

**Ties van
de Werff**

PRACTICING THE PLASTIC BRAIN

**Popular neuroscience
and the good life**



PRACTICING THE PLASTIC BRAIN

popular neuroscience and the good life

Ties van de Werff

ISBN 978-94-6295-885-2

NUR 730

Cover design: Naomi Naus

Printing and layout: Datawyse Maastricht

© Ties van de Werff, 2018

The printing of this dissertation has been financially supported by the Netherlands Graduate Research School of Science, Technology and Modern Culture (WTMC).

PRACTICING THE PLASTIC BRAIN

popular neuroscience and the good life

Proefschrift

ter verkrijging van de graad van doctor aan de Universiteit Maastricht,
op gezag van de Rector Magnificus, Prof.dr. Rianne M. Letschert
volgens het besluit van het College van Decanen,
in het openbaar te verdedigen
op woensdag 16 mei 2018 om 10.00 uur

door

Ties van de Werff

Promotores:

Prof. dr. T. E. Swierstra

Prof. dr. H. J. Pott (Erasmus Universiteit Rotterdam)

Beoordelingscommissie:

Prof. dr. ir. H. van Lente (voorzitter)

Prof. dr. K.T. Bijsterveld

Dr. M. Boenink (Universiteit Twente)

Prof. dr. J. de Mul (Erasmus Universiteit Rotterdam)

CONTENTS

Acknowledgements	7
Chapter 1 Brain Plasticity and the Question of Moral Change	9
1. Introduction	9
2. Promises and Perils of a Plastic Brain	11
3. The Plastic Brain as Medicine for Living Well	19
4. Three Cases of a Brain-inspired Good Life	28
Chapter 2 Acting as a Good External Frontal Lobe: parenting teenage brains	35
1. Introduction	35
2. A Brief History of Parenting and Adolescence	38
3. Adolescent Brain Development and the Maturing Prefrontal Cortex Thesis	41
4. The Teenage Brain as Parenting Advice	47
5. Taming the Future: moral changes in parenting practices	56
6. Conclusion	64
Chapter 3 A Monk at the Office: stress and the mindful brain in the workplace	67
1. Introduction	67
2. A History of Work Ethic and Science-based Management	70
3. The Mindful Brain: from Buddhist practice to brain training	75
4. The Mindful Brain at the Office	84
5. Wholesome Working in a Technologized Work Culture	93
6. Conclusion	101

Chapter 4 Engaging the Ageing Brain: cognitive decline and ageing well	105
1. Introduction	105
2. Ageing Well Throughout History	108
3. Brain Games for Seniors: rejuvenating the ageing brain	113
4. From Fragile to Agile: repertoires of an ageing brain	119
5. Successful Brain Ageing in a Hypercognitive Society	131
6. Conclusion	137
Chapter 5 Practicing the Plastic Brain	141
1. Introduction	141
2. Changing Brains, Changing Moralities?	143
3. Conclusion	151
List of Figures	157
References	159
Samenvatting	177
The Value of Value Work: a note on valorisation	187
About the author	195

Brain Plasticity and the Question of Moral Change

1. Introduction

In the bestseller *De Tien Geboden voor het Brein* [Ten Commandments for the Brain] (2011), Dutch psychiatrist René Kahn asks: “We take care of our heart, muscles, bodies. Why shouldn’t we do the same for our brains?” Drawing on knowledge from the neurosciences, Kahn explains how our brains are *plastic* and argues that we can influence its development by changing our behaviour. To take matters in our own hands – to get “the best out of your brain” – he instructs us to study hard, sleep well, stress less, make friends, exercise, play with music and art, and refrain from alcohol. Lastly, indicating some limits to our wish to control our behaviour and fate, the author ironically suggests that we should choose our parents wisely, as their genes do influence our brain’s development. Kahn promises that if we follow these commandments and change our behaviour by working on our brains, we can improve ourselves.

Books like Kahn’s are not easy to miss when visiting your local bookshop. In the past twenty years, neuroscience knowledge has spread from the laboratory into society. Newspapers and magazines eagerly write on how we should nurture our brains, by training through exercise, mindfulness, eating healthy ‘brain food,’ or living a ‘brain-conscious’ life. Through popular-science books, self-

help manuals, TV programmes, apps, and neuro-gadgets such as brain games and DIY EEG headsets, neuro-advocates offer all kinds of advice and suggestions on how to best train our brains and improve our lives. The Biblical reference in the title of Kahn's bestseller *–Ten Commandments for the Brain–* while obviously meant as a marketing-friendly catch phrase, succinctly captures the new status the neurosciences seem to have received in our contemporary society: as an authoritative beacon we can turn to for questions of what to do and how to improve ourselves.

At the heart of this emerging brain culture (Ortega & Vidal, 2011; Thornton, 2011) lies a specific and relatively new view of the human brain. The prevailing conception within the neurosciences for the better part of the 20th century was that the adult brain is fixed and immutable after childhood. Since the 1990s, this conception of the human brain has been replaced by a view of the adult brain as mutable through its entire lifespan. Our brains are now described as *plastic*, or able to functionally and structurally change due to development, experience, or injury (Malabou, 2008; Trevarthen, 1987). Brain plasticity “opens up” the brain for all kinds of interventions (Abi-Rached & Rose, 2013), as we are invited to *do something with it*. The idea of a plastic, changing brain allows neuroscientists and neuro-advocates to propose all kinds of prescriptions for what to do and how to flourish – in short, it allows them to engage in *ethics*.

This book is about the promises of a neuro-inspired ethics. More specifically, it explores how the concept of brain plasticity is normatively used in societal practices of self-fashioning and flourishing. Questions of how to improve oneself in accordance with one's natural set-up are characteristic of the tradition of virtue ethics or *good life ethics* (Heller, 1988; MacIntyre, 1985; Swierstra, 2007). Ethicists in this tradition ask: *How can I live a good life? How can I become a good person? How can I flourish, given the possibilities I have as human being?* The aim of this book is to explore how the concept of the plastic brain is mobilized to answer these questions. How are the ethical implications of a plastic brain constructed in societal discussions about self-fashioning and flourishing? What are the consequences of reformulating the timeless question of the good life into neuroscientific terms? To answer these questions, I turn to different societal domains – practices of neurobiological self-fashioning – where the plastic brain is made valuable as a means to articulate what we can and should do in order to flourish and live well.

In this chapter, I introduce the concept of plasticity and identify the challenges it poses for understanding the ethical and societal implications of the

neurosciences. I argue that both proponents and opponents of a plastic brain share the assumption that the proliferation of the plastic brain automatically will result in specific moral changes – for better or for worse. They thereby forgo the question of how the plastic brain *is actually made valuable* in specific contexts in the first place. In this dissertation, I sidestep the theoretical debate between proponents and opponents by taking a pragmatist and empirical approach towards understanding how the ethical implications of the concept of brain plasticity are enacted in practices of neurobiological self-fashioning. After I introduce my analytical framework for studying valuations of a plastic brain in these practices, I introduce three case studies in which I scrutinize neurobiological flourishing.

Throughout history, when faced with questions of what to do and how to improve our lives, we turned to counselling experts – be they philosophers, church-fathers, essayists, or spiritual gurus. As the Big Science of today, the helping hand now seems to come from the neurosciences. In a society where (technological) change is the imperative, the plastic, changing brain appears to a fitting means for addressing challenges and ideals for living well. By showing how the plastic brain is used to answer this timeless ethical question, this book aims to give a glimpse of how, in an affluent and secular society, the ‘hard’ and technologized sciences become imbued with the promise of bringing us evermore closer to the good on the horizon.

2. Promises and Perils of a Plastic Brain

Traces of the idea that our brains are not fixed or hard-wired after a certain age, but instead remain changeable throughout our adult lives, can already be found in the history of the neurosciences. Historians of (neuro)science have shown how psychologists and neuroscientists throughout the past century already considered the idea of plasticity (Abi-Rached & Rose, 2013; Pitts-Taylor, 2016; Rubin, 2009; Teskey, 2001). William James, for example, is often seen as one of the early predecessors who thought about the brain as a plastic organ, as he stated in 1890: “organic matter, especially nervous tissue, seems endowed with a very extraordinary degree of plasticity” (Begley, 2009, p. 13; Pitts-Taylor, 2016, p. 24). Similarly, the quote famously ascribed to neuroscientist Hebb in 1949 – “neurons that fire together, wire together” – indicates forms of *synaptic plasticity*: changes in the strength of connections between synapses, the junctions between neurons. Syn-

aptic plasticity was generally accepted at the first half of the 20th century, just as the idea of critical or sensitive periods in the brain development of infants (Abi-Rached & Rose, 2013; Pitts-Taylor, 2016). Still, the dominant view within the neurosciences (and beyond) in the 20th century was the view of Santiago Ramón y Cajal, one of the founding fathers of modern neuroscience:

Once development has ended, the founts of growth and regeneration of the axons and dendrites dried up irrevocably. In the adult centers the nerve paths are something fixed, ended and immutable. Everything may die, nothing may be regenerated. It is for the science of the future to change, if possible, this harsh decree. (as cited in Begley, 2009, p. 13).

Cajal perceived this immutability of the human brain as harsh because it would mean that there is no growth in an adult brain and that the brain cells at birth are all that we would ever have – implying a firm biological limit on the quest for finding remedies for brain diseases and lesions.

Cajal hoped that future research methods and technologies would shed a different light on the static image of the brain. Indeed, with the advent of new imagining technologies such as electroencephalogram (EEG), by which electrical activity in the brain could be measured, and functional magnetic resonance imaging (fMRI), which measures changes in the level of oxygen in the blood flow of the brain, the idea of a static brain became slowly replaced from the 1990s onwards with the view of our human brain as inherently plastic. This shift was further solidified by the 1990s research of prominent neuroscientist Fred Gage, which questioned the widely-held belief that adult brains were not capable of creating new neurons by demonstrating an ongoing neurogenesis in the adult human brain (Rubin, 2009, p. 418). In a field already adapted to the concept of synaptic plasticity and to developmental plasticity in infants, the brain was now envisioned as open for *structural* changes. This resulted in the emergence of a strong therapeutic discourse, which promised that this novel type of plasticity could come with new remedies for brain diseases and a potential for a “self-healing brain” (Society for Neuroscience, 2007; Rubin, 2009, p. 420). As this therapeutic, promissory discourse intermingled with the scientific discourse on plasticity, it paved the way for the wide acceptance of the possibility of structural brain plasticity over fixed views of the human brain (Rubin, 2009; Rees, 2010 & 2016). As Cajal already hoped for, the harsh decree of an unamenable brain was denounced, as our plastic brain became perceived as amenable through all kinds of therapy, drugs, and self-nourishment. The plastic

brain became the premise for those who were interested in the implications of neuroscience for therapy and policy (Abi-Rached & Rose, 2013).¹

In the contemporary neurosciences, plasticity has become an umbrella term that encompasses mechanisms of change on different levels of neural organization in the brain: from individual synapses and neurons, to structures or networks of neurons, and eventually behaviour.² While plasticity nowadays is widely seen as a fundamental property of the central nervous system (CNS), there remains a high level of uncertainty and disagreement within the neurosciences about the degree, quality, and scope of plasticity or about the specific cells, regions, networks, or brain functions it involves (Shaw & McEachern, 2001; Teskey, 2001). In its most simple description, plasticity is the ability of the brain to change and be changed. The brain is said to change due to genetic developments (i.e., sensitive periods in infants), self-directed thought and action, our experiences and interactions with the environment, and injuries (Malabou, 2008, p. 20; see also West-Eberhard, 2003; Wexler, 2006). Plasticity embodies different meanings, depending in part on how it is measured and defined in research designs (Pitts-Taylor, 2016, p. 23).

This shift from an immutable, hard-wired brain to an open and changeable brain allows for conversations about the malleability of human behaviour – once the epitome of debates on nature/nurture or agency/structure – to be articulated in terms of the plastic brain. The concept of the plastic brain implies a mutual shaping between the individual, her brain, and the environment: the plastic brain shapes us, and we are said to be able to shape the plastic brain through our own thoughts, actions, and interactions with the environment.

¹ Within the diverse field that makes up the contemporary neurosciences, brain plasticity is described through multiple notions and theories. *Neuroplasticity* commonly refers to the ability of the brain to functionally (degree of connectivity) and structurally (how tasks are organized in the brain) change, due to either intrinsic activities such as genetic development processes, individual experiences, and self-inflicted nourishment, or extrinsic factors such as pharmaceutical interventions or electrical brain stimulation. *Synaptogenesis* and *synaptic pruning* describe the creation and removal of whole synapses or groups of synapses that build or destroy connection between neurons, while *neurogenesis* refers to the creation of new neurons. Brain plasticity can be seen as part of the wider development in biology from genomics towards epigenetics, where the actualization of phenotypes in the interaction between the organism and the environment are central objects of study (cf. Papadopoulos, 2011).

² The core epistemological problem of contemporary neuroscience is the relationship between behaviour and neural activity, the relationship between mental processes and neurobiological processes (the so-called mind/body problem, or the “explanatory gap” as Abi-Rached & Rose (2013) call it). While many neuroscientists see the brain as the seat of human behaviour, contemporary methods (such as fMRI or EEG) are based on finding correlations, not causations.

Critiques on the plastic brain as being reductionist and determinist therefore seem to have lost their critical purchase (Pitts-Taylor, 2016, p. 7): Our brain is no longer only biologically determined, as it is being shaped in relation to its environment. Hence, some scholars see plasticity as bridging the gap between nature and nurture (cf. Beaulieu, 2000; Ledoux, 2002; Mohr, 2003). Nature/nurture debates are about drawing a line between what can be changed and what should be accepted as unchangeable. They are about the (limits of) malleability of man and society. Now that nature and nurture “speak the same language” (Ledoux, 2002, p. 2) – namely the language of the amenable brain – the demarcation between the two has become blurred.

At the same time, the malleability or openness of the plastic brain is not total. Whether due to developmental programmes, self-directed nourishment through use- or activity-dependent plasticity (Ganguly & Poo, 2013), or exogenous stimuli, plastic changes are not temporary. The term plasticity (as opposed to elasticity) implies that changes to the brain are to some extent robust, fundamental, or definitive. Like a sculpture made of stone: once it has taken form, it cannot return to its earlier state.³ This implies that plasticity is positioned in between malleability and determination, between softness and rigidity, between potentiality and actuality. Or, as the adage goes: We are our brains, but our brains are what we do with it.

The plastic brain entails that we are both *objects of change* and *agents of change*. Being both master and servant of our plastic, changing brains obscures questions of agency. In principle, the concept of brain plasticity allows for multiple views on human agency in relation to its environment. Based on conceptual analyses of plasticity by Malabou (2008) and Pitts-Taylor (2016), we can discern three (theoretical) possibilities. Agency can be seen as “inhabiting” the brain, shaping itself through processes of development or injury for example. Agency can also be attributed to the individual subject, as when our self-directed thoughts and actions are said to change our brain functioning. And agency can be located outside of the individual subject and given to culture, for example when the plastic brain is seen as susceptible to being shaped, habituated, and inscribed by social, cultural, or material influences within its environment (Pitts-Taylor, 2016, p. 22).

³ Hegel, in his *Phenomenology of Spirit* (1807), traces the concept of plasticity to the Greek verb *plassein*, which means to mould or to shape, like a sculptor moulds his stone. Hegel resurrected the concept from the Greek arts (plastic arts, e.g., sculpture) and the Greek idea of self-fashioning as the moulding of character to show that we are ever capable of improving ourselves (Malabou, 2008).

This indeterminate and interactionist nature of plasticity turn it into an ethically ambiguous concept. It positions us, the brain bearers, in-between malleability and determinism, and in-between our own brain functioning and our environment. The concept of the plastic brain thereby conceals a clear distinction between which aspects of ourselves or our surroundings we can consciously change, which we cannot – and who should change what. In theory, one could mobilize plasticity to address our capability and freedom for sustained and durable self-determination, but one could also use plasticity to propose changes in the way social structures or cultural factors should (or should not) shape our brain functioning. Thus, the undetermined, interactionist nature of plasticity makes it an ethically equivocal and performative concept: In principle, it affords multiple action programmes of what we can, could, and should do with our ourselves and our environment, and to what end.

Normativities of a plastic brain: Beyond empowerment and control?

As articulated by its appropriators, the promises of a plastic brain are plenty. In the past two decades, the many interventions that emerged that aim to change the brain present the plastic brain as deeply malleable. The widespread proliferation of prescription drugs for depression, ADHD, burnout, autism, and other mental disorders is an example of plasticity-based interventions that aim to alter behavior through drug-induced neurological change.

But the promises of the plastic brain are not limited to the clinical potential of such exogenous stimuli. The therapeutic potential of the plastic brain has spilled from the clinical domain into our everyday lives. Books with titles such as *The Plastic Brain – Harness the Power of Neuroplasticity for a Healthy & Happy Brain* or *Neuroplasticity: This Is How to Train Your Brain for Success* promise that through endogenous stimuli – self-directed plasticity through brain training – we can achieve happiness, health, or success more easily and with longer-lasting results. Some interventions seem to articulate new ideals, such as “brain health” or a “brain conscious lifestyle”. All aspects of our lives can be made subject to the idea of brain plasticity, “for it is the life we lead that creates the brain we have” (Schwartz & Begley, 2002, p. 286). Plasticity would give us “a remarkable built-in ability to strengthen and grow the person that you are, at any age” (Merzenich, 2013, p. 2).

An understanding of ourselves as neurologically plastic thus comes with the promise of new and better ways to improve ourselves, and maybe even new ideals to strive for. The promise is thus that knowledge of the plastic brain

comes with certain *moral changes*, changes in the ways and ideas we can and should improve ourselves. This promise of *neuro-induced moral change* is the central topic of this dissertation. It also underlies the current debate on understanding the implications of the increasing societal import of neuroscience knowledge. In the past years, scholars from different disciplines have scrutinized the possible implications of the import of neuroscience knowledge in academia and society. We can roughly distinguish two major positions in the debate on understanding the implications of the plastic brain. Proponents and other enthusiasts – e.g., popularisers of neuroscience knowledge and some scholars in the humanities and social sciences – see in plasticity a liberating and empowering force, a new means to improve ourselves and society. In contrast, critics warn of a reiteration of an “ethic of neoliberal self-care” or a new “brain-based biomedical citizenship.” (Papadopoulos, 2011; Pitts-Taylor, 2010; Rose, 2007; Abi-Rached & Rose, 2013).

Knowledge of a plastic brain appears to be easily transferable from the neuro-lab to a variety of societal and scholarly domains. As the plastic brain is open and receptive to its environment, it can safely be used by scholars from the social sciences and humanities without facing critiques of biological or social determinism. Similar to those who see plasticity as the end to nature/nurture debates (cf. Beaulieu, 2000; Ledoux, 2002; Mohr, 2003), some scholars mobilize brain plasticity to bridge or counteract determinist and structural explanations of human behaviour, such as hard-wired sex differences and gender stereotypes (cf. Schmitz & Höppner, 2014; Jordan-Young & Rumati, 2012; Vidal, 2012), technological determinism (Rotman, 2000), neo-liberalism (Malabou, 2008), or stigmas on mental illness (Martinez & Mendoza-Denton, 2011). This reading of plasticity attributes to the plastic brain the power of liberation from (structural) constraints to our autonomy and celebrates its ability to empower our individual agency. Plasticity is interpreted here through the discourse of emancipation and empowerment, and it is seen as biology-based evidence of the potential of human adaptability and freedom.

In contrast, other scholars warn that the plastic brain has been embraced too enthusiastically. Here, the plastic brain is not hailed as an empowering ally against structural constraints to our autonomy (be they biological, technological, or economic) but rather is viewed as a reiteration or deepening of such constraints. These scholars question the apparent alignment between plasticity and dominant ethical frameworks – in the affluent West – of self-determination, healthy citizenship, embodied self-stylization, and the neo-liberal virtue of flex-

ibility. In this view, the contemporary brain sciences should be seen as forms of power and governance, within which we are urged, through Foucauldian “technologies of the self” (e.g., psychopharmaceuticals), to care and take responsibility for properly managing our bodies (Papadopoulos, 2011; Pitts-Taylor, 2010; Rose, 2007; Abi-Rached & Rose, 2013). Interventions based on brain plasticity then become yet another form of a “neoliberal ethic of personal self-care” (Pitts-Taylor, 2008). Indebted to the scholarly tradition of bio-politics (Lemke, 2011), life politics (Giddens, 1991; Dehue, 2014), and governmentality studies (Rose, 2007), scholars in this position fear that the plastic brain turns from individual opportunity into a societal obligation. The plastic brain then becomes a new a site of choice, prudence, and responsibility: “Once more, now in neural form, we are obliged to take responsibility for our biology, to manage our brains in order to bear the responsibilities of freedom” (Abi-Rached & Rose, 2013, p. 23).⁴

What we see in these recurring analyses on brain plasticity is that the ethical implications of the plastic brain are either celebrated as empowering and liberating, or feared as a reiteration of the status quo – which, in a context of neoliberal bio-medicalization, would imply a further constraining or disciplining of our options to act and care for ourselves. While both positions in the debate value the plastic brain differently, they share the assumption that neuro-induced moral changes are *imminent*: They presuppose that the import of knowledge of neuroscience in society *will* automatically lead to specific normative effects and moral changes, conceptualized as either strengthening our autonomy or undermining it by instigating new forms of discipline and (social) control. Scholars in both positions run the risk of assuming and overstating the novelty and importance of the neurosciences in transforming subjectivities and practices, thereby unreflexively buying into the promise that knowledge of the brain will transform our conceptions of self, our behaviour, and ultimately *what it means to be human* (O’Connor et al., 2013; Pickersgill & Van Keulen, 2011; Pickersgill, 2013; Schneider & Woolgar, 2015). Moreover, in assuming specific

⁴ While the earlier governmentality work of Nikolas Rose remains quite influential in studies of the societal impact of the neurosciences – especially his concepts of the “neuromolecular gaze” and “neurochemical selves” – the position he develops together with Abi-Rached in *Neuro* (2013) is somewhat more ambivalent. In contrast with his earlier work on neuroscience, the ‘late Rose’ downplays his earlier concern that our personhood would be replaced by a “brain hood,” and he points to some limits of Foucauldian governmentality approaches, especially, for understanding unexpected or complex engagements with bio-medical knowledge in practice, resulting in multiple subjectivities (Rose, 2003 & 2007; Abi-Rached & Rose, 2013).

moral changes, *how* such changes would come about in particular practices remains unclear. In theorizing about the societal implications of the plastic brain, both positions in the debate ignore an important question: How is the knowledge of the neurosciences *made relevant and valuable* in the first place? And how are these valuations *made to challenge* or destabilize ideas of flourishing?

It is not at all obvious that such highly technical knowledge can play a role in answering questions of what to do and how to live – let alone that it changes ideas and practices of flourishing. Several scholars have empirically scrutinized the import of neuroscience knowledge in society instead of assuming specific moral changes beforehand (cf. Pickersgill, 2011 & 2013; O'Connor & Joffe, 2013; O'Connor & Nagel, 2017). For example, some of these studies explore how novelty is performed in practices of mental health care and law, revealing that knowledge of the brain seems to be made relevant in such practices not by challenging existing views on responsibility and free will but rather by aligning to existing cultural tropes, thereby perpetuating them (Choudhury et al. 2009; O'Connor et al. 2013; Pickersgill et al., 2011). In a similar vein, O'Connor & Nagel (2017) have shown that neuro-enhancement discourse in practices of parenting children and caring for the ageing is not only taken up to reinforce individualist forms of (self-)care. In these practices, the authors show, the self and other become blurred, as parents and seniors engage with neuroscience knowledge to articulate their relationships of care towards those around them (O'Connor & Nagel, 2017).

What these examples indicate is that it is not evident from the outset how knowledge of the brain will be made valuable in practice, nor that such valuations can be sufficiently understood through analytical frameworks of individual empowerment versus societal control. These studies show that the dissemination and appropriation of neuroscience knowledge is a deeply socially and culturally embedded process – an insight that is at the core in fields such as Science & Technology Studies (STS), Sociology of Scientific Knowledge, and Critical Neuroscience (cf. Choudhury & Slaby, 2012). Instead of assuming a transformative potential of the neurosciences, how neuroscience knowledge is perceived and valued as to change conceptions and practices of flourishing then precisely becomes a topic of empirical inquiry.⁵ This calls for a broadening of

⁵ The very process of rendering the plastic brain ethically valuable is thus a topic of empirical enquiry instead of a topic that requires (meta-)ethical speculation. This means that I do not engage in discussions about fact/value distinctions or the naturalistic fallacy and their mud pool of metaphysical and linguistic arguments (cf. Appiah, 2008; Hume, 1739/2000; Putnam, 2002; Quine, 1951). From

the conceptual framework used for understanding the possible normative effects and possible moral changes of neuroscience in specific contexts.

This especially applies for understanding the normative usages of the plastic brain. The performativity and ethical ambiguity of the concept – its indeterminate and interactionist nature – implies that only in appropriations or usages does it become visible how boundaries are drawn between what parts of ourselves or society we can and should change, and what we should accept as unchangeable. To conceptualize these possible valuations of the plastic brain beforehand as either empowering our autonomy or disciplining it potentially limits my exploration of the ways the plastic brain in different societal contexts could be made valuable to address certain concerns, hopes, fears, and ideals of flourishing. Thus, instead of asking whether the plastic brain either limits or empowers our quest for self-determination, I ask the question: To what desirable ends is brain plasticity made valuable in practices of self-fashioning in the first place, and how are such different valuations of the plastic made to challenge or destabilize prevailing ideas of flourishing and living well in these practices?

3. The Plastic Brain as Medicine for Living Well

The key questions this thesis addresses are: How is the plastic brain made valuable for questions of flourishing, and how are these valuations of a brain-inspired good life made to (de)stabilize ideas of flourishing? To answer this question, I will explore the ways the plastic brain is made valuable in three different practices of the good life across our lifespan: parenting, working, and ageing. Before I introduce these three case studies of neurobiological flourishing, I first explicate my conceptual framework for analysing valuations of the plastic brain. Inspired by recent work in Science & Technology Studies (STS), sociology of valuation, sociology of expectations, and pragmatist virtue ethics, I construct an analytical model for tracing the moral life of the plastic brain in society (cf. Pickersgill, 2013).

a pragmatic point of view, the blurring of the fact/value distinction when making a practical judgement is not so surprising: If we aim for a solution to the question of what to do, we need at least some view on what is the case (including what kind of human beings we are) and what the possible and desirable consequences of our actions can be.

Articulating and Coordinating the Good through Value Work

In traditional virtue ethics, the question of what to do and why emerges when we face particular challenges that give rise to concerns. In such situations, when it becomes unclear what to do, we often turn to counsellors for advice. When normatively mobilizing the plastic brain for questions of how to do and be good, translators and popularisers of neuroscience take on this role of ethical counsellor. In the advice of what to do with the plastic brain and for what reason, the question of truthfulness of the advice is less important than its suitability to address certain concerns or problems and to bring about desirable improvements. Just like therapists, translators and popularisers of neuroscience knowledge need to tune in to the concerns, needs, hopes, and desires of their audiences to make their knowledge relevant and meaningful. To explicate how the plastic brain is used for questions of flourishing, I thus turn to the advocates of brain plasticity and trace their efforts at what I call *value work*.

Value work is the act and process of *valuing*: the attribution of value to something, and/or the assessment of something as valuable. Values can be broadly defined as ‘ends-in-view’ (Dewey, 1913) or as something ‘desirable, good or proper’ (Dussauge, Helgesson, Lee, & Woolgar, 2015; Graeber, 2001). I use the term value work instead of valuing to denote that attributing value or assessing something as valuable requires deliberate activities: The relevance and meaning of the plastic brain, for specific audiences and for specific ends, is not given, but has to be established. I base the notion of value work on a recent body of work in the field of sociology of valuation (Dussauge et al., 2015; Helgesson & Muniesa, 2013; Lamont, 2012), which in turn is indebted to the pragmatist view on values and valuation of Dewey (1939). A pragmatist view on values holds that values are not transcendental, fixed, or absolute entities that silently structure our behaviour. Instead, values are seen as the outcome of (social and discursive) processes of valuation, where values become enacted, articulated, ordered, and negotiated (Dussauge, Helgesson, Lee, & Woolgar, 2015; Kjellberg & Mallard, 2013). This shift from value as noun to value as verb – a ‘flank movement’ towards values, as Dewey called it – assumes an agnostic and empirical stance towards values as things that are performed (and thus can be studied) in practice (Muniesa, 2011).⁶

⁶ By focusing on the process of attributing or giving value to something, one bypasses the question of whether values “really” exist, or whether they only exist in the eye of the beholder (the dualistic relationship between objectivity and subjectivity of values).

Scholars who study valuation from a sociological perspective often focus on specific valuation practices, metrics, or devices in places where the assessment and ranking of values is explicitly reflected upon: TV talent shows, the assessment of peculiar economic goods, quality instruments in health care, or peer-review processes in academia, for example. I do not focus on such reflective processes of valuation-as-ranking. Instead, I see the plastic brain as a kind of valuation yardstick: It invites its users (appropriators) to articulate what we should do with it, and for what reason. It invites actors to enact, articulate, and order values – to do value work. This happens especially at moments and sites where knowledge of the plastic brain is diffused beyond the laboratory and where meaning and relevance have to be established – such as University press releases, popular science books, magazines, newspaper articles, blogs, TV shows, etc.⁷

Recent bodies of research in STS, particularly in the sociology of expectations and the ethics of emerging technologies, show some fruitful venues for studying such value work. For example, valuations are enacted in what some have called *concern-making*: addressing certain challenges or issues and translating these to (neuro)scientific knowledge, linking matters of fact to matters of concern (Dussauge, Helgesson, Lee, & Woolgar, 2015; Kraus, 2012; Latour, 2004). As we will see, neuroscience research on ageing is often made relevant by addressing either individual issues (e.g., forgetting names) or broad societal developments (e.g., the greying society). It's through concern-making that certain diagnoses of what constitutes the problem for or obstacle to flourishing are proposed. By invoking specific challenges, certain concerns can be debunked and replaced by others, existing concerns can be reaffirmed and reiterated, or new concerns can arise. Articulating, aligning to, or debunking concerns are ways to appeal to specific audiences and persuade them to care for neuroscience knowledge.

Reflections on new science and tech often take the form of value-laden vistas of promises, hopes, and expectations about possible usages and desirabilities

⁷ Strictly speaking, value work pervades the whole process of scientific knowledge formation, from decisions regarding funding and research priorities to the choice of theories of mind to be used, statistical models built, and behavioural concepts addressed. As I focus on the translators and popularisers of the plastic brain, I limit my examination to forms of value work on the level of dissemination and appropriation of neuroscience claims in specific value-laden contexts. In this journey of valuation, I do not assume a direct, causal relationship between sender and receiver, as is often implied in deficit-models of science communication, or notions of science communication as “knowledge transfer” (cf. Horst, 2016; Wyne, 1992).

(Lucivero et al., 2011; Van Lente, 2012). Promises and expectations are generative: They guide activities, provide structure and legitimation, attract interest, and foster investment (Borup, Brown, Konrad, & Van Lente, 2006). They form the bridge between the “inner and outer worlds of techno-scientific knowledge communities and fields” and link the technical realm of science with societal issues (Borup et al., 2006, p. 286). Promises and expectations are closely linked to concern-making: Only after addressing the problem can a solution be promised – a solution that often takes the form of action programmes or ideals. Concern-making and promissory discourse are basic features for any debate on the societal impact of modern science and technology (Brown 2003; Swierstra & Rip, 2007; Swierstra 2015), and they provide a rich resource for studying how valuations of science come into being.

By appealing to the perceived concerns and challenges of a specific audience and linking scientific knowledge to their hopes and ideals, advocates of emerging science and technology not only attribute (moral) relevance to scientific claims but also prepare the ground for a normative appropriation of these claims. Articulating certain values and not others, or aligning the plastic brain with certain ideas of the good and contesting others, is a way to anticipate ethical appraisal and possible value conflicts. Coordination of the normative uptake, through mobilizing concerns, promises, and expectations, is an important function of value work and turns it into a form of ethical boundary work (cf. Wainwright et al., 2006).⁸

To explore to what extent the plastic brain in practice amounts to moral changes, I thus explicate the ways advocates are able to render the plastic brain relevant and meaningful for particular audiences, and for particular ends, through articulating values in concern-making and promissory work. I do this by tracing the trajectory of valuations of the plastic brain from its diffusion in public discourse to concrete interventions in particular contexts. This entails studying the ways neuroscientists themselves – but also science journalists, companies, social scientists, and other neuro-translators and popularisers – use the plastic brain to articulate what it means to do and be good. As studies in ethics of emerging technologies have shown, value work does not seem to happen at random: Public deliberation about emerging technosciences such as the neurosciences are often characterised by recurring patterns of moral argumen-

⁸ Wainwright et al. (2006) coin this term, based on Gieryn’s notion of boundary work, to show how ethics has become an integral part of maintaining the image of science in in the embryonic stem cell laboratory.

tation (cf. Borup et al., 2006; Swierstra & Rip, 2007). By explicating the journey of valuations of the plastic brain, I aim to discern possible recurring patterns of valuations. I thereby focus on a specific subset of valuations: those that pertain to the good life.

A Pragmatist and Therapeutic Model of the Good Life

To study valuations of the plastic brain in practice, I take a pragmatist stance towards ethics (cf. Keulartz et al., 2004). A pragmatist view on ethics does not start from abstract or absolute laws or principles but instead focusses on the acting individual in concrete practices where dilemmas and challenges occur. Dualisms such as fact versus value, objectivity versus subjectivity, or technology versus culture – often the object of metaphysical ruminations in the field of ethics – are not seen as essentialist or a priori given but are constructed in practice where they fulfil a certain function (Keulartz et al., 2004). I treat ethics as being about the concerns of everyday life, about the practical questions of what to do and how to live. Not every how-to question is ethical; I regard only those questions that deal with how to act in relation to our own and others' well-being as ethical (Sayer, 2011, p. 145).

As the promises of plasticity in popular culture are about new self-understandings and new ways to improve ourselves, I take my inspiration from good life ethics or virtue ethics. In this revived tradition of ethical thinking, the focus is not on consequences or principles but on the possibilities of individual self-realization or self-fashioning in a particular practice. Virtue ethics deals with questions such as how to become a good person, how to attain a good character, and how to flourish in a particular practice given the possibilities one has as a human being. This practical view on ethics as characterized by well-being or flourishing – which is not limited to individualistic virtues but can also include socially oriented virtues such as honesty, concern for others, or kindness – is in stark contrast with both rule-based and principle-based ethical theories, which search for absolute or general laws and regulations (such as Kant's categorical imperative), and consequentialist ethical theories, which emphasise consequences of actions (such as utilitarianism).

There are many different theories of virtue ethics, each with different conceptions of how we should live our lives (cf. Annas, 1993; MacIntyre, 1985; Slote, 2001; Williams, 1985). Instead of theorizing about such virtue ethics theories, or measuring up practices with a specific virtue ethics theory in hand (as is common in applied ethics), I take a practical stance, akin to practical philosophy

or empirical ethics (cf. Mol, 2002; Pols, 2004; Swierstra, 2011): There is ample ethics in the world out there, as ethics is a pervasive yet largely implicit dimension of our everyday life.^{9,10} The task of the philosopher or ethicist is not to measure or correct the daily lay-ethical doings with abstract theories in hand, but rather to help make visible, articulate, and broaden such lay-ethics. I will thus not side with one particular theory of virtue ethics but instead will explore how, in particular societal practices, the plastic brain is made valuable for questions of flourishing by neuroscience translators and popularisers.

Instead of a substantial, preconceived theory of virtue ethics, I therefore need an analytical tool that is abstract enough to capture the range of views and ideals of the good life proposed across three different cases studies, yet sensitive enough to explicate the characteristics of such ideas of the good life and how they are envisioned to change existing notions of the good. To this end, I combine theories from two different pragmatist ethicists. I use the analytical model of virtue ethics and moral change of Swierstra (2011), and the concept of therapeutic argument of Nussbaum (1994), in order to distinguish some basic elements or variables that any theory of the good life needs to address.

According to Swierstra, any theory of virtue encompasses ideas about the *perception* of ourselves, or *self-knowledge*, and of the *practical options* we have to act, or what we can call *self-stylization* (or ascesis). Self-knowledge is about how we understand and know ourselves. Knowledge about ourselves can arise from experiences or from the opinions of others, but it can also come from science and technologies, such as diagnostic tests. A brain scan gives a different understanding of one's self than, say, a family history or a religious community. How we come to know and understand ourselves has implications for what we can do. Factual descriptions of what it means to be a parent, an employee, or a senior are not neutral, but are action-guiding. Understanding a scientist to be a civil servant or a truth-seeker indicates different ideas of what a good academic should be and do.

In addition to self-knowledge and practical options to act, any theory of virtue also includes some view of the world or environment in which we can flourish, including the degree of control or influence we think we have over this

⁹ The applied ethics-view is also common in the field of neuroethics, a subfield of bioethics where scholars study the ethical and philosophical implications of neuroscience research (see for example Racine, 2010; Roskies, 2002).

¹⁰ I base this view on the ontological assumption that our relation to ourselves, each other, and the world around us is one of valuation (Dewey, 1956; Taylor, 1986)..

world. Do we perceive the world as having a particular order, or rather as a contingent chaos? How much room for achieving the good life do we have in the environment in which we are supposed to flourish? Can we bend the environment to our will, or are we rather subject to fate? These views on the world and the environment in which we are supposed to flourish affect the practical possibilities we think we have and how we can and should operate within them. In the tradition of virtue ethics, ideas of what it means to flourish as a human being are always situated within a particular context. For example, for Aristotle this context was the political life in the polis, whereas for Epicurus it was the social life of friendship. In contrast to purely subjectivist models of virtue ethics, the analytical model of Swierstra (2011) allows me to conceptualize and deduce assumptions about the world and environment in which we are to flourish.¹¹ The resulting model of a good life is thus conceptualized along four variables: perception and action, and self and world.

Building on Dewey's pragmatism (1954) and on philosophies of technological mediation (Ihde, 1990; Latour, 1992 & 2005; Verbeek, 2000), Swierstra uses these basic elements to conceptualize how recent and emerging technologies might impact ideas of the good life. Emergent science and technologies – such as the neurosciences – are able to exert influence over our interpretations, our norms and values, and our established interpretations. In turn, values and norms can inform the development of science and technology (Swierstra, Van Est, & Boenink, 2009). This mutual shaping of technoscience and morality is called *techno-moral change* (Swierstra et al., 2009). An iconic example is the introduction of the contraceptive pill. The pill gave women a choice over family planning and gave them autonomy over their own bodies, changing their self-understanding, while it also came with new (gendered) responsibilities and requirements of self-discipline. At the same time, the pill created the possibility to separate sexuality from reproduction, which paved the way for the sexual revolution in the 1960s and the subsequent emancipation of homosexuals (Keulartz et al., 2004). Other now well-studied examples that are closer to the topic of this dissertation involve the use of neuro-pharmaceuticals. The use of Ritalin and Adderall by college students to improve their cognitive abilities is not only a new practical possibility (of which its refusal can also become a moral choice) but also potentially challenges what comes to count as talent, intelligence, and

¹¹ Swierstra uses the term 'world' to refer to perceived degrees of chaos/order and fate/will. In addition to these fundamental world-making outlooks, I also include in this variable more specified views on society in which we are supposed to flourish.

the skills needed for learning (Sandel, 2007). Similarly, the widespread use of anti-depressants has challenged our views on sadness and tragedy in life and on which aspects of our environment we believe to be under our influence and control (Dehue, 2008).

Emerging technosciences such as the neurosciences have the potential to challenge our perception of the world and how we act upon it. The plastic brain can, for example, destabilize or change how we perceive ourselves and how we see an issue or concern. It can also challenge the practical (im)possibilities we have for achieving the good life, including the virtues, skills, or dispositions needed to overcome a challenge. And it can (de)stabilize the underlying hierarchy of justifications and valuations we use for articulating what it means to live well. This implies that neuro-induced moral change not only reveals itself in substantial changes in (articulations of) the good but can also take the form of a change in the visibility or prioritizing of certain valuations over others, highlighting some while pushing others from view. The concept of moral change is necessarily pragmatist: In order to explore shifts in our understanding of the good, or in the hegemony of valuations, it assumes that our ideas of the good are not transcendental or fixed but instead are subject to change. Another way of putting this is to say that I empirically study possible shifts in the acceptance of certain valuations, not their acceptability in principle.

Swierstra's model allows me to analyse how the plastic brain is used to propose certain moral changes regarding the four basic elements of a good life. It also enables me to analyse how the relationship between the self and the environment is constructed in brain-based accounts of flourishing – the interactionist nature of plasticity. However, it falls somewhat short for analysing the perceived malleability of the plastic brain. As we have seen, the concept of plasticity promises to offer both a new understanding of ourselves and a new understanding of what we might become. Plasticity would explain both “the origin of the person you are, and the better, stronger person that you could be” (Merzenich, 2013, p. 14). In Swierstra's model, self-knowledge only pertains to the actual understanding of ourselves, not to the ideals of what we might become.

Nussbaum's notion of *therapeutic argument* can help here. Nussbaum uses the concept of therapeutic argument to describe how Hellenistic philosophers (virtue ethicists) pragmatically used philosophical reasoning as medicine for living well (Nussbaum, 1994). Nussbaum's model is an illustration of how early Greek and Roman philosophers such as Epicurus, Seneca, and the Stoics proposed (moral) changes to improve daily lives. Based on a medical model of

ethics, the aim of a therapeutic argument is to give a diagnosis of suffering – or the lack of flourishing – and to propose practical tools to overcome these obstacles in order to attain the good life (Nussbaum, 2001; McMahon, 2003). Nussbaum's therapeutic argument consists of a diagnosis of the disease (i.e. socially taught beliefs), a norm of health or conception of flourishing, and a method or procedure to attain this ideal. Nussbaum makes a relevant distinction between diagnosis and ideal: between the obstacles that prevent us from flourishing, and an ideal of what we can become when following the philosopher's advice. In Nussbaum's model, our understanding of ourselves (self-knowledge) is thus differentiated between what we are in *actuality* and in what we *potentially* can become. While the 'medicine,' or practical tools, for Hellenistic philosophers consisted of proper philosophical reasoning, the medicine I am exploring here is not philosophical but neurological: it is the plastic brain that promises to give new knowledge and tools to attain the good life. I therefore tweak and translate Nussbaum's elements of a therapeutic argument to complement and refine Swierstra's model of virtue ethics.

Using this analytical model, I aim to explicate the value work needed to make the plastic brain relevant for questions of flourishing. As I am looking for recurrences in such valuations, I call this model a *therapeutic repertoire of living well*. A repertoire can be seen as a result of successful value work: When certain valuations are taken up and repeated by different advocates, they slowly become solidified, settled, and thereby more easily used by others. A therapeutic repertoire thus consists of a recurring configuration of diagnosis and ideal (self-knowledge), an action programme and the skills needed to achieve it (practical options), and views on the environment in which we are supposed to flourish (i.e., world view and societal challenges). I base the notion of therapeutic repertoire on the notion of interpretative repertoire (Mesman, 2008; Wetherell, 1998; Wetherell & Potter, 1988).¹²

Combined, this results in the following model (see Figure 1). The first element is *self-knowledge*, which includes a *diagnosis* (actuality) of the obstacles that prevent us from achieving an *ideal* of flourishing (potentiality). To what extent does the plastic brain offer a new perception of ourselves, of who we are and who we might become? The second element consists of ideas about self-

¹² The concept of repertoire – etymologically, an inventory or treasury (*repertorium*) – is a "habitual line of argument comprised from recognisable themes, common places and tropes" (Wetherell, 1998, p. 400), which "determines what those involved view as relevant, which arguments or strategies, they feel, matter" (Mesman, 2008, p. 49).

stylization, or askesis: an *action programme* or norm that aims to guide behaviour – what we can do to overcome the diagnosis and achieve the ideal – including the *skills and virtues* needed to flourish. What kind of practical options for self-fashioning does the plastic brain afford us? And how do these new options challenge the skills and virtues needed to flourish? The third element consists of a perception of the environment in which we are supposed to flourish (including social beliefs and societal expectations about this environment), while the fourth element captures the degree of grip or influence we think we have over this environment. What kind of world or environment is implied by the self-knowledge and action programmes of flourishing? How orderly or chaotic do we perceive this world to be, and how much control and room does that imply for us to achieve the good life? These four elements allow me to map the ways the plastic brain is made valuable in practices of flourishing, and to discern for what kinds of problems, prescriptions, and ideals the plastic brain is normatively used – in short, it enables me to analyse how the ethical implications of the plastic brain for achieving the good life are constructed in practice.

	Changing perceptions	Changing practical options
Self	(1) Self-knowledge: diagnosis and ideals of flourishing	(2) Self-stylization (askesis): action programmes, skills, and virtues
Environment	(3) Societal beliefs about the environment in which we flourish (incl. societal developments)	(4) Degrees of grip or control we think we have over the environment (fate/will)

Figure 1: Model of a therapeutic repertoire of living well showing the relations amongst its four key variables.

4. Three Cases of a Brain-inspired Good Life

In the chapters that follow, I will demonstrate the normative usages and the construction of ethical implications of brain plasticity in three societal domains: parenting, working, and ageing. In these value-laden contexts of neurobiological flourishing, a particular manifestation of the plastic brain has emerged in recent years: the teenage brain in the context of parenting; the adult, stressed-out brain in the context of work; and the ageing brain in the context of self-care.

These cases were selected after an initial LexisNexis analysis on the issues connected to brain plasticity in Dutch public discourse.¹³

Case selection was guided by three theoretical considerations. First, the cases each represent a specific part of a good life across the lifespan, where there is (continuous) discussion about what it means to do and be good. Each case addresses particular (societal) challenges for which the plastic brain is heralded as a solution or means to deal with these concerns. Second, each case study seems to feature a particular manifestation of the plastic brain. These plastic brains differ in their emphasis on a specific configuration of the ethical ambiguity of plasticity: agency (who is changing the brain) is attributed either to the environment (first case), the individual (second case), or the brain itself (third case).

Third, cases were selected in which the plastic brain was mobilized to propose mundane or soft interventions. This means I selected cases that feature forms of endogenous, activity-based plasticity – forms of neurobiological self-fashioning, or what we can call *neuroascesis* (Ortega, 2011) – rather than exogenous, invasive, medical technologies such as pharmaceuticals.¹⁴ There is already ample research done on the ways pharmaceutical interventions challenge and destabilize certain practices (cf. Dehue, 2008; Dehue, 2014; Furedi, 2004; Horwitz & Wakefield, 2007; Rose, 2007; Abi-Rached & Rose, 2013). Focusing on pharmaceutical interventions when exploring possible changes in our ideas of the good life might be a bit of a red herring, as it is more likely that engagement with neuroscience knowledge penetrates everyday life through less extreme and costly practices (Kraus, 2012; O'Connor & Joffe, 2013).¹⁵ At the same time, these 'soft' technologies can make visible the possible moral changes in daily life inflicted by 'hard' technologies; the interventions under study are based on research that is itself the outcome of a technologized understanding of human behaviour (i.e., through fMRI scanning techniques in highly technologized research environments). The three cases show how brain plasticity is made valuable for common and everyday concerns and challenges in different phases of

¹³ LexisNexis Academic is a news media database that contains the archives of over 10,000 newspapers, magazines, and other published (Dutch and international) media.

¹⁴ There are many more societal domains where the plastic brain also appears as an emerging framework for understanding topical concerns such as nutrition and baby-brains; education and sexed brains or ADHD brains; or law and criminal brains.

¹⁵ While these three cases span three meaningful constituents of our adult life, it should be clear that this selection is not exhaustive for the appropriation of the plastic brain in society and thus puts some limits to my reflection on the ways the plastic brain is made valuable for questions of flourishing.

our good life, across the lifespan. I briefly introduce each case, then I present my empirical material and address some methodological limitations.

In chapter two, I explore how the notion of the teenage brain is mobilized in contexts of pedagogy and parenting to tell parents how to parent their adolescent children. I explore the valuations of the teenage brain by following the popularizing work of Dutch neuropsychologist Eveline Crone, who played a leading role in establishing the concept of the teenage brain in Dutch public discourse as a widely used vocabulary to address adolescent behaviour. The idea that the teenage brain is not finished and is therefore impressible to environmental stimuli took flight in parenting magazines and pedagogical circles as basis for a variety of prescriptions to parents of what they should do with their teenagers, and why. To answer the question whether the teenage brain challenges ideas of good parenting, I put the plastic, teenage brain in the historical context of science-based parenting advice, which started in the 1950s with books such as *Dr. Spock* (cf. Depaepe, Simon, & Van Gorp, 2005; Wubs, 2004). As we will see, the teenage brain as parenting advice offers parents different (and at times conflicting) prescriptions for dealing with their adolescents.

In chapter three, I analyse a different kind of plastic brain: the adult, stressed-out brain on the contemporary work floor. Here, the changing brain is not a given, as in the case of the teenage brain, but becomes a task for modern employees: Agency to change the brain is attributed to the individual subject. I focus on the intervention of mindfulness. Training programmes and popular management books invoke knowledge of the plastic brain to diagnose problems on the work floor and to herald the benefits of meditation and mindfulness. In these programmes, authors invite readers and participants to take control of, and to change, their brain functioning in exchange for new ways to increase productivity and achieve happiness and well-being at work. The mindful brain is presented as a particularly plastic brain, a brain able to withstand and adapt to changes on the work floor. Instead of following a specific actor, as in the case of the teenage brain, here I trace valuations of the mindful brain from a group of neuroscientists to specific mindfulness programmes for managers and employees. As I will argue, advocates use the mindful to cater to different demands for being a good employee in the “new spirit of capitalism” (cf. Boltanski & Chiapello, 2005; Davies, 2015). Work in mindfulness programmes becomes a kind of vocation, in which flourishing depends on a disciplined lifestyle. Compared to earlier ideas of work in the history of management and

work, the ideal employee in mindfulness programmes combines emotional self-control with social self-fashioning.

In chapter four, I explore the valuations surrounding the ageing brain in the context of self-care. In contrast to the long-held idea that our brains passively deteriorate when getting older, losing neurons along the way, since the 2000s the ageing brain has been presented as a plastic brain that is characterized not only by decline and decay but also as an active, adapting brain still capable of neurogenesis and change. Here, agency for change is located in the brain itself. This newly found plasticity of the ageing brain invites actors to articulate a variety of action programmes targeting how seniors should cope with these brain changes. I follow the trajectory of the ageing brain through the public controversy about a specific and popular intervention: brain games for the elderly. These commercial applications of neuroscience knowledge, which form a billion-dollar industry, sparked a scholarly and public controversy. Brain games for seniors appear to function as an ethical yardstick used by advocates in advice literature to propose alternative action programmes and ideals of ageing to seniors. As I will argue, advocates use the ageing brain to reiterate and tap into different views of successful ageing, reflecting ambiguous philosophical views on old age throughout history.

In the concluding chapter five, I reflect on the ways popularisers and translators have made knowledge of the plastic brain valuable in these three contexts of neurobiological self-fashioning. Whereas the empirical chapters exemplify the specificity of valuing plasticity and its moral changes for a particular context, here I aim to draw some similarities in valuations of the plastic brain and to reflect on how the ethical ambiguity of the concept played out in the different cases. I return to the debate on understanding the ethical implications of the neurosciences in order to show how the approach of value work contributes to understanding of the ethical implications of neuroscientific knowledge for our contemporary society.

Studying Popular Neuroscience in Discursive Practices

To study valuations of the plastic brain in the three cases, I use a variety of methods and sources. The empirical material spans both the dissemination of specific neuro-research on plastic brains in a diverse range of media in Dutch popular culture as well as the appropriation of that research by different and context-specific actors. Sources include research articles, press releases by universities, interviews with neuroscientists, policy reports, mass media (newspa-

per articles, magazines), genre-specific media (i.e., parenting magazines, management magazines, magazines for seniors), digital media (blogs, online forums, and official websites of neuroscientists and companies), popular science works (books and popular science magazines), self-reports, and scholarly critiques. This material focuses on public debates and contexts of application in the Netherlands between the time period of 2000–2015, though non-Dutch material is included when it is translated to or appropriated in Dutch debates and contexts.¹⁶ I only included texts in which the plastic brain features as a significant and substantial part of the author's argument; texts in which knowledge of the neurosciences only plays a marginal role in the argumentation are excluded.¹⁷ Texts in which knowledge of the (plastic) brain is only used in a clinical context, without general prescription for the daily lives of parents, employees or seniors) were excluded as well. I focus foremost on the written word; some video fragments are included (lectures, presentations and interviews), but overall, visual imagery is excluded from analysis. I selected the most widely read popular-science works using LexisNexis and bestselling lists of branch organizations (debestseller60.nl) and consumer websites (bol.com and managementboek.nl, for example). A more specific overview of the selection of sources for each case is presented in each of the case study chapters.

The majority of my research material is comprised of advice literature, including popular neuroscience appropriations in self-help literature and expository works (Mellor, 2003) – works that aim to translate recent insights from a particular discipline (in this case, a particular subdiscipline in the neurosciences) to different audiences. Expository works and advice literature are the nexus between neuroscience and society. In these materials, authors articulate and contemporary concerns; discuss practical, everyday problems, dilemmas, and difficulties; and mobilize recent insights from science to offer advice on what to do with them (cf. Fahnestock, 1998; McGee, 2005; Mellor, 2003; Turney, 2008). While such popular neuroscience is often dismissed as “neurohype,” or over-inflated interpretations of science (Illes et al., 2010; Tallis, 2009; Quart, 2012; Caufield, 2010; Grubs, 2016), these dismissive labels ignore how public debates and popular discourse on

¹⁶ When using quotes from Dutch sources, I use the author's own English translation wherever one is available; otherwise, the translations are my own.

¹⁷ Using the snowball technique, I included as much relevant material as possible until the moment of saturation occurred (when no new valuations and/or therapeutic arguments seemed to emerge). However, to be clear, the goal of analysing these sources is not to quantitatively count and weigh every possible valuation of plasticity; it is to provide insight into the multiple ways the plastic brain is made valuable within these contexts.

emerging science and technologies can provide a rich resource of valuations and ethical deliberations (see also Van de Werff, Slatman, & Swierstra, 2016).¹⁸ Moreover, as the neurosciences span a huge variety of highly specialized subfields, this same popular-science work is often an extension of professional scientific debates and, moreover, are frequently used as legitimate sources by scholars within different subfields in the neurosciences, as well as by scholars in the humanities and social sciences (Cassidy, 2006; Littlefield & Johnson, 2012). As such, popular-science works are part and parcel of the success of the neuroscience endeavour itself (cf. Heinemann, 2012; Johnson & Littlefield, 2012; Pickersgill, 2011).

Given the diversity of empirical settings and disciplines in which the plastic brain intervenes in the three cases (i.e., pedagogy, management, gerontology), an interdisciplinary perspective is called for. Building upon theories and methods drawn from both STS and practical philosophy, I use a combination of methods, including both historical and contemporary document analysis as well as elements from argument analysis (i.e., Toulmin's model of argumentation [Toulmin, 1958]), conceptual analysis, and (critical) discourse analysis (cf. Fairclough, 1995; Hajer, 2006), to devise a tool for "normative analysis." This tool is intended to tease out the explicit and implicit valuations in texts about the plastic brain. The goal of my normative analysis is to deconstruct public deliberation on neuroscience along normative lines, recognizing patterns of valuations (i.e., therapeutic repertoires), analysing how factual and normative statements intertwine, and reflecting on the conditions of possibility of such argumentations. I manually labelled and coded valuations and normative instances of plasticity in each text; these were partly deduced from the elements of a therapeutic argument (challenge/concern, diagnosis, action programme, ideal) and partly a result of the presence of specific themes and tropes that eventually emerged from the material. I looked not only at the content of individual texts but also at the relationship of valuations between different (kinds of) texts in order to discern recurring therapeutic repertoires as well as changes in valuations of the plastic brain in the public debate over time.

The now-already-two-decades-long 'turn' to practice and empirics in contemporary theory urges me to explicate what I mean when I employ the term

¹⁸ I will thus not engage in philosophy of science debates about the validity or truthfulness of (popular) neuroscience knowledge claims, un-masking their hidden epistemological and ontological assumptions regarding the translation of (concepts of) human behaviour into measurable brain states, the implied theory of mind (i.e. relation between brain/body/mind), or other conceptual difficulties that are characteristic for contemporary neuroscience research (cf. Dumit, 2004; Hagner, 2009; Rose, 1997; Rose, 2005; Schirrmann, 2013). While such critiques remain relevant for understanding the scope and depth of the contemporary neuroscience endeavour, these fall beyond the scope of this book.

practice in this dissertation. Contemporary scholars can use the term to mean or emphasize different aspects of human activity: that which is embodied, materially interwoven, and/or organized around shared understandings (Schatzki et al., 2001, p. 12). I focus not on the materiality of a practice, nor on the situated embodiedness of individual experiences. Rather, I focus on the constructed, shared meaning of human activity. Following the virtue ethicist MacIntyre (1997), I regard a practice as a socially established human activity characterized by certain goods that are internal to it. How the plastic brain is used to construct the shared valuations of the internal goods of practices such as parenting, working, or ageing is precisely the topic of this thesis. I thus refer to practice as the discursive activity of value work: how the plastic brain is used to articulate the shared (internal) goods of a socially established activity.

Furthermore, I study the three cases as *discursive practices*, which means first and foremost that I focus on analysing written documents *about* these practices. Instead of providing rich descriptions of situated, embodied, and lived experiences of parents with their teenagers, or experienced anxiety of seniors, I chose to focus on the broader context in which such concerns and valuations of these practices are discussed and deliberated upon. There is a practical and strategic reason for this. As this thesis aims to shed light on the ways values and norms play a role in the societal trajectory of neuroscience knowledge, it necessitates a broad scope (of three different cases of the plastic brain in societal contexts). More importantly, advice literature and expository works are places where contemporary concerns, challenges, and ideals become articulated. As historians of science know all too well, advice literature and expository works present a timely window to the moral and/or scholarly climate of the day (cf. Ortega, 2011). Authors of advice literature and popular science are in the business of selling their ideas. One could explain this as implying that their articulation of the problem and solution are not necessarily shared with the lived experiences of the subjects they describe (i.e., parents, employees, or seniors). For this thesis, it is precisely because these authors construct themselves as ethical counsellors by tuning in to their audiences that their work is highly suitable for studying how neuroscience knowledge is made valuable.¹⁹ It allows me to show how the plastic brain is used as a resource for public, ethical deliberation.

¹⁹ To be clear: I do not engage in quantitative reception research, which implies that my analysis rests on the assumption that bestselling authors apparently are able to strike a chord with their target audiences and that their works have some effect on those readers.

Despite its complex scientific technicalities, in the past decade knowledge of the brain has spread from the laboratory into a variety of societal domains. This book examines how translators and popularisers of neuroscience knowledge engage with values in order to make their brain claims relevant and valuable.

Key to our emerging 'neuroculture' is the concept of brain plasticity: our brains are now imagined as changeable, and open to interventions. The idea of a plastic brain allows neuroscience translators and popularisers to promise and propose new ways of changing our brains for the better – enhancing the good and preventing the bad. Combining theories and methods from Science and Technology Studies (STS), pragmatist ethics, and the sociology of valuation, this book empirically traces valuations and normativities of the plastic brain in three different societal practices of a good life: parenting, working, and ageing. It shows for what sorts of problems, prescriptions, and ideals the plastic brain is mobilized in these cases of a brain-inspired good life, and whether this results in changes in what it means to be a good parent, a good employee, or to age well in our contemporary society.