CREATING PERCEPTION

the First Person Perspective in Neuro Art

by

Boris van Overbeeke

MA Thesis Arts and Culture
supervisor: Prof.dr.ing. R. Zwijnenberg
second reader: Dr. L.M.F. Bertens
student number: S1428802
b.van.overbeeke@umail.leidenuniv.nl
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ABSTRACT

This thesis explores the insights that the contemporary practice of neuro art can add to knowledge that is held over the construction of consciousness. This is done through considerations of the work of Annie Cattrell and Helen Chadwick. In order to identify the added value of art, first an analysis is made of the current neuroscientific stance and its influence in society. Secondly, the thesis minutely demarcates the limits of the neuroscientific method. Here it is laid bare why its objective nature is inherently inadequate for a full understanding of consciousness, that is subjective per definition. The third chapter offers a concise introduction to neuro art. In the subsequent two chapters, the confrontation with the two artworks takes place. Through a reflection on how the artists employ their artistic means to conduct their research on the subject, insights on the construction of consciousness are deduced. The thesis is ended with a reflection on the position of art regarding science is present-day society. Art that engages itself with science enriches the ideas about the construction of consciousness.

Keywords: neuro art, consciousness, mind-body problem, first-person perspective, neuroscience, Helen Chadwick, Susan Aldworth,

This thesis goes accompanied by a podcast. Find it on
https://tinyurl.com/creatingperceptionpodcast

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“ Every act of perception, is to some degree an act of creation “
Oliver Sacks (1933-2015)

FOREWORD

Research always starts with an observation. A curious soul makes an observation and wants to know what it is so he tries to put it into words and find out what’s behind it. My consciousness, the most elementary of observations. I am not so much interested in its dry biological establishment. I want to know what it means. It is how I live my life. What I live my life in. It’s me. And I hardly have a grip on it. If it’s happy, I’m happy. If it’s empty, I’m empty. Freud wrote that artists have a keener eye than scientists. This research is an attempt to gain a handhold.

INTRODUCTION

Everybody who ever wrote a thesis knows how many times he was asked the question: “Ah, you’re writing your thesis, nice! What is it about?” I suppose that I am also not the only one who has tried to reduce the thinking effort needed to produce an answer to this question by developing standard replies. After some time, all I had to do was push my mental play button and my mouth would start pronouncing the internal tape on which I had recorded the answer. After some more time, I even introduced (fake) thinking pauses to vivify the text and hide the routinely nature of my answer. After even some more time, I found that different versions of the text started to gain shape. One complicated version for people I wanted to impress. One simple version for people who were easily impressed. One long version for people who I expected to like the subject. One short version for people who I did not expect to like the subject. One ultra-short version for if I had already told the story five times that day and felt more like talking about the weather.

During the time that my mouth was doing the talking, my mind had time to wander off and think about other significant subjects like climate change, conflict in the Middle-East or dinner. In these moments, the people and places that my mind wandered off to appeared more real than the person of flesh and blood I was sitting opposite of, or at least more present. The only thing that I had to make sure was to return my conscious self to the conversation in the here and now before my answer reached its end. The two or three occasions where I failed to return in time were enough to prove that conversations do not need much more to turn rather awkward.

My thesis, the text in your hands, is about those moments that my mind wandered off. That I saved myself a little energy when I answered the same question for the twentieth time does not mean that I find the subject any less interesting. What I told my questioners is that I find it mind-blowingly fascinating how we construct our consciousness, how we *live our world*. We live inside some sort of film, an amazing multi-D film. Apart from vision and sound, we have smell, taste and touch. We have bodily experiences like pain and hunger. We have emotions. We have memories playing before our eyes. We have our stream of thought as a constant narrating voice-over. All together, these constitute something that we call consciousness, an immaterial and intangible but nevertheless very real phenomenon.

Even though the construction of our consciousness is perhaps the most fundamental phenomenon of our live - it determines how we see what we see, think what we think, say what

we say, just about everything – to date, we have no idea how it is established.[1] We know that it has something to do with electric pulses running through neurons and synapses in our brain. We have gotten better at determining which regions of neurons and synapses turn active during certain mental tasks. But we still do not understand how we get from electricity through biological matter to immaterial *lived* experience. We do not know how our mind sprouts from our body. This problem, yet unsolved, is called the mind-body problem. It has preyed on philosophers for centuries. From Greek philosophers, via Descartes to modern-day scientists: the construction of consciousness has never seized to evoke fascination.

Recent developments have given the mind-body problem new urgency. Our society is increasingly focused on the bodily aspects of human life and progressing technology has allowed neuroscientists to search ever deeper in the human body. The development of instruments like MRI- and CT-scanners has allowed us an increasingly detailed exploration of the human brain. This has led to an intensifying influence of the field of neuroscience in the last twenty years and a neuroscientific optimism in the progress that will be made in finding definitive answers to the mind-body problem.

I do not begrudge the neuroscientific discipline their optimism or influence but I do think that it is important to be critical and to interrogate the confidence that the neurosciences show. Firstly, the questions that underlie the mind-body problem are too fundamental to leave entirely to brain researchers. With the mind-body problem come all sorts of problems concerning identity, dualism, free will and morality. The mind-body problem is just as much a cultural, as it is a scientific question.

Perhaps even more importantly, the neurosciences are not going to deliver a complete understanding of consciousness. Its biological idiom of nerve cells, synapses and neurons does not match how *I experience my* consciousness. With many other unsolved problems, science is our best shot at establishing explanations. Its method of experimentation, falsification and peer-to-peer validation has proven itself many times over at being perfectly adequate for finding the objective truth beyond phenomena in the world and the universe that surround us. I certainly believe that neuroscience still holds a promise of advancing more on the current knowledge. But the unique feature of the problem of consciousness is that it is by definition *subjective*, not objective. This subjective element is so vital that it must be a part of an explanation of

[1] Aru and Bachmann, 'Still Wanted—the Mechanisms of Consciousness!' 1-2

consciousness. We cannot reach a full understanding through the objective means of neuroscience alone. To fully understand what is going on when we experience our conscious self, we should open our eyes to other disciplines to enrich the view offered by neuroscience. I think that through art, we can gain insights that would otherwise be hidden. Artists gain access to the subjectivity of our consciousness. Art can open and create a space for the inconsistencies, discrepancies and dilemmas. Elements that spoil scientists' dreams but are nevertheless a very real part of human life. In this thesis I will explore this hypothesis.

To explore what art can contribute to the knowledge of our consciousness I analyse two artworks that arose in the contemporary art movement neuro art, Helen Chadwick's 1991 *Self-Portrait* and Susan Aldworth's 2013 *Transience* series. Neuro art is a movement that started gaining shape around the beginning of the 21st century at the crossroads of art with neuroscience[2]. Neuro art takes its inspiration from neuroscientific concepts but it operates outside the scientific realm. It is not a tool for neuroscience. It is not a movement that tries to decipher the neurological basis of aesthetic experience or use neuroscientific knowledge to benefit art theory. Nor are works of neuro art illustrations of particular scientific topics. It is a creative aesthetic exercise that purposefully takes neuroscientific ideas beyond their scientific relevance.

In this thesis I expressly search for connections with other academic disciplines like neuroscience and philosophy of mind This thesis is art historical in the sense that I offer a contextual and interpretative examination of the contemporary art practice of neuro art. I investigate how two artworks can offer an entrance to an insight on consciousness that is specific to those works. To arrive at the analysis of two artworks we take a long run-up. We very precisely define the niche where this type of art can be of added value. In the first chapter, we analyse how the current neuroscientific influence has come to being. Here, we also identify the main drivers behind the growing influence. We put neuroscience in its societal context. In the second chapter, we minutely demarcate the limits of the neuroscientific method. Here we lay bare why its objective nature is inherently inadequate for a full understanding of our subjective consciousness. The third chapter offers a concise introduction to neuro art. In the subsequent two chapters, the confrontation with the two artworks takes place. I end with a conclusion and reflection

[2] D'Souza, 'Art and Neuroscience: The Historical Emergence and Conceptual Context of Neuro-Art'. 7

CHAPTER 1 NEUROSCIENCE: HISTORY AND ITS INFLUENCE

In this chapter, we explore nowadays' place of neuroscientific ideas in society and the way society thinks about the mind-body problem. To later be able to try and rethink and contemplate on the mind-body problem with a clean slate, we must first investigate how the neuroscientific tendency has come to being. We will find that its influence is highly reciprocal and embedded in our present day society.

Brainhood or the materialist conviction

The neursoscientific influence fits in a more general growing focus on the bodily aspects of human life. This is apparent in the bodily focus in beauty ideals and in the medicalization of psychosocial problems.[3] In spite of its perplexing complexity and puzzling intricacy, neuroscientific ideas, concepts and idioms have seeped through the bell jar of the scientific community into popular culture, modern society and daily life. Today, neuroscientific images, concepts and ideas circulate in commercial products, the mass media, literature and works of art. Neurological concepts like mirror neurons have become part of everyday language. Neuroscientists have written down their popularized accounts in best-selling books. Hollywood has made films like *the Matrix* and *Eternal sunshine of the spotless mind* and many of us play games on our phones to keep our brains healthy.[4]

The prominent place of neuroscience in society is not very surprising. All fields of human knowledge in some way depend on the functioning of the brain. Neuroscientists address questions on fundamental issues. Questions about what it means to be human, about individuality, free will and personhood. Questions about how we think of ourselves, our bodies and our mental states. These questions concern everybody. The answers that neuroscientists propose capture the attention of the public eye and are often adopted. But what we do not always realize is that in science answers often derive, at least partly, from underlying assumptions and convictions. This is not different for the neurosciences. Assumptions and convictions determine to some extend the results that scientists arrive at. These assumptions namely determine what questions are asked in the first place, which methods are employed and what the outline of an answer should look like. This bias does not necessarily render scientific results less true but is

[3] Verhaeghe, *Identiteit*. 179-207

[4] There are many apps but two of the biggest, *Lumosity* and *NeuroNation* already constitute for respectively 70 million and 10 million users.

an insurmountable consequence of the fact that science is intrinsically a human activity. The first to describe this were Bruno Latour and Steven Woolgar in their ground-breaking study of scientific practice.[5]

Latour and Woolgar wrote in their 1979 book *Laboratory Life* that a scientific fact can only emerge in a contextual network. Outside of this network and its context, the fact loses its meaning. Latour and Woolgar describe a world where there is no pure nature or culture. There are only networks that can gradually extent and contract, thereby erasing one another, copying one another and producing the shape of space and time in doing so. The scientific world is merely one of many of these webs. Latour and Woolgar demonstrate that the exceptional authority that is given to science, is not based on a law of nature. They remind us that scientists are humans and bring them down from their privileged position to place them on a level with other professions.[6]

Latour and Woolgar retain their respect for science but they dispel its fairy tale of a higher power of objectivity. Instead, they take seriously its rootedness in practice and in things. They show that the related concepts of construction, persuasion, materialism and circumstance and the urge to create order from disorder are important factors in the construction of the authority of science. Scientific facts are constructed from the daily activities of working scientists and scientific developments rarely occur independently of social, political and cultural developments. Historians and philosophers of science have convincingly argued that scientific theories originate in ways of thinking that are external to science itself. [7]

In this chapter I will first specify the idea of this rootedness of science in society with regard to the neurosciences. Then, I will explore the interaction of modern neuroscience and its underlying principles with society and culture. This interaction has had consequences for the way in which we understand ourselves and the relationship with our body. I end this chapter with an analysis of this mind-body relationship.

Neuroscience and *brainhood,* or the materialist conviction

In the previous paragraph, Latour and Woolgar have shown how scientific practice is rooted in societal concepts, norms and values. Underlying most modern neuroscientific practice is a

[5] Latour and Woolgar, *Laboratory Life. The Construction of Scientific Facts*.
[6] Latour and Woolgar. 187-223
[7] Latour and Woolgar. 235-244

materialist understanding, an idea that mental phenomena are essentially sophisticated states and processes of a complex physical system, the brain. The materialist understanding of human life has become very dominant in how we regard ourselves. So dominant that it is hard to step outside of it. We will later explore this into detail but I first want to briefly introduce two other angles to the underlying principles of consciousness. I introduce these other two perspectives to remind the reader that there are other conceptualisations of human consciousness outside the materialist one. This will help us to soak ourselves off the materialist understanding of our consciousness.

Behaviourism

Philosophical behaviourism is a discipline that was very popular between roughly 1930 and 1985.[8] According to behaviourism, the most important obligation of the science of psychology was to explain the *behaviour* of the subject it addresses, hence the name. Behaviour in this sense was either the observable and measurable or the conditional activity of a subject.[9] Consequently, behaviourists were not interested in internal consciousness itself. The only relevant context of mental states or processes was as a factor in the causal chain reaction of behaviour. Philosophical behaviourists therefore understood emotions and sensations as a shorthand way of talking about actual or potential patterns of behaviour. Consequently, they claimed that any statement about a person's mental state could be paraphrased into a statement about her or his observable behaviour given a certain circumstance. No loss of meaning would occur.

The methods that behaviourists employed were largely restricted to observing and figuring out ways to correctly predict activity of their subjects. They were willing to keep themselves to these restrictions because these were thought to be the unavoidable price of making psychology into a genuine science. The underlying idea was that psychology could only count as a proper scientific branch if it treated its subjects as natural phenomena, predictable and controllable. Behaviourism was essentially an attempt to reconstruct psychology along the lines of the physical sciences.[10]

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[8] Graham, 'Behaviorism'.
[9] Churchland, *Matter and Consciousness*. 36-40
[10] Churchland. 40

Dualism

Another conception of the fundamentals of consciousness is given by dualists. The dualist school consists of several different branches but all agree that the essential nature of conscious intelligence resides in something nonphysical. In something that is beyond the scope of sciences like physics, neurosciences and computer sciences. [11] This view is not the most widely held nowadays in the philosophical and scientific community but it is deeply entrenched in most religions and was the dominant theory of mind for most of western history.

The most straightforward dualist definition of the mind is given by substance dualists. They understand the mind as a distinct nonphysical thing, an individual package of nonphysical substance, whose identity is independent of any physical body to which it may be temporarily attached. Property dualists use a slightly different definition. They say that while there is no substance to be dealt with beyond the physical brain, it has a special set of properties possessed by no other kind of physical object. These are properties like being in pain or seeing a colour. Properties that can never be reduced to or explained solely in terms of the concepts of the familiar physical science. [12]

Materialism

Having had a look at behaviourism and dualism as different perspectives on how human consciousness can be understood, we now arrive at materialism. Materialists make no distinction between body and mind whatsoever. In the materialist school, all human emotion, all instincts and all thoughts are the result of neurological processes in our brain. Materialist theories of mind claim that what we call mental states and processes are essentially sophisticated states and processes of a complex physical system, the brain.[13]

The basic idea of materialism is that cognitive activities are ultimately just activities of the physical nervous system. The most obvious way to understand these activities is to examine the nervous system itself. To understand consciousness, materialists say that scientists should set about to explore the physical structure from which it stems. The materialist methods therefore involve investigating the physical, chemical, electrical and developmental behaviour of neurons and systems of neurons. The guiding conviction of methodological materialism is that if we aim to understand neurons and the ways in which they exert control over one another and over

[11] Robinson, 'Dualism'.
[12] Churchland, *Matter and Consciousness*. 11-36
[13] Churchland. 40-63

behaviour, then we will be on our way towards understanding everything there is to know about natural intelligence. [14]

Materialism and neuroscience

Materialism and contemporary neuroscience are tightly connected to each other. This connection works two ways: materialist assumptions enable neuroscientific research - after all, there is no point in investigating a human brain if you do not first believe that there is something to be found there – and in turn, neuroscientific findings reinforce and strengthen the materialist assumptions. Thus, materialism and neuroscience engage in an interaction.

It is tempting to regard materialism not as a conviction presupposing the neuroscientific research but as an inevitable result of this research. Recent development in science have made it possible for neuroscientists to search ever deeper in the human body. The development of instruments like MRI- and CT-scanners has allowed researchers an increasingly detailed exploration of the human brain. But it is too simplistic to state that it were the discoveries, made possible by progressing technology, that have led scientists to conclude that human consciousness should be understood from a materialist perspective. The influence goes both ways.

In an article on *brainhood* Fernando Vidal extensively explicates the reciprocal connection of materialism and neuroscience.[15] Brainhood, as he calls it, is the quality or condition of being a brain, and is the underlying principle and driving force behind the rise of not only neuroscience as a discipline but also of the neuroscientific influence in our society. Fernando Vidal traces the concept of brainhood all the way back to the 17th century. An age where the concept predates modern neuroscientific breakthroughs by several centuries. Thereby Vidal shows that materialist and reductionist convictions are not so much following from, but were driving forces behind neuroscientific discoveries. He writes that "The idea that 'we are our brains' is not corollary of neuroscientific advances, but a prerequisite of neuroscientific investigation."[16] Vidal convincingly argues that the idea of brainhood predates neuroscientific discoveries, and constituted a motivating factor of the research that in turn legitimized it.

In the act of tracing brainhood as a concept back to the 17th century, Vidal shows how neuroscientists are guided by an assumption and conviction that precedes them. Neuroscientists

[14] Churchland. 40-63
[15] Vidal, 'Brainhood, Anthropological Figure of Modernity'.
[16] Vidal. 7

are, as everybody, inextricably and reciprocally connected and embedded in society. Vidal points out that even though neuroscientists might consider themselves as having an impact on society, in fact they are themselves engaged in social activities that prosper largely through strategies embedded in social fabric. In the next paragraph we will further explore the embeddedness of neuroscience in society.

Neuroscientific influence

Fernando Vidal has expounded how modern day neuroscience is inextricably connected to what he calls brainhood, or a materialist conviction. This connectedness in itself does not explain why neuroscience have become so influential in our present-day society. In this paragraph we will first explore the driving factors behind the growth of neuroscientific influence in society. Secondly we will further explore the embeddedness of neuroscience in today's culture.

Rise of neurosciences

The irresistible rise of the neurosciences is neatly chronicled by Hillary and Steven Rose. [17] They describe how neuroscientific influence is a rather recent phenomenon. As recently as in the 1990's, the US National Institute of Health declared the arrival of the 'decade of the brain'. Following this declaration, neurosciences profited from a massive increase in funding. Ten years later, around the year 2000, the focus (and confidence) shifted from understanding the brain's physical structures to uncovering its mental aspect. Researchers claimed that the neurosciences were then entering the 'decade of the mind'.

Hillary and Steven Rose describe how the driving force behind this development was the neuroscientists' pursuit of what they called biology's last frontier. They wanted to understand the brain and through the brain, the mind itself. Researchers believed that neuroscience would tackle the last great mystery of life, that of human consciousness. In their book, the Roses recollect that around this time leading neuroscientists started to express themselves in very materialist and even reductionist statements. Claims were made that there was no longer a mind-body problem, that it had become obsolete. Statements like 'you are your brain' and 'you are nothing but a bunch of neurons' were commonly made and many books proclaiming neuro-

[17] Rose and Rose, *Genes, Cells and Brains: The Promethean Promise of the New Biology*. 245-247

essentialism were published.[18] A more recent publication on this notion is the book by neurologist Dick Swaab.[19]

Scholars have identified the driving forces behind the growing neuroscientific influence in the past decades. The most important reason for the growing influence of neuroscience was the progressing technology that made new investigating methods possible. Especially the development of better scanning and visualization techniques played an important role.

Sarah de Rijcke and Anne Beaulieu sketch how the particular visuality of brain scans has played a fundamental role in the growing influence of the materialist conviction underlying modern neurosciences.[20] When we look at a brain scan, we tend to forget that these are no snapshots, and cannot and should not be understood as photographic images. Brain scans are representations of non-visual data, made visual. Academic analyses have shown that a number of assumptions of mechanical objectivity associated with photographic realism do not hold for neuroimages.[21] What we perceive as a simple photo of the brain is in reality a synthesis of thousands of data points, plotted over a three-dimensional template map of a human brain. Nevertheless, in the public eye, brain scans are often considered as photographic accounts of a person's mental state.[22] People think that, by using complex and sophisticated equipment, neuroimages give a direct view of a subject's brain activity. Seeing the neuroimage, people do not realise how many steps are needed to produce that simple picture and that each of those steps is based on methodological choices and assumptions that are arbitrary and not necessarily sound. [23] In other words, brain scans enable the multiplication of witnesses of neurological conditions and states of mind, that appear to be grounded in the empirical and observable, while that is only partly justified.[24] The misinterpretation of neuroimages as photographic images has been an important factor in an intensifying influence of the field of neuroscience in the last thirty years.

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[18] Rose and Rose. 247
[19] Swaab, *Wij Zijn Ons Brein*.
[20] de Rijcke and Beaulieu, 'Networked Neuroscience: Brain Scans and Visual Knowing at the Intersection of Atlases and Databases'.
[21] Mechanical objectivity is a term described in Daston and Gallison, *Objectivity*. as "… the insistent drive to repress the wilful intervention of the artist-author, and to put in its stead a strict protocol, if not automatically. This sometimes meant using an actual machine…" 121
[22] Dumit, *Picturing Personhood. Brain Scans and Biomedical Identity.* 139-169
[23] Dumit. 53-106
[24] de Rijcke and Beaulieu, 'Networked Neuroscience: Brain Scans and Visual Knowing at the Intersection of Atlases and Databases'.

The supposed accessibility of mental states that was attained by brain scans, attracted other scholars to the realm of neuroscience. The Italian academics Paolo Legrenzi and Carlo Umiltà explain how the supposed authority of neuroimages has led to a growing focus of other disciplines on the neurosciences. This in turn led to the rise of various neuro-disciplines like neuro-economics, neuro-aesthetics and neuro-theology.[25] These neuro-disciplines aimed to appropriate some of neuroscience's authority by formulating a common prerequisite, a neuronal prerequisite. In turn the new neuro-disciplines also reciprocally granted authority back to the neurosciences. Human behaviour is always in some way dependant on the functioning of the brain, but in the rise of these neuro-disciplines, Legrenzi and Umiltà say, one might recognize a tendency to trace back *all* knowledge of human behaviour to brain activity.

Today: neuroscience in culture

We have seen how neuroscientific influence has grown within the scientific realm since the 1990's. Also in the rest of society, materialist ideas exert their influence. The developments of the past three decades have resulted in a situation where neuroscientific ideas and concepts are interwoven in our culture. Giovanni Frazetto and Suzanne Anker have described the neuroscientific influence and analysed its interaction with the rest of society. Frazetto and Anker recognize the rise of a neuroculture (or neurocultures) in the embeddedness of neuroscientific knowledge in daily lives, social practice and intellectual discourse.[26] They define neuroculture as "the incorporation of neuroscientific knowledge into our live, culture and intellectual discourses."[27] Frazetto and Anker underline that neuroculture is a cultural phenomenon that developed along with the understanding of the nervous system. Neurocultures take shape in a triangular relationship between neuroscience, laboratories and scientists in one corner, public and society in another corner, and visual arts, film, literature and other cultural expressions in the third corner (figure 1).

In this relationship, neuroscientific ideas are transferred between laboratories and society through so called neurocultural products. These products may be books and visual works of art but also drug advertisements or videogames advocating brain training. Influence via these products goes in two directions. On one hand, concepts and ideas are articulated in diverse neurocultural products. These facilitate the public understanding of neuroscience. They create and inspire narratives about current neuroscientific research and about the crucial role of the

[25] Legrenzi and Umiltà, *Neuromania: On the Limits of Brain Science*. 41-90
[26] Frazetto and Anker, 'Neuroculture'.
[27] Frazetto and Anker. 819

brain in our lives. On the other hand, neuroproducts have the power to critically address neuroscientific findings and thus communicate worries that might live in society back to scientists.

With their description of this reciprocal relationship, Frazetto and Anker embedded the neuroscience in the framework of neuroculture as cultural construct. They showed that the relationship between neuroscience and the rest of society is more complex than 'neuroscientific influence' (which implies one-way traffic) suggests. We should not regard neuroscience as a discipline external from the rest of society, nor is the influence flowing unidirectional.

This intertwining is not neutral. The embeddedness of neuroscience in society is consequential for how we understand ourselves. The omnipresence of medical images have become a dominating factor in how we regard and understand our own bodies. José van Dijck writes about the consequences of the presence of human body in society, media and culture and the way in which it affects how we regard ourselves.[28] She writes that medical imaging technologies have rendered the body seemingly transparent. The ideal body is a body that is fully understood and thereby also malleable and perfectible. Van Dijck describes how the idea of the transparent body is a cultural construct mediated by medical instruments but also by media technologies, artistic conventions and social norms. Medical imaging techniques provide more knowledge about health and illness, but these technologies do much more. They affect our view of the body. Looking into the body is not an innocent activity but it affects our conceptualization and representation of the body. The resulting representations, in turn, fashion our knowledge of the body and set the parameters of its conceptualization in a recursive process. How the doctor visualizes the body affects the way in which society envisions health issues.

Concluding this chapter

I began this chapter with Bruno Latour and Steven Woolgar. They have shown how science should be understood as a human activity taking place in the greater context of human society. They demonstrated that the exceptional authority that is given to science is not based on a law of nature and argued that scientific theories originate in ways of thinking that are external to science itself. Scientific developments rarely occur independently of social, political and cultural developments. Fernando Vidal specified this to the neurosciences. He explicated how

[28] van Dijck, *The Transparent Body: A Cultural Analysis of Medical Imaging*.

the concept of brainhood is the underlying assumption of modern neuroscience. Brainhood enabled brain research and is itself reciprocally enforced by scientific results. The ideas of Woolgar, Latour and Vidal together paved the way to conclude that the emergence of a materialist understanding of human consciousness was not a discovery in the sense that it was the uncovering of a self-evident solid truth. Materialism is not a solid, inescapable objective truth but at least partly the result of a construction.

I then analysed the influence that neuroscience and its appurtenant materialist understanding of human consciousness have come to exert in our present-day society. The most important reason for the growing influence of neuroscience was the progressing technology that made new investigative methods possible. Especially the development of better scanning and visualization techniques played an important role. Legrenzi and Umiltà argued how this led other scientific disciplines to search for answers on their research questions in the realm of brain activity. Frazetto and Anker subsequently showed how this influence manifested itself in the rest of society. They conceptualized the embeddedness of neuroscience and its ideas in society as neurocultures. Lastly, I have looked at wat Jose van Dijck argued is the result of this influence for the way we look at, and understand our own bodies. Van Dijck concluded that we have come to see our bodies differently as a result of medical influence. She said that we regard our bodies as more transparent.

What now, is exactly my problem with neuroscience? Why do I go out of my way to argue that materialism is a conviction that has found its way to social authority and is not an inescapable, solid result of hard science? Is there a need to stop its growing influence before it becomes inescapable? No. Brainhood or materialism is not the sole prevailing conviction nowadays and as the Roses point out, materialist and essentialist claims have also strongly been criticized over the last decades. However, in this chapter I have given an account of how the influence of materialism and neuroscience has grown and is growing. It is important to interrogate this growing influence. Brain research has answered questions but is also leading to new ones.

If the omnipresence of neuroscience influences how we understand our bodies and ourselves, I do not want to settle for the view that is offered by the neurosciences. For it is limited. I want to know things that neuroscience is not going to teach. It is not about indicting materialism or neuroscience. It is important to formulate the boundaries and limits that a certain discipline offers. Materialist ideas and methods definitely help to understand what is going on underneath our skull. Neuroscience can tell us a lot but it cannot tell us all. Reflecting on its interpretations and implications strengthens the case. To understand how exactly, we turn to the next chapter.

CHAPTER 2 BRINGING STRUCTURE TO THE MIND-BODY PROBLEM

In the previous chapter, we saw that the neuroscientific societal influence is at least partly based on a social construct. Its authority is not based solely on ground-breaking scientific discoveries, societal mechanisms and technological influences were important factors as well. Still, its influence is consequential for how we regard ourselves as human beings. It is therefore justified to interrogate neuroscientific confidence. I do not want to impeach the discipline as a whole or question scientific results. However, I do believe that the mind-body problem is a question so fundamental and all-encompassing that neuroscientists are not going to thoroughly and abundantly answer it alone. The explanation of consciousness that is offered by the neuroscience leaves room for other disciplines to enrich. In this chapter I will explain the basis of my scepticism.

In this chapter I will first get myself better acquainted with the mind-body problem. I will explore, define and demarcate it and investigate why exactly it is problematic. I will find why it is not just another scientific question. As I get to know the mind-body problem better, I will also come to define exactly where the limits of neuroscience lie.

Structure to the mind-body problem

The mind-body problem is an enormous and all-encompassing problem that has been preying on philosophers' for centuries. It is a question about human life and our relationship to our body. It is about the connection of our mental self to our physical appearance, about the translation from sensory input to lived experience and back out again. From ancient Egypt to Greek philosophers, via Descartes to modern day scientists: the construction of consciousness has never seized to evoke special interest.[29]

With the mind-body problem comes a variety of questions on human identity, free will, morality and what it essentially means to be human. how do we construct our consciousness - an intangible and untouchable, but nevertheless very real phenomenon - from a physical object, a collection of organs, neurons and synapses? How does the sensation of jealousy (or any sensation at all) arise from a collection of electric pulses running through a network of synapses? Why does this sensation arise? When in evolution did the phenomenon emerge? Why in evolution did it emerge? Will our consciousness disappear when our brain ceases to function?

[29] Finger, *Minds Behind the Brain*.

Is it possible to construct a computer in such a way that it resembles our synaptic network and thus can generate real conscious intelligence? If human actions are the result of determinate brain processes, what then remains of free will and the legal concept of responsibility?

It is very easy to get utterly lost in all the questions, sub-questions, and underlying and associated problems of the mind-body problem. Before I can get to an analysis of the problem's complexity I have to bring some order into the chaos. An academic who can offer this is Gardar Árnason. In an article on challenges to neuroscience that rise from the materialist perspective on consciousness, he brings structure to the problem. Árnason identifies three different levels where distinct challenges are to be faced:[30]

1. On a metaphysical level we face a determinist challenge. This is the challenge that rises over the incompatibility of the mind as nothing more than the brain (and the brain as biological matter in a physical, deterministic system) and the concept of free will.
2. On an epistemological level we face a reductionist challenge. This is the challenge that rises over the question whether the mind and mental phenomena can be fully understood in terms of neural states, structures and functioning.
3. On an empirical level we face a cognitive challenge. This is the challenge that rises over questions associated with the fact that a lot of decision-making happens unconsciously and is therefore arguably not free.

It is in the questions on the second level, the epistemological level and the associated reductionist challenge, that I am primarily interested. Nevertheless, I will briefly explore the other two challenges to neuroscience before we move on with the reductionist one.

The first, determinist challenge that is at play on the metaphysical level is in itself not new. There are scientists and philosophers who have claimed that neuroscience is undermining the concept of free will, or even revealing free will to be an illusion. This is problematic as free will is a precondition for moral responsibility and moral responsibility is more or less the rock on which we built our liberal society. We assume that people have a free will to make their own choices and because of this assumption they can be hold accountable for these choices. In the determinist challenge we can hear a resonation of the question of divine predestination that has been around for centuries. Disagreement over the question of how God's omniscience renders man as a free being has instigated many disputes in the course of history. Only now, divine

[30] Árnason, 'Neuroscience, Free Will and Moral Reponsibility'. 148

predestination has been replaced by a determinism by the rules of Newton that say that in the physical world, every action leads to an opposite reaction. This new aspect to an old question is fascinating but not something that we will be directing our attention to in this thesis. For further reading I refer to Daniel Wegner who has written a very interesting and quite readable book on the matter.[31] A more concise reflection can be found in an article by Martin Heisenberg.[32]

The third, cognitive challenge that works on an empirical level is rather new compared to the determinist challenge but also not new for neuroscience. Sigmund Freud, in his writings on psycho-analysis, already wrote about how we are primarily driven by unconscious drifts. A more recent bestseller on the cognitive challenge was written by Nobel laureate Daniel Kahneman. He writes about the ground-breaking research that he conducted with Amos Tversky on a dichotomy between a fast, instinctive and emotional mode of thought versus a slower, more deliberate mode of thought.[33] A theory that is highly indebted to Freud's. While no less fascinating than the determinist challenge, I will leave this question to psychologists like Kahneman and not elaborate on it in this thesis.

Giving meaning to consciousness

In this thesis we will elaborate on what Árnason calls the reductionist challenge that we face on an epistemological level. Epistemological is derived from epistèmè, meaning knowledge or understanding. So the questions that arise on the epistemological level are the question pertaining to our knowledge and understanding of mental phenomena. The reductionist challenge lies in the fact that we want to understand these phenomena, without bringing them back, without reducing them to their physical substrate. As Árnason formulates it, "the reductionist question is that the mind, and mental phenomena can be fully explained in terms of neural states, structures and functioning."[34] To most neuroscientists this would be a necessary and even obvious assumption. A neurological study would be quite pointless if it didn't assume that mental phenomena like perception, consciousness and emotion are grounded in underlying neural structures and processes. There is no doubt that mental phenomena can at least be partly

[31] Wegner, *The Illusion of Conscious Will*.
[32] Heisenberg, 'Is Free Will an Illusion'.
[33] Kahneman, *Thinking Fast and Slow*.
[34] Árnason, 'Neuroscience, Free Will and Moral Reponsibility'. 150

explained in terms of their underlying neural structures. What Árnason doubts however, and I share his doubt, is whether we can *fully* explain mental phenomena neurologically.

Árnason formulates two reasons why we cannot fully understand consciousness from a neurological explanation. His first objections is derived from systems theory. It states that it is possible to create systems that are so complex that it becomes impossible to predict how the system evolves or what properties emerge in it. This might be true even for systems that are based on simple rules and with a known initial setup. The system's result can only be found out by letting it run its course. Examples of such systems can be the shape of ice crystals, ocean currents or the development of the weather. We more or less know all the factors that determine the system's outcome but its interactions are so complex that is impossible to exactly predict it. According to Árnason it can be argued that we should consider the brain as such a system and mental states as emergent properties of it. This would mean that even if we exactly knew the neurological basis of these mental phenomena we still could not predict or explain them. Mental properties can be fully determined by the brain's neurological states, structures and functions but still not be fully explained at that level.

The second obstacle that Árnasson formulates is that a fully reductionist model of consciousness would likely be of limited pragmatic use. To understand what is going on at a high level in a complex system, the explanation has to work on a similar level of complexity. Knowing every single zero and one running through a computer's circuits is of no use for somebody who aims to understand how it produces the images on its screen. Let alone does knowing all electric pulses that run through somebody's synapses explain how her consciousness is constructed. What a non-pragmatic answer can lead to is strikingly described by Douglas Adams in his *The Hitchhiker's Guide to the Galaxy.* An alien civilization builds a supercomputer to calculate the answer to the Ultimate Question of Life, the Universe and Everything. When, after millions of years, the supercomputer reveals the answer to be '42', nobody has the slightest idea what it means and they have to start again and build another supercomputer to find out. An explanation to a question must be at the same level of complexity as the question itself. From Árnason we understand that in order to develop an explanation with pragmatic use, we have to formulate an understanding at the level of complexity of consciousness itself.

First-person versus third-person data

Gardar Árnason organised all the questions that come with the mind-body problem into three distinct categories. In this thesis I will turn my attention to the question whether the mind and

mental phenomena can be fully understood in terms of neural states, structures and functioning. We want to gain a better understanding of mental phenomena. A scholar who has made a very useful effort in a sharper definition of mental phenomena is David Chalmers. Chalmers is a renowned Australian philosopher who has written a lot on the philosophy of mind.

His basic argument lies in a separation that he applies on perspectives on mental events. He distinguishes first-person from third-person perspectives on mental phenomena and argues that this distinction is the fundamental duality of the philosophy of mind.[35] First-person phenomena encompass the aspect of consciousness that we experience as ourselves, as I. The third-person perspective is from where mental phenomena are observed by somebody other than the person subjected to them. Chalmers says that this distinction between perspectives is the fundamental duality for the mind-body problem. Dualities that others identify as between the mind and the body, the mental and the physical, or the subjective and the objective can all be reduced to the duality between the first- and the third-person.[36]

The distinction between first-person and third-person mental phenomena is very important for our argument. I explore the two perspectives in more detail. Chalmers defines first-person phenomena as the phenomena that we experience 'in ourselves', our mental content. First person data are the subjective experience that all combined, constitute our stream of consciousness. These are the intangible and untouchable but nevertheless very real experiences that at any moment in time make up how we live our world. Thomas Nagel (whom we will come back to) contributed to this definition by describing them as *that what it is like* to be a conscious organism.[37] Important first-person data are the perceptual experiences that come through us via our senses. We see colour and depth and hear sounds. Other experiences add to our sensory input. We have bodily experiences (hunger, pain), emotional experiences (love, sadness) and occurrent (wordily or otherwise) thought. All these first-person data add up to that what is at any moment present in our consciousness.

Chalmers opposes first-person data to third-person data. Third-person data are the data that can be observed by somebody other than the person subjected to them. These can be behavioural or neuroscientific data. We can observe how a subject reacts to seeing something and if we position our subject in a fMRI scanner we can observe the brain regions that increase activity

[35] Chalmers, *The Conscious Mind*.
[36] Chalmers, 'The First-Person and Third-Person Views (Part 1)'. 3
[37] Nagel, 'What Is It Like to Be a Bat?' 436

upon registering visual input. Other data from a third-person perspective would be our understanding of a subject's verbal report on an internal state; "I feel happy" or "I see a tree".

The mind-body problem from Chalmers' view reduces to the question, what the first person is, and how it is possible.[38] In an article in which he tries to outline how a science of consciousness should look like, Chalmers calls this the hard problem of consciousness. The answer to this question is still, excitingly, rather mysterious. The hard part of the problem lies in the fact that first-person and third-person phenomena are two separate and distinct perspectives. We cannot explain first person data from a third person perspective. We cannot understand internal phenomena from an external point of view.

Let me consider this irreducibility of third-person and first-person data more extensively. We can say that third-person data are data about the performance of mental functions. We can for example observe how a neuron runs from a subject's eye to her brain. From this, we can deduce how a light signal triggers her retina and travels through the neuron to the visual cortex. From this, we derive an understanding of the mental function of vision. In principal, all third-person questions are questions about the performance of functions. While not to be underestimated, these questions are merely technical. From the third-person view, consciousness is an extremely complex but essentially understandable physical system. To explain third-person phenomena, we have to explain the objective functioning of the mechanisms that performs those phenomena. It may take another hundred years to untangle these mechanisms but ultimately it is about biological matter abiding to physical laws. What makes the hard part of the mind-body problem really hard is that it goes beyond the problems about performance of functions. The enigma in the duality of first- and third-person data lies in the fact that first-person phenomena seem to resist any explanation from the third person. We cannot understand and explain first-person experience from a third-person view. First-person data are not reducible to third-person data.

David Chalmers adopts this irreducibility of first- to third-person phenomena from Thomas Nagel. Nagel explains that first-person phenomena cannot be fully understood from a functional explanation. This irreducibility derives from the fact that every subjective phenomenon is essentially connected to a single point of view. [39] An objective, physical theory will inevitably abandon that point of view. He illustrates this by showing the impossibility of human knowledge over what it is like to be a bat. We cannot understand the consciousness of a bat

[38] Chalmers, 'Facing Up to the Problem of Consciousness'.
[39] Nagel, 'What Is It Like to Be a Bat?' 437

because we are restricted to the resources of our own mind and these are inadequate for the task. A bat uses sonar to percept its surroundings. Sonar is not similar in its operation to any sense that we possess and consequently there is no reason to suppose that it is subjectively like anything we can experience or imagine experiencing. We cannot have knowledge of what it is like to be a bat.

Nagel reflects on this: "This bears directly on the mind-body problem. For if the facts of experience - facts about what it is like *for* the experiencing organism - are accessible only from one point of view, then it is a mystery how the true character of experience could be revealed in the physical operation of that organism. "[40] He proves that one's consciousness is very much one's own, not knowable for anybody other than oneself. The attempt to objectify experience will inevitably lead us away from that experience. With this insight we must conclude that we have bumped into the limit of the knowledge on the mind-body problem that the scientific method can provide us with.

Concluding this chapter

In the first chapter we have seen how neuroscience and its appurtenant ideas and are tightly interwoven with our present-day society. We have seen how this has led to consequences on how we regard ourselves as human beings. We have also seen that it is justified to scrutinise this scientific influence and authority, for it is not based on a law of nature but result of human practice. It is therefore justified to interrogate neuroscientific confidence. With those conclusions in mind I set out in this chapter to interrogate neuroscience and specifically its applicability to the mind-body problem.

In the first part of this chapter Gardar Árnason brought structure into the many questions and problems that relate to the mind-body problem. I then decided that I am primarily interested in the question of whether the mind and mental phenomena can be fully understood in terms of neural states, structures and functioning. I am interested in the part of the mind-body problem that has to do with the construction of consciousness. I explored to what extend the neuroscience is equipped to provide a better understanding of the problem that we face. Staying with Árnason, I concluded that neuroscience is of limited pragmatic use for a thorough understanding of all elements of the construction of consciousness.

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[40] Nagel. 442

The second and most fundamental reason was brought by David Chalmers and Thomas Nagel. I found that the inherent subjective character of the construction of consciousness makes that neuroscience, as an objective method, is not suitable. It is not possible to understand the subjective, from an objective viewpoint. With that, I have clearly reached the limitations of what neuroscience offers. It is impossible to understand the mind-body problem without turning to the sciences. And yet, to understand every aspect of consciousness, it is impossible to settle for the image offered by science alone. If I decide not to settle for the knowledge that the neurosciences offer us, if I decide that I want to go beyond these limits, we have to try a different discipline.

Art is not bound to the borders that limit neuroscience. Therefore I believe that it can contribute to our knowledge on the construction of consciousness. In the next chapters of this thesis, we explore this promise.

CHAPTER 3 TURNING TO NEURO ART

I want to gain a better understanding of the construction of consciousness. In the previous chapter I have explored the difference between first-person and third-person perspectives on mental phenomena. I have seen that these two perspectives are not reducible to one another, that an attempt to fully understand one perspective in terms of the other is bound to fall short. To fully understand consciousness, I must regard the first-person and third-person perspectives as complementary and both aspects should be part of the research. Science, and neuroscience in particular is the pre-eminent method to study the third-person perspective of consciousness. However, as a method to study the first-person perspective of consciousness science is inherently inappropriate and inadequate. To study the first-person component of consciousness I have to find a method of research that is not bound to the limits of science. In the next chapters I will investigate how neuro art can contribute to the understanding that we have of the first-person perspective on consciousness. I will turn to the actual artworks shortly but first I want to briefly introduce and explain the movement of neuro art.

Were an investigation and inquiry of lived experience always at least implicitly present in the arts, with the rise of neurosciences we saw the development of an art form that made these the explicit subjects of its practice. Carin D'Souza has given the first art historian analysis of the artistic practice under the influence of neuroculture.[41] She recognized that artists started to draw inspiration from neuroscience to such a degree that a new artistic phenomenon began to emerge. An artistic practice that she christened neuro art. With her thesis, she wanted was to initiate the historiography of neuro art. She defines neuro art as those creative practices which, in the past decades, emerge at the crossroads of art with neuroscience.[42]

D'Souza indicates the 2002 *Head On: Art with the Brain in Mind* exhibition in the Science Museum in London as the unofficial starting point of neuro art. In this exhibition, the curators invited direct artistic collaborations with neuroscientists in their goal to establish parallels and juxtapositions between art and neuroscience. Artistic explorations in the field of neuroscience had been regarded, up until then, as isolated incidents within the larger framework of art and science. *Head on* was one of the early indicators that artistic encounters with neuroscience had become related events and part of one and the same practice that was taking shape. Judging from the current literature, D'Souza writes that the three most iconic works of neuro art are

[41] D'Souza, 'Art and Neuroscience: The Historical Emergence and Conceptual Context of Neuro-Art'.
[42] D'Souza. 7

Andrew Carnie's *Magic Forest* (2002), Nina Sobell's *Brainwave Drawings* (from 1974) and Helen Chadwick's *Self-Portrait* (1991).[43] She immediately adds that there is much more to discover about neuro art beyond these highlights.

Where it was D'Souza's aim to analyse an art tendency that relies on knowledge of the brain, I want to build on her work by attempting to take this analysis one step further. Her thesis is still rather descriptive, mine will be more interpretative. I want to investigate how artists in neuro art engage with neuroscience and perform their own, artistic research to enrich neuroscientific knowledge on the construction of consciousness. I want to analyse how their artworks convey these insights to be interpreted by a spectator. I will try to interpret the knowledge that this form of art contributes to the understanding of our mental selves. D'Souza initiated the academic story of neuro art. In this thesis I try to add a chapter to its story.

There are several academic accounts of how neuro art may contribute to our understanding of consciousness. In his contribution to a book on art in the age of technoscience, Robert Zwijnenberg describes how art by its very nature may contribute to the knowledge of our bodies in ways that differ from the contributions of both the natural and the social sciences.[44] In a text that is more specific on neuroscience and the brain, Zwijnenberg specified this notion. Here, he wrote that artists in neuro art do not wish to keep themselves to traditional views about the brain and the mind, or to the mind-body dualism. Instead, they thematize from an artistic perspective the cultural consequences of a field that assumes mind and brain are identical.[45]

In his chapter in the exhibition catalogue of works by Susan Aldworth, Paul Broks writes how Aldworth's art celebrates the paradox that science tries to dispel. He writes how we are conscious of our consciousness and that Aldworth's work brings another twist to this spiral. It intensifies consciousness of feelings, images and ideas and as such puts consciousness itself under scrutiny. Broks feels that the work sends him tumbling to the brink of an infinite collapse chasing consciousness of consciousness of consciousness.[46]

Frazetto and Anker embed neuro artistic practice in their concept of neurocultures. Neuro art is one of the neuroproducts in their model, products flowing through society through which ideas and concepts are articulated. They indicate that in the interaction between art and science,

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[43] D'Souza. 20
[44] Zwijnenberg, 'Art, the Life Sciences and the Humanities: In Search of a Relationship'.
[45] Zwijnenberg, 'Brains, Art and the Humanities'. 15
[46] Broks, 'Infant Fingers'.

possible futures and aspects of science's progression can be explored, envisioned and critiqued.[47] Culture responds to science by envisioning potential consequences of a given field. They specified this to neuro art by writing that, "Some of the original, at times whimsical, artistic representations of personhood, consciousness and behavioural manifestations remind us that these are all polymorphic phenomena shaped by biological substrata, culture, changing social norms and evolving practices."[48] Artistic paradigms of human life can incite reflection and discussion about our individuality and offer a paradigm of human life as alternative to the scientific one.

I have demarcated this concise overview of academic literature to neuro art and consciousness. Would we loosen this demarcation and look at knowledge practice in art in relation to science more generally, we could find much more texts. Those are excluded in this overview. Recurring notion in the accounts that I did include is that artists embrace the ambiguity of their chosen subjects. The purposeful choice of ambiguous and unresolved issues is in itself an artistic strategy that distinguishes the scope of art from the scientific method. While scientists choose knowledge gaps to uncover and explain, artists celebrate the discrepancies and ambiguities of these issues. Using their imagination, they appreciate topics that escape scientific elucidation. Artists may take up ideas where scientists have left them. Art opens and creates a space for the inconsistencies, discrepancies and dilemmas of life, concepts that often spoil scientists' dreams and night's rest. Artists widen the perspective.

While I agree with their notions on artistic knowledge, I feel that for our specific subject, these academic descriptions can be further specified. In the first half of this thesis, we have very explicitly identified the limits of the scientific method. Its objective nature is unfit for the inherent subjectivity of consciousness. In the second half of this thesis. I want to try to point artistic knowledge exactly there. I want to explore how artists complement scientific knowledge with their artistic insights. I want to try to explore the entrance to the first-person perspective that art could provide us with. By looking at two works of art, I will try to find out how the ideas underlying these works are communicated to a spectator and can complement to an understanding of consciousness that only art can offer.

[47] Frazetto and Anker, 'Neuroculture'.
[48] Frazetto and Anker. 820

CHAPTER 4 SUSAN ALDWORTH *TRANSIENCE*

The first works that we consider are prints 4, 5 and 6 from the *Transience* series by Susan Aldworth (figure 2). *Transience* is the name of a series that Aldworth made in 2013 together with professor of Neuropharmacology David Dexter and master etcher Nigel Oxley. For the production of *Transience,* Aldworth worked with real human tissue, donated to science by deceased persons. The series comprises of prints produced through two different techniques. To produce the etchings, Aldworth pressed slices of brain tissue directly to a zinc plate. The fatty deposit of the tissue protected the zinc from reacting with the later applied acid. These plates were then pressed with ink on paper. Other prints are digital photographs of paper on which Aldworth directly put tissue on to produce a 3d pattern were the fluids reacted with the paper.[49]

Susan Aldworth (1955) is a British artist who lives and works in London. She studied philosophy at Nottingham university and fine arts at Central Saint Martin's in London. Aldworth has a strong fascination for investigating the workings of the human mind, consciousness and our sense of self. This fascination was triggered by the experience of observing her own brain live on a monitor during a diagnostic brain scan in 1999.[50] From this year onwards she has produced many works and exhibitions exploring the multiple themes that cohere with the relationship between the physical and the sense of self and the material basis of personality. She mostly works with etches and monotypes but has also made animated films, digital prints and light installations.

Susan Aldworth has had several solo exhibitions including ones at the Cuenca Biennial in Ecuador, at the National Portrait Gallery and the GV Art Gallery in London and at the Waterside Arts Centre in Manchester. Her most recent exhibition was at York, St. Mary's. She contributed to group exhibitions around the world including in the Netherlands, Switzerland, Japan, China and the Czech Republic. Her work is held in many public and private collections including the Victoria & Albert, The British Museum and the Williams College Museum of Contemporary Art in the USA. Seeking collaborations with other disciplines, she also held multiple residences. She was artist in residence at several hospitals in London. She was part of an artist collaboration at the institute of neuroscience at the University of Newcastle. She has curated multiple

[49] Crouch, *Susan Aldworth: Gallery Talk*.
[50] Crouch.

exhibitions and festivals. Currently, she holds a position as an associate lecturer on the Art & Science MA at Central Martin's in London. [51]

Susan Aldworth is an artist who operates on the cutting edge of art and science. She expressly takes her inspiration from neuroscientific ideas and tries to translates these, using artistic means. In a conversation that she had with Cathy Gere, Aldworth told how she is preoccupied with finding artistic expressions to the materialist idea of the localization of different brain functions. In her work she wanted to bring this idea back to something imaginable. She says about it, "[I was] trying to think about what it meant to conceive of consciousness as physical, as having a location where it resided."[52] About another work she says, "How do you make work feel like it's a thought, about something internal that you've made external?"[53] She expresses how she appropriates scientific ideas and tries to represent them using her own means. In order to be able to engage with present-day neuroscience, Aldworth has sought collaboration with people from the scientific discipline, like doctors, neuropsychologists and neuroscientists. With them, she has undergone more brain scans herself and observed numerous brain scans from other subjects. She has also cooperated with other artists, etchers and musicians in her search for a better understanding of the materiality of personality.[54]

Time in Transience

Approaching the prints in *Transience* I am struck by their volatility. The works are not very big, they measure about forty by thirty centimetres. They don't have the inescapability of say, a Rothko. But, like Rothko, Aldworth has given these blobs of printed brain tissue a vibrating movement that pulls me in. The blobs are zinging from the paper, vibrating from the medium. The works radiate a tremor that gives them a dynamic but at the same time is very silencing. A silent unrest that imposes itself into my experience.

The colour scheme in these prints, with a light grey shape piercing through a dark background, is very reminiscent of the medical images that we know from brain scans. In the first chapter I discussed how such medical images are often misunderstood as direct snapshots of our mental states. Perhaps it is because of this evocation that also in these prints I feel like I am watching a thought, caught in the image. I feel like I am watching an experience. Aldworth has taken the

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[51] Odiase, 'Susan Aldworth'.
[52] Gere, 'Thought in a Vat: Thinking through Annie Cattrell'. 425
[53] Gere. 422
[54] Gere. 416-418

associations with medical imaging and has turned them back into something that looks like a thought. In a video that was made of Aldworth giving a tour of her exhibition in the gallery, she says that the experience that triggered her into neuro art was seeing her own thinking brain on a monitor during a diagnostic research.[55] *Transience* may be one of her attempts to reproduce this experience. The work represents the thought. The experience that I have in *Transience* therefore might be somewhat similar to hers and we get a glimpse on why this experience so fascinated Aldworth that she devoted a big part of her artistic career to it.

Looking at the works, I am watching a thought. I percept a perception, experience an experience. As I experience the work I experience a representation of an experiencing brain. We are looking at a representation of what could be our own brain. The realization establishes a connection between our experience of the work and the work itself. I may be looking at myself. But as soon as this realization fully penetrates into our thought, it pushes the experience of the work out and the connection is lost. The work influences the manner in which we experience our consciousness and our consciousness is necessary to experience the work. *Transience* plays with the distinction between first-person and third-person perspectives. I have a first-person experience, seeing what could be my own brain from a third-person perspective having that first-person experience. Standing before *Transience* the distinction between first-person and third-person perception fades. Until we realize this, than the distinction solidifies again. The effect is whimsical.

Aldworth has given the prints a vulnerability that I find striking. The thoughts in the prints are so very frail. I feel like death has a presence in these works. The work is named after our impermanence in life. The brain slices that the prints were taken from were undeniably dead. The blackness in which the brainy blobs float breathes an air of lifelessness. And yet, despite death's looming presence, the works are definitely alive. The prints cast an esoteric mist around themselves and from this mist radiates a volatile sense of presence, living presence. A liveliness that is very vulnerable, as if we have to hold our breath not to blow it from the paper. *Transience* is about the volatility of a thought. A memento mori is a commemoration of the temporariness of the flesh but in this case I interpret this referral not so much as an emphasis on the end of our time but more on the time before our end. Not about death but about time. The work evokes a contemplation on the passing of time. The work thematizes time.

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[55] Crouch, *Susan Aldworth: Gallery Talk*.

It is through time that we are connected to our environment and to the world. In our lives, we are bound to time more than to anything else. We reside in time. We can move our bodies relatively freely through space but we move with time in one direction and in one direction only. We are inconceivably timebound. The passing of time is a solid and invariable law. The fragility of the caught thought in *Transience* evokes us realizing this. The works are about acute consciousness. The consciousness of every moment, real life, first person. Our river of consciousness travels through time. Our thoughts appear from the dark and dissolve in time. With its catching of a thought, the work disturbs this flow. It brings it out of the dark and into the light. As we realize this the work catches another thought, ours, as we pass a moment in quietness. We realize that not only does our consciousness happen in time, but time happens in our consciousness. We are connected to time through our consciousness. While it is through our bodies that our minds are connected to space, our minds connect our bodies to time.

This connection in incredibly strong. We are given a tiny cordon of moments strung together and it is unimaginably impossible to come off this string. And even so, our time is part of the world's total time. We realize that our tiny string is part of the world's total time. In our experience of the world we are bound to the world. Through our consciousness, we are connected to time and trough time to the world. The artwork evokes our belonging to the world but there is still that fragility. In every moment that we have, another moment is taken off of our string, utterly inescapably.

CHAPTER 5 HELEN CHADWICK *SELF-PORTRAIT*

Self-Portrait (figure 3) is a work by Helen Chadwick that she made in 1991. The work is regarded as one of the most typical of neuro art works. It is an oval-shaped transparent print behind glass, mounted on the wall and back-lit in a light box. It measures about 50 by 40 centimetres. For this work, Chadwick took photographs of a real human brain that was held by a London hospital, thereby accompanied by a laboratory technician to supervise the handling both technically and ethically.[56]

Helen Chadwick (1953-1996) was a British sculptor, photographer and installation artist. She went to Brighton Polytechnic School before she enrolled in a Masters at the Chelsea School of Art (now Chelsea College of Art and Design and part of University of the Arts in London) in 1976. Later in her career, from 1985, Chadwick taught at different London art schools. She held positions at the same Chelsea School of Art and also at Goldsmith's Central Saint Martins and the Royal College of Art.

She was nominated for the Turner prize in 1987 with her installation *Of Mutability*, her first major solo exhibition.[57] An installation that toured museums in England, Scotland and Switzerland and involved large sculptures and photographs. Chadwick's work featured in the *Head on* exposition. Her exhibition *Effluvia* in the Serpentine in London broke the venue's record for the number of visitors and it was widely covered in national press. In 1995 Chadwick received a solo exhibition in the Museum of Modern Art in New York. After her sudden death in 1996, a retrospective of her work toured the Barbican, the Manchester Art Gallery and two galleries in Sweden and Denmark. Chadwick's work is nowadays found in collections at the MoMa, The Tate and the Victoria and Albert Museum.

Just like Susan Aldworth, Chadwick had a deep interest in the relationship between art and science. This interest coexisted with an obsession with the human body that is apparent throughout her work. The position from where she observed the body however, changed in the course of her career. She gradually traversed from the body's outside to its inside. She is perhaps best known for her early work in which she addressed questions of space, gender and power relations.[58] Early in her career she explored these feminist motives by depicting the female body and with it the aspect of the male gaze. She moved away from these motives and more into the

[56] Manchester, '"Eroticism", Helen Chadwick, 1990'.
[57] Beckett, 'What a Swell Party It Was'.
[58] Walker, 'Helen Chadwick's "Composite Images"'.

body around 1982. From then on, Chadwick started to produce work in which she attempted to rethink ideas about human identity. Ideas that she thought, were heavily influenced by a rigid scientific framework. In order to be able to work at the interface of science and art, she took up several residencies at scientific institutes. She had a residency at King's College Hospital in London and in the Hunterian Museum and Wellcome Pathology Room of the Royal College of Surgeons.

By engaging her art with (then) new scientific ideas she wanted to address what she perceived as the shortcomings of worldviews based on the static framework of traditional science. [59] She called into question and challenged the objectivity that she considered was too frequently claimed by the scientific method. In her personal notebooks, she described how she believed that science is not the only way of gaining access to the truth of the universe. She believed that access can be gained by non-scientific means. In her art she searches for ways to express these ideas. Chadwick gauged the position of art as complementary to science but she also did not scare away from interfering or even colliding with scientific ideas.

Her position vis-à-vis science becomes apparent in her *Viral Landscapes* (1988-1989), as is described by Stephen Walker. Chadwick starts to explore notions of bodily boundaries and the divide between the body's inside and outside, thereby trying to redefine an understanding of alternative, non-binary notions of subjectivity and individual identity.[60] Walker described how she is inspired by cellular biology. Drawing on emerging, and then considered quite radical, ideas in cellular and molecular biology about interaction and interdependencies of cells and their environment she explored the idea of the body as a continuum. She tried to understand how the cell and the self should be considered not as discrete entities but as systems that are in such close interaction with their environment that is hard to draw the line of their border. Chadwick's work addressed the possibility of an identity based on the idea that the body does not stop at the physical boundary of the body's skin or cell wall. [61]

The Self in *Self-Portrait*

The photograph depicts a human brain that is tenderly held by two hands. The brain and the hands are set on a background of a crumpled piece of flesh-coloured velvet. The folds of which

[59] Walker. 459
[60] Walker, 'Viral Architecture, Viral Landscapes'.
[61] Walker. 460

seem to continue in the convolutions of the brain. Most striking is perhaps the affection with which the hands hold the brain. They seem to be folded as if in prayer or as if receiving a communion, giving the work a nearly spiritual atmosphere. An association that is enhanced by the oval shape of the photograph, the oval of prayer cards. In the work, Chadwick connected this spiritual notion to the body's materiality. *Self-Portrait,* much more than Aldworth's works, evokes a fleshiness that reminds of the material substrate of our consciousness. The work is about materiality. About the vulnerability of the material that makes us up.

Like *Viral Landscapes, Self-Portrait* is very much about human identity. The work is described by scholars as a work that thematizes the risk of a tendency to reductionism and materialism in neuroscience. Zwijnenberg for example, already argued that the strength of this work lies in how Chadwick cancels the anonymity of the organ with hands that clearly belong to an individual. The conclusion of which is that we must be more than our brain.[62] Apart from a thematization of the construction of human identity in general, the work is also about the personal aspect in the constitution of human consciousness. The work is about how meaning is acquired in acute consciousness. How we attach meaning to the world that we percept. The meaning of perception is constantly *created*.

The elements of *Self-Portrait* that most intrigue me are the rings that are around her fingers. They are big and golden. Rings are physical objects but people wear them because they resemble something non-physical. Rings eminently are physical memories to moments in our life. We might wear them as a symbol of our family. We wear them as memories to the day that we, in attendance of our friends and family, promised to stay with our partner. We might wear them because they belonged to a dead family member whose memory we want to keep alive.

We universally recognize rings as symbols and as bearers of memories. But for individual rings, only the owner and wearer can be fully aware of their specific meaning. The objects lose this meaning for other people than the owner. While many rings to their wearer are considered utterly priceless, the existence of jewellery auctions and other markets prove that this value is highly particular.[63] Only the wearer of the rings grasps their full meaning. She connects them as little tokens to the memories that they belong to. Via the rings, these past moments are present and it is only because of this presence that the rings represent their value. What is in extremis

[62] Zwijnenberg, 'Brains, Art and the Humanities'. 15.
[63] Second hand is an appropriate term here. As if it is not the jewellery that is exchanged but the fingers that wear them

true for the meaning that we attach to these rings holds a truth for how we attach meaning to everything that we percept. Our experience of the here and now only makes sense as the latest addition to the concatenation of moments that we have already strung on our string. Our past must always be present in our consciousness. In our consciousness we link our past experiences to the here and now. Through *Self-Portrait* we realize how loaded with personal experience our consciousness is. Without our past, our consciousness would be like the lighting up and fading out of a firefly in a dark forest. We would be like a goldfish swimming laps in his bowl, in total awe of the unprecedented beauty of the landscape.

The individuality of the moment is beautifully described by Oliver Sacks, a British neurologist and writer. He writes about how is sitting in a café on Seventh Avenue writing that very passage. "… it is not just Seventh Avenue that I see but my Seventh Avenue, marked by my own selfhood and identity."[64] Seventh Avenue bears meaning to him only because he was there before. The coffee that he is drinking only bears meaning to him because he drank coffee before. Memories are always present. We appropriate the present and make it ours. We have no choice but to do so. We cannot turn this appropriating off if we wish to as we cannot step outside ourselves. Consciousness is always active and selective, charged with feelings and meanings uniquely our own, informing our choices and blending into our perceptions. Sacks' moment on Seventh Avenue itself will also be added to his basin of memories to become part of a continuum.

Our experiences are never directly transmitted into our brain. They are experienced and constructed and that is subjective. The memories that we pull from are also not neutral. They are themselves to a great extent constructed and remodeled to fit the present. It is fascinating how there is a past and a present and that our minds create a route that connects these places to each other. We are able to tell a chronological and more or less logical story of our lives. It does not matter how many drawbacks or detours we have met on the way, in our minds we have always followed a track. Somehow in every moment that we experience, we manage to regard ourselves all the way back as one and the same, who despite years of growth and change always was more or less the same person. Our experience becomes part of our narrative truth and our narrative truth becomes part of our experience. Helen Chadwick's *Self-Portrait* lays bare the fundament under this constructed reality. The artwork offers an entrance into the tractability of this presence. The artist pulls its latent presence up to the surface of consciousness. It shows how loaded with the personal past the present always is. Nothing in reality is uncut. Our only

[64] Sacks, *The River of Consciousness*. 173-184

truth is our narrative truth. Everything is interwoven with personal elements and it's only this personal element through which we make sense of the world.

The consequentiality in Chadwick's work does not only lie in that she shows the individual aspect of the construction of consciousness. It does more. By pulling it to the surface, her work effectively becomes a part of it. *Self-Portrait* becomes part of this process of appropriation, she twitches it. Chadwick wrote about how her work acquires its meaning only in interaction with the observer. It is only upon interference from an observer in the event of perception that this interaction was fixed.[65] In this interaction, I am also changed. The meaning of her art is mediated between the work and me. Standing before S*elf-Portrait*, I see what I see, a brain. A brain, I suddenly realize, that could be my own. As in *Transience*, I realize that I am looking at myself. Je est un autre, Rimbaud wrote. *Self-Portrait* allows me a brief look upon the meaning of the fact that I can take an external look at myself, and all its consequences.

The instant that the work takes to permeate into my awareness, it changes something fundamentally. In an intangible moment it lights a fuse that starts an utterly uncontrollable fire for which I need a thesis of almost 16.000 words to extinguish. Somehow, the simple image of two hands holding a human brain triggers a fascination that determines that the old explanations do not suffice anymore. Through the tiny glimpse that *Self-Portrait* offers me on myself, my conscious becomes so self-absorbed that it goes on a search for a new layer of meaning to understand *itself*.

[65] Walker, 'Viral Architecture, Viral Landscapes'.

CONCLUSION AND REFLECTIONS

I set out on this thesis with the observation that the idiom of brain research and neuroscience is so far away from my own experience of consciousness. The explanations that brain research provides us with are characterized by an idiom of biology: nerve cells, electrical currents through synapses, neurons. This language goes accompanied by images rendered to us by instruments like MRI and CT scanners. Neuroscience's idiom and its accompanying images have trickled through to society and determines how we define ourselves.

However hard I try in the name of science, I cannot understand my lived experience, my seeing, feeling and thinking, as electric pulses running through biological matter. The two phenomena are too distinctly different to understand in terms of each other in a way that works intuitively or pragmatically. My lived experience is something that I live in. Something that at times hurts or is happy. At times ambitious and sometimes lazy. Sometimes on fire, sometimes phlegmatic. It is something in which at uncontrollable moments the most inappropriate thoughts pop up. My consciousness is animated. In possession of an anima. Spirited. If I am to try and understand my consciousness this anima must be part of the subject under scrutiny. An explanation of consciousness that excludes this element misses perhaps its most essential part.

Helen Chadwick's *Self-Portrait* and Susans Aldworth's *Transience* series provided an entrance through which I could include the anima of consciousness into my reflections on it. As we stand before them, the artworks emphasize and enhance consciousness. An enhancement that leads to a reflective experience in which a connection appears with experience itself. This connection is so fragile and volatile that it evaporates as soon as we become aware of it. The connection's volatility creates a dual effect: a feeling of both reality and elusiveness. Reflecting on the artworks, a feeling of real concrete connection to experience emerges but as soon as I set my focus on this connection, it disappears. It is as if this experience is an Orphean shadow behind me that I want to lead into the light but that falls back into darkness when I turn over my shoulder. I feel its presence but I lose it when I set my eyes on it.

The artworks bring me to the brink of what I can grasp in the understanding of my consciousness. Not by presenting it as something that I can see, hold and examine. But as something that is fleeting, whose presence I can only feel. In my moment before them, the artworks bring me to the brink of my understanding of consciousness, the gate through which I experience reality and through it to the brink of my understanding of myself. The artworks provide an experience through which an understanding arises of the incomprehensibility of

human consciousness. Our brains consist of atoms, molecules and biological matter, where the former are the building blocks of the latter. These building blocks are inanimate and there is no explanation in science as to why they would acquire experiences, consciousness or be alive. Let alone as to *how* they would. And yet, here I am, torturing myself on why I think what I think, feel what I feel and write what I write. There is no objective explanation conceivable and in that lies the most objective explanation conceivable. By engaging with the neurosciences, the artworks made its ideas that are unimaginable, imaginable. Through our experience of the artwork we could form an insight about the questions of consciousness that works intuitively. The experience of the artworks enriched the scientific rationale with an insight that is hard to put under words but that better suits our intuitive sense of awareness.

The problem of consciousness is not the only problem that science cannot (yet) answer: Each of those ungraspable problems are ungraspable in their own way. Some problems are waiting for a mind brilliant enough to solve them. Like unifying the theory of relativity with quantum mechanics. Some questions are unknown because we don't have accurate devices to detect them, like until very recently the Higgs particle. Some scientific facts raise more question than they answer, like the fact that known matter only accounts for five percent of the universe and that the rest is dark matter. Some scientific facts are so unimaginable to us underlings that we can barely fathom them, like the vastness of the universe.

The relation between art and the sciences has been subject to permanent change and debate over the past centuries. This dynamic is ongoing. The position of art regarding science is not always clear, a situation that is upheld by the overpowering presence of science and technology in today's society. Although the cultural status and importance of the natural sciences are taken for granted, the cultural role or significance of the arts is much less clear. In my thesis I have made this position a little more clear. Art that engages itself with science can shine a light on the parts that are left dark by the sciences. It does not answer scientific questions but gives an experience that is outside the scientific realm. It offers an enrichment. Throught these artworks, we have an experience that may very briefle disclose the essence of our connection to existence and permeates into the heart of life itself. Our bond to life is pulled from its everyday self-evidence and presents it as something new. Artists give an insight that we cannot work with scientifically but all the more existentially.

ILLUSTRATIONS

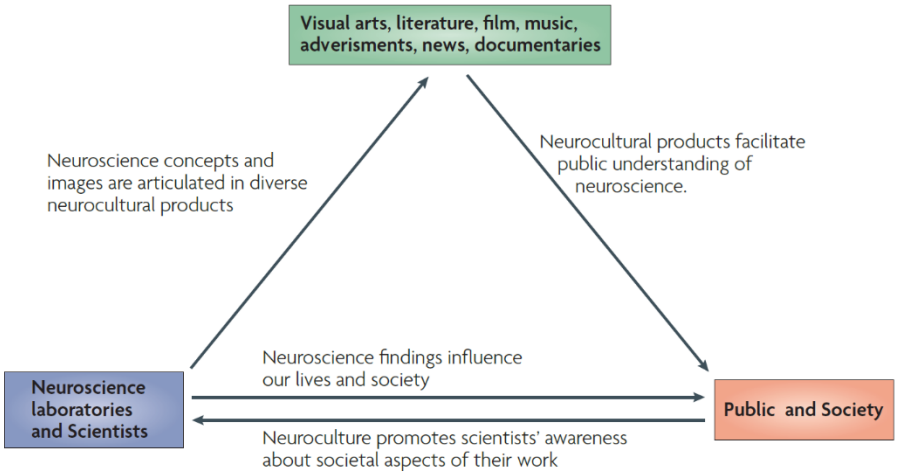

Figure 1: Graphical representation of triangular relationship between scientists, arts and the media, and the public.

Figure 2: Susan Aldworth, *Transience 4,5 and 6*, 2013, etching and aquatint, 40 x 25 cm (London, Blyth Gallery, Imperial College)

Figure 2: Helen Chadwick, *Self-Portrait,* 1991, photographic transparency on glass in aluminium frame and electric lights, 51 x 45 x 12 cm, (Edinburgh, Scottish National Gallery of Modern Art, Accession number. GMA 4096)

ILLUSTRATION SOURCES

Figure 1. Frazetto and Anker, ‘Neuroculture’, fig. 4

Figure 2. Downloaded October 2019 from https://susanaldworth.com/transience-2013/

Figure 3. Downloaded October 2019 from https://www.nationalgalleries.org/art-and-artists/42351/self-portrait

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