision transformation mechanisms map these value representations onto probabilities of potential behaviors, and concomitant, value representation is matched to prior experience to gauge positive and negative (i.e., "go" versus "no go") signals. Finally, value representations are summated to differentially weigh, and initiate, viable behaviors to affect particular outcomes.

[18] Cf. Berns G. S. et al.: A shocking experiment: new evidence on probability weighting and common ratio violations, loc cit.

[19] Ibid.

[20] Ibid.

7.5 Neurobiological and Psychosocial Mechanisms: A Basis for Economic Trust?

As Sugrue has noted, the schema is incomplete though, in that it does not consider in detail those neural networks that may be involved in decision-processing. It is crucial to recall that the "Expected value" equation at the basis of a brain-related economic theory consists of gains and the probability of the occurrence of such gains. Knutson and colleagues have identified brain networks that are putatively associated with these components.[21] According to their studies, anticipated gains seem to involve limbic mechanisms of behavioral activation and reward, inclusive of activity of the *nucleus accumbens*, while the probability of Expected value seems to involve the medial *prefrontal cortex*.

Psychologically (and socio-psychologically), "yoking" anticipated gains to expected or experienced probabilities seems to co-establish a basis for decisional trust. Kenning and Plassman maintain that a mathematical-economic model of trust can be quantified by the equation:

$$p * G > (1 - p) * L \tag{7.1}$$

where p is the probability of *perceived* gains G and L is *perceived* losses. This equation can be reduced in terms of the expected value of the gains versus losses, such that:

$$EV_G > EV_L.$$

This experimental equation relates expected value—as the assumed basic economic decision-making concept—to trust.[22] Its fundamental premise is: If the expected value of "gains" outweighs that of "losses," then the decision involves a sense of "trust."

As a consequence, it could be posited that a combined, interdisciplinary, and integrative neuro-bio-psycho-social model of trust in economics should be constructed so as to better qualify, quantify, and understand the specific ecology, as well as the complex psychology of economic decision-making within the relationship of the individual, and the nature of trust in environmental, cultural, and social contexts. We opine that this explicitly experimental (i.e., heuristic) neuro-bio-psycho-social model of trust should encompass at least seven dimensions:

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[21] Knutson, B. and Wimmer, G. E.: Neural Circuitry for Social Valuation. In: E. Harmon-Jones and P. Winkielman (eds): Social Neuroscience: Integrating Biological and Psychological Explanations of Social Behavior. New York: Guildford Publications 2007, pp. 157–171.

[22] Castelfranchi, C. and Falcone, R.: Principles of Trust: Cognitive Anatomy, Social Importance, and Quantification. In: Proceedings of the International Conference on Multi-Agent Systems, July 3–7, 1998, Paris, France. Boston, IEEE Press 2000, pp. 72–79.

1. A *neural* level that describes the neural networks involved in economic decision-making;
2. A *biological* attribute that describes the evolutionary and developmental bases—and relevance—of decision-making and trust;
3. An *anthropological* component that defines and describes the collective meaning and basic value of trust for human beings as a self-conscious species among other (conscious) species;
4. A *psychological* aspect that provides a definition of trust pertinent to the specific cognitions, emotions, and character of an individual;
5. A *philosophical* dimension that regards the rational dimension of trust in the sense of an in-depth scrutiny of causes and origins as related to effects;
6. A *social* level of influence, that describes the dependent inter-relations of a self with others, and the respective past and present experiences of these inter-relations;
7. A *culturo-civilizational* characteristic that portrays the consequences and importance of trust as an accepted collective form of behavior and value over time.

Overall, such a multi-dimensional and thus potentially integrative approach to economic decision-making would need to combine neuro-biological, social, and cultural dimensions of trust into a "stratified image" of the human being and its behavior.[23] This paradigm has to characterize the interaction of physical, psychological, cultural, and even metaphysical cognitions that establish various decisions, relating decisional actions and outcomes to evaluations of trust.

7.6 Applying Theory to Practice

At this point, let us briefly apply some of these dimensions and assess their potential inter-relation. In principle, *neural* networks of trust relate circumstances to prior experience in order to formulate a value and validity alignment. These cognitive and emotional formulations entail *anthropological*, *philosophical,* and *social* assessments and are affected by *culturo-civilizational* paradigms that reflect *biological* and *psychological* needs and desires. From this, a probability (or contingency) is assessed to form a tentative belief about one's imminent action. The likely final step is to detail and solidify this mental process into a reliable set of expectancies and contingencies that allow intuitions about various activities, outcomes, and reliabilities.

Overlooking what occurs in very short timeframes, an expected value judgment occurs both at the value and validity alignment process and when contingencies are evaluated. The decision-making process, where values and probabilities must be evaluated from input and then processed to form a choice or action-guiding belief,

[23] Ibid.

can also be regarded as an individual or collective "lead story" or "paradigm."[24] In this context, the constructivist (or "postmodern") approaches that were dominating the social sciences, including various aspects of economic theory, and the humanities from the 1990s until the mid of the 2000s may contribute viable aspects to be integrated into the overall picture.[25] Yet, any orientation to an encompassing constructivist approach cannot—and should not—disregard an evolutionary component, as it is important to consider how and why such cognitions and actions were established, preserved, and modified in relation to human ecology over time.

In this light, neuroscientific studies suggest that trust allows agents to cooperate and hence enhance their ability to survive and reproduce, maximizing "genetic fitness even though myopic self interest suggests cheating."[26] As it seems, one's affinity of another's well-being could *also* be correlated to the magnitude of genes shared.

Thus, trust, together with cultural, social, and spiritual components, may have probably *also* a "bodily" unconscious, often culturally removed, but an evident evolutionary component that sparks its existence and vitality. As Rousseau and colleagues have noted, mechanisms and patterns of decision-making and operational definitions of trust seem to pertain to "individual, group, firm and institutional" activities that sustain elements of survival, and flourishing, in and across environmental circumstances and contingencies.[27]

It could be argued that at least in principle, one's decision to act based upon any of the levels of trust is fundamentally the same. As an initial component of decision-making is reliant upon subjective experience, interpretations, and beliefs, it is probable that environmental factors are assessed to form a "common reward currency" operational in various situations that involve the acquisition, distribution, and use of resources and relations necessary for individual and group fitness and interaction.

From this perspective, the different dimensions of trust render the same types of "reward currency" to be evaluated. Reasons to trust (at any level) vary individually but may be uniformly surveyed through an expected value judgment: through the aforementioned decision-making algorithm. The psychological aspects that define trust reflect an "individual characteristic"[28] that renders a "gain" type value judgment, which are subsequently incorporated into more and broader elements and stages of the decision-making process.

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[24] Batenson, P.: The biological evolution of cooperation and trust. In: D. Gambetta (ed.): Trust: Making and breaking cooperative relations. Basil Blackwell 1990, pp. 14–30.

[25] Zak, P. J.: The Neuroeconomics of Trust. In: R. France (ed.): Two Minds. Intuition and Analysis in the History of Economic Thought, London 2005.

[26] Berg, J, et al. Trust, Reciprocity, and Social History. In: Games and Economic Behavior 10 (1995), pp. 122–142.

[27] Rousseau, D.M.: Not so Different After All: A Cross-Discipline View of Trust. Academy of Management Review 23(3)(1998), pp. 393–404.

[28] Bhattacharya, R.: A Formal Model of Trust Based on Outcomes. In: Academy of Management Review 23(3)(1998), pp. 459–472.

This concept is supported for example by theorists like Adolphs who has claimed, “it is not only the features of the stimuli that are driving the judgments made …, but also the personalities and autobiographies of the judgment-makers that matter.”[29]

This infers that cause and effect parameters of decision-making and trust are established in social, that is, behavioral and cultural environments, and can lead to reciprocity, cooperation or uncooperativeness, stability or instability of groups, organizations, and societies, as well as to patterns and trends of economic activity within the respective clusters of interaction. As Castelfranchi and Falcone rightly state, “trust is one of the pillars of society … no social exchange, alliance, cooperation … is possible without trust.”[30]

Moreover, trust leads to economic growth. For example, it has been suggested that a 15% increase in the fraction of those who believe other people are trustworthy in a nation results in a 1% increase per person in income for each year afterward.[31] Thus, the cognitive processes that establish values and expectancies and codify prior experiences to direct decision-making exert social effects that massively impact the conduct of economics and communal life, as Stanford’s Karen Cook has noted.[32]

What does all this imply?

7.7 Brain, Bias and Behavior: A Prudent Neuroscience of, and for, Economics

From an evolutionary-developmental neuroscientific view, the outstanding role of reason in human cognition, emotions, and social behavior comports well with a bio-psychosocial model of both individual and cultural cognitive capabilities and with decision-making relevant to the production, acquisition, distribution, and use of various ecological resources, that is, with economics. As a species, humans tend to augment existing biological capabilities and skills and compensate for those that are lacking. In this way, there is a benefit in the ability to engage particular cognitive capacities that obtain both individual resources and enable some form of stable social interactions.[33]

As Mercier and Sperber claim, it seems that reasoning is based upon a set of fundamental cognitive constructs and intuitions, in order to provide mechanisms

[29] Adolphs, R.: Trust in the Brain. In: Nature Neuroscience 5(3)(2002), pp. 8–9.

[30] Castelfranchi, C. and Falcone, R.: Principles of Trust, loc cit.

[31] Zak, P. J.: The Neuroeconomics of Trust, loc cit.

[32] Cook, K.: Cooperation Without Trust? New York: Russell Sage Foundation, 2007.

[33] Bugliarello, G.: The Biosoma paradigm and environmental engineering. In: Environmental engineering science 24(3)(2007), pp. 245–256.

with which to navigate through the nuances of an issue.[34] However, this does not indicate a lack of bias in cognition and action; rather, quite the opposite: it suggests that subjective cognitive and emotional perspectives operate in comparison, concert, and perhaps contest with the ideas and actions of others. Frequently, and economically, it is a case of “let the best biases win.”

This supports what is referred to as *Anselm’s Paradox*. Simply stated, humans believe in order to understand, rather than understand things in order to form beliefs about them.[35] The root of the paradox lies in the process of rationalization: despite apparent reasoning, humans remain wedded to fundamental beliefs that shape the way are engaged and employed (including beliefs about the power of reason itself). Decision-making is subject to emotional influence, and thus decisional reasoning processes tend to be “skewed” by resonance or dissonance to emotionally valent ideas or beliefs.

This may provide some relative survival benefit: having opinions and knowing likes and dislikes (based upon experience, or in some cases on what has been tutored) can serve to guide ways to intuit situations and make what is perceived to be “rational” decisions about what is held and valued to be good or bad. Such emotional flavoring of cognitive processes seems to be inherent to reasoning in order to work through problems in a variety of ecological and economic situations. Neuroscientist Antonio Damasio asserts that in many cases a “reduction in emotion may constitute an … irrational behavior.”[36] Therefore, any iteration of economics as a human endeavor would need some account of substrates, mechanisms, and effects of emotional influence upon the cognitive functions operative in decision-making processes relevant to ecological resources.

7.8 The Future of Neuroeconomics

As Christian Smith has claimed, human cognitions and actions are based upon and predicated by beliefs—including a belief in the capacity for, and solidity of reason.[37] However, reasoning as an individual and group process may often advance biases that can both initiate and be used to justify depriving resources form and more overt forms of aggression against those who do not share—or are the object of—particular biases. Thus, it is critical to develop a fuller and more finely-grained knowledge of the mechanisms and expressions of decision-making. Such insight

[34] Mercier, H. and Sperber, D.: Why do humans reason? Arguments for an argumentative theory. In: Behavioral and brain sciences 34 (2011), pp. 57–111.

[35] Giordano, J.: Neurotechnology as demiurgical force. In: J. Giordano (ed.): Neurotechnology: Premises, Potential, and Problems. Boca Raton, Florida: CRC Press 2012, pp. 1–14.

[36] Damasio, A.R.: The feeling of what happens: Body and emotion in the making of consciousness, New York, Mariner 2000.

[37] Smith, C.: Moral, believing animals: human personhood and culture. Oxford University Press 2003.

into the ways that humans perceive, recall, and relate to environmental experiences and interactions, establish expectations, and generate notions of good and bad all influence decision-making, and could thus be decisive for the future of neuroeconomics, as a discipline, and for economics as a set of activities and practices in general. Furthermore, the approach to understanding the neurobio-psychosocial basis of human interaction (with environments, resources, and species) should be an important focus of neuroethics, or what we have referred to as "neuro-ecology."[38]

Yet, here too, let us exercise prudence. While neuroscience, neuroeconomics, and neuroecology may be seen as a critical and pragmatic unity to sharpen the mirror with which to view human capabilities and limitations, it must be ensured that the methods employed—both to conduct such science and in its utilization as a social force—are rigorous and sound, and that they are not exclusive. Robin Horton has posited that both science and traditional beliefs, like for example myths, represent forms of theoretical thinking[39]; the scientific orientation differs only when embraced as an open culture that is aware of its own limitations and the presence and influence of other constructs and concepts. This fortifies the need for neuroethics in the "second tradition," namely, an assessment, articulation, and analysis of the ethical issues that transcend narrow limits and interests.

The most current instantiation of the tools engaged to enable and embellish biology, social interactions, and the ability to understand the world at large is science and technology, and like any tool, these too reflect "builders' bias" in the way they are developed and employed. Despite certain claims to the contrary, science—including neuroscience—is based upon a set of beliefs and is neither a value-free nor an unbiased culture. Its saving grace, however, is its methodology, which, when scrupulously applied and adhered to, dictates and enables particular controls for bias, and other threats to validity and reliability. Most importantly, good science is dialectical and presents reasoned perspectives with the aim of incurring arguments that function in the iterative refinement of ideas and concepts toward the achievement of (at least temporary) truths. Therefore, a neuroscientific understanding of reason that comports with an evolutionary bio-psychosocial view could contribute to gaining insights into human cognition, emotions, and actions—including those that have economic relevance and influence.

7.9 Conclusion

Might twenty-first-century neuroeconomics be looking back to the spirit of young Karl Marx? Neuroeconomics is an emerging field that employs neuroscientific and neurotechnological approaches to interdisciplinary socio-economic theory and

[38] Benedikter, R., Giordano, J., and Kohls, N.B.: Neuroscience and the Importance of Neurobioethics: A Reflection Upon Fritz Jahr, loc cit.

[39] Horton, R: African traditional thought and Western science. In: Journal of the International African Institute 37(1)(1967), pp. 50–71.

practice at the interplay of social and cultural innovation. Can its findings give a limited, but precise contribution to the renewal of contemporary economics in a neo-humanistic, more empathetic, and at the same time more realistic approach? And can this orientation offer a practical path toward realizing the ideals so eloquently stated by the young Karl Marx, as depicted at the beginning of this chapter?

In our view, neuroeconomics could become one factor among others in developing a more down-to-earth approach to human decision-making and resource engagement that maintains fundamental connections to the questions of the classical poses of anthropology to humanity and human culture. To some, the elements and approaches of current neuroeconomics may seem overtly naturalistic or even Darwinist, and to others, they may seem to be opposed to a sound humanism. Yet, the findings of the new natural sciences and their technologies cannot be ignored if inter-disciplinary economic theory is to advance.

To be sure, the natural sciences—and perhaps the neurosciences most specifically—are in the process of co-establishing a new, less illusory humanism that must reconcile its findings with the social sciences and the humanities. The advancements of the neurosciences do not reinforce a simple economic materialism as espoused in the late nineteenth and twentieth centuries but rather create opportunities for a richer, integrative systems' approach that recognizes and acknowledges the complexity of humans as bio-psychological organisms nested and vested within an environment that they influence and are affected by. In this way, economic theory must integrate objectivism and materialism with a newly developing insight into the importance of the neurobiological basis of the human mind.

In this sense, we believe that, a bit paradoxically, the work of the young Karl Marx might provide the emerging field of neuroeconomics some needed support—and direction—in its discussion of the "object" of the modern economy:

> The object cannot be seen as merely an 'object,' but it is a social product. As such it is not merely something which affects the 'thought' in my head or yours, but which is a link between us and everybody else … Let us suppose that we had carried out production as human beings. I would have been for you the *mediator* between you and the species, and the other person. ... and therefore would become recognized and felt by you yourself as a completion of your own essential nature and as a necessary part of yourself, and consequently would know myself to be confirmed both in your thought and your love.[40]

And Marx concludes:

> The chief defect of all previous materialism … is that things [*Gegenstände*], reality, sensuousness are conceived only in the form of the *object,* or of *contemplation*, but not as *sensuous human activity, practice* ... Hence, in contradistinction to materialism the *active* side was set forth abstractly by idealism—which, of course, does not know real, sensuous activity as such. This ... does not conceive human activity itself as *objective* activity. Hence (it) does not grasp the significance of 'practical-critical' activity. The materialist doctrine concerning the (economic) changing of circumstances and upbringing forgets that circum-

[40] K. Marx: Comments on James Mill's Elements of Political Economy (1844), loc cit.

> stances are changed by men and that the educator must himself be educated ... The coincidence of the changing of circumstances and of human activity or self-change [*Selbstveränderung*] can be conceived and rationally understood as *revolutionary practice.*[41]

There may not be a better description of, and direction for, the way that neuroeconomics may be experimental in the years ahead.[42]

[41] Marx, K.: Theses on Feuerbach (1845). Accessed at The Marx-Engels Internet Archive, http://www.marxists.org/archive/marx/works/1845/theses/index.htm

[42] This chapter is a reworked version of an earlier article published by Roland Benedikter, James Giordano and Nadia Flores.

Chapter 8
Neuro*anthropology*: Toward a "Posthuman" Technological Self?

Abstract Many observers are convinced that given that neurotechnology is changing the traditional self-image of human beings throughout very different societies, it might ultimately induce a "posthuman" technological self that will be the new normal. This chapter explains what neuroanthropology is and how it is changing our perception of ourselves.

Keywords Neuroanthropology · Self-image of the human being · Concepts of being human

Neuroanthropology addresses the self-image of the human being in the age of neurotechnology, human enhancement and "transhumanism." In a book on the recent emergence of a first truly global biotechnological civilization, Tamar Sharon rightly described the state of things as follows:

> New biotechnologies have propelled the question of what it means to be human—or post-human—to the forefront of societal and scientific consideration. (But) the main approaches in the current debate on posthumanism ... do not adequately address the question of what it means to be human in an age of biotechnology. Not because they belong to rival political camps, but because they are grounded in a humanist ontology that presupposes a radical separation between human subjects and technological objects. Key issues range from human enhancement to eugenics, to new configurations of biopower, questioning what role technology plays in defining the boundaries of the human, the subject and nature for each ... In this framework, technology is neither a neutral tool nor a force that alienates humanity from itself, but something that is always already part of the experience of being human, and subjectivity is viewed as an emergent property that is constantly being shaped and transformed by its engagements with biotechnologies.[1]

In the present moment of broad and deep-reaching civilizational and cultural transition, one question seems to become the center of most other societal and

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[1] Sharon, T.: Human Nature in an Age of Biotechnology, Springer New York 2014.

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socio-political questions. Will the basic self-perception of the human being as we know it change under the influence of the new neurotechnologies that are connecting brains and machines for daily use, and under the impact of their accompanying ideologies like "human enhancement" and "transhumanism"? And if yes, to which extent?

There is no doubt that applied consciousness research, and with it the investigation about the nature of the human being, is currently rather one-sidedly understood as empirical brain research. It is carried out mainly by the natural sciences under the growing influence of the "economic-technological complex" and its legitimate, but relatively narrow interests. With its sometimes radical, paradigmatic materialism determining the cultural spread of its temporary findings, it is in the process of modifying our imagination about what a human being is, what his rational self-determination can be, and how a "good society" can and should work. What is at stake with the change related to the findings of the new brain–machine technologies is not only the principal socio-philosophical and socio-political status of the human "self" or "I" but also closely related—and in many cases directly dependent—concepts such as humanism, enlightenment,[2] open society, individualism, freedom of will and choice, equality, and rationality.

Thus, neuroscience and neurotechnology together with their accompanying "neurophilosophies" are currently profoundly influencing the very basics of our cultural self-understanding, grown over centuries. What will be the implications of this development within the greater picture of the current "global mindset change" driven forward by the rise of biotechnology to a key player in all and every sector of globalized society[3]?

8.1 Humanism and Modernity

The origin of the self-image of the (Western) human being proceeds from the historical interweave between Humanism and Modernity. By definition, modernity, though strongly reliant on technology from its beginnings, has conceived itself as a humanistic worldview. From the intuitions of societal balance and differentiation expressed in the American Constitution and the French Revolution to the ultra-liberal "postmodern" societal blueprints of radical diversity, gender emancipation, and multicultural freedom, the very concept of open societies has always been built around a core concept of the human being. This concept has changed over time, initially focusing upon a "human measure" mirrored in the self-centered confidence

[2] Benedikter, R.: The Enlightenment. In: M. Juergensmeyer and H. K. Anheier (eds.): The SAGE Encyclopaedia Of Global Studies. SAGE Publishers London and Thousand Oaks 2012, Volume 1, pp. 484–488.

[3] Benedikter, R., Giordano, J., and Fitzgerald, K.: The Future of the (Self-)Image of the Human Being in the Age of Transhumanism, Neurotechnology and Global Transition. In: Futures, The Journal for Policy, Planning and Futures Studies 42 (2010), pp. 1102–1109.

of the "new equal" of the second half of the eighteenth century, transforming into the proud and self-assured national "citizen" of the nineteenth century and eventually becoming the "positive fragmentated de-centered subject" of the post-industrial late twentieth century.

Despite these changes, modernity has always kept a certain continuity and a relatively stable center of gravity. Commonly considered as "humanism," the continuing lead concept of Western modernity affirmed: "the dignity and worth of all people, based on the ability to determine right and wrong by appealing to universal human qualities, particularly rationality … It endorse(d) universal morality based on the commonality of the human condition, suggesting that solutions to human social and cultural problems cannot be parochial."[4]

Rather, solutions must be found within the individual, relying upon his or her own capabilities of analysis, self-observation, self-critique, and dialectical correction of earlier decisions to forge a new decisional awareness and ability that must continuously be renewed. This insight in the self-reliance of consciousness and freedom of will is on a (synthetically) higher level than the changing everyday decisions and, in principle, tends to strive for some capacity of self-determined intersubjective expression and orientation toward the common good.

The resulting overall mindset is the core strength at the heart of global success, if not the predominance of Western liberal and capitalistic democracy which would never have been possible without it. The political and economic success thus relied in its center on the liberal, enlightened, and humanistic mindset and ultimately on the underlying image of the human being as a free and self-determined spirit able to master his or her physical and social reality. The respective conviction was also the modern embodiment of core traits of the traditional Christian religion, which in many ways resulted compatible with it, as even secular thinkers like Jürgen Habermas have pointed out.[5]

In other words, modern humanism has invested significant effort on working toward a rational self-awareness of the universal "logos" in its individualized form, stating that the "essence" of the human being must be seen in the unity of the subjective (individual) with the objective (universal) "logos"—that is, in the participation of subjective awareness and consciousness in objective knowledge and "being."

These two dimensions of "logos" (or principal order structure of the known world, as far as it has become conscious of itself within a self-aware consciousness and thus can be articulated and discussed) constitute an ontological unity that at its core can be regarded as the "human being." This is because the "human being" is the only known "place" in the world where both subjectivity and objectivity meet and merge; thus, the human being enjoys a privileged status compared with all other sentient beings based on the fact that it is conscious of itself. It is both "free" to act following its own insight due to the unchanging nature of its mental or subjective

[4] Humanism. In: Compact Oxford English Dictionary, Oxford University Press 2007.

[5] Calhoun, C. et al. (eds): Habermas and Religion, Wiley and Sons 2013.

“logos” and at the same time “un-free” as it must fully submit to the universal laws of material and biological change, that is, the universal or objective “logos.”

That is why epochal thinkers of modernity like Johann Wolfgang von Goethe held that freedom and necessity are one and the same, because they belong together, and the place where they meet in consciousness is the human being. Thus, the human being in essence is less the observer of the “world process” but rather its main expression—both in the form of a tragedy and, simultaneously, a game (as Goethe’s friend and colleague Friedrich Schiller put it).

8.2 The Human Being: Where Freedom and Bondage Merge

The exact place where freedom and bondage or self and body (or, put in more current terms, mind and brain) merge is the “self” or the “I.” It must thus be the essence of being human and at the same time the interface at the center of “everything.” The perpetual tension between freedom and bondage and the simultaneous self-awareness of this struggle instantiate the human being as truly “tragic” in the lyric sense and at the same time incline it to the “unbearable lightness of being” experienced as a game, where the lifespan is about “everything” and “nothing” at the same time and where life is presence as well as dream simultaneously. The combination of both these dimensions in a unique, different, and unrepeatable way for every individual imparts a special dignity. This dignity lies in the fact that the “self” or the “I” is the embodiment of an unreproducible process of awareness as experience in an ultimate solitude because the self (or “I-ness”) is *per naturam* defined to be the “not-other.”[6]

The “I” is thus (a) an iterative process of disruption and integration, in which individual and social effects and values are continuously born and perish, and (b) unique in its “self-ness.”

In this way, every individual according to modernity must enjoy a “proto-sacred” status of inviolability and mutual respect, “untouchable,” as a unitary “event” and therefore of value in and of itself.

Because of this basic image of the “essence” of the human being, the core characteristic of the individual for modernity is the unity of the objective and the subjective world as “embodied” in the primary capacity of self-determined rationality. Derivative of this view was an emphasis on the superiority of mind over matter and of the self-conscious “spirit” over the biological body which characterized the enlightenment and humanism. “*Materia principium individuationis*” became the primary motto that guided modernity from the eighteenth to the twentieth century. The material world was seen mainly as a tool to be manipulated by the hands of the “logical” mind of a human individual.

[6] Derrida, J.: *Monolinguism of the Other*, Stanford University Press 1998.

In such a view, history or the "world process" (G. W. F. Hegel) itself can be seen as a continuous striving for increased self-consciousness. Through the process of achieving and improving individual self-awareness and self-determination, the subject not only increases societal and technological progress but sharpens the universal "logos," being the latter part of the "logical" structure (or principal functioning) of the subjective mind. The universal "logos" is thus brought to a greater understanding of itself through the self-awareness of the individual.

In this way, the transcendental is seen by classical modernity as manifesting a certain unity with the life and the will of the individual. A "transcendental secularism" resulted which formed the main worldview of the primary phases of modernity. In this worldview, technological progress and humanism are not divided but form a single identity, and that was described by Hegel and later Marx and the Neo-Kantians as "societal morality" or "ethics" (*Sittlichkeit*) of modern life.

8.3 A Far-Reaching Concept: Birthplace of Social Order

This concept of the "essence" of the human being constituted a cultural and civilizational self-perception that gave rise to paradigms and organizational patterns of social structuring. The "humanistic" self-perception of the human being in classical modernity constituted, to a remarkable extent, a common ground for the very diverse (i.e., partly competing, partly mutual) efforts of emancipation in European–Western culture. It successfully built commonalities capable of bridging the rifts that existed within and between modern movements throughout the last three centuries of development and struggle.

From a current perspective, the "modern" concept of the "essence" of the human being was decisively tied to ideas that originated in the Renaissance and antiquarian Greece and Rome. It fostered a self-perception of the human being (and humanity as a whole) that accompanied the development of modernity through the eighteenth, nineteenth, and twentieth centuries and accounted for (if not upheld) most of their inherent dialectics, contradictions, and implicit and explicit oppositions. Ultimately, the "humanistic" self-concept of the human being established the groundwork for what has been achieved during the past three centuries by European–Western Modernity in the name of freedom, equality, and individualism and for the representation of societal pluralism and libertarianism. This conception is historically valid in at least five ways:

1. The "humanistic" concept of the human being gave defenders of open societies the idea of an ultimate, untouchable value of the individual. It augmented the inalienable worth of responsible self-guidance in society, providing both the *inner* (moral) and the *outer* (cultural and political) compass to overcome repeated challenges brought forward by anti-modern forces.
2. Following World War II, the humanistic concept of personhood and individuality became the foundation for the declaration of "universal human rights" by the

United Nations in 1948. This subsequently led to the search for a transcultural "global humanism" by new, non-governmental political movements and recently by the international civil society.

3. Enlightened humanism served as inspiration for the institutionalization of the modern welfare states and, more generally, of structured social solidarity and "secular justice" particularly in the European hemisphere, but to another extent also in the Anglo-American world.
4. It embodied an enduring ideal of "moderate" progress to reconcile (justify and temper) technological and material progress with social and individual advancement, and it did so within both the conservative and the liberal stripes, decisively inspiring both the concepts and political realities of social democracy (left) and social market economy (right).
5. The humanistic self-image of the human being served, albeit in an indirect and sometimes "negative" manner (cf. the movements of "historical anthropology" and then of "negative anthropology" closely connected to the paradigmatic patterns of "postmodernism" since the 1970s[7]) as a conceptual tool to argue against "science and technology as ideology"[8] (Jürgen Habermas).

That humanistic image continued to serve as a corrective force acting upon the stage of developed or "mature" (post-monistic and thus post-naïve) modernity in the face of de-nationalization, cultural and social disintegration, globalization, and increasing pluralism throughout the 1980s, 1990s, and 2000s.

In sum, from the viewpoint of a contemporarily informed history of ideas, there can be no doubt that a sort of "guiding image" of the human being, closely connected with an image of what a "good life" and a "good society" could be, was always at the center of modernity. It acted to legitimize individual self-empowerment behind the curtains of collective societal and political events, and it was crucial in both keeping the ideals that were determined to build a "rational civilization" alive—and in keeping those ideals "open" within themselves (Karl Popper). *Modernity as concept of rational progress and the self-concept of the human being as "humanistic" were inseparable.* They formed a constitutive unity at the center of the enlightened, progressive open societies of European–Western civilization from their beginnings until today.

8.4 The Dawn of "Posthumanism" in Mature Modernity

If we accept all this to be the case, then it becomes clear that today we are facing an all-encompassing change in the fundamental structure of modernity through the hands of neuroscience and neurotechnology, as well as its multiple applications and

[7] Augé, M.: An Anthropology for Contemporaneous Worlds, Stanford University Press 1999.

[8] Habermas, J.: Technology and Science as "Ideology": In: J. Habermas: Toward A Rational Society, Beacon Press 1971, pp. 81ff.

side developments. This change is yoked to far-reaching shifts in worldviews regarding the “essence” of the human being. That is because we are witnessing that the “humanistic” core paradigm as the embodiment of both monistic and “mature” stages of modernity is increasingly challenged by information gained from and applications of new neuro- and biotechnologies. The influence of these endeavors on the cultural paradigm of the European–Western civilization cannot be underestimated because their accompanying philosophies are changing the fundamental self-concept of what it means to be human, if not the notion of “beings” more broadly. Therefore, neuroscience and neuroethics, because directly related to the center of self-awareness, self-reliance, and consciousness: the brain, possess and will likely yield considerable power to existing societal ideals in the coming years.

On the most basic level, their potentially outstanding impact on human futures is because they are questioning, or more accurately threatening the primacy of “mind over matter” worldviews. On the contrary, the new neural sciences, including biophysical brain research, consciousness studies, and the technologies that arise from these endeavors like brain–computer interfaces and human–machine interfaces are asserting that what has been called the self-aware mind is causally derived from the function of the brain as a biological entity, and thus not a primary cause, but a secondary effect. The “self” and the “I” become issues of debate and contention, not only in their diverse appearances and cultural variations but also in their framing within biological, psychological, and social contexts.

This in turn frames certain humanistic ideas within “folk” constructs and counters social and political idealism. That situation forces re-consideration of (a) the extent to which “I” think and make decisions versus “the brain” thinks and makes decisions and (b) whether the self-aware decision of an “I” is a primordial cause or just the secondary reflection of what has been already decided by biological and physiological necessities that, according to parts of current empirical brain research, function in an “autopoietic” way independently of the subject.

Much of the previously held “humanistic” worldview and its special status for humans and their “dignity” have reached the stage of maturity, only to get re-assessed by brain research and neurotechnology, in the face of strong counter-currents defending humanism. As neuroscientist Antonio Damasio has provocatively noted, perhaps Descartes has made a fundamental error stating that “I think, therefore I am.” From the view of strictly physiological brain research, it may well be that “I think only because (and after) I am.” Or more precisely, as Damasio puts it: “the brain thinks only because it is.”[9]

The result of the modification of the self-concept of the human being is the dawn of “posthumanism.” Under the influence of the neurosciences and neurotechnology, it, namely, takes on the form of a new ideology called “transhumanism”: the wish and active effort to overcome the human being so far known through its fusion with technology, in particular, by the fusion of the human brain with computers and machines and ultimately the transformation of the human being into a

[9] Damasio, A.: Descartes’ Error: Emotion, Reason, and the Human Brain, New York, Putnam, 1994.

"superhuman" or cyborg,[10] perhaps with the help of technological "superintelligence."[11] According to transhumanism, the human being should and must become something else than it is, both in its physical constituency and in its guiding self-concept: it must become "transhuman," thus leaving the human (and humanistic) phase of its history behind.

Is contemporary neuroscience, fueled by rapid and robust advances in neuro- and biotechnology, thus bringing three hundred years of societal humanism to an end? Many observers believe that this trend could portend the demise of confessional religion, civil religion, and "spirituality" and that open societies may change into a "posthuman" stage of yet unknown dimensions based on more competition, greater social inequality, and less solidarity. And some influential commentators determined to defend humanism, rationality, and enlightenment as the beacon of the free world like Francis Fukuyama stated that the potential shift from humanism to "posthumanism" could result to be the most dangerous development in the world of the twenty-first century, more deep-reaching than any political, economic, or social development.[12] Others though believe that this new era may be necessary, at least to a certain extent, to impart a new level of human consciousness.[13]

8.5 "Post-Mature" Modernity and Transhumanism

Irrespective of the trajectory or potential result, what is clear is that Western civilization appears to have come to a crucial point of anthropological, social, and scientific awareness, where the intertwining of ideas, self-criticism, self-revision, and directed potential become palpable and, perhaps for the first time in recent history, realistic. Today, we face the end of modernity and even of "mature modernity" and are currently potentially entering the stage of what we could call, in the absence of a better term, "post-mature modernity."

This word suggests a certain ambiguity. "Post-mature" can mean "beyond maturity," suggesting that something is already over-mature and over-due for change. Yet, at the same time, "post-mature" does not necessarily include "maturity" anymore; instead, it could connote a new irrationalism, laden with paradigmatic and societal imbalances of unknown proportions.

Since the eighteenth century, there has been little doubt that the future of open societies and social morality depends upon some "essential" concept of the human being. Hence, this question then arises: In light of these new developments, how

[10] Warwick, K.: I, Cyborg. The University of Reading, http://www.kevinwarwick.com/icyborg.htm

[11] Bostrom, N.: Superintelligence. Paths, Dangers, Strategies, Oxford University Press 2014.

[12] Fukyama, F.: Our Posthuman Future: Consequences of the Biotechnology Revolution, Farrar Straus & Giroux 2002.

[13] Cf. the contributions collected in R. Benedikter (ed.): Italienische Technikphilosophie für das 21. Jahrhundert (Italian Philosophy of Technology for the twenty-first Century). Frommann Holzboog Verlag, Stuttgart 2002.

will the human being conceptualize itself and its society, in the decades to come? At the center of that question lies an even more crucial inquiry: What will be the future of the self-image of the human being—and hence of being human—in the age of neurotechnology, transhumanism, and global transition?

It can be assumed that rarely has a question been of more importance in the history (and possible future) of modernity as we know it. As it seems, this question addresses a new level of complexity within a modernity poised to transform itself and emerge from its current cocoon. The question of what is the "essence" of the human being is becoming a new catechism of our age, paradoxically because of the increasing influence of transhumanism, and it increasingly lies at the center of most other fields of action, including politics, economics, technology, science, medicine, culture, and religion. Each and all of these fields are becoming increasingly dependent on this central question about how humans are going to conceive themselves—and thus in many ways, the geno- and neuro-centric approaches (i.e., socio-behavioral genetics, neurogenomics, etc.) which each bespeak the applied issues raised and contested within the debates regarding "self," "I," and intentionality.

But to what extent is this the case? Is it really that important? Or is it in the end just a side-stream of contemporary socio-political development?

8.6 Has the Human Genome Project Caused an Epistemic Crisis?

To make the potentially epochal turn somewhat clearer, let us take a closer look at a concrete case study. Let us try to understand the meaning of the alleged current mindset change, and the resulting implications by revisiting one of the biggest and most influential scientific-industrial projects in recent history, the Human Genome Project (HGP). The HGP has in many ways served as an example of what could similarly happen with the impact of neuroscience and neurotechnology in the coming years.

The HGP (1990–2003) has been the largest single investigation of the "natural" (bio-physical) dimensions of the human being in history. It concentrated every effort to explore the "material" basis of human existence, in the specific case of the role of the gene in the nature of human "identity."

Concomitantly, applications of genetic research in neuroscience, coupled with major advances in computational technology, spawned significant developments in consciousness studies. That combination yielded a forum for renewed engagement of philosophy, science, and even such remote areas like aesthetics and theology. This almost inevitably narrowed the non-material dimensions of "being" that were the concerns of traditional and mature modernity, in anticipating implicit or explicit "solutions" to the mind–body problem to eventually get to "post-mature" modernity. The pendulum of progress had swung, and the concatenation of scientific, technological, and social forces had (at least inter-theoretically) reduced "humanism" to a new "physical monism."

This monism is currently influencing the concept and the self-perception of the human being and its society much more than is casually (and mediationally) perceived. It is altering the bases of the present societal consensus because it is changing the core of the leading cultural paradigms of our epoch. Even if only viewed as scientific and technological enterprises, neuroscience thus becomes ideological, philosophical, and cultural forces writ large. In reality, these sciences became the explicit *epistemic* endeavor of cultural (and perhaps civilizational) centerpiece value. This is currently evolving within the nuances and depths of contemporary society, and it will probably unfold its full cultural and paradigmatic power only in the years to come, after an incubation phase of several decades.

It is thus interesting that the progress in biotechnology and genetics has been readily applied to neuroscience, leading to discoveries, inventions, and possibilities, for example, neuroprosthetics, xenografts of neural tissue, human–machine interfaces for augmented cognition, "designer" psychotherapeutic agents, human–animal neurochimeras, and so on. All of these may modify our understanding of consciousness, the "self," non-human (i.e., animal and machine) "others," and the nature of being as such.

8.7 The Present "Technologic Turn"

This consciousness-related science of the "third generation" and its ideological implications take center stage. The crucial point of all these issues is that ethical aspects, questions, and problems of neuroscience, neurotechnology, and biotechnology are no longer "siloed" within each of these disciplines, but have become germane to all. In light of this, the terms "neuroethics," "neurotechnology ethics," or "human enhancement ethics" might be considered subsets of a larger intellectual domain that seeks to identify and analyze the extant and predicted gaps in knowledge, margins of uncertainty, and the ethical, legal, and social issues that arise in, and from research at "frontier" areas of science that have the capacity to affect the future of humanity. In many ways, these terms reveal indeed a potentially new worldview that acknowledges that we are facing what Thomas S. Kuhn called an "epistemic crisis": a time of change based upon a mass effect of new knowledge.[14]

The technological advances that have driven much of the recent inquiry into consciousness indeed have progressed with ardent strides in at least *three* generations of development. These are as follows:

1. The first "industrial-scientific" enterprise of the modern age: the atomic bomb project of the 1930s and 1940s transformed science (a) from an inquiry into an

[14] Kuhn, T. S.: The Structure of Scientific Revolutions, University of Chicago Press, third edition, December 5, 1996.

industry, (b) from a rather protected, elitist and private occupation into a public and political business, (c) into an endeavor capable of both tremendous harm as well as good.
2. The impact of "neo-liberalism" (which despite the name was in the strict sense not a liberal, but rather a radical concept of economics) on the idea of science increased the merging of technology, science, and business to the point of mutual identification, as manifest in an exemplary way in today's neurotechnology.
3. The new religious threats against rationalistic and self-critical science that derived from fundamentalist streams within the global "renaissance of religion" since the fall of the Berlin Wall (1989) and the collapse of Communism (1991) in turn de facto strengthened a decisive secularist, "value free" idealization of science throughout much of European–Western society.

The theological, albeit in part dogmatic struggle ideology of some of these fundamentalist groups regarding the nature of human consciousness and its study, became a much-publicized rift, which had its subconscious impact on Western mass culture strengthening secularism and materialism.

8.8 Neuroscience and the Unfinished Project of Modernity

To a certain extent, many phenomena which increased the social influence of the natural sciences have been due to the fact that as so often during the "unfinished project of modernity"[15] (Jürgen Habermas), the philosophical premises and ethical frameworks that guide the use of advancing technology and the conduct of socially contentious areas of research have once again lagged behind.

In recognition of this, neuroethics is being employed to prioritize the ethical, legal, and social issues. Such inquiry has taken us to the boundaries of what is known, what is unknown, and what may be unknowable. The tenuousness of these boundary conditions mandates careful reflection upon the trajectories that might result from the use or non-use of new technologies, techniques, and knowledge.

Research fuels and sustains this knowledge and should provide an understanding of which techniques and technologies work, which don't, and why. Obviously, scientific research—and the policies that dictate its scope, tenor, and uses in the public sphere—do not occur in a social vacuum, and thus, the direction and conduct of both are susceptible to particular socio-cultural and temporal values and biases. Given that science can never be truly "value-free," it is incumbent upon scientists (and the users of scientific knowledge and enactors of public policy) to recognize this potential for value-ladeness, and respond with self-criticism, self-revision, and self-control. This is the meaning of the task to continue the project of modernity—not to "fulfill" it, as it must remain by its very nature open and "unfulfilled" to

[15] Benhabib, S. et al.: Habermas and the unfinished project of modernity: Critical essays on the philosophical discourse of modernity, Polity Press 1996.

dedicate itself to progress, but to remain in accordance with its guiding principles deriving from its basic image of the human being.

Nevertheless, determining which neurotechnologies to develop and use, and which to avoid can be a problem of excessive choice, as much of the practical and intellectual landscape of modern society has been shaped by technological advances. In general, this has yielded a net effect that has tended to reinforce the claim that technology is progress. The industrial revolutions within modernity gave rise to incentives to develop machines to ease and improve the quality of life. By the end of the twentieth century, this had led to considerable social technophilism and technocentricism.

Given these facts, it would be counter-intuitive, if not pragmatically and ethically unsound to ignore or refute the benefits of technology in numerous domains of society. But to balance that reality, we need to consider philosopher Hans Jonas' reckoning that in modern society, technology has become a process and a worldview on its own.[16] Taken together, these factors cumulatively contribute to what Hans Lenk has called "the technological imperative,"[17] namely, the notion that "if we can build it, we will, and if we build it we must use it," and the problems that such thinking and actions incur.

Is it possible to speak of "generalizations" with regard to the human being in this moment of transition? To this point, we have described the current change in the core concept of modernity arising from the neuroscientific and neurotechnological revision of the "humanistic" concept of what a human being is. We have also identified attempts toward an effort not to fall into simplifying, anti-technological hysteria, but to carefully ponder the deep, constitutive ambiguities of the present and potentially future situations.

If we try to bring both dimensions together, we must ask what at the present moment can be said about the future of the human being and its ecology as we stand poised at the emerging new frontier of technology, science, and society. Can something be claimed about our conduct and future given our present stage of transition into a potentially new paradigm, not knowing whether the ontological concepts and constructs of the human being will ever be the same again?

It could be premature—philosophically, politically, and scientifically—to discuss perspectives arising from this new dawn of understanding, and the change(s) in the self-image of the human being that could evolve out of neuroscientific research and the use of neurotechnology. Perhaps at present, we can and should speak only in generalizations, or, as Thomas Fararo put it, in "stratified images as idealizations of typological value,"[18] trying to place some very first (and insecure) cornerstones of an inclusive theory that accounts for the speed and direction of progress—even if any such theory must remain, at least for now, solely descriptive and thus a heuristic

[16] Jonas, H.: Technology and Responsibility: Reflections on the new task of Ethics. In: M Winston and R. Edelbach (eds.): Society, Ethics and Technology, Boston 2006, pp. 116ff.

[17] Lenk, H.: Notes on extended responsibility and increased technological power. In: P. T. Durbin and F. Rapp (eds): Philosophy and Technology. Dordrecht, Reidel, 1983, pp. 195–210.

[18] Fararo, T. S.: Generating Images of Stratification: A Formal Theory, Springer New York 2003.

rather than an analytic exercise.[19] Maybe, the price to pay for engaging in the risky endeavor of understanding the present and its potential is to be relegated to only summarizing what is already known, and maybe, today it is only possible to grasp the meaning and implications of what are "partial truths" with regard to the past decade of neuroscientific and biotechnological progress.

8.9 At the Boundaries

A number of observations about transhumanistic and posthuman trajectories of neuroscience and neuroethics can be made with confidence.

First, the same biotechnological progress that has allowed considerable insight into nature has also afforded means and capabilities to access, if not manipulate the natural world. Second, these technologies have afforded scientific advancements that have changed much of the "philosophy of the mind" ("Philosophie des Geistes": Hegel, Searle[20]) in repeated waves, so that a certain level of change is not totally new to the existing paradigm.

The difference to the present is that the new, body- and brain-penetrative technological options of neuroscience and neurotechnology may raise principal questions about the validity of human/non-human differences as "natural" distinctions and generate profound ontological, practical, and moral re-assessment of the notion of the self and the other. Biotechnologically blended boundaries between human and non-human (animal and machine) beings question the future of the human body and thus of classical aesthetics until today strongly reliant on the view of ancient Greek culture on human proportions.

In this context, Donna Haraway invites us to consider the implications arising from "species in collision" and speculates upon utopian and dystopian possibilities that progressive technological imperatives could foster.[21] Haraway, Bruce Clarke, and others warn that the self/other distinction of human/non-human relatedness may be the focus of increasing scrutiny, as (a) neurotechnology provides means to evaluate finer degrees of distinction previously maintained by categories of species; (b) neuroscience reveals structural and functional similarities of multiple dimensions of physiology (including neural function and capacity); and (c) the synergy of neuroscience and neurotechnology affords capability if not likelihood to create human/non-human chimeras.

[19] Benedikter. R.: Global Systemic Shift. A Multidimensional Approach to Understand the Present Phase of Globalization. In: New Global Studies 7(1)(2013), pp. 1–15, https://www.degruyter.com/document/doi/10.1515/ngs-2012-005/html. Cf. Benedikter, R.: Global Systemic Shift. The "Three Ends" of our Epoch and their Perspective in the Interplay between the four system spheres Economics, Politics, Culture and Religion. May 2007 Lecture at the Future of Humanity Institute, Oxford University: http://www.fhi.ox.ac.uk/events/roland%20benedikter%20abstract.pdf

[20] Searle, J.: Intentionality: An Essay in the Philosophy of Mind, Cambridge University Press 1983.

[21] Haraway, D.: When Species Meet, University of Minnesota Press 2008.

The respective research to produce such chimeras was given an official green light by the UK government in May 2008 with the "Human Fertilisation Embryology Act" which "legalised the creation of a variety of hybrids, including an animal egg fertilised by a human sperm; 'cybrids,' in which a human nucleus is implanted into an animal cell; and 'chimeras', in which human cells are mixed with animal embryos."[22] At least 150 such chimeras were produced by 2011, most of them secretly: "Scientists have created more than 150 human-animal hybrid embryos in British laboratories. The hybrids have been produced secretively over the past years by researchers looking into possible cures for a wide range of diseases. The revelation comes just a day after a committee of scientists warned of a nightmare 'Planet of the Apes' scenario in which work on human-animal creations goes too far."[23]

Although not at the forefront of such experiments, neuroscience and neurotechnology are one experimental sector involved. Given that attributes of self-identification are important for individuals' construct of and attitudes toward others, it becomes important to consider what effect "blending the boundaries" of human/non-human beings will have on these values and behaviors.

At present, there is a building body of interpretative patterns or "founded assumptions" from neuroscience to support that cognitive processes and capabilities may be relatively similar in humans and certain non-human species. This has fortified the philosophical claim that we cannot know what it is like to be "an other" (human or otherwise) and therefore should be cautious (if not adopt some formal, precautionary principles) in our actions and treatments. It may be that differences in important domains of structure, function, and being are a matter of degree and, in this way, are to a certain degree arbitrary. Might this extend beyond the organic, to the synthetic?

And even if these are, at the present moment, only speculative assumptions or heuristic ideas, what of the possibilities that may arise in what Fukuyama has posed as the civilizational threat toward a posthuman future?

If we heed Haraway's projection that bio- and neurotechnology will dissolve the biological boundaries between humans and non-humans either by allowing some insight into consciousness or by creating human/non-human chimeric organisms, then we must ask such questions as these:

What meaning do self/other, human/non-human distinctions have, and how will they be handled in the future? This is as much an anthropological as a biological and political issue that will give birth to fierce ideological fights.

Furthermore, how should we respond to the new insights into the self/other binary? In many ways, this raises the Socratic question of where we are coming from and where we are going and directs this inquiry on scientific, social, and spiritual levels.

[22] Martin, D. and Caldwell, S.: 150 human animal hybrids grown in UK labs: Embryos have been produced secretively for the past three years. In: Daily Mail London (22 July 2011), http://www.dailymail.co.uk/sciencetech/article-2017818/Embryos-involving-genes-animals-mixed-humans-produced-secretively-past-years.html

[23] Ibid.

Optimistically seen (and this is also arbitrary), a bio- and neurotechnologically-enabled transhuman or posthuman future might lead to what Michel has termed "blurred boundaries … with natural entities … constructed in terms of mutuality with nature and other organisms."[24] Hawkins believes that such fluid identities "might help us find better ways of living within ecosystems … that respectfully acknowledge our continuity … with other inhabitants."[25] Of course, it is possible that the dissolution of human/non-human borders may be important in developing and sustaining a more meaningful ecological communitarianism, which would support and enable what Kalof sees as "new … forms of shared survival."[26]

Yet, each of these claims is based upon an idealized assumption that bio- and neurotechnology in conjunction with bio- and neuroscience will not only dissolve borders of distinction but will also dispel relational asymmetries between human and non-human selves and others. Anna Peterson envisions this to be a "radical alternative to the individualism of dominant Western anthropology," adding that such "a relational view of selfhood provides strong philosophical basis for reducing consumption, species extinction … and other damaging practices."[27]

But will it? Most transhumanists base their pleas in favor of "overcoming" the present human being on similar arguments.[28] But lest we be lured into the naturalistic fallacy, it is vital to remember that biotechnological applications will be enacted and engaged within a sociocultural milieu and in the framework of a guiding ideology or "overall lead paradigm," and if the appeal to appreciate the past and present so as to realistically consider the future is to be used as a Socratic lesson, then how wise is it to believe that the bio- and neurotechnological trajectories will confer distinctly different values than those that currently dominate technological societies?

In other words, while we can posit that neuro- and biotechnology *ought* to give rise to a broadened worldview, it would be wise to heed the reality of *what is*, and ask whether technological innovations and developments have significant purpose to alter such social trends and tendencies.

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[24] Michel, S.: Golden eagles and the environmental politics of care. In: J. Wolch and J. Emel (eds.), Animal Geographies: Place, Politics and Identity in the Nature-Culture Borderlands, Verso New York 1998, pp. 162–183.

[25] Hawkins, R. Z.: Ecofeminism and Nonhumans: Continuity, Difference, Dualism, and Domination. Hypatia 13 (1998), pp. 158–197.

[26] Kalof, L.: The human self and the animal other. In: S. D. Clayton and S. Opotow (eds.): Identity and the Natural Environment: The Psychological Significance of Nature, MIT Press, Cambridge 2003.

[27] Peterson, A. L.: Being Human: Ethics, Environment, and Our Place in the World, University of California Press, Berkeley 2001.

[28] Bostrom, N.: The Future of Humanity. In: J.-K. Berg Olsen, E. Selinger and S. Riis (eds): New Waves in Philosophy of Technology, New York: Palgrave McMillan 2009, http://www.nickbostrom.com/papers/future.pdf

8.10 The Fallacies of Futuristic Prognoses

It is noteworthy that many futuristic prognoses about technology have been criticized for misestimating the effect of social constructs and values, and the effects of the market system that has been advanced by technology. Initial industrial incentives for time efficiency were intended to ease the human condition, and in many ways, this has been the case. However, the pervasiveness of the market wedded technological time- and cost-efficiency to goals of increasing economic gains with minimal loss of fiscal, physical, and temporal resources has come to define much of the use of technology according to an ethic of profit.

Neuro- and biosciences are no exception. Far too often, the market-model mindset, business ethic, and ethos dictate what and how technologies are studied, developed, marketed, and utilized. These market forces can be both economically and politically driven, and as a result, the value of research to define the benefits, burdens, and harms of neuro- and biotechnologies is lessened. This can produce different effects. It can.

1. "Sidestep" the discriminative, intellectual integrity of science,
2. Advance particular scientific findings and agendas,
3. Subvert knowledge, and thereby.
4. Compromise, if not denigrate the humanitarian and fiduciary aspects of science.

8.11 BioSoMa, *Homo Faber*, and New Neurotechnological Imperatives

We believe that it is critical to redefine Hans Lenk's notion of the "technologic imperative" so as not to merely develop and use technology, but to understand how such technology could best be used to achieve social good.[29] Rather than becoming bound by the inherent tendency for progress, which in the post-industrial age translates into technophilism, this new imperative must acknowledge and comport with a rational understanding of how our biology gives rise to, and is affected by the intersecting artifacts of society and machination, what is referred to as BioSoMa, so as to heed the classical invocation of modern thought that we embrace our strivings as *Homo faber* to provide a stable world in which humanity in its intellectual and moral virtue can develop and thrive, rather than being enslaved by labor and its artifacts, as *animal laborans*. In many ways, the economic priorities of the post-industrial age and the new technocracies have oppugned the pursuit of higher ends as proper moral and practical concerns.

[29] Lenk, H.: Technokratie als Ideologie. Sozialphilosophische Beiträge zu einem Politischen Dilemma, Kohlhammer, Stuttgart 1973.

Granted, *Homo faber* also produces the artifactual, creating a world distinct from nature by shaping and transforming it according to the needs, desires, and plans of humans. However, it is the intellectual recognition of artifacts as the product of labor, and the moral regard that is focused both upon the activities and artifacts, that upholds the construct of *homo prudentia*—that is, a prudent human being engaging the practical wisdom to use such tools in ways that are "good."

To be sure, the work of neuro- and biotechnology is no longer dictated solely by necessity, but rather is directed by inquisitiveness and desire, and thus can be governed by human intentions and motivations. However, the self-reflective and self-deterministic capability of *homo faber* is endangered by the tide of the social. The activity of labor, commodification, and consumerism qua social values (with political undertones) have come to dominate an increasingly expanding worldview, and thus, the reversion to *animal laborans* as a durable socio-cultural force threatens the extinction of *homo faber*.

In this way, we are at risk of being overwhelmed, both individually and communally, by the speed and potential misuse of technological advances and scientific information. How will we be able to evaluate and judge those things that we produce (or which evolve) at the transhuman and posthuman frontier? Those opportunities might be unprecedented, or incredible, and defy our established understandings and experiences.

Therefore, we suggest a form of Kantian "reflective judgment" which we believe could be operationalized within a process of periodic reflective pause during which some governance and (re-)direction of technological imperatives may be formulated and, after a couple of years, revised if necessary. Such conscious periods of reflective judgment could be a kind of sabbatical get-together of all involved in the field: scientists, administrators, decision-makers, and media, in a celebration of democratic and collaborative reasoning. They must acknowledge the asymmetrical relationships we have with others (not some notion of well-aligned relationships that we *ought* to have), and they should attempt to proceed from this perspective. This perspective will become obligatory as neuroscience may provide greater insight and access to the consciousness of others.

Indeed, it may be that the very neurotechnology that leads us to the frontiers of transhumanity or posthumanity by providing tangible tools to enable a "pan-psychical" mentality, visit other consciousnesses, and gain access to the exigencies of other selves. The constitutive paradox inherent to this long-term perspective is that the technological and (anti-essentialist) transhuman and posthuman worldview could unwillingly pave the way for a new, more down-to-earth "spirituality." Such "spirituality" could be unintentionally generated from a fundamental ambivalence of unknown dimensions and depth and insecurely rests on anthropological, social, and individual grounds.

8.12 A New Stage of Transdisciplinary Dialogue and Inclusion

But again, to assume that neuroscientific access to the mentalities of "selves and others" will simply be the unshakable basis for instantiating a more homogeneous social milieu once again fails to account for the durability of market influences upon social stratification and polyglot values. The challenges are to recognize the impact and limits of the market in the scope and influence of socio-cultural values and integrate these factors into a meaningful appraisal and reflective governance of the potential future effects of neuro- and biotechnology. How might such integration be achieved?

Undeniably, our understanding of our human condition is significantly informed by scientific knowledge, and hence, requires such information. A broad spectrum of scholars—ranging from the German systematic theologian Karl Rahner to philosophers such as Ilya Prigogine and Alicia Juarrero, and including scientists such as E. O. Wilson and Theodosius Dobzhansky—posit that human nature operates within particular parameters and is constrained by physical, biological and social limits. Hence, these scholars and many more like them recognize the need for an open dialogue between science and the humanities to further our understanding of what it means to be human and exist in the natural universe.

We concur. Studies of neuroscience and neurotechnology must not reduce the human to the merely biological. The rich psycho-socio-cultural and spiritual (i.e., introspective) tapestry of human experience, and our interpretations of environments in which humanity is nested, cannot be ignored. Mathematical trends in the growth and applications of neurotechnology, and statistical inferences regarding the correlation of one event to another, can fuel futurological forecasting. Yet they remain inadequate by themselves for realistic predictions, omitting the effects and influence of social values and tendencies, and introspective and non-rational experiences must be taken into account, even if they elude "scientifically" measurement.

As Bruno Latour noted, science (alone) does not provide answers but only extends the horizon of uncertainties.[30] The goal therefore is to more fully appreciate the possible trajectories that lead to these horizons and to practically and ethically assess the limits of our actions at the margins of uncertainty. Such an account necessitates integrating anthropological, philosophical, sociological, religious, and spiritual perspectives with those of neuroscience, to more fully elucidate the basis of our experiences, beliefs, and being, and afford a better perspective on the potentials of the future.

Such a broad scope of reflection will also need to be implicitly balanced, as different fields of inquiry view these questions and issues through different lenses. The assumptions, orientations, and limitations that each area of expertise brings to the discussion must be made explicit so that each and all can participate as equal

[30] Latour, B.: Pandora's Hope: Essays on the Reality of Science Studies, Harvard University Press, Cambridge 1999.

members in the discourse. No perspective can assert any particular dominance over the others. While inquiries into the nature of being human and the issues that arise from them are often ascribed to the most "scientifically valid" approach, it remains equally important to weigh any evidence relative to what makes information "best" for science, healthcare, public policy, law, society, and human self-understanding and self-determination.

We believe that the pursuit of such thorough and balanced reflection can be called, with one word, *neuroethics*. Ethics, under the conditions of the present "transhumanist" cultural and civilization transition, will no longer remain a predetermined worldview but will be defined as the search for balance and inclusion. In other words, in the framework of the current "global mindset change," ethics develop from a qualitative attitude in the field of action toward a combined qualitative–quantitative attitude in the field of systemic interaction.

8.13 Revisiting Ethics to Revive Humanism

The fact that we may have to revise the way we approach and enact ethics does not infer that scientific research and technological development be suspended until some overarching anthropological and philosophical understanding or socio-ethical consensus has been reached. On the contrary, we feel that any such call for abatement of neuroscientific and biotechnological advancement would be counterproductive and hence unrealistic. Instead, we maintain that reflection, discourse, and dialectic must be an ongoing and sustained process that encourages self-evaluation, self-criticism, and self-revision of the ideas and applications themselves. This compels a broadening perspective that acknowledges the strengths and limitations of extant knowledge, and more clearly defines the nature of flourishing, good, and responsible conduct—both toward humanity and other species, as well.

Would such a never-ending, continuous self-inquiry and self-critique of the rational mind not be an indirect return of the "humanistic" self? That could be, and thus humanism could be resuscitated in ways that we have not foreseen (or anticipated). If this is the case, we opine that the "new humanism" will be explicitly vested in the quality of the process of inquiry, rather than some extrinsic definition of "identity" and "the good." It will be rather an *act* than a *content*.

That means that if the pathway forward is through inquiry, then it is necessary to unify scientific efforts through inter-disciplinary discourse that aims to shape ethical conduct in research, practice, and social domains, as well as ensure and direct applications of scientific developments toward realizing and sustaining the public good.

Such tasks are not simple, and addressing them requires an open exchange of ideas among groups of scholars from the sciences and humanities to provide insight into the anthropological premises, ethical issues, and pragmatic realities that dictate social change.

8.14 Cognitive Monisms

We next offer a few observations about neuroethics, philosophy of mind, and the three ideological monisms of our epoch. As we have attempted to illustrate, the transition to a posthumanistic condition of modernity through the impact of neuroscience and neuroethics, and overall seen through rapidly evolving new biotechnologies, entails an immensely complex cultural change, which is ridden with deep contradictions and ambivalence.

Today, the principal mindset change involved with this transition is shaped by the paradigmatic tensions between *three* cognitive monisms. These monisms are currents within the contemporary philosophy of the mind. They sustain three public discourses or cultural rationalities which at present are rarely able to engage in meaningful dialogue but rather compete with each other for intellectual hegemony, without noticing the relative legitimacy that each of the others possesses. All three monisms attempt a "true" interpretation of neuroscience, and all three seek to provide "human culture" with new neuro- and bioethics that will chart the course to the "next stage" of humanism. With this claim, all three influence our self-image as human beings in a one-sided way. We posit that the more the monisms conflict, the greater the risk that each may become an isolated ideology. These three monisms profoundly involved with the new neuro- and biosciences are the following.

1. *Materialistic objectivism.* This first guiding ideology (and ethics) of contemporary neuroscience is based upon the assertion that the "essence" of the human being is its material substrate and that everything else, including consciousness, the self, and the "I," are causal derivatives. In this view, a new humanism should recognize an absolute dependency of the mind from matter and must overcome the illusions of the classical mind–body dichotomy through the dissolution of the classical humanistic notion of the supremacy of spirit over matter. Matter is everything (monos), and "spirit" is only a secondary effect of it; the human being is a high-order biological machine, and the brain is its ultimate component. Consciousness, from the viewpoint of this ideology, is an autopoietic mechanism that is able to understand only what is implicit in its own, rather restricted logic (Steven Pinker[31]). In a certain sense, this constitutes something of a "neurotechnological Neo-Parmenideism," in which both individuality in the strict sense and the "spiritually" transcendental implications are absent.
2. *Transcendental objectivism*. In opposition to the monism brought forward by the followers of a new "natural paradigm," a renaissance of pre-modern and prehumanistic theories urges that the essence of the human being is "purely immaterial" or "spiritual." In this view, the human being is a meta-materialistic "soul" that in principle consists of pure self-consciousness or spirit and uses the body and the material world for certain purposes. The essence of this being "… is

[31] Pinker, S.: The Brain: The Mystery of Consciousness, loc cit.

therefore in the world, but not of this world" (Elio Sgreccia[32] and Joseph Ratzinger[33]). The human mind is the primary cause that "builds" the brain, and without the innate logos structure of the self, the complex structure of the human brain would never come into existence. In this view, consciousness may be restricted to certain boundaries but is in principle of the same origin as the universal logos itself. That means that the absolute in the cosmos and the structure of the mind are of the same logical order, and they are both immaterial. In a certain sense, this view creates a "posthumanistic" renewal of medieval Thomism, overcoming the somewhat Schelerian (existentialist) current within the European–Western Christian institutions that prevailed during the 1970s to the 1990s, and which was associated with the work on the personhood of Karol Wojtyla.[34]

3. *Empirical (or experiential) subjectivism.* A third monism is dedicated to the experiential primacy of subjective consciousness. The argument here is that every materialistic assertion of a fact is ontologically dependent on the prerequisite of an active stream of self-aware consciousness (or an "I") that anticipates it, thus making the immediate stream of consciousness the primary cause of the world, to which every sensitive act and perception is dependent and secondary—including the concept of "brain." This worldview takes the concept of "self"-hood as ontologically absolute. It thus constitutes a modern, secular subjectivism as it can be found in "postmodern" thinking and some currents of feminism but has also some foundations in Karl Popper's and John C. Eccles[35] thinking.

Contrasting these three monisms on consciousness is especially instructive. For the third worldview of empirical subjectivism, the sentence "The brain is the origin and cause of subjective consciousness" cannot possibly be correct, because, empirically speaking, there is the need for a "subjective consciousness" that precedes this sentence and is already active to utter this sentence and thus to express the concept of "brain" at all. Therefore, from a strictly logical and epistemic viewpoint of empirical subjectivism, the sentence must read: "Subjective consciousness is the origin and cause of (speaking about) the concept of the brain." The sentence: "The brain is the origin and cause of subjective consciousness" annuls itself if its ontological act is observed (i.e., using ontological or act-based logic, instead of analytical or content-based logic alone). To the person stating this sentence, the question can be posed: Who says this? The only possible answer to this question is: "I do." That means that logically speaking, an "I," or an ontologically active, self-conscious

[32] Sgreccia, E. et al. (eds.): Identity and Statute of the Human Embryo: Proceedings of the third Assembly of the Pontifical Academy for Life, Rome 1997.

[33] Ratzinger, J.: Retrieving the tradition: Concerning the notion of person in theology. In: Communio 17 (Fall 1990), pp. 439–454, http://www.communio-icr.com/files/ratzinger17-3.pdf

[34] Taylor, J.: Beyond Nature: Karol Wojtyla's Development of the Traditional Definition of Personhood. In: The Review of Metaphysics 63(2)(2009), pp. 415–454.

[35] Popper, K., and Eccles, J.C.: The Self and its Brain: An Argument for Interactionism, Springer 1977.

stream of consciousness is the empirical presupposition of every assertion about the nature of consciousness.

For empirical subjectivism, "the brain" or other materialistic-biological substrates rely already on an active stream of consciousness that forms them as terminological and cognitive constructs; therefore, something like "the brain" cannot be "the first cause." On the contrary, reality shows that everything, including the sentence "The brain is the origin and cause of consciousness" already is the product of a preceding, self-aware consciousness. Therefore, the "I" (or the ontological fact of "self-givenness" or subjectivity, something not found in other sentient beings, although animals show some individual characteristics and psychology) as the empirical "place" of self-aware consciousness must, strictly empirically speaking, be the first origin of everything, and the true sentence must be: "(I say that) the 'I' is the cause and the origin of the brain (as a construct and fact)."

In such a way, (radical) empirical subjectivism asserts that there are no facts, but only interpretative acts, and that there is not only "causation from below" (i.e., from the brain to the subjective consciousness) but also "causation from above" (i.e., from the subjective consciousness to the brain, the latter experientially and empirically being a construct of the first). To put it in Popper's and Eccles's words, the relation between self and brain is not the relation between "the brain and its self," as objectivist materialism declares, but rather between "the self and its brain." This view constitutes an "ontological subjectivism" that is purely experiential and empirical. Thus, it renovates some basic principles and assertions of classical rationalism, enlightenment, and (self-)critical humanism but reduces the balanced body–mind dualism of this humanism to a subjectivist monism (although Popper and Eccles are more moderate than postmodernism and feminism, adding the plea for an "interactionism" between brain and mind).

8.15 The Twofold Perspective: Subjective *and* Objective

Given that these three exemplary (and paradigmatic) "monisms" are all relatively radical and do not tend to compromise, the question is how they can be integrated, and how their—all legitimate, but partial—views and assertions can be reconciled in order to form a greater, more realistic *and* experiential picture. How might one defend *societal dualism* (subjective versus objective) while searching for a new *cognitive monism* of inclusive shapes (subjective *and* objective)?

In the larger view on the currents of thought surrounding contemporary brain research, philosophy of the mind, neuroscience, and neurotechnology, in general, most of the "postmodern" paradigms (including those of the social sciences and the humanities) tend to follow empirical subjectivism, whereas most of the natural sciences including empirical psychology follow materialistic objectivism. Third, most of the confessional religions, including some domains of modern theology (which are also of ethical importance to the public discussion about the origin and the wishful future of the human being) tend to follow some form of transcendental objectivism. The schisms and dissonances that exist between these three monisms and their respective knowledge systems remain one of the most powerful driving forces within the current "global mindset change."

However, in order to effectively appreciate the profound, self-referential enigma of human consciousness (Colin McGinn[36]), it will be necessary to build a more dialogical paradigm. Such an "inclusive" paradigm must:

1. Attempt to integrate the material (materialistic objectivism), the transcendental (transcendental objectivism), and the introspective approach (empirical subjectivism), with acknowledgment of strengths and limitations of each of their different methodologies of inquiry;
2. Recognize the principal value of all three monisms, but add borders of legitimacy to each. None of these monisms should claim hegemony over brain research, neuroscience, and neurotechnology, because none can cover effectively *all* aspects and dimensions in play;
3. Synergize the potential of each monism to mutually complement and thus enrich each other, without crossing the borderlines of competences.

That is a huge task. We believe that in order to achieve such a balanced paradigm, co-development in two intellectual and practical domains will be necessary:

4. Defense of *societal pluralism* against the monocratic claims of validity of each of the three monisms (keep the dualism subjective versus objective alive), and.
5. Search for a new, *multidimensional and structured cognitive monism* of inclusive shapes (integrate subjective *and* objective).

Toward these two goals, it will be important first to defend what has been achieved in paradigmatic pluralism to date by "mature modernity." *Societally* speaking, the dialectics between objectivistic and subjectivist paradigms should not be sacrificed simply to achieve some form of unity in the thinking about neuroscience and its implications for the notion of the human being. As history teaches, absolute unity of cultural and social thinking is, in most cases, more harmful than progressive, and thus it is better to keep complementary, but different paradigmatic approaches, given that cultural pluralism is a most precious good to be acknowledged. However, at the same time, it will be necessary to intensify the search for an innovative, integral approach that should combine the different stances and perspectives of the three monisms in a *cognitive* unity. This unification could be similar to the cognitive and methodological structures of other branches of inquiry, for example, quantum physics or relativity theory, both structured in paradoxical ways.

In sum, it will be the *synchronic combination* of the defense of societal pluralism coupled with the search for a new cognitive, even if differentiated complementarity, that can bring the current paradigmatic tensions over an appropriate neuroethics toward some resolution. It is, in the end, a "double strategy" that combines dialectics with inclusion.

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[36] McGinn, C.: Consciousness and Its Objects. Oxford University Press 2004.

This "double strategy" has to pursue the goal is to enrich the conceptual "essence" of the human being that we know and at the same time defend the pluralistic bases within "post-mature" modern societies. To attempt to introduce the search for new monisms in the societal sphere (i.e., into the structure of current society) would be contra-productive; any realistic attempt at unity can only entail the *cognitive*, not the *societal* domain. On the contrary, to simply maintain the status quo of competition and mutual exclusion between the different cognitive monisms would be irresponsible given the increasing importance (and complexity) of the question at stake: *What is a human being, and what potential consequences could the answer to this question incur for our societal future.*

8.16 Outlooks for a New Cultural Paradigm

The current end of traditional humanism could become the dawn of a new humanistic, but more inclusive cultural paradigm. Possibilities await, but what outlook can we draw?

First, a global paradigm change is occurring at the interface between neuro- and biotechnology and society, and it will dominate the coming years. *Second*, this change is based upon attempts to redefine the "essence" of the human being in the framework of neuroscience, neurotechnology, and biotechnology, which are currently ideologically dominated by three epochal monisms. *Third*, the definition of the human being attempted by these monisms occurs in the context of the end of traditional humanism, as we know it. *Fourth*, these monisms compete with each other, but this tension has not been wholly productive to date in generating an inclusive paradigm for cooperativity or alignment.

Perhaps the most durable question that will arise from this constellation is whether a redefined ontological construct of humanity based upon the work of neuroscience, biotechnology, and genetics can be the first stage of a new, more inclusive, experiential, and empirical humanism for the future. If so, this transformation could result in the enlargement of our understanding of what it means to be "human," and what the consequences for our political and social concepts should be.

A "new" humanism rising from the ashes of the "traditional" humanism is only possible if we invest our energies into a more inclusive cognitive and cultural paradigm. We believe that the task ahead is to interrelate the three monisms of our time, and this can only be accomplished if we recognize that all three must be regarded as legitimate and viable in principle, but as unilateral contributions to the enigma of being. By considering each and all as valid, and restricting the three monisms to their respective "boundaries of legitimacy" (Jürgen Habermas), we may enable a new, cognitively resonant, yet socially diverse cultural paradigm.

Is this a Sisyphean task? Is there realistically any room for optimism that we might act in time, before the momentum of the three monisms creates an intractable inertia toward non-reconciliation, potentially harming neuroscience and its legitimate merits by further fragmentation and one-sidedness?

We think that there can be some hope. In the end, it is our obligation to use neuroscientific information prudently, avoid the laissez-faire of the mereological trap, and take responsibility for our intentions and actions. Irrespective of the mechanisms and activities of the brain, we argue for a role of the self-conscious mind, in sustaining our capacities as *Homo faber* and *Homo prudentia*. What else could make sense? What else would correspond to our implicit and explicit convictions, ontological reality, and experience? Will it be "the brain" to take decisions of what we are and of how we should live? Or, are these decisions at the disposal of our rational, self-conscious, self-critical, and embodied "I"s?

Answering these questions on an experiential basis, it is inevitable for the reader to discover that the basic principles of "humanism" are still alive. This is so, not because they are posed as ideological necessities, but simply because they are given realities that can be verified by the very act of reading and understanding these lines here and now. In these terms, the very act of asking the questions of this book is a form of "humanism" at work. As a direct, yet at the same time immensely complex act of self-consciousness and self-reliance, it affirms the validity of the ontologically "I" and substantiates both the subjective self and its material substrates, and their unity in actu. What else could be the origin of more hope than this?

Questioning the future implies an ontological "I": only the being who is an "I" is able to actively know its past, feel its present, and question its own future. The very act of wondering about the future of the human being and of "being human" is an affirmation of the role of human consciousness, as well as that of "the brain." As long as we maintain the value of the subjective "I" and do not subordinate the importance of the subjective self in the process of engaging neuro- and biotechnology, in understanding the function of the brain, and maybe in moving toward some semblance of the "transhuman," then options of interpretation, decision, and action will remain, if not come to greater prominence. Perhaps this is how we must define the rebirth of humanism.

It may even be that we cannot escape the return of humanism, in our time and in our doing, simply because there is always a self-conscious "I" that is the origin, and the end of all our questions, perceptions, and desires. It is this recognition of the conscious "I" and the regard for "self" and other selves that it imparts that is the source of hope as we stand before the unknown possibilities of a "transhuman" or "posthuman" future.

Chapter 9
Neuro*philosophy*: "Post-Humanistic" Thought and Brain–Mind Dualism

Abstract This chapter provides an introduction to neurophilosophy which is not a well-confined field but often rather the eclectic use of elements of the history of philosophy for the observation and further development of neuroscience and, in particular, neuroethics. This chapter describes its foundations in "post-humanistic" thought with particular regard to the traditional brain–mind dualism.

Keywords Neurophilosophy · Posthumanism · Phenomenology · Brain–mind dualism

In the 1900s, German philosopher Martin Heidegger described the profundity of human experience while avoiding both the notion of substance and the classical problem of mind–body dualism. Given his rediscovery by theorists of avant-garde technologies in the 2000s, Heideggerian thought has recently been often related to philosophical questions of robotics,[1] in order "to steer … towards the question of … pre-ontological notions of artificial systems, and robots in particular … [by the means of a] provisional ontological analysis that considers robots specific, non-human and non-animal beings."[2] Much less effort has been put though into revitalizing Heidegger's philosophy for investigating and theorizing the challenge of the new findings on the human brain in general, and neuroethics in particular. Although Heidegger's work has become popular in certain academic circles, its applicability and strength for crucial contemporary questions at the interface between brain, consciousness, self, being, and existence are still frequently overlooked.

Heidegger claimed, though not unproblematically, to be one of the first "posthumanists," since he wanted to overcome classical humanism which he thought had

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[1] See, for example, Welchman, A.: Heidegger among the Robots. In: Symposium. Canadian Journal of Continental Philosophy 17(1) (2013), pp. 229–249.

[2] Herrera, C. & Sanz, R.: Heideggerian AI and the Being of Robots. In: Müller, V. C. (ed.): Fundamental Issues of Artificial Intelligence. Springer 2016, pp. 497–513.

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become uninspiring, if not decadent, in order to forge a new humanism able to specifically connect the subjective experience of existence with the greater realm of being which he conceived as something super-human or "objective." To be sure, much of Heidegger's writing is enigmatic and, as such, subject to vastly different interpretations. Perhaps this is why it has remained somewhat inaccessible, and why it has been rarely included in the debate about contemporary neuroethics.

We, like some others, believe that Heidegger's phenomenology can be of value for co-developing an integrative neuroethics of the clinical encounter. In particular, we maintain that Heidegger's early theoretical work can be reframed in the light of contemporary neuroscientific knowledge to give rise to a provocative yet practical conception of how the human brain–mind complex functions to afford a sense of "being in the world," and in turn, how its functional embeddedness in experience is vital to a meaningful understanding of the self-other relationship.

Thus, we believe that a timely re-interpretation of Heidegger's phenomenology through selected findings of the contemporary neurosciences may provide a profitable conception applicable not only to the ethics of both inter-personal relations but also to the practices of the social relationship, more specifically. We do not claim to offer the "truest" nor the "latest" or the "most contemporary" interpretation of Heidegger or his work. We offer a view that is indubitably Heideggerian but, more importantly, constructive in its own right toward a contemporary neuroethics of the self and the other in relationship.

9.1 The "Brain–Mind Continuum" and the Nature of Reality

One concept at the center of Western philosophy since its beginning in ancient Greek thought is the problem of "meaning." The current neuroscientific understanding of "meaning"—at least in its mainstream interpretation—is that physical objects in the world produce some sort of activity within neuronal networks that allow (and perhaps in some way correspond to) mental representations. For example, when a person perceives a knife it is meaningful insofar as it is connected to the viewer's idea of "knife." As already Platonism stated, every "meaning" is due to an act of recognition of something that in some mysterious way had already been known, although in most cases unconsciously.

This, however, elicits multifarious questions, such as:

- How do we know that our mental representations correspond to the physical substances that are out there in the world?
- How do we know that others have the same mental representations?
- How do we know that mental representations are not only subjective (a direct individual experience) but *also* objective at the same time (i.e., a shared, lasting reality to build conceptual and social life upon)?

While with regard to these questions, most traditional philosophy remained more or less the same over centuries, Martin Heidegger, acknowledging the outstanding importance of these questions for the future of the interface of science, philosophy, and metaphysics in the post-World War II Western world, attempted something new.

Heidegger in the first instance suggests that in the “day-to-day” events of a “normal person” (e.g., someone who is not a theoretical scientist), the notion of physical objects versus mental representations is utterly irrelevant to the ability to find meaning.[3] In watching a friend use a knife, the knife is not what is meaningful; rather, it is the act of using it that bears meaning.

As a consequence, Fredrick Svenaeus states, “experience is not looked upon as formless content—as sense-data for instance, but as a structure of meaning. This structure belongs to experience itself.”[4]

In other words, interpretation (and with it the construction of meaning) is inherent to the process of experience. Humans (and likely other conscious organisms) do not collect all the data *and then* make sense of them. Happening and experience are imbued with meaning, starting from the very instance of experience itself. Thus, in an attempt to find the most basic and universal essence of human experience, Heidegger suggests that it is not *objects* or representations that we encounter and deal with, but *events*.[5]

At this point, a clarification needs to be made about the notion of “reality” in mental representations. First, we wish to emphasize that Heidegger is not saying whether there is, or is not, substance to the mental representation of objects and events, but rather only that this distinction is irrelevant to how we live our lives and understand our world. This is not an ontological claim. According to Svenaeus, “the phenomenologist abstains from making any ontological claims about what the (mental) acts are directed towards, but rather tries to study the acts themselves in order to investigate and classify them.”[6]

This does not deny substance or the validity of representation, but instead posits a switching of attention. Therefore, to understand the human not as “a body plus a mind,” but as a whole subject, we must focus on the *event* of the brain-mind continuum and the respective substrates of experience.[7]

De-emphasizing substance—or: “essentialism”—may seem contrary to the project of humanism and modernity, like contrary to the project of neuroethics, as ethics is always about some kind of essence or substantial belief. While not denying this, Heidegger’s work is concerned with the *experience of consciousness*, not with *how*

[3] Guignon, C.: Heidegger’s Anti-Dualism: Beyond Mind and Matter. In: Polt, R. (ed.): Heidegger’s Being and Time, Rowman & Littlefield 2005, p. 77.

[4] Svenaeus, F.: The Hermeneutics of Medicine and the Phenomenology of Health. Dordrecht: Kluwer 2000, p. 75.

[5] Stenstad, G.: The Turning in *Ereignis* and the Transformation of Thinking. In: Heidegger Studies, Number 12, Duncker and Humblodt, Berlin 1996, pp. 83–94. Cf. Lyotard, J.-F.: La Phenomenologie, Paris 2005.

[6] Svenaeus, F., loc cit., p. 76.

[7] Cf. Guest, G.: La tournure de l’Événement. Pour situer la «déconstruction» dans la topologie de l’Être. In: Heidegger Studies, Number 10, Duncker und Humblodt, Berlin 1996, pp. 33–90.

minds arise from brains. It will not answer Chalmers' proverbial "hard questions" of neuroscience,[8] because it does not assume a mind versus body distinction.

This can be seen as one of Heidegger's great merits: consciousness, in his view, is about neither the brain nor the mind, as we traditionally think of these entities. More simply, it is an experience exactly *in the interplay* between the subject (mind) and the object (brain)—and therefore it has the potential to provide explanatory value for neuroethicists, but most importantly, for ethical practitioners, among others in the field of medicine and its contemporary anthropological and dialogical challenges. Heidegger's work does so by focusing on the subjective–objective event of consciousness in which he identifies the "nature" of its experience.

9.2 "Being Human" Is No *Essence* or *Content*, but an *Event*

Heidegger suggests that we should imagine a human being not as fixed "essence" or "content" (for example as self, psyche, character, or name), but rather as a continually unfolding event. This viewpoint is, from his perspective, embedded in—and legitimated by—the very etymology of the term "human being" itself, as it has been brought forward by the Western history of ideas. Human being for Heidegger means *being* human—it is an execution or performance rather than a pre-given. The primordial event of being human[9] according to classical theory can be divided into two crucial aspects:

- *Situatedness*: The history of the "lived self" that defines the human as he or she *is* in the world.[10] On various occasions, Heidegger calls this the "throwedness" of the human being into existence (*Geworfenheit*).
- *Projection*: The imagined future of the "life-happening" through which humans progress in order to realize (i.e., bring into fruition) their identities.[11] Humans usually project themselves into an imaginary future self and try to live accordingly only to become something else.

These two aspects seem to be both interrelated and interactive. For example, if one's *situatedness* is that of being a woman with a "normally"[12] functioning uterus, this makes possible the *projection* of motherhood. To a man, motherhood is not a

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[8] Chalmers, D. J.: Facing up to the Problem of Consciousness. In: Journal of Consciousness Studies 2(3)(1995), pp. 200–219, http://consc.net/papers/facing.html

[9] With regard to the meaning of the term "being human," some theorists in the field of contemporary neuroscience include the classical Greek notion of the "human being" as "being a thinking animal." We will not address the application of this notion to animals, but simply note that a Neo-Heideggerian approach is not necessarily and not exclusively oriented toward *homo sapiens*.

[10] Guignon, C.: Heidegger's Anti-Dualism, loc cit., p. 78.

[11] Ibid.

[12] We do not discuss the problems of the term "normal" here, as we have mentioned some of them here and there in previous chapters. However, we are aware that the most important feature of this

conceivable future self—that is, it is not within the range of possible identities. Thus, an identity is both a construct and dependent on the physical presupposition and both at the same time. Only the synchronicity of both these dimensions creates a three-dimensional "stream of existence," including an "embodied stream of consciousness," in time and space. And *exactly (and only) as such "double essence" or "paradoxical unity,"* "being" is self-building and determining an individual path of existence.

Furthermore, one's *projection* can contribute to one's *situatedness*. A graduate student and an illegal immigrant might be living in the same level of poverty, but because of the identity that they are *in the process of realizing*, their situations take on very different meanings. *Projection* is toward the future, but it is not the same as the future; *projection* is here and now, like the stream of self-consciousness or "I." *Projection* and *situatedness* simultaneously give meaning to the individual, as far as they center it in itself and open up a constantly changing, event-dependent, but at the same time also event-creating life-space.

But who decides one's *projection* and *situatedness*? What is the *source of meaning* for these dimensions of an individual? Speaking in terms of contextual politics,[13] these questions have been addressed most frequently by *communitarian* and *liberal* accounts of the "I," the self, and self-determination. Hence, they have to be taken into account by contemporary neuroscience and their cognitive and practical derivatives.

9.3 Heidegger's "Integrative Paradox"

We point toward a communitarian *and* at the same time liberal conception about the relationship between brain and self. The *communitarian* movement in contemporary (neuro-)philosophy seeks to reduce ideas to moral relativism due to social practices, and a perceived "fragmentation" of ethical discourse.[14] In doing so, it seeks a "shared vision of the good life or a shared hierarchy of goods."[15]

Communitarian neuroscience theorists usually emphasize the importance of the community both in forming the individual and in giving meaning to the notion of a self, including the findings of brain research. They claim that an individual's society does not simply *influence* his or her actions and choices; the self finds and maintains meaning *within* the community. As such, the community in which a self is located

term is to be (rightly) in itself politically incorrect in pluralistic societies and thus to a certain extent in itself "abnormal."

[13] Goodin, R. E. and Tilly, C. (eds.): The Oxford Handbook of Contextual Political Analysis, loc cit.

[14] Sandel, M.: The Case against Perfection: Ethics in the Age of Genetic Engineering, Harvard University Press 2007; and Sandel, M..: What is the right thing to do? The Harvard Lectures. In: http://www.justiceharvard.org/, retrieved 8 December 2013.

[15] Kuczewski, M.: Fragmentation and Consensus, Georgetown University Press, Washington D.C. 1997, p. 24.

is therefore partially constitutive of that self in the strict sense, although in most cases unconsciously.[16]

The communitarian view is occasionally interpreted to mean that the individual is merely a cog in a greater machine of (evolutionary) neuronal and social context. This notion tends to reject the traditional Western notion of "free will" in favor of a more behaviorist conception of rational choice. As a foundation for ethics, it posits a somewhat bleak reality in which no one is responsible for their actions, change cannot be effected on an individual level, and so on.

We are not attesting to the fairness of these criticisms; we are only citing their contemporary prevalence.

In contrast, *liberal* theories of self and "I" aim to defend the rights and responsibilities of a person through the assertion of individuality. In many strictly liberal models, the individual is conceived as utterly separate from his or her community in one way or another. For this view, the autonomous individual comes to society "preloaded" with his or her own preferences, ready to be expressed through personal choice.[17]

This perspective on individuality is, in principle, a great foundation for notions of personal responsibility and individual rights. However, strict liberalism tends to ignore the role of culture and society in forming a person, as if people somehow develop independently. Furthermore, liberalism is sometimes accused of leading to moral relativism (although this is certainly defeasible).

In light of these objections, we believe that a successful theory of self able to grow up to the challenge of neuroscience and neurotechnology must reconcile both of these viewpoints. Among others, Ezekiel Emanuel has attempted this reconciliation, proposing that "liberal communitarianism" emphasizes the social nature of selfhood such that "it is only by knowing what the community is, what the community takes itself to be, that an individual can know himself."[18] In this way, Emanuel leaves room for the individual to take part in shaping personal identity by arguing that it is through the community that the individual finds and expresses the realities of autonomy. He asserts that "participation in communal deliberation permits the possibility of controlling and shaping the social world in which we live."[19]

To be sure, identity and personal meaning are not solely defined by others, nor can they be attributed to an individual in abstraction. The individual negotiates his or her own identity in, and through interaction with the community. In other words, meaning is socially constructed, but the individual plays a role in this construction, that is, he or she has the opportunity to express individual preferences and ideas as a crucial member of a meaning-giving community.

Mark Kuczewski conceptualizes this participation of individuals and others within an ethical system which he refers to as "communitarianism as mutual

[16] Ibid, p. 51.

[17] Kuczewski, M.: Fragmentation and Consensus, loc cit., p. 56.

[18] Emanuel, E. J.: The Ends of Human Life. Harvard University Press 1991, p. 158.

[19] Ibid., p. 158.

self-discovery." He suggests that "the person begins as a situated entity within a tradition or multiplicity of traditions and then engages in a 'quest' of mutual self-discovery with his (or her) fellows."[20]

In sum, it is as "actors" situated in a cultural narrative that we discover our *selves* cooperatively with others. While this may not touch the question of sheer self-experience, or "I-ness" as such, where it comes from and what it means, it must be certainly related to it. While social factors will never be able to explain the "hard problem" of neuroscience, it is certainly an indispensable factor in the overall picture that cannot be ignored, and about which neuroscience has produced little knowledge yet.

9.4 Problems of Neuroscience Recast in a Heideggerian Framework

As we know, the easy and the hard problems of neuroscience are two different problems:

> What remains is not one problem about consciousness but two, which the philosopher David Chalmers has dubbed the *Easy Problem* and the *Hard Problem*. Calling the first one easy is an in-joke: it is easy in the sense that curing cancer or sending someone to Mars is easy. That is, scientists more or less know what to look for, and with enough brainpower and funding, they would probably crack it in this century.

What exactly is the *Easy Problem*? It's the one that Freud made famous, the difference between conscious and unconscious thoughts. Some kinds of information in the brain—such as the surfaces in front of you, your daydreams, your plans for the day, your pleasures and peeves—are conscious. You can ponder them, discuss them and let them guide your behavior. Other kinds, like the control of your heart rate, the rules that order the words as you speak and the sequence of muscle contractions that allow you to hold a pencil, are unconscious. They must be in the brain somewhere because you couldn't walk and talk and see without them, but they are sealed off from your planning and reasoning circuits, and you can't say a thing about them.

The Easy Problem, then, is to distinguish conscious from unconscious mental computation, identify its correlates in the brain and explain why it evolved.

The *Hard Problem*, on the other hand, is why it feels like something to have a conscious process going on in one's head—why there is first-person, subjective experience. Not only does a green thing look different from a red thing, remind us of other green things and inspire us to say, 'That's green' (the Easy Problem), but it also actually looks green: it produces an experience of sheer greenness that isn't reducible to anything else. As Louis Armstrong said in response to a request to define jazz, 'When you got to ask what it is, you never get to know.'

[20] Kuczewski, M., loc cit., p. 110.

The Hard Problem is explaining how subjective experience arises from neural computation. The problem is hard because no one knows what a solution might look like or even whether it is a genuine scientific problem in the first place. And not surprisingly, everyone agrees that the hard problem (if it is a problem) remains a mystery."[21]

If we recast this in a Heideggerian framework, the alleged mono-causality of the brain with regard to consciousness and self can't be the whole story. Neither can an asserted solipsism of "pure" subjective experience without the brain or the community be the whole reality we live through and call "being."

Instead, to speak in Heidegger's terms, one's *situatedness* arises also from a cultural value system. Furthermore, the individual negotiates *projection*, realizing his or her own identity in community with others.

This is the reason why for Kuczewski "self-realization" is a process of "mutual self-discovery." However, here we find the use of the term "discovery" to be a bit ambiguous and in need of clarification. When Heideggerian scholars address life-being as a process of self-realization, it is sometimes overlooked that the word "realization" can be construed in two ways. In one sense, to realize is to become aware (e.g., "I realized I had a coffee stain on my tie"). However, to realize is also to make real, that is, to bring into fruition.

The term "self-discovery" has connotations that are more consistent with the first kind of realization. "Self-discovery" might give the impression that through our interactions with others, we come upon our own destiny or perhaps elucidate some deep, fundamental truth about ourselves. Discovery implies that the object (i.e., the self) existed in some sense prior to the discoverer's knowledge.

Contemporary neuroscience has to take account of both these options, because they are most probably both facts, and they are interrelated. Neuroscience, then, has to add a third factor to the prevailing dualism of brain and self: community, or the social. It has not to consider it as a side factor, but as an equally important element in its own right, at least experimentally.

This is because it is no coincidence that Heidegger refers to human existence as *sich (selbst) zeitigen* (bringing itself into fruition, literally "constituting a self through time").[22] Humans do not only discover themselves as "I"s (the liberal version) because they can think about themselves, but they also create themselves in community. Interestingly, from the perspective of Heideggerian phenomenology, there is no distinction between inventing oneself mentally and physically. Dualism disappears when we imagine the person as an *event*. Hence, the projection of a person could be considered both imagination and invention. The mutual affirmation of an imagined self is the beginning of a quest toward realization of the self (here with the latter meaning of "realization" as "making real"). *Sich (selbst) zeitigen* is a process of negotiation, bringing together the individual and his or her community to

[21] Pinker, S.: The mystery of consciousness, loc cit, p. 2.

[22] Guignon, C., loc cit., p. 79.

mutually imagine, and (in so doing) mutually invent the self, the identity, and the person.[23]

Again, while this is not the whole truth regarding subjective experience and cannot explain the fact of "being an I," it is an element still neglected by neuroscience that will have to be included in its further progress. The reason is that it is one element that can overcome the classical "humanistic" dualism between brain and mind by building a bridge between them. In Heidegger's view, to overcome this dualism by entering the mind–time–body–community continuum was to make the first sound steps into a "post-humanistic" age and thus toward a potential new humanism—something he was eager to achieve.

9.5 Mirror Neurons

Let us proceed further toward a neuroscience of "individualistic communitarianism" as man's nature of "being-in-the-world." How and why might such a tripolar "brain-self-community" of integrative "new humanism" be sustainable across time and culture? Do substrates exist that compel the ability to appreciate *situatedness*, *projection*, and the roles and "meanings" of others in the community? Is there a biological basis for such a phenomenological "individualistic communitarianism," as Heidegger's early work sketched it, with potential benefits also for the epoch of an alleged "transhumanism"?

The phenomenological approach Heidegger suggested to overcome the brain–mind dualism deals strictly with understanding experience by exploring experience, whereas neuroscience attempts to approach experience using a different paradigm: observing its physiological correlates from the outside. However, contemporary theories in neurobiology and physiological psychology are in principle not at odds with phenomenology but, in fact, offer a similar and thus compatible understanding of intersubjectivity. This is the case, for example, with certain theories about the role of mirroring neurons in social cognition.[24] Can they bridge the gap between neural activity and interpersonal experience of the self and others—and thus provide a viable lesson of an "integrated" approach?

In the 1990s, Italian neurobiologists Giacomo Rizzolatti, Leonardo Fogassi, and Vittorio Gallese revealed neurons in the macaque monkey that are activated both when the monkey engages in a behavior and when the monkey observes other organisms (human or monkey) perform the same type of behavior. These neurons

[23] Heidegger, M.: Aufzeichnungen zur Temporalität (aus den Jahren 1925 bis 1927). In: Heidegger-Studies, number 14, Duncker and Humblot, Berlin 1998, pp. 11–21. Cf. Dastur, F..: La constitution ekstatique-horizontale de la temporalité chez Heidegger. In: Heidegger-Studies, number 2, Duncker and Humblot, Berlin 1986, pp. 97–109.

[24] Benedikter, R.: Der Mensch—ein Automat des Kosmos? Das Rätsel der "Spiegelneuronen." In: A. Neider (ed.): Wer strukturiert das menschliche Gehirn? Fragen der Hirnforschung an das Selbstverständnis des Menschen, Stuttgart 2006, pp. 76–92.

came to be called mirroring (or more commonly, "mirror") neurons and have been shown to exist in several brain regions; as well, their activity of neuronal mimicking has been demonstrated for a range of motor behaviors.

Mirror neurons seem to be a mechanism in the brain for matching the behavior of others with one's own experience. The original findings in macaque monkeys were soon replicated in experiments using human subjects. Experiential trials suggest that "insofar as the [mirror neuron system] generates internal representations of actions common to oneself and others, it is likely to be involved in our capacity to understand the actions and experiences of other people."[25]

Simply put, it appears that we understand the experiences of others by linking them to our own experiences—and in this case to some extent, "the brain" does it for us. This function of the mirror neuron system suggests that we possess the neurological capability (perhaps biologically pre-disposed) to relate self-referentially with others. This might be considered a sort of natural tendency toward self-transposal: attributing our own experience to others.

Mirror neuron function has been shown to be triggered by a wide variety of stimuli. Not only watching an action but hearing an action triggers the response. Narratives alone can elicit this self-transposal, that is, we put ourselves into the characters in a story, and recent studies have indicated that reading about an action will also activate mirror neurons.[26]

It has been suggested that the activity of mirror neurons might simply be due to an association between observing an action and performing it. Alison Gopnik offers the explanation that for a monkey, a given hand movement will usually be accompanied by the visual experience of a hand moving.[27] Through association, the movement of a hand comes to activate the same neurons whether the monkey is performing the task, or just watching. Therefore, the firing of "mirror neurons" would essentially be just a result of classical conditioning.

However, if we assume, for the sake of the argument, that Gopnik's suggestion could be extended to address the observations of auditory excitation of mirror neurons, we find that her alternative explanation does not account for the ability of linguistic phrases to stimulate mirror neuron activity. We do not read the word "chew" every time we chew. Therefore, how would the experience of reading the word "chew" have become so closely associated with the act of chewing that the word alone would trigger chewing responses? Hence, we believe the available literature strongly supports that it is the *idea* of an action, not solely the observation of that action itself or its sheer physicality that stimulates the mirror neuron system (although observation and its representation may work in concert).

We acknowledge that all evidence for the mirror neuron system in humans is contingent on our acceptance of functional magnetic resonance imaging (fMRI)

[25] Nouchine, H. et al.: Anatomical Differences in the Mirror Neuron System and Social Cognition Network in Autism. In: Cerebral Cortex 16 (2006), pp. 1276–1282.

[26] Aziz-Zadeg, L. et al.: Congruent Embodied Representations for Visually Presented Actions and Linguistic Phrases Describing Actions. In: Current Biology 16 (2006), pp. 1818–1823.

[27] Gopnik, A.: Cells That Read Minds? In: Slate (5 July 2007), http://www.slate.com/id/2165123/

data[28]—as opposed to animal studies in which we are able to record the firing of individual neurons by implanting electrodes directly into cells. Given the debate about the validity and value of fMRI, if one were unwilling to accept the legitimacy of this data, then little can be said to convince the reader that this conception of the human mirror neuron system is any more than an interesting speculation. However, if we consider that despite its flaws fMRI, particularly when employed with other forms of neuroimaging, can provide some reliable depiction of regionally networked activity in the brain, then we must regard the body of literature on the mirror neuron system as providing some meaningful evidence for their existence and putative function.

Therefore, while we acknowledge that much of the mirror neuron systems' function might be taken out of context, there is still a significant body of well-documented research to indicate the importance of mirror neurons as a mechanism through which intersubjective understanding might be facilitated. If properly addressed in an interdisciplinary way, it might (in the best case) develop toward a bridging field between materialism, idealism, and intersubjectivism in consciousness research.[29] That research would center on the "integrative" question between Platonism and Aristotelianism,[30] the two main streams of basic ideological approach newly present, in various contemporary forms, in current consciousness research. The field of consciousness research would hence progress toward realizing some Heideggerian aspirations toward "post-humanistic" thinking as a more evolved form of humanism.

To what extent could that be the case?

9.6 Phenomenology and Idealism Intertwined by Context

First of all, it is important to remember that the mirror neuron system does not mirror the "brain of the observed," but the brain of the observer. It works by associating an observed or imagined action with some remembered experience. It directs the interpretation of an action insofar as it associates the imagined "mind" of the other with what it is like to be for the observer. The "idea" of the observer assumes a central role in the overall process, not merely as an individual thought, but rather as a perceived "objective" being inherent to the experience itself. In other words: not

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[28] Gopnik, A.: Cells That Read Minds?, loc cit.

[29] Kohls, N. B., and Benedikter, R.: Culture and "the brain." Origins of the modern concept of "Neuroscience" in Wilhelm Wundt's experimental psychology. The importance of the epistemological battle between "Empiricism" and "Idealism" in the second half of the 19th century for today's concepts of "Neuroscience" and "Neuroethics." In: G. Giordano and B. Gordijn (Eds.): Neuroethics. Scientific and Philosophical Perspectives, Cambridge University Press 2009, pp. 38–61.

[30] Geiman, C.P.: From the Metaphysics of Production to Questioning Empowering: Heidegger's Critical Interpretation of the Platonic and Aristotelian Accounts of the Good. In: Heidegger Studies, Duncker and Humblot, number 11, Berlin 1995, pp. 95–121.

as the *content* of the experience, but, as Heidegger showed us earlier, rather as the *event* of the experience as inextricably ontological unity between idea and observation.[31]

Let us remember Fredrick Svenaeus's statement here, "experience is not looked upon as formless content—as sense-data for instance—but as a structure of meaning. This structure belongs to experience itself".[32] That means: The process (or the "event") of experience itself contains a (if not "the") structure of meaning. This structure seems to be closely connected, related, or even identical to the structure of the "self" (or "I") of the observer, which brings itself "into existence" ("being-in-the-world") through the very time aspect of the experience, and independently of its exact "contents": Heidegger's *sich (selbst) zeitigen*.[33] *Sich (selbst) zeitigen* than would assume the definition: Repeat something that is already "out there" (i.e., the idea or "structure" inherent in the observed act of another) but as an individual and original act of the self (i.e., the structure of the "I" performing the act of experience—by bringing itself "into existence" *through* the subject). To a certain extent, the overall process, at least as seen in its functional unity, forms a bridge between observation and concept, that is, between (material) phenomenology and (constructive) idealism as mutually complementary constituents of one and the same *event*.[34]

In saying this, it seems to be clear to us that it was the complex *unity* of the overall system of consciousness that was of interest for Heidegger[35]—not its single components or its detailed mechanisms and functions. And it seems obvious that his strong, at times almost stubborn, if not grim "focus on unity" of the subjective–objective "being-in-the-world" constitutes the interdisciplinary chances, but also the limitations of Heidegger's approach.[36]

Second, it appears that context plays an important role in the function of the overall system of the brain–mind process and of consciousness in general. Iacoboni and colleagues reported that "observing grasping actions embedded in contexts yielded greater activity in mirror neuron areas in the interior frontal cortex than observing grasping actions in the absence of contexts or while observing contexts only."[37] Thus, the context of the action seems to co-modulate the function of the

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31 Witzenmann, H.: Intuition and Observation. 2 Vol., Northridge CA 1996.

32 Svenaeus, F.: The Hermeneutics of Medicine and the Phenomenology of Health. Dordrecht, Kluwer Academic Publishers 2000, p. 75.

33 Heidegger, M.: Die Grundfrage nach dem Sein selbst. In: Heidegger-Studies, Duncker and Humblot, Berlin 1986, number 2, pp. 1–3; and M. Heidegger: Über die Maxime "Zu den Sachen selbst" [aus dem Nachlass]. In: Heidegger Studies, Duncker and Humblot, Berlin 1995, number 11, pp. 5–8.

34 Sijmons, J.: Phenomenology and Idealism. ZENO, the Leiden-Utrecht Research Institute for Philosophy of the University of Utrecht 2004, book series *Quaestiones Infinitae,* Volume 50.

35 Stenstad, G.: Thinking What is Strange. In: Heidegger Studies, Duncker and Humblot, Berlin 1994, number 10, pp. 185–194.

36 Stenstad, G.: Thinking (Beyond) Being. In: Heidegger-Studies, Duncker and Humblot, Berlin 1990, number 6, pp. 143–151.

37 Nouchine, N. et al.: Anatomical Differences in the Mirror Neuron System and Social Cognition Network in Autism, loc cit.

mirror neuron system. In his investigation of the "event" of consciousness, Heidegger tended to stress out this crucial factor.

Therefore, the model of an "individualistic intersubjective" understanding as one basic mechanism of human consciousness suggested by the findings of the new neurosciences is strikingly similar to the tenets of certain phenomenological concepts of medicine and healing, that is, of one of the most pronounced fields of application of neuroscience and neurotechnology. For example, Herbert Spiegelberg proposed a theory of psychiatry, *Phenomenology Through Vicarious Experience*, which posited that to understand a patient's life-world, and thus to be able to heal, the clinician needs to try as best he or she can to imagine the inner, subjective experience of the patient. Spiegelberg called this ability the "activation of the transposing self." He writes, "the transposing self … adopts imaginatively as much as it can of the frame of mind of the other person. Clues for this adoption are to be derived from our firsthand perception of the other and from facts of his available biography."[38]

In theory, the mirror neuron system "inbuilt" in the brain facilitates the understanding of "the others" by generating an "automatic" imagination of their experience through self-reference. This is initiated by the perception of the observed subject's actions and modified by the common context. As Karl Jaspers noted, in psychiatry, context entails biography and culture, but this is knowable only in reference to the clinician's first-person experience of the world. The key here is that "the psychiatrist interprets in analogy with his own ways of experiencing."[39]

We understand the other by imagining *their* experience of the world, based on a memory and (idealized) construct of *our own* experience when acting in the same way, modulated by the *situatedness* of the observed and by the world (the *Lebenswelt*[40]) we share.

9.7 The Teacup Experiment

The importance of context (and, by extension, its aspects and qualities assimilated into individual intention and, most importantly, intuition) to the function of mirror neurons is illustrated in the "teacup experiment." When watching a teacup being picked up in different contexts, the subject is "automatically" guessing at the intention of the actor. The tea accouterments serve as clues for decoding intention. Studies have suggested that the mirror neuron system plays an important role in the

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[38] Spiegelberg, H.: Phenomenology Through Vicarious Experience. In: E. W. Staus (ed.), Phenomenology: Pure and Applied, Pittsburgh PA: Duquesne University Press 1964, p. 121.

[39] Spiegelberg, H., loc cit., p. 107.

[40] Heidegger, M.: Unbenutzte Vorarbeiten zur Vorlesung vom Wintersemester 1929/30: „Die Grundbegriffe der Metaphysik. Welt - Endlichkeit—Einsamkeit." In: Heidegger-Studies, Duncker and Humblot, Berlin 1994, number 7, pp. 5–12.

"capacity to understand non-intended actions."[41] This supports the assertion of Rizzolatti et al. that "the human motor system codes both the goal of an observed action and the way in which the observed action is performed."[42] The motor system codes both the *idea* within the action and its *phenomenological* manifestation and performance—both diachronically as well as synchronically. This suggests that intention is about imagining the future, as a *projection* enacted through intuition "automatized" by the brain. This pairs with the Heideggerian notion that we understand both the self and others in terms of *situatedness* and their *projection*.

As studies of the mirror neuron system imply, our immediate understanding of a person's experience (i.e., the way in which we imagine ourselves as them) is imbued both with the observed person's context (*situatedness*) and his or her intention (*projection*). The similarities between these two conceptions of intersubjectivity (the physiologically framed conception and the phenomenologically framed conception) and their implicit third conception (the socially framed conception) support that Heidegger's phenomenology, as we interpret it, is by no means at odds with current neuroscience. In fact, phenomenological explanation provides a coherent and meaningful interpretation of results demonstrated in mirror neuron studies. In this way, such a Heideggerian perspective could (and perhaps should) be relevant to neuroscientific findings. Emerging knowledge in neuroscience can shed mechanistic light upon Heideggerian constructs, and Heideggerian ideas provide insight into the "inbuilt" phenomenological dimensions of the brain and its mechanisms of experience.

Let us try to summarize by "making sense" of the results of brain research. Return to the original quote cited from Svenaeus: "experience is not looked upon as formless content—as sense-data for instance—but as a structure of meaning. This structure belongs to experience itself."[43] Experience is always and unavoidably imbued with meaning. We do not experience the world as it is. We do not simply encounter substances and objects, or selves and brains. We experience the world through mental processes that arise in and interact with neural substrates and are simultaneously mediated by contexts. In fact, our experience of the world is a physiological–mental–social process. As a consequence of automated relations, we experience meaning at least in part as the very structure of the "event" of consciousness itself. The most basic element of human experience is not molecular; it is the experience itself. The mirror neuron system represents part of the complex neuroanatomical system that instantiates informational (i.e., negentropic) meaning to incoming perceptions, constructs, and energies—in other words, it mirrors experience as much as it "makes" it.

We believe that Heidegger's "individualistic communitarian" conception of the human being—as s*ich (selbst) zeitigen*—is wholly compatible with modern

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[41] Buccino, G., Rizzolatti G., et al.: The neural basis for understanding non-intended actions. In: NeuroImage 36 (2007), pp. T119–T127.

[42] Gallese, V., Keysers, C., and Rizzolatti, G.: A unifying view of the basis of social cognition. In: Trends in Cognitive Sciences 8 (2004), pp. 396–403.

[43] Svenaeus, F.: The Hermeneutics of Medicine and the Phenomenology of Health, loc cit., p. 75.

neuroscience, and vice versa. The brain changes and reorganizes as a consequence of experiencing the world. Humans, like other organisms, are pre-disposed to the capability to convert physical energies into information, make sense of data, and organize these data into knowledge according to their allegedly "embedded" meaning. The mirror neuron system may be an example of such a neuro-biological-conceptual pre-disposition that matures and is embellished through experience.

The organizations of human brains are in some ways similar, but, in totality, each brain functions differently. It is likely that each person experiences the world in ways that are somewhat unique, even if they seem to rely on a strikingly similar, thus assumingly objective structural "content" of the world (objective both in the sense of the organization of material objects and their "embedded" "ideas" or "meanings"). Thus, only if we assume that the "structure of being" is both "objective" and "subjective" *at the same time* (and within a complex overall mechanism of consciousness), the findings of "mirror neurons" make sense in their full amplitude.

9.8 Psycho-Philosophy of Neuroscience and Neurotechnology

We foretell a psycho-philosophy of experience as the "meaning of the self in action" with some guiding questions. What is the consequence of such an attempt of interpretation? And where are the perspectives for the further elaboration of the hypotheses presented in this chapter?

If it is plausible, as we have argued, that the uniquity of experience is defined by the interaction of one's biology, environment, and social culture, then it is also plausible that experience modulates brain function, and brain function modifies (present and future) experience.

Contemporary neuroscience points to the individuality of complex organisms. Though brain science may very well be a pursuit of commonalities, we must acknowledge that no two brains are completely similar. Perhaps there is an element of chance at play. As Martin Heidegger astutely noted, and as current neuroscience seems to confirm, the "experiential mind" (i.e., Heidegger's "*Gestimmtsein*"[44]) may be an outcome of being concretely amidst the variety of beings within a whole ("*das Seiende im Ganzen*"), such that the essential factors in the development and function of the brain-mind-social-complex are the unique nature of an individual nested within an environment of others. We believe that such an understanding necessitates an integrative ethical system that addresses both the communal and individual factors in shaping human experience and conduct, and see this as important to the philosophical (i.e., epistemic) bases of neuroethics.

There are diverse consequences of such a view. For example, one often neglected, but still important question deriving from such a viewpoint is: What would be

[44] Haar, M.: Le primat de la Stimmung sur la corporéité du *Dasein*. In: Heidegger-Studies, Duncker and Humblot, Berlin 1994, number 2, pp. 67–80.

"Geist" then? Could this famously ambivalent lead concept of the European history of ideas of the past 200 years acquire a new productivity for today's debate about the nature of consciousness? And most important of all: Could it give an "integrative" contribution to a debate currently ridden, as we have mentioned in previous chapters, by a new ideological fight between (objectivistic) mechanistic materialism, (subjectivistic) secular rationalism and the (metaphysical) global "renaissance of religion," which all propose viewpoints on the nature of consciousness and "reality" that are to a large extent incommensurable, if not incompatible and tend rather to exclude each other instead of dialoguing?

Following the Heideggerian notion, "Geist" as a concept for an inclusive viewpoint on consciousness could be described as the intermediate dimension between "Mind" and "Spirit" or the subjective and the objective order structure as seen at the point of their specific interweavement, that is, physical reality as it becomes "real" (*wirklich*) *through* the self-reflexive subjective human mind, the latter characterized in its core by the faculty of a "self" or "I" as an event in time, which by the very inbuilt structure of this event has to "realize itself" (*sich selbst zeitigen*) together with its constructs.

Insofar as "Geist" in the Heideggerian perspective thus becomes a natural "bridging" concept between the individual mind and its surrounding objective reality (by integrating both subjectivity and objectivity into the constitutive unity of *one* "event"), *such* a "Geist" concept seems to be fully compatible with the findings of the "mirror neurons," and with progressive neuroscience more in general. It is also more complex, rational, and contemporary than the various, rather one-sided concepts of "spirit" brought forward in the current consciousness debate by religious and "spirituality"-oriented groups, often used in fruitless opposition to the concepts of "brain," "mind," and "body."[45]

Last but not least, such a "fluid" concept of consciousness like that implicit in Heidegger's philosophy shows, as the processes connected with the "mirror neurons" itself do at least to a certain extent, some affinities with some principal findings of experimental quantum physics.[46] Perhaps "mirror neurons," neuroscience, quantum physics, and Heidegger's philosophy of time and being point toward a

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[45] Cf. Derrida, J.: Heidegger et la question. De l'esprit et autres essais, Paris 1993; and Kovacs, G.: Heidegger's Transition to Another Inception of Thinking. In: Heidegger-Studies, number 13, Duncker and Humblot, Berlin 1997, pp. 163–175.

[46] Zeilinger, A.: Dance of the Photons: From Einstein to Quantum Teleportation, Farrar, Strauss and Giroux 2010. Zeilinger writes, "Einstein's steadfast refusal to accept certain aspects of quantum theory was rooted in his insistence that physics has to be about reality. Accordingly, he once derided as 'spooky action at a distance' the notion that two elementary particles far removed from each other could nonetheless influence each other's properties—a hypothetical phenomenon his fellow theorist Erwin Schrödinger termed 'quantum entanglement.' In a series of ingenious experiments conducted in various locations - from a dank sewage tunnel under the Danube River to the balmy air between a pair of mountain peaks in the Canary Islands—the author and his colleagues have demonstrated the reality of such entanglement using photons, or light quanta, created by laser beams. In principle the lessons learned may be applicable in other areas, including the eventual development of quantum computers."

similar insight: the basic concept of reality (and its connection to "consciousness" as an "entangled" act) deriving from these different approaches, which seems to show, at least to a certain extent, striking common features and perspectives. A future "inclusive" approach of neuroscience and neuroethics may take into consideration the diverse aspects connected with elements of all three of these disciplines: neurobiology, quantum physics, and "post-humanistic" (in the positive sense) philosophy. Thus, the "riddle of consciousness" may become a more rich enquiry and acquire the role of a principal motor toward a future, truly inter- and transdisciplinary system of science.

In asserting all this, we agree with Jaan Valsiner about the general perspective to pursue in the coming years with regard to a sound psycho-philosophy of neuroscience and neurotechnology when he writes:

> (We are in) need of (a) psychology as a whole for the study of dynamic, meaning-making human beings. Cultural psychology—using the term *culture* as a generic term in various versions—continues to be an arena where innovations can occur. Separate research fields—such as the dialogical self, social representation processes, semiotic mediation, symbolic action, and actuation theories—have all been co-participants in (the) advancement of ideas. Yet the central problem—an innovation of empirical research methodology which would appropriately capture human active meaning-making—has not been solved. Likewise, … psychology has only marginally touched upon the lessons from … the cultural over-determination of objects used in human everyday living … The current state … indicates a re-construction of the social nature of knowledge. Moving beyond … postmodernist and empiricist confines, psychology is set to return to the level of an abstracted generalization of its culture-inclusive theories. Culture—in terms of semiotic mediators and meaningful action patterns—is the inherent core of human psychological functions, rather than an external causal entity that has effects on human emotion, cognition, and behavior.[47]

Martin Heidegger's view of the nature of human consciousness may provide valuable, even if experimental (and in part still speculative) contributions toward the advancement of brain research, neuroscience, and neurotechnology in the years to come.

[47] Valsiner, J.: Cultural Psychology today: Innovations and Oversights. In: Culture and Psychology 15(1) (2009), pp. 5–39.

Chapter 10
Neuro*realism*: Toward a Balanced Ideology Between Empiricism and Subjectivity

Abstract Given that there are new ideological fights around the "right use" of neurotechnology and neuroscience, the divide between idealistic and realistic stances has widened. Sure is that a new neurorealism is needed to find a balance between empiricism and subjectivity, or the outer and the inner dimensions of what is addressed by neuroresearch.

Keywords Neurorealism · Ideology · Empiricism · Subjectivity

How could contemporary consciousness research, namely, neuroscience and its neurotechnological applications, result in a commonly accessible critical realism positioned at the center of the techno-philosophical debate—instead of leading to battles between differing ideologies for supremacy? If a critical realism could be developed, it may contribute to the progress of the theoretical and practical stance of neuroscience and neurotechnology and strengthen particularly neuroethics which is a field that needs special dedication given the many paradoxes inbuilt in consciousness research exactly at the interface between the natural and the social sciences.

10.1 Overcoming or Integrating the Pluralistic Culture of -Isms?

Since the eighteenth century, philosophy has entertained a number of nuanced positions and distinctions to contour socio-political and scientific macro-developments that have been syntactically marked by the suffix "-ism." Intense academic debate has raged over the validity of constructs that served to define philosophical analysis of timely technological developments such as idealism, positivism, rationalism,

Lead authors: Roland Benedikter and James Giordano

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realism, relativism, materialism, transcendentalism, modernism, and postmodernism, to name a few.

Similar demarcations in the technological sphere have been obtained and utilized in other academic debates that build upon these philosophical foundations. For example, in the politico-legal realm, dialectical discourse on communism, socialism, (neo-)liberalism, conservativism, and capitalism has been the norm since the end of the First World War. In the social sciences, issues of hegemonism versus pluralism have been normative cornerstones of the debate since the 1950s and 1960s, and in the cultural sciences, many of the academic disputes of the past decades have focused upon the tensions between modernism, meta-modernism, post-modernism, post-postmodernism, and the respective implications and consequences for cultural post-modernism, constructs.[1]

In the natural sciences with which technological development is particularly heavily interwoven, naturalism versus creationism has become a common *topos* (if not a basic conceptual framework) into which other, more empirical, and applied arguments have been framed since the late 1990s. Last but not least, in the field of religious studies, monotheism versus the new polytheisms of individualized faith have constituted an important dialectic of analysis and public attention since the "secular turn" of the 1980s and the subsequent global "return of religion" of the 1990s and early part of the twenty-first century.[2]

In retrospect, despite usually well-founded criticisms of "isms" as too broad brandings, this sort of labeling has in fact yielded measurable benefits in several fields of investigation. By grouping a common set of criteria, beliefs, and values within a discrete term, larger concepts and implications can more easily and efficiently be engaged and employed. In other words, such fuzzy, but broadly inclusive terms tend to be inter- and trans-disciplinary by definition, and thus work well as placeholders for a specific corpus of ideas and commitments on different issues. Of course, upon deeper inquiry, additional and more detailed distinctions can and arguably must be made, for example, global versus local realism; or formal causal versus pragmatic rational explanations. However, "ism"-terms still represent basic conceptual and analytic building stones that ground relatively uniform philosophical (i.e., epistemological, ontological, metaphysical, and ideological) positions that

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[1] See, for example: Henriques, G.: What is metamodernism? Metamodernism is the cultural code that comes after postmodernism. In: Psychology Today (17 April 2020), https://www.psychologytoday.com/us/blog/theory- knowledge/202004/what-is-metamodernism. Cf. Benedikter, R.: Re-Globalization: Aspects of a heuristic umbrella term trying to encompass contemporary change. An introductory overview. In: Roland Benedikter, Ingrid Kofler, Mirjam Gruber (eds.): Re-Globalization: New Frontiers of Political, Economic and Social Globalization. London: Routledge 2022, pp. 7–32, https://www.routledge.com/Re-Globalization-New-Frontiers-of--Political-Economic-and-Social-Globalization/Benedikter-Gruber-Kofler/p/book/9780367642846

[2] See in detail Benedikter, R.: Religion in the Age of Re-Globalization. A Brief Introduction, Palgrave MacMillan 2022.

can be well articulated and worked within an open setting as provided by the democratic societal frameworks within the present-day "global imaginary."[3]

It is in this historico-ideological context that we encounter the various approaches toward a timely *neuroethics*. In much the same way that "postmodernism" was intended as both post-ideology and practice, neuroethics can be seen as a dynamic project of ideas and actions, built upon an integrating meta-paradigm of academic scrutiny and (self-)criticism. The fact that contemporary neuroethics is pluralist, dialectical, and sometimes highly variable in conceptual structure is not a fault but instead adds to its reputation. In fact, many important ethical and philosophical movements since the eighteenth century have been pluralistic, diversified, and dialectically structured in both their inner dimension (well beyond the mere dialectic between left and right "wings") and their outer dialogue.

In light of this, we view the highly diversified field of contemporary neuroethics as describing not only an attempt toward open scientific and social paradigm building but also a distinct philosophical epistemology and ontology that is grounded in the advancements of the present. Yet, the field also must aspire to function as a practical integrative methodology between the different "-isms" currently in play. The attempt at an inclusive neuro-"meta-ethics" meant by specifically "contemporary" neuroethics has to aspire to constitute the critical, innovative scientific basis of a (simultaneously conceived) "subjective-objective" reality experience in the neurotechnological field and thus seek to continue the basic strive of the enlightenment project.

10.2 Applying Critical Realism to Contemporary Neuro-Realities

If the notion of an "inclusive critical realism" is to be of any value besides its sometimes occurring monopolizations by different interest groups, its tenets and concepts must find a place within timely applications of science and social engagement. Indeed, the approach of critical realism—and its various ramifications and predecessors—can be applied to, if not seen as intrinsic to contemporary neuroscience, and the resulting social and ethical manifestations are being iteratively characterized by the nascent discipline of neuroethics. This is because neuroethics by its very contemporary nature works exactly at the interface between objective and subjective dimensions of material reality and subjective consciousness and thus engages opportunities, limits, potentials, and problems at the intersection of the physical evidence observed by the material natural sciences on the one hand, and hermeneutics, that is, experience-based interpretative subjectivism on the other. Because all sciences involved in contemporary consciousness and brain research must bridge

[3] Steger, M.: The Rise of the Global Imaginary: Political Ideologies from the French Revolution to the Global War on Terror, New York: Oxford University Press 2008.

these two poles and are widely experimental fields of investigation, they remain in need of paradigmatic experiments in order to make both theoretical as well as practical advances at the subjective–objective interface and to overcome any unidimensionality or exaggerative materialism.

In other words, contemporary neuroscience and neuroethics are applied subfields of the science of the brain and consciousness in the larger sense, situated exactly between the objective (materialistic) presuppositions of the brain and the individual mental process, that is, between the physical substance of neuronal tissue and—apparently immaterial—individual (self-)awareness. Empirically speaking, objective facts like the observed structure and functions of neural tissues, and, more importantly, the respective capabilities and expressions that make the observation of these objective facts possible, are not existent in the first place without a thinking, self-aware subjective mental process that has to be already there before they are perceived, in order to make the observed facts reality and expressible through concepts. Thus, logically speaking, the subjective dimension and the objective dimension are inextricably linked from a strictly empirical view when—as it is not only necessary but also unavoidable in advanced brain research—integrating functional logics with ontological logics, as we have seen in the previous chapter.

As a consequence, neuroethics cannot be appropriately conceived and explored without considering both objective and subjective dimensions simultaneously and without hierarchy, as both the objective dimension (the observed neuronal basis of individual awareness and thought process) and the subjective dimension (individual awareness and self-reliant conceptual capacity) seem to cause, condition, and determine each other in a kind of simultaneous dyadic process that has yet to be fully understood. To be sure, we are still far from such a knowledge of the paradoxes of consciousness arising from the interweaving of underlying objective factors and constitutive subjectivity. As philosopher Colin McGinn has noted, this may be a cognitive cusp that will be slow—albeit not necessarily impossible—to overcome.[4]

In this sense, neuroethics seems to be particularly well-aligned with the effort toward a new, inclusive critical realism that—both within and beyond the field of brain research—understands itself as a realism of empirical self-perception.

10.3 An "Objective-Subjective" Paradigm of Interdependence, Mutuality, and Inclusion

In short, armed with critical realism, neuroethics may gain a more robust perspective on social planes and places of interaction. Both neuroscience and critical realism allow that there may be independent, real, albeit hidden, and putative mechanisms and structures that perform causal-generative work. Contemporary neuroscience does not just passively observe empirical causes and effects that occur in the natural

[4] McGinn, C.: Consciousness and Its Objects, loc cit.

world but rather seeks to actively locate the brain–mind–self continuum as informing and producing events, constructs, and interpretations in a socially embedded and co-caused conditional context based on a vast variety of "mutualities."

In other words, according to an advanced and paradigmatically balanced neuroscience, the self is produced by the brain, and the brain is produced by the self, while both the notions of "the self" and "the brain" are produced and mediated by their social context. Simultaneously, the social context is produced by the self relying on a brain, and thus, to some extent, all three are produced by each other simultaneously. Understanding the nature of this reciprocity and co-terminality (and not merely the parts and its pieces) represents a main—and overwhelmingly huge—challenge for contemporary and future consciousness science. From a strictly neuroscientific perspective, the notion of "cause" is part of a holistic system of real-time interconnected neural networks that vary in complexity and are constantly informed by the dynamics and environmental contexts that remain in flux by being in an unending "dialogue" with "the self and its brain."[5]

Therefore, every progressive method of neuroethics must explicitly reject the positivist move toward type identity and cut-and-dry binaries. At any individual point, a mono-causal mechanism may be rendered inert by other relevant reciprocal systems, appear uninvolved (yet carry primary causal force), or be wholly disengaged. However, this does not entail non-existence of causality. Thus, neuroethics must be used as a leverage to both ground and provide inter- and trans-disciplinary epistemological positions in neurophilosophy (as, e.g., those of Antonio Damasio and Paul Churchland) and analytic philosophy (specifically, those of W.V.O. Quine, Hilary Putnam, Richard Rorty, and Donald Davidson).

This is not merely circular or self-supportive reasoning. Neuroethics marries well to an emerging "subjective-objective" philosophy in that it both sustains the iterative, self-revising paradigm of science and acknowledges the empirically subjective nature of approaching any objective reality. Thus, a neuroethical lens of neuroscience enables studies of the workings of the brain to understand the bases of consciousness, cognition, reason, and by extension science and, at the same time, emphasizes that cognition, reason, and science are the very means that enable studies of the brain in the first place.

Simply put, neuroethics as critical realism allows for and affords analysis of the shifting realities of contemporary naturalism that are generated through an ever-increasing fund of information, knowledge, and understanding of neurophysiological processes.[6] While allowing the possibility of knowledge acquisition of the external world that is allegedly independent of the subjective mind, a balanced neuroethical stance acknowledges the entrenched role of subjective qualia in the perception of the world and advocates reflection upon the procedures of that perception as related to that which is perceived.

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[5] Popper, K. and Eccles, J. C.: The Self and its Brain: An Argument for Interactionism, loc cit.

[6] Almeder, R.: Harmless Naturalism. The Limits of Science and the Nature of Philosophy, Chicago: Open Court 1999.

Overall, contemporary neuroethics, in its explicitly inter- and trans-disciplinary epistemology, grants the existence of physical reality (i.e., the brain; putative neural mechanisms as the necessary bases of ecological and moral cognition, emotions, and actions) but is nonetheless appreciative of how neuroscience (*qua* science) affects—and is influenced by—bio-psychosocial and strictly individual variables of consciousness. Thus, the reflective view of neuroethics consists in that it compels and sustains the flexibility required to incorporate new information achieved through the use of evermore complex technological capabilities that characterize the heuristics of current neuroscience. When taken together, a neuroethical approach to neuroscience in the sense of critical realism offers a useful and complementary (if not synergistic) set of macro-integrative theoretical notions, as well as a non-dogmatic, pragmatic method that can be employed to evaluate the anthropological (individualistic), hermeneutic, scientific (materialistic), sociological, and ethico-legal claims that co-define the field and its place in contemporary society.

10.4 Outlook

To be sure, *neuroscience* and the technologies it has generated and employed have contributed to the contemporary trend to view, examine, and gain insight into the concept and implications of human understanding as an *activity*. *Neuroethics* may provide a viable lens that can be applied to neuroscience (and its ever-growing fund of information), the effects of this science on social ideas, and the influence of sociocultural variables upon the constructs and conduct of science and technology in contemporary and future civilizations. We maintain that the requested integrative paradigmatic approach of neuroethics that is necessary today affords both values of qualified subjectivism and social-scientific naturalism that allow open, yet rigorous guidance in dealing with issues such as the nascent fields of neuro-politics, neuro-economics, neuro-anthropology, and neuro-philosophy which we have briefly sketched in this book, and that give birth to a variety of phenomena such as postformal personhood, human enhancement, animal ethics and the rights of nature, technophilia, and human–machine convergence which characterize the contemporary landscape of neuroscience in society. In this context, we observe not only new ideological factions and fights but also a rise of sustainability-oriented and thus neo-inclusive worldviews in much of Western culture and civilization,[7] and this is evident in the fields of neuroscience and neuroethics too.

Within this historic environment, the objective of neuroethical analyses is to facilitate continued reflection toward scientific research by achieving concrete,

[7] Benedikter, R. and Molz, M.: The Rise of Neo-Integrative World Views. Towards A "Rational Spirituality" For The Coming Planetary Civilization? In: M. Hartwig and J. Morgan (eds.): Critical Realism and Spirituality. Routledge London and New York 2011, pp. 29–74, https://fsi-live.s3.us-west-1.amazonaws.com/s3fs-public/Rise-of-Neo-Integrative-Worldviews-1.pdf?fbclid=IwAR2svU4TpsQrlKpDVxjm1-ET6h33DDS3wyJtzenEVGwTWruQVrN1QwBCCXs

tangible results. In order to gain an effective epistemic, ontological, sociocultural, and ethico-legal understanding of the neurocentric worldviews dominating our time, we call for critical reflection upon the constructive discourses that shape them and cultivate space for "objective-subjective" education, outreach, and engagement. Contemporary neuroethics must seek recognition of the dynamic causes, mechanisms, and structures that underlie individual and social actions. Neuroethics thus must be inter-disciplinary, methodologically open, and progressive in their attempts to effectively address the issues of neuroscience and neurotechnology.

In this framework, we argue that neuroethics might yield a current meta-philosophical toolkit to allow insight into the ways that crucial decisions on the nature and application of human consciousness are made, evaluated, and put into practice. In our view, neuroethics may offer a useful and realistic set of theoretical positions, as well as a rigorous method of inclusion that can be employed to evaluate the claims, knowledge, and planes of interaction that define issues affecting human lives in post-modern, globalized societies. Clearly, in such a perspective, neuroethics is and must remain an open work in progress.

Chapter 11
Neuro*transhumanism*: Questions and Answers

Abstract While posthumanism remains a strong influence on the concepts of neuroscience and neuroethics, there is a second major ideology that is impacting the orientation of the field: neurotranshumanism. Contrary to posthumanism, transhumanism aims at using neurotechnology to radically modify the use and concept of the human body and mind in order to progress, as fast as possible, beyond the existing human condition.

Keywords Neurotranshumanism · Posthumanism · Transcendence · Human condition

What role will world views play for the future of the brain sciences, and of neuroscience and neurotechnology in particular?

World views, and especially views on the future of the human species, are key driving forces in many technological fields at the interface between the human body and technology. In most cases, world views are even brought forward as a rationale for developing technologies that often seem very avant-garde.

What are examples of this situation?

I am referring to developments that reach right into the core of the debate about what it means to be human, such as brain–computer interfaces (BCIs), brain–machine interfaces (BMIs), brain–brain interfaces (BBIs), and brain–cloud interfaces (B/CIs). Some, but not all, include brain implants understood as brain upgrades designed to extend human capabilities. These rapidly advancing types of technologies have their roots and driving energy not least in the desire for extended personal outreach and mobility. In general, in our time of fluid and permeable high-tech, humans want to use it to move beyond the limitations of their physical bodies and their minds.

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From that perspective, what does mobility mean?

Today's predominant definition of mobility still widely dates back to the first heyday of capitalism in the nineteenth century, when mobility was the motion of a physical object from point A to point B. The main idea was to create production routes that were as efficient as possible. In "postmodern" times, this ideology has been personalized and individualized, to some extent. The use of the term has diversified. For instance, research is being conducted into sustainable, environmentally friendly mobility based on renewable energy and new concepts for propulsion. Ideas such as "electric charging in motion," where electric cars charge their batteries while driving on the road, are progressive, as new semi-biological battery systems are. Areas such as bio-batteries and bio-computing transcend the area of traditional mobility management. They transform the search toward a transcendence of the limitations of the human body as such through the means of fusing it with avant-garde technology such as the applications of neurotechnology.

To which extent "consciousness"-related technological prostheses are changing the limitations of the human body and mind?

The concept of mobility has been radically extended. On the most basic level of extension, there is now virtual mobility. Even in the Sahel region of Africa, I can open a bank account by using a smartphone and then use it to pay, without having to trek long distances to the nearest major city as before. On a more complex level, there is population mobility, where people move among different social and political systems. Mobility since the 2000s also includes everything we call "liberation technology," that is, a special form of information technology consisting of a laptop, Internet access, and the knowledge to use both. Liberation technology is employed around the world to get people access to ideas, compare political and social realities, defend rights, fight poverty, and promote economic development in far remote places. All these new forms of mobility have changed the perception of the term, which now stands more generally for "moving beyond the limits of the human body and mind." This is also what the advertising industry suggests to us day by day: that we have no limits, and that we can transcend ourselves ad libitum. The—sometimes more hidden, sometimes more open—mood of the times is to let us go beyond the *conditio humana*. This is what we call the "trans-humanist" condition: the general desire to go beyond the human being that we know. That aim seems to be increasingly possible with the help of applied avant-garde technologies.

What is, then, the new dimension added by neurotechnology?

If we imagine that social media which already allows for an extended concept of virtual global mobility may 1 day be connected directly with the human body, in particular with the human brain via BCIs and BMIs, a new dimension could open up: a society for which it is perfectly natural to melt the human brain with technology and the Internet in order to increase the mobility—understood in a universal sense—of the human self, instead of just the mobility of the human body.

In which sense neuroscience is exactly part of this change?

Neuroscience can transform—and is increasingly changing—what it means to be human in the first place. This is a major transition within the contemporary self-understanding of the mobility concept: the trend is for mobility to cease being something humans use to just physically move. Mobility instead becomes a constituent part of the human organism itself. Kevin Warwick, from Britain, already in the 1990s had an implant surgically inserted in his arm and linked to computers. With his arm movement, he could trigger a command and thus bypass the computer mouse. In the second phase, he was able to send impulses via radio transmission over longer distances. The new relationship between human tissue, real-time sensoring, and chip technology played a decisive role in making these experiments possible.

The attempts to extend the mobility of the human body by linking it directly to computers and machines have rapidly evolved since.

Nowadays, it is perfectly possible to steer a wheelchair simply by thinking of the direction it should drive. Via BCIs and BMIs, it is also possible to control machines over long distances just by thought. As the experiments with BBIs have shown since 2019, "human mind control" has evolved to a concrete possibility even within the inter-species biological realm between humans and animals. This way, mobility has emancipated humans from some of their bodies' limitations; we have learned to cover great distances by means of technological body and mind extensions. The price is that technology is to some extent literally "entering" the human body, and more exactly the human brain, in the future probably also the spinal cord, thus potentially starting to create human–technology hybrids that in a few decades from now could not be exactly the human being anymore as we knew it. To which extent, this development toward modifying the human body may modify the human mind, and what this will practically mean in its social and political implications, remains to be seen.

Are humans becoming part of a data stream?

For the Swedish philosopher Nick Bostrom, who directs the Future of Humanity Institute at the University of Oxford, the possibility of merging the human mind with machines is an impetus for transhumanism. The modern "transhumanist" movement, which he co-founded together with David Pearce in 1998 in the form of the "World Transhumanist Association" (WTA), seeks to transform humanity into a kind of "enhanced" species—into something posthuman with entirely new capabilities implemented by invasive technology. Transhumanism calls for releasing the body and mind from their natural characteristics—and brain science and its derivatives are key instruments to do so.

That sounds like "Beam me up, Scotty!"

Transhumanists advocate the development of technologies that prolong the human lifespan and expand the human body's abilities by means of BMIs. It is already technically feasible to switch off the lights by using only your thoughts if you dispose of a BCI connected with radio transmission or Internet connection. For transhumanists, that is the logical next step of virtual mobility, that is, a mobility of the spirit without the need to move the body. In their view, it opens up new options also in other fields of application like, for example, in medical science—which could be transformed into a science of "body mobility" by body exchange and brain enhancement.

Do BCIs, dedicated to connecting brain and computer, overcome or, on the contrary, ironically confirm the division of body and "spirit"?

They do it both ways. The BCI philosophy is the outcome of a materialistic idealism: it is meant to empower the self by making it more independent of the body. Thus, it produces the dream of a "pure spirit" or immaterial self, who uses all kinds of devices and technological prostheses to his or her advantage, including the physical body which is becoming just one among its many tools. This materialistic idealism is the ideology that dominates transhumanism—for better or worse, as we will have to see.

Should the public take a critical stance toward transhumanism and its interpretation of brain research and neurotechnology?

We should be absolutely for progress while being critical or even skeptical about making use of each and every available option just because it becomes possible. It may not be clear if innovations may monitor and modify human beings in an appropriate manner or not. For example, various scholars in the framework of a UK "Children mobility project" suggest that the government of the future should ensure that every child is provided with a chip that automatically measures the child's blood pressure, kidney functioning, release of hormones, breathing rate, and other data on bodily functions. Other transhumanists advocate the introduction of performance-enhancing drugs in schools or the insertion of extended data space via chip implants into the human brain.

What is wrong with that?

We still do not know what practical consequences that sort of fusion of humans, computer chips, and machines would have on our humanity. Transhumanists consider modern human existence to be a hardship and believe that technology of any kind could only improve our lives which in essence they see as miserable because permanently threatened by disease, unpredictability, existential risk, and death. In their view, the deployment of technology should not be impeded or even limited, but, on the contrary, progressively furthered by nation-states and the United Nations for the sake of all. Otherwise, they say, the few who could afford it privately would buy themselves a technological head start exclusive of others, thus creating rapidly expanding "enhancement inequality." On the contrary, humanists—sometimes called "bionaturalists" in a slightly depreciative manner, which is undeserved—advocate for a more conscious use of "invasive" technology, that is, of technology that penetrates the human body, and the human brain in particular.

What can be done to prevent the development of a technological class division?

We would need some form of global governance to manage the current biotechnological progress politically—but we are far from that. Think of the attempts by a few neighborhoods in some European cities to create mobile-free zones, which have always failed. If not even that can succeed, what could prevent the emergence of future technologies developed anywhere in the world? Politics is currently in the dark, and so is public opinion. There has never been such a huge discrepancy between what is possible and what is discussed publicly. We have yet to understand the real consequences, and the public desperately needs more information about the pros and cons of what is going on.

Back to the present: What are the next steps in the ongoing human–technology merger?

Thought-controlled devices combined with the upcoming new experience options of the Interplanetary Internet, as recently conceived and patented by Vint Cerf. As early as 2012, American astronaut Sunita Williams controlled a robot in Germany from the International Space Station (ISS). It is conceivable that we will be able to visit Mars without needing to fly there but still have a real-life experience. We can call these developments "mobility by proxy," meaning that a person will be "present" on location by technology and experience it in real time, based on BCI technology.

How important will this kind of mobility become?

Today, mobility by proxy still plays a relatively minor role. However, before long, it will play a role similar to physical mobility. Physical mobility will persist, but overall it will be faster, more immaterial, and more environmentally friendly. The ramifications for culture and society of incorporating our nervous systems into mobility via neuroscientific and neurotechnological innovations are still underestimated.

Can the effects of mobility by proxy be anticipated?

Thanks to modern media, we can be in another place in real time and receive unedited information. People are growing up with that.

The next step of this development is just ahead.

In the coming years, mobility by proxy will reach a new level with the help of neurotechnology, in particular BCIs. People will consider carefully whether they really need to drive a hundred miles or whether there is another option. Many American universities allow people to study in India or South Africa. Full-time employees no longer need to go to their offices every day, as they also have mobile access to the information they need. The entire interrelationship between work, learning, and research has already changed drastically, not least under the effect of the COVID-19 pandemic. Fixed working hours will be less and less common. The dream of realizing a common "thinking sphere" between humans, that is, of making bio-theologist's Teilhard de Chardin's idea of a joint "noosphere" of humanity could become a reality by connecting the mental processes of different people via interconnected BCIs, or even trough human–human BBIs. Last but not least, artificial intelligence largely based on neuroscience will invade many fields of everyday life and society. Neuroscience and neurotechnology are about to incept the next "turning point" of human history, and it is quite likely that we will witness the emergence of a new kind of technological civilization based on "neuroculture."

Considering the negative implications of aspects of this development, does that mean we need to do some rethinking?

We need to free ourselves somewhat from certain aspects of our current attitudes. Europe in particular remains dominated by Western posthumanism, exemplified in the attitudes of Heidegger and similar philosophers, which goes hand in hand with a certain technophobia, or aversion to technology, that has long been anachronistic. This attitude is still somewhat pervasive in Germany, for example. Yet most people cannot fully wrap their heads around the—both hopeful and challenging—changes connected with neuroscience and neurotechnology and thus remain unable to hold up their own opinion in a public discussion, which brings the idea of democratic consensus of what to do with neuroscience and neurotechnology, that is, of neuroethics to its limits.

And that means?

The transhumanists in essence hold that we should simply introduce all available new technologies, enhance the human body and brain through implants, and then get used to the new techno-human condition by adaptation. I am in favor of another approach: We should invest much more of our energies as citizens to play an active part in jointly anticipating and influencing the change ahead. To do so, we need top-notch, multidisciplinary teams to study what is taking place from a civil society viewpoint. We need to reinvent mobility, but not let our role as humans be defined by small ideological or expert stripes, or by technology. Through an ongoing exchange and open public debate that we must supply with more and better information (as compared with the past years), we should jointly determine what the future holds. International organizations such as the UN and UNESCO may help us with this task—to fulfill it in a "glocalized" way, that is, with the goal of contextualization.

Chapter 12
Afterword: Neuroscience, Neuroculture, Neuroethics: A Futures Field on the Rise: How to Proceed?

Abstract This chapter presents a conclusion and outlook on the future of neuroscience, neuroculture, and neuroethics. It discusses how these fields and their intersection might evolve and be further developed.

Keywords Neuroscience · Neuroculture · Neuroethics · Futures

Neuroscience, neuroculture, and neuroethics together form an inter- and trans-disciplinary future field on the rise. It comprises or concerns almost all fields of contemporary thought and investigation. While, for example, already since the 2010s emerging questions such as "What is neuropsychoanalysis?"[1] have been advanced to "understanding crucial behavioral psychology concepts and the neurological origins of habitual behavior,"[2] critical philosophy has simultaneously underscored the "dimensions of the threat to the self posed by deep brain stimulation: personal identity, authenticity, and autonomy."[3] The respective, ongoing debate includes in particular the question of free will.[4] More recently, questions of

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[1] Solms, M. and Turnbull, O. H.: What is Neuropsychoanalysis? In: Neuropsychoanalysis 2011/13/2, edited by the International Neuropsychoanalysis Society, pp. 133–145, https://doi.org/10.1080/15294145.2011.10773670.

[2] Carrasquillo, Y. M.: Understanding Crucial Behavioral Psychology Concepts and the Neurological Origins of Habitual Behavior. Herkimer College, The State University of New York, October 2022, https://www.researchgate.net/publication/371081824_Understanding_Crucial_Behavioral_Psychology_Concepts_and_the_Neurological_Origins_of_Habitual_Behavior

[3] Zawadzki, P.: Dimensions of the Threat to the Self Posed by Deep Brain Stimulation: Personal Identity, Authenticity, and Autonomy. In: Diametros. A Journal of Philosophy, Volume 18, No. 69 (2021), pp. 71–98, https://doi.org/10.33392/diam.1592

[4] Rietz, C.: John-Dylan Haynes: Gibt es den freien Willen? [John-Dylan Haynes: Does free will exist? In: Die Zeit, 10 October 2023, https://www.zeit.de/2023/42/john-dylan-haynes-freier-wille-entscheidungen-neurowissenschaft

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bioengineering such as about the employment of brain–computer interfaces for rehabilitation purposes[5] or practical industrial applications such as "car control by using brain waves"[6] have stood in the foreground. Overall, "identifying thematics in brain–computer interface research"[7] has become one of the fastest-growing areas of contemporary techno-scientific inquiry. Last but not least, there is an intense debate about whether human intelligence can be strengthened versus artificial intelligence by neuroscientific intelligence augmentation.[8]

All in all, such enthusiasm about the times of neuroscience and its applications often still undervalues the importance of digging deeper into fundamental questions of humanity and its future related to such endeavors. This is nevertheless necessary since what we branded as "New Human Technologies"[9] are converging the human being with technology like never before. Thus, they must undergo in-depth scrutiny of their philosophical foundations and implications and their social, economic, and political perspectives from both a humanist and a post-humanistic view.

Indeed, the challenges are rising in level and quantity proportional to the chances opened up by neuroscience and neurotechnology to all dimensions of contemporary culture. This has been made clear, for example, at the celebrations that accompanied the formal end of the 10-year-long European "Human Brain Project" in the summer of 2023 and the respective conclusions drawn by its leaders. The "vision of the simulated brain" was an EU project involving 122 research institutions from 17 countries that ended in September 2023. The aim was "to completely decode the brain, cure neurodegenerative diseases and thus advance society as a whole. Now, after ten years, the major project has come to an end. One of the benefits was the consolidation of interdisciplinary research data."[10] Although some doubted that this was truly the start of a new era in brain research, the declarations at the formal end of funding of the EU Brain Project in September 2023 anticipated even bigger projects for the coming years not least due to the intense activities of competitors on the

[5] Orban, M. et al.: A Review of Brain Activity and EEG-Based Brain-Computer Interfaces for Rehabilitation Application. In: Bioengineering 2022, 9, 768, https://doi.org/10.3390/bioengineering9120768.

[6] Alsammarraie, K.: Car Control by using brain waves and Arduino based Mind wave Mobile. In: Conference: 2022 International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA), https://doi.org/10.1109/HORA55278.2022.9799911

[7] Alharbi, H.: Identifying Thematics in a Brain-Computer Interface Research. In: Computational Intelligence and Neuroscience, Volume 2023, Article ID 2793211, https://doi.org/10.1155/2023/2793211

[8] Makridakis, S. and Polemitis, A.: Human Intelligence (HI) Versus Artificial Intelligence (AI) and Intelligence Augmentation (IA). In: Hamoudia, M. et al. (eds.): Forecasting with Artificial Intelligence: Theory and Applications, Springer International 2023, pp. 3–29.

[9] Benedikter, R.: Artificial Intelligence, New Human Technologies and the Future of Mankind. In: Challenge: The Magazine of Economic Affairs 66(3–4)(20 June 2023), online first publication, https://doi.org/10.1080/05775132.2023.2223061

[10] Deeg, J.: Human Brain Project: Die Vision vom simulierten Gehirn [Human Brain Project: The vision of the simulated brain]. In: Spektrum der Wissenschaft (4 October 2023), https://www.spektrum.de/magazin/human-brain-project-die-vision-vom-simulierten-hirn/2175555

field like China.[11] Similar projects such as the BRAIN project in the USA were able to create an "atlas of all brain cells"[12] which was branded as a concrete breakthrough for new applications to the benefit of humans by many in the scientific community.[13]

In essence, what most of the news and commentaries on current neuroscientific research and neurotechnological applications indicate is a disputed core motive of post-modern neuroscience and neuroethics: that its result may ultimately lead, paradoxically, not to the rise of technology, but "the return of the human being"?[14] Others though warn that the new findings could also lead to a new kind of warfare by means of new brain technologies.[15]

In the end, avant-garde technologies are, by their very nature, a two-edged sword, and this brings with it a multitude of voices and opinions that are often difficult to classify and to relate to each other. Some interpretations are short-lived, others more enduring, and some in retrospect turn out to be fashionable, others to be "classical" in their explanation of basics and trajectories.

In this perspective, the questions arise: How can the reader proceed from what was learned here to further sound information and knowledge? How can she or he broaden his or her horizon without falling into reductionism or overspecialization on the one hand or into inappropriate generalizations on the other? And what is the state of things in building an inter- and trans-disciplinary approach to take neuroscience to a new level of inclusion and insight?

In order to answer these questions, let us first briefly reassume what we have seen in this book in order then to proceed to some recommendations.

As we have seen, *neuroscience* is still a relatively young discipline within the canon of the inter- and trans-disciplinary sciences. Its main characteristics are that it has become an agent of change and inclusive innovation within these sciences, fostering a mindset destined to integrate natural, social, and human sciences, quantitative and qualitative realms, the empirical and the speculative—and that departing from this point, after a period of incubation, it is now slowly, but steadily becoming an agent of profound socio-psychological, ideological, and social change too.

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[11] Müller-Jung, J.: Wir sind den USA und China einen Schritt voraus (We are one step ahead of the U.S. and China). In: Frankfurter Allgemeine Zeitung (FAZ) (29 September 2023), https://m.faz.net/aktuell/wissen/medizin-ernaehrung/europas-gehirn-grossprojekt-ist-beendet-usa-und-china-einen-schritt-voraus-19199539.html

[12] ORF [Austrian Public Broadcasting Agency]: Meilenstein: Atlas aller Gehirnzellen erstellt [Milestone: Atlas of all brain cells created] (12 October 2023), https://science.orf.at/stories/3221649/

[13] Parsch, S.: Dies ist wirklich der Beginn einer neuen Ära in der Gehirnforschung (This is truly the start of a new era in brain research). In: Die Welt–Welt der Wissenschaft (27 October 2023), https://www.welt.de/wissenschaft/article247963114/Gehirnatlas-Dies-ist-wirklich-der-Beginn-einer-neuen-Aera-in-der-Hirnforschung.html

[14] Steffens, A.: Philosophie des 20. Jahrhunderts oder die Wiederkehr des Menschen (Philosophy of the twentieth century or the return of the human being). Reclam-Verlag, Leipzig 1999.

[15] Mac Ghlionn, J.: Inside China's plans to hijack Western minds in hidden 'cognitive war' against America. In: The Express (1 October 2023), https://www.the-express.com/news/world-news/113532/china-cognitive-warfare-mind-control-plans

In fact, since the 2000s, neuroscientific research has been challenging, and in many ways changing the roots of open Western societies by addressing perdurable questions such as the nature of self and individuality, free will, rationality, solidarity, and morality—as well as the modern, enlightened and emancipative concept of the human being in general. These projections stood at the basis of the open democratic societies of the West, and they enjoyed a more or less stable status within the social convention, which is now in many ways undermined by neuroscientific research. Such research seems to show that some of the assumptions on which basic Western concepts like self-sufficiency or human exceptionality were based are questionable theorems without much evidence so far in the "hard" findings of brain science. Such research thereby affords a profound "neurocentric" shift in Western culture and civilization that will likely give rise to new concepts of the human being and ecology.

If this is the case: What are the key socio-cultural changes evoked by neuroscientific progress as manifested through the application of neuroscientific information to such fields as ethics, philosophy, economics, law, politics, and spirituality studies?

If we streak through the currently available "classical" literature published in the past two decades, first of all, we see broad consensus that we can indeed define neuroscience to be a convergent project that conjoins brain research with other disciplines such as genetics, nanotechnology, and cybertechnology to effect changes in the constructs and conduct of numerous aspects of understanding the human being, society, and culture. Neuroscientific research, knowledge, outcomes, products, and ideas have changed social attitudes, values, and practices. The findings of the field are relevant to applications in economics, medicine, anthropology, the social sciences, and the military, and they address the current discourse (and debates) that focus on humanistic versus trans-humanist ideologies fostered through neuroscientific advancement. The potential impact of neuroscientific developments includes lifestyles, social and individual practices, and systems of law in both open Western societies and increasingly on the world stage inclusive of non-Western cultures. The question is if the current turn of globalized societies to "neurocultures" will be a liberating or a "confining" endeavor and if such changes will broaden the concept and responsibilities of human beings in the natural world. In short, neuroscience is both a scholarly discipline and a human endeavor that will most probably be appropriating itself as a social force over the coming decades.

Neuroethics, in response, is interested in neuroscience as a human endeavor for human development. It thereby explicitly grounds its features to responsible conduct, thus establishing a philosophical and inter-subjective orientation. It assumes a non-biased view of the current state of the science as related to core domains of influence inclusive of healthcare, human ecology and socio-politics. It affords a concise overview of the field of neuroscience—as a convergent inter- and trans-disciplinarity—that brings together a variety of other natural, physical, and social sciences with a human touch. It builds upon a foundational overview of the field to pose important—and provocative—questions about the extent and trajectories that neuroscientific developments may entail and obtain in the present and the near future. It thereby appeals to a diversified audience of scientists, philosophers, ethicists, sociologists, anthropologists, and policy-makers at a variety of levels, ranging from undergraduate students, graduate and professional students, professionals in these and other fields, and the lay public.

Accordingly, the literature about the interface between neuroscience, neurotechnology, and neuroethics has exploded over the past few years. It is thus not always easy for the average reader to follow a clear line when trying to further deepen insight and understanding of what is going on in the midst of a variety of titles and statements often contradictory with each other and directed to starkly differing audiences. In order to get a raw orientation, the reader can depart from the assumption that books addressing the topic may be classified into *three* distinct categories:

- *First* are those books and publications that approach the topic from a *purely ethical* perspective, that is, those on bioethics or neuroethics that include discussion of issues surrounding the use of particular neuroscientific techniques or technologies—for example, neuroimaging. Examples from the founding phases of the craft include Judy Illes' *Neuroethics* (Oxford, 2006), Steven Ackerman's *Hard Science, Hard Choices: Facts, Ethics and Policies Guiding Brain Science Today* (Dana Press, 2007), and Neil Levy's *Neuroethics: Challenges for the 21st Century* (Cambridge, 2008). Characteristically, any of these books (including James Giordano's own: *Scientific and Philosophical Perspectives on Neuroethics: The Silent Revolution in Neuroscience* (Cambridge University Press, 2009) feature passages that at least discuss the social effects of neuroscience and neurotechnology. Leon Kass' *Beyond Therapy* (US Government Printing Office, 2003) gives a rather detailed account of the treatment versus enhancement of the brain and human body debate from scratch and discusses how advances in neuropharmacology as applied to augmented cognition and emotionality may evoke questions of existential loss versus gain, and the eventuality of medicalizing our personal and social discontents. However, most of the more recent books in the field of neuroethics tend to take a deep dive and do not afford a viable introductory guideline that is tangible to a broad inter-disciplinary audience as well as the lay public.
- *Second* are those books that are explicitly devoted to biotechnology or neuroengineering in the technical sense and that might include a chapter or discussion of ethical, legal, or socio-cultural implications arising from the use of a particular technique or technology. These tend to assume a stance that is more closely aligned to the explanatory justification for the technology at hand, rather than presenting a complete review of possible—positive and negative—trajectories for use, implications, and ethico-legal and social impacts arising from each, or venues for resolution of the respective problems. For example, see: James Giordano: Ethical obligations in infrared imaging research and practice. In: N. Diakedes, J. Bronzino (eds.): *Medical Infrared Imaging*. Boca Raton: CRC Press, 2008. A somewhat notable exception is Dennis McBride and Dylan Schmorrow's *Quantifying Human Information Processing* (Lexington Books, 2007) which tends to explicitly address the ethical and policy issues that arise from various approaches to and uses of augmented cognition. But here, too, the focus is mainly on this one area of neurotechnology, rather than providing a broad and deep examination of new developments in the field writ large, and the extensive range of ethical issues and questions that are entailed.

Within these two categorical distinctions, there is usually some cursory overarching, so as to orient the reader to a basic knowledge of the other respective domain. However, this mutuality is fundamental, at best, and does usually not provide discussion to afford readers in one audience meaningful knowledge of complementary perspectives from other disciplines or engage readership from those disciplines directly. These approaches fail to engage the overall discourse sufficiently enough to genuinely serve an overarching informational or thought-provocative purpose.

- *Third* are those books that offer a futurist perspective and examine the scope and ramifications of possible realities incurred by progress in bioscience and biotechnology. Notable among these are Chris Gray's *Cyborg Citizen* (Routledge, 2001), Andy Clark's *Natural Born Cyborgs: Minds, Technologies and the Future of Human Intelligence* (Oxford, 2003), Gregory Benford and Elizabeth Malartre's *Beyond Human: Living with Robots and Cyborgs* (Tom Doherty Associates, 2007), J. Storrs Hall's *Beyond AI: Creating the Conscience of the Machine* (Prometheus, 2007), and Francis Fukuyama's now classic *Our Post-human Future: Consequences of the Biotechnology Revolution* (Farrar, Strauss & Giroux, 2002). Certainly, these are each and all excellent books. They pose provocative insights into the potential, possibilities, and problematic nature of the current and planned path of neuro- and bio-technological advancement and directly confront dystopian issues with rigor and insight. Fukuyama's work is equally compelling in the richness of his philosophical perspective. These books do a fine job of considering the Socratic question of "where we have come from, and where we are going" with regard to specific progress in neuroscience and neurotechnology.

In mentioning just these fundamental classics which have co-founded the field in lasting influential ways, we think that the reader is well advised to take a look at examples in each of the three book types, instead of concentrating exclusively on only one type of book. He should synergize as much as possible of their contents by actively comparing their information and judgments, in that this will provide him with a more balanced address of neuroscientific and neurotechnological developments, evolving ethical directions in the field, the philosophical constructs that are impacted (and perhaps threatened) and the socio-cultural and -political issues that are the source of the authors' concerns and hopes.

Comparing the trends inbuilt in each of the three book types all heavily influenced by their respective audience expectations and the adherent discourse habits and terminologies, and pondering their on all sides legitimate, but unavoidably restricted focus, the reader will get a good chance to become *empowered to take care*: to influence the concrete further impact of neuroscience and neurotechnology on the ethical, cultural, and social spheres by following up the trends, by understanding the different viewpoints in play and by acing consequently, for example, when it comes to debate on practical implementations and to transformative policy decisions.

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J. Giordano et al., *Neuroscience, Neuroculture, and Neuroethics*, SpringerBriefs in Political Science, https://doi.org/10.1007/978-3-031-74024-4