The influence of neuro-reductionism on the stigmatization of mental disorders

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J.J.G. Nijs
Student number: 2064365
MA track: Health Humanities
Department of Culture Studies
School of Humanities and Digital Sciences
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Supervisor: I.F.D. van den Bold / J. Slatman
Second reader: S.E. de Haan

Table of contents

CHAPTER 1: INTRODUCTION

The complexity of psychiatry has inspired many studies on the functioning of the brain and mental disorders. One important topic of interest has been the causal or influential factors for mental disorders. These include a variety of factors, such as socio-economic status (Muntaner et al., 2004), genes (Bienvenu et al., 2011), sex and gender (Riecher-Rössler, 2017), traumatic experiences (Álvarez et al., 2011), neurotransmitter dysfunction (Nutt, 2008) and stress (Virtanen et al., 2007). In order to structure the relations between causes and consequences in psychiatry, overarching frameworks have been proposed to 'provide orientation, treatment rationale, a shared language for communication with all those involved, and the means to explain treatment decisions to health insurers and to society at large' (de Haan, 2020a, p. 3). In short, these models help understand and communicate about a discipline in which much is still unknown, such as psychiatry.

Overarching frameworks designed to structure knowledge of a certain discipline are known as explanatory models, of which multiple exist within psychiatry. They typically range from holistic or integrative models to dualist/complementary models and single aspect or reductionist models (de Haan, 2020b). Holistic models on the one side of the spectrum aim at including as many relevant perspectives as possible into one model in order to approximate as close as possible a highly complex reality (Ghaemi, 2009). A well-known example of a holistic model is the biopsychosocial (BPS) model, to which an additional 'existential' dimension was suggested in addition to the biological, psychological and social dimension to match reality even more (de Haan, 2017). Next on the spectrum, which ranges from holistic models that include as many perspectives as possible, to reductionist models focussing on one perspective only, are dualist or complementary models. These models are dualist in that they include two perspectives, of which values-based psychiatry is an example (Fulford, 2008). In the case of values-based psychiatry, evidence-based scientific facts are complemented with values in order to integrate more perspectives into psychiatry, aiming at more 'personalized' psychiatry (Fulford et al., 2005). Value-based psychiatry therefore is a combination of a neuro-physiological perspective, represented by scientific facts, and the values-based perspective, represented by values (de Haan, 2020b). The spectrum is then completed with reductionist models, which are opposed to holistic models and typically revolve around one perspective only.

Where both holistic/integrative and dualist/complementary models do not prioritize between the perspectives that they include, which has been one of the critiques of these models, reductionist or one-sided models clearly focus on one dimension, with all other perspectives only being relevant in how they influence this primary dimension. Although in some cases a reductionist model might be a better representation of current knowledge than other models (Ghaemi, 2009), these models do not necessarily claim to be exhaustive (de Haan, 2020b). The main goal of reductionist models, of which biological psychiatry is currently the only one, is to provide new insights and a coherent picture of the complex biological processes of the brain that corresponds with other medical specialties (de Haan, 2020b). Reductionism within biological psychiatry is called neurophysiological reductionism, and is popular among scientists because of its possibilities to understand and treat the brain as a coherent system of interacting parts (Frisch, 2016).

Multiple advantages have been attributed to neuro-reductionism in psychiatry. One of these advantages is its ability to conceptualize mental disorders as brain disorders (Banner, 2013). The idea behind this advantage is that a holistic explanation of people with mental disorders portrays these people as having less influence on their disorder and therefore being less able to control their disorder, resulting in blame and avoidance of these people. A brain disorder, on the other hand, is more susceptible to medical treatment and easier to control. This idea was reinforced by studies that showed more stigmatization of mental health disabilities compared to physical disabilities because of a correlation between mental health disabilities and decreased controllability and stability (e.g. Corrigan et al., 2000). With stigmatization being a major barrier to several processes within healthcare and social life (Kvaale, Haslam, et al., 2013), decreasing stigma through neuro-reductionist explanations of mental disorders would be an appealing strategy. Other authors, however, warned for a neuro-reductionist explanation of mental disorders, pointing at a possibly related increase in stigmatization (e.g. Haslam, 2000). These authors

argued that mental health stigma is not based solely on blame, but that also labelling, negative stereotyping, separation of 'us' from 'them', status loss, discrimination and a desire for social distance play a role (Kvaale, Haslam, et al., 2013; Link & Phelan, 2001). Neuro-reductionist explanations might reduce blame, but at the same time reinforce other forms of stigmatization.

As outlined above, both the use of neuro-reductionism as an explanatory model in psychiatry and the implications of this use for stigmatization of mental disorders are highly debated. The goal of this study therefore was to provide a comprehensive overview of these debates by combining an analysis of different conceptualizations of neuro-reductionism with an analysis of the influence of this neuro-reductionism on the stigmatization of mental disorders. In order to achieve this goal, I conducted a literature study, which aimed at answering the following question: What is the influence of neuro-reductionism on stigmatization of mental disorders?

In the next chapter, I address the conceptualization of neuro-reductionism by describing neuro-reductionism from a philosophy of mind/philosophy of science perspective. In this part of the thesis, I include a short history of (neuro-)reductionism, the relation between neuro-reductionism and neuroscience and the relation between neuro-reductionism and mind-brain dualism. In the third chapter of this thesis, I address the consequences of neuro-reductionism for the stigma of mental disorders. I look at the influence of both specific neuro-reductionist narratives and neuro-reductionism in general on mental health stigma. I conclude this thesis with a discussion in the fourth chapter and a conclusion in the final chapter, in which I summarize the most important findings of this paper, outline future perspectives on the influence of a neuro-reductionist narrative on stigmatization of mental disorders and make possible recommendations for future research.

CHAPTER 2: NEURO-REDUCTIONISM

Reductionism has a long history within philosophy. This history dates back to Aristotle and Galen, among many others (Brigandt & Love, 2017). Several definitions, conceptualizations and critiques have been introduced since. For this thesis, I focus on neuro-reductionism, which is also heavily debated within philosophy. Two strands of thinking about neuro-reductionism are especially relevant for this debate: philosophy of mind and philosophy of science (Riel & Gulick, 2014). Philosophy of science aims at answering questions about what science is, what limits of science are, how it works or is supposed to work and so on (Rosenberg, 2011b). Philosophy of mind is concerned with questions such as what it is to be a creature with a mind, what mental states are and how minds relate to bodies (Kim, 2010). Neuro-reduction, with its focus on both the brain and (neuro)science, can be placed at the intersection of philosophy of mind and philosophy of science.

In this chapter, I aim at exploring neuro-reductionism from the perspectives of both philosophy of science and philosophy of mind. In the first section, I start with a description of multiple conceptualizations of (neuro-)reductionism. I focus on the most influential conceptualizations of reductionism and neuro-reductionism in recent history to describe the development of philosophy of science and philosophy of mind related to reductionism in general and neuro-reductionism in specific. In the second section, I define the relation between neuro-reductionism and neuroscience and introduce neuroscientific explanations of the brain that are frequently used in neuroscience as well as psychiatry. The third section of this chapter is centred around a crucial issue of philosophy of mind, the relation between the mind and the brain. In this part of the chapter I illustrate how neuro-reductionism relates to mind-brain dualism and how critiques of neuro-reductionism refer to mind-brain dualism. Lastly, I end this chapter with a short conclusion in which the main findings of this chapter are summarized.

2.1: Conceptualizations of (neuro-)reductionism

2.1.1: ONTOLOGICAL, METHODOLOGICAL AND EPISTEMIC REDUCTIONISM

Reductionism is a very broad concept. Usually, three types of reductionism are distinguished: ontological, methodological and epistemic reductionism (Sarkar, 1992). Ontological reductionism can be defined as 'the assumption that reality consists of a minimum number of entities or materials' (Kricheldorf, 2016, p. 63). This is a metaphysical position, also referred to as physicalism or materialism, in which it is assumed that all properties or processes may be reduced to one property or substance. In a biological context, which is the basis of biological psychiatry, this implies that all differences in biological properties are caused by underlying physical properties and all biological processes are caused by physico-chemical processes (Brigandt & Love, 2017). According to ontological reductionism, for example, organisms are exhaustively composed of atoms, and all biological processes are caused by the interaction of these atoms (Ayala, 1987).

While ontological reductionism focusses on one entity that processes or systems, including organisms, consist of, methodological reductionism is the idea that these processes and systems are best investigated at the level of the smallest entity (Brigandt & Love, 2017). In biomedical sciences, this means that molecular and biochemical causes should be the subjects of investigation (Andersen, 2017). Examples of methodological reductionism are studies that look for the cause of a disease at the level of cells or the molecular processes within cells. While methodological reductionism is often based on ontological reductionist assumptions, these assumptions are not always best investigated with methodological reductionist studies (Brigandt & Love, 2017). As Holly Andersen argued, following the example of Parkinson's disease, medical reductionism can yield great insights regarding causal structures, but at the same time ignore some causal structures that are too complex or difficult to investigate with a methodological reductionist approach (Andersen, 2017).

A last type of reductionism that can be distinguished is epistemic reductionism. Epistemic reductionists argue that certain scientific knowledge can be reduced to other, more fundamental or

general knowledge (Brigandt & Love, 2017). While a combination of ontological reductionism and methodological reductionism could motivate some form of epistemic reduction, this is not necessarily the case, and epistemic reductionism in science is in fact controversial (Brigandt & Love, 2017). This type of reductionism is therefore the main focus of this chapter.

2.1.2: DIFFERENT TYPES OF EPISTEMIC REDUCTIONISM

Two types of epistemic reductionism can be distinguished: theory reduction and explanatory reduction (Brigandt & Love, 2017). Theory reduction is the idea that one specific theory can be absorbed by a more general theory (Kricheldorf, 2016). Explanatory reduction is defined as a transformation of a higher-level explanation of a phenomenon to a lower-level explanation (Kaiser, 2011). Both forms of epistemic reductionism are described in more detail in the remainder of this section. I will start with theory reduction, which is often called 'Nagelian reduction', referring to the philosopher Ernest Nagel. Although other philosophers characterized his model as explanatory (Riel & Gulick, 2014) or ontological (Sarkar, 1992) reductionism, I regard Nagel's ideas and the models that were built on his ideas as theory reductionist, because Nagel himself referred to his model as theory reduction. Next, I describe explanatory reductionist models and other relevant types of reductionism that are somewhat related to explanatory reductionism.

Theory reduction

Many models of theory reduction are based on the work of Ernest Nagel (Brigandt & Love, 2017). In 1949, he introduced his model of theory reduction as 'the normal expansion of some body or theory, initially proposed for a certain extensive domain of phenomena, so that laws which previously may have been found to hold in a narrow sector of that domain, or in some other domain homogenous in a readily identifiable sense with the first, are shown to be derivable from that theory when suitably specialized' (Nagel, 1949, pp. 102-103). According to Nagel, theory reduction is a kind of explanation within a secondary science which can be derived from a primary science if both sciences are based on the same theoretical assumptions (Nagel, 1961). In a biological context, for example, when genes were found to consist of molecules, biological genetics could be reduced to atomic physics. In other words, theory A (often referred to as T_A) reduces theory B (T_B) if and only if T_A logically entails or explains T_B (Brigandt & Love, 2017). Nagel identified two types of his 'Nagel model of reduction', one in which 'bridge laws' or definitions linking two theories are required (nonhomogeneous cases) and one in which bridge laws are not required (homogeneous cases) (Gold, 2019; Riel & Gulick, 2014).

The idea of Nagel's bridge laws is that they enable the use of definitions from the reduced theory within the reducing theory while keeping the same meaning. Nagel described three types of laws to ensure this preservation of the meaning of definitions: conceptional links, conventional links and links through empirical facts (Van Riel, 2011). Entities, according to Nagel, are linked either because they belong to the same realm of concepts or are linked through stipulations based on scientific evidence or empirical hypotheses (Schaffner, 1967; Van Riel, 2011). Through these bridge laws, a new term can be introduced into the reducing science with the same meaning as another term in the reduced science. An often used example of bridge laws is mean kinetic energy. A bridge law is then a conceptional link, a conventional link or a link through empirical facts which ensures that a term from one theory (mean kinetic energy) has the same meaning as a term from another theory (temperature) and vice versa (Klein, 2009). The concept of bridge laws to ensure the same meaning of a term across scientific disciplines has been criticized, both because the exact same meaning of a term is a too strong requirement and because this similar meaning is not sufficiently guaranteed by bridge laws (Riel & Gulick, 2014). The reduction model of Kemeny and Oppenheim, for example, did not require any bridge laws (Kemeny & Oppenheim, 1956), whereas other models required even stronger relations between the term of the reduced and the reducing theory (Schaffner, 1993; Sklar, 1967).

Kenneth Schaffner, building on the Nagel model of reduction, argued that reduction is not solely based on linking two theories, but sometimes the reducing theory corrects or completely replaces the reduced theory (Schaffner, 1993). This argument is mainly based on the idea that a theory cannot be

deduced from another theory if the former is false. For example, if T_A is going to reduce T_B, but T_B is false, then T_A cannot be a reduction of T_B because T_B can no longer be deduced from T_A (unless T_A is also false). The reducing theory (T_A) is then a reduction of a corrected version of T_B. Applying his thoughts on reductionism to a biological context, Schaffner argued that all traditional fields of experimental biology will eventually be reduced to biochemistry, as has already happened when classical genetics were reduced to molecular genetics (Brigandt & Love, 2017). In his model, Schaffner also included the possibility of partial reductions, in which not a whole theory is reduced, but only a part of a theory (Riel & Gulick, 2014). This is the case when the reducing theory does not entail the reduced theory completely, but does entail parts of the reduced theory. A lot of debates in the 1970s and 1980s about reduction in the philosophy of biology were based on Schaffner's model of reduction (Brigandt & Love, 2017).

In reaction to the Nagel model of reduction, and building on Schaffner's model, philosophers elaborated on the work on reductionism in the philosophy of mind, creating the 'New Wave' model (Riel & Gulick, 2014). Firstly, New Wave reductionists argue that bridge laws as 'biconditionals', statements linking the meaning of a term between two theories, are too narrow. Biconditionals require the same meaning of two terms at all times, whereas 'conditionals' are links that can be true in one situation, but false in another (Kahane et al., 2020). According to John Bickle, for example, the reduction of pain to a physical-chemical state shows that reductionism can also occur only as conditionals. After all, pain can be reduced to one physical-chemical state in one species, but to another state in a different species (Bickle, 1998). In New Wave models, terms of the reduced theory and the reducing theory are linked through relevant similarities (Churchland, 1985). The exact mechanism behind two terms does not necessarily have to be similar, as long as the explanation is similar. This way, false theories can be reduced by true theories if they are relevantly similar to a certain degree.

Ronald Endicott referred to the similarities between a reduced theory and reducing theory, which he identified as one of the four main features of New Wave reductionism, as analogical relations or 'New Wave relations'. Citing Paul Churchland, he argues that theories can be replaced if the vocabulary of the reducing theory reflects the vocabulary of the reduced theory to a sufficient degree (Endicott, 1998). A second feature he identified is that these analogical relations can be strong or weak, corresponding to more or less similarities between two concepts ('New Wave continuum') (Endicott, 1998). Strong analogical relations, for example, occur when almost all principles of one theory have analogues in the reduced theory. If the analogical relation is strong, the original terms from the reduced theory should be preferred. If the relation is weak, reduced concepts should be eliminated. The other two features are 'New Wave construction' and 'New Wave deduction', the construction of a corrected version of the reduced theory within the vocabulary of the reducing theory and the corrected version being deduced from the reducing theory respectively (Riel & Gulick, 2014). New Wave construction ensures that all corrections of the reduced theory are formulated in the vocabulary of the reducing theory. A new, corrected version of the reduced theory can then be deduced from the reducing theory. For example, when a neuroscientific theory reduces a certain psychological theory, a new corrected version of the psychological theory can be deduced from the neuroscientific theory, incorporating the vocabulary of the neuroscientific theory. In conclusion, the main focus of New Wave reductionism is how reduction should be carried out, as opposed to the exact rules about the relation between terms of the reduced and reducing theory which are central to Nagel models of reduction (Riel & Gulick, 2014).

Explanatory reduction

More recently, another type of epistemic reductionism was distinguished in addition to theory reduction: explanatory reduction. Explanatory reductionism is based on a reductive explanation of a theory (Brigandt & Love, 2017). In contrast to theory reduction, explanatory reductionism does not necessarily reduce a whole theory or part of a theory, but can also reduce one fact or mechanism (Weber, 2005). This way, a molecular explanation of, for example, neurons, can fit in an otherwise classical biological theory.

Another difference between theory reduction and explanatory reduction is that explanatory reduction typically explains a causal relation between the whole and its parts (Winther, 2011). Multiple philosophers have shown how, especially in a biological context, processes can often be explained by the functioning of the different parts (Bechtel & Richardson, 2010; Kauffman, 1976; Wimsatt, 1976). This way,

explanatory reductionism comes down to an explanation of the underlying mechanism of a phenomenon. This explanation does not necessarily consist of only 'lower level features', as is required in theory reduction, but can make use of references to higher level features as well (Delehanty, 2005). Explanatory reductionism is therefore popular among biologists and neuroscientists because it enables the explanation of higher level features such as thinking by lower level features like the interaction of neurons, but with a reference to higher level features such as social or environmental factors (which Delehanty refers to as background or context that influences the functioning of the lower level features). When a certain process can only partly be explained by, for example, molecules, explanatory reduction can explain this part of the process with a reference to a molecular causal mechanism. Parts of the process that are not fully explained by the (reductionist) molecular mechanism can then be explained by reference to other (less reductionist) phenomena.

Along these lines, several models of explanatory reductionism have been developed. William Wimsatt emphasized the fact that explanatory reduction can occur when the cause of only one phenomenon is explained (Wimsatt, 1976). Sahotra Sarkar identified two types of explanatory reduction, one in which a phenomenon is explained by a combination of its physical parts ('spatial hierarchical reduction' or 'strong reduction') and one in which the phenomenon is not necessarily the combination of its physical parts ('abstract hierarchical reduction') (Sarkar, 1998). Using classical genetics as an example of the latter, he argues that two genes combined do not necessarily form a certain phenotype, because this process is mediated by, for example, mutations and variation in expression. Molecular biology, on the other hand, is an example of strong reduction, because a certain combination of molecules will result in the same cellular process. Marie Kaiser further differentiated explanatory reductionism from a mechanistic explanation by combining Sarkar's idea of strong reduction of a 'higher level' phenomenon into 'lower level' physical parts with the notion that these parts only form the higher level phenomenon in isolation (Kaiser, 2015). That is, as a result of the way in which biological phenomena are studied and discovered, explanatory reductionist models often focus on the explanation of these phenomena *in vitro*, or in the laboratory. Such an explanation might differ from an explanation of the same phenomenon *in vivo*, or in 'real life'. An explanatory reductionist explanation then is a decomposition of a phenomenon into its different physical parts as observed by scientists within a laboratory.

One more philosopher that developed an explanatory reductionist model is Alex Rosenberg. As an advocate of ontological reductionism or physicalism he argued for an 'eliminativist' adaptation of explanatory reductionism. According to Rosenberg, 'why-necessary' questions are better than 'how-possible' questions because the latter only shows how something could have happened, while the former shows that something had to happen (Rosenberg, 2008). The 'ultimate explanation' is therefore an explanation that explains why something had to happen and sticks to a number of criteria. This way, explanations that did not necessarily happen are eliminated. Rosenberg identified three criteria that are additionally required for the ultimate reductionist explanation. Such an explanation has to be universal (the explanation should be generalizable), exceptionless and spatio-temporally unrestricted (the explanation has to be valid on all places and at all times) (Brigandt & Love, 2017). Since, according to Rosenberg, natural selection is the only law within biology that corresponds to all these criteria, a reductionist biological explanation must be compatible with natural selection (Rosenberg, 2008). Rosenberg's reductionist thinking eventually resulted in a (much criticized) denial of everything except science (Rosenberg, 2011a). This argument and its critiques are beyond the scope of this thesis, but a final categorization of explanatory reductionism was introduced by one of these critiques.

Daniel Dennett distinguished 'good' reductionism from 'greedy' reductionism, where good reductionism was defined as explaining something in terms of what it reduces to (such as the whole and its parts), and greedy reductionism was defined as explaining something with a lack of supporting theory, thereby underestimating the complexity of a concept (Dennett, 1996). According to Dennett, Rosenberg often exemplified greedy reductionism (Pigliucci, 2018). Dennett himself did not provide any all-encompassing reductionist models, but rather sticked to 'piecemeal reductionism' (Margolis, 2010). Piecemeal reductionists use individual reductionist explanations for specific entities in a specific situation, without providing an underlying reductionist model (Gatherer, 2010). Daniel Dennett, for example, used piecemeal reductionism to describe the mind as a computer, with all incoming signals being unconscious, and consciousness arising where all unconscious signals leave the internal processes of the brain and form

one activating signal to the body (Margolis, 2010). The relation between reductionist explanations and the brain and its functions will be the subject of the remainder of this chapter.

2.2: Neuro-reductionism and neuroscience - neuroscientific explanations of the brain

Neuroscience is very complex. In order to structure the knowledge about the brain, neuroscientists often use neuro-reductionist explanations. As we will see in this section, these explanations often make use of references to ontological reductionism (when referring to molecular interaction as the cause of all mental processes) or epistemological reductionism. Concerning the latter, this often involves explanatory reductionism, since most neuroscientists believe that their current knowledge is limited, and that this knowledge might be expanded or even corrected in the future (Jacobson, 1993). Most neuroscientists therefore do not aim at reducing a theory as a whole but only the parts that can be reduced with the current knowledge. The goal of explanatory reduction as used by neuroscientists is to understand the mechanisms and processes behind important mental events, such as perception, memory, volition, and consciousness (Jacobson, 1993). In this section, these events will be used to illustrate how neuroscientists make use of neuro-reductionism, and some influential neuroscientists will function as examples of how neuroscience influenced neuro-reductionist thinking throughout time. Although neuroscientific explanations of all these important mental concepts rely on neuro-reductionism, the type of reductionism is not always explicit. I start by introducing the neuron doctrine using the neuroscientific explanations of perception and memory. In the second part, I use examples of more complex cognitive processes (volition and consciousness) to show that even within neuroscience, neuro-reductionist explanations are still under debate.

2.2.1: THE NEURON DOCTRINE

A neuroscientific explanation of mental events relies on the neuron doctrine, which was first formulated in 1891 (Shepherd, 2015). This theory states that the nervous system, including the brain, consists of individual cells, called neurons, of which the interaction facilitates behaviour (Barlow, 1995). The development of the neuron doctrine was initiated by and heavily dependent on the development of the microscope, which made it possible to see the individual neurons (Shepherd, 2015). In 1953, Horace Barlow used this neuron doctrine to explain how perception happens in frogs (Barlow, 1953). He later developed a theory of perception in humans based on the interaction of neurons (Barlow, 1972). This theory was based on the idea that a stimulus, such as light, touch or sound, activates a minimum number of single neurons. The stimulus is then transferred as electrical signals to certain neurons in the brain through intra- and intercellular processes. Perception occurs when certain neurons in the brain, specific for one type of stimulation, are activated through electrical signals by peripheral nerve cells.

The electrical signals and the interaction of nerve cells is also important for the neuroscientific explanation of memory, as was shown by Eric Kandel. Inspired by Freud, who argued that 'all our provisional ideas in psychology will presumably one day be based on an organic substructure' (Freud, 2014, as cited in Kandel, 2007, p. 46), he showed how different types of electrical signals made connections between nerve cells stronger or less strong (Kandel, 2007). Repetition, for example, creates stronger connections between nerve cells. These stronger connections make it easier to recall this information and perform tasks that have been performed frequently before. This way memory, which is defined as the capacity to save and recall certain information, could be reduced to the strength of the chemical or molecular connection between two neurons (Swaab, 2010). Remembrance, then, is the equivalent of the reactivation of neurons through stronger chemical or molecular connections.

The example of the theory of memory by Eric Kandel shows that neuroscientific theories can reduce or replace other theories, such as the theory of classical conditioning that was developed within psychology (Rescorla & Wagner, 1972). This is a good example of theory reduction, although there is some debate about whether Kandel's theory succeeded in replacing a whole theory (theory reduction) or just provided different explanations for parts of the theory (explanatory reduction) (Gold & Stoljar, 1999).

Unlike many other times in the history of neuro-reductionism, when philosophical views were not influenced by neuroscience and vice versa, this discussion shows a philosophical evaluation of neuroscientific research. The work of Kandel on classical conditioning inspired philosophers such as Patricia Churchland, which I will turn to later in this chapter, to connect neuroscience and philosophy of mind in order to reduce psychological theories to neuroscientific theories (Bickle, 2012; Churchland, 1989). Despite all debates, Kandel's theory therefore did succeed in reducing psychological concepts to neuroscientific processes using epistemic reductionism, thereby making way for the reduction of complex cognitive functions such as volition and consciousness.

2.2.2: VOLITION AND CONSCIOUSNESS

Volition, often referred to in the context of 'free will', has extensively been debated by both neuroscientists and philosophers. Neuroscientific explanations of volition have been developed since Benjamin Libet published his first study on volition in 1985 (Libet, 1985). He showed that neurons are already active, in terms of electrical activity, milliseconds before there is a conscious experience of intention or wanting to move. Although the cause of this activation is not yet known, and it is not clear whether there is something that can intercept this activation, the general idea among neuroscientists is that volition is just the result of this activation. Volition can then be reduced to electrical activity of neurons, resulting in awareness of a brain activity that has already taken place (Zhu, 2004). The debate between neuroscientists, philosophers and psychologists about the definition of volition and its implications for the existence of 'free will' are beyond the scope of this thesis, but the neuroscientific explanation of neuron activation preceding intention, shared by most neuroscientists, generally rejects the possibility of 'free will' (e.g. Swaab, 2010).

Another cognitive process that is closely related to volition, namely consciousness, has been the subject of lots of recent studies (Frith, 2021). The main theories, including the Integrated Information Theory (Tononi, 2008), Recurrent Processing Theory (Lamme & Roelfsema, 2000), Global Neuronal Workspace theories (Dehaene et al., 2003) and Higher-Order theories (Lau & Rosenthal, 2011) all assume that consciousness is created by the interaction of (networks of) neurons, although these studies provide different explanations about which neurons or neuronal networks are responsible. This is exemplary for the state of neuroscience on the complex subjects such as consciousness. Because current techniques only allow for correlational studies that relate certain mental events to activity in certain brain regions, neuroscientific explanations are hypotheses based on these correlational studies. In the case of mental events in humans (and also to some extent in animals (see e.g. De Waal, 2016)), current neuroscientific explanations embrace the existence of neurons and their causal involvement in mental events.

The different models that aim at reducing consciousness show that complex mental processes often cannot be reduced to one theory yet, but can provide useful explanations of certain aspects of a theory using explanatory reduction. Based on these types of neuroscientific studies, most neuroscientists are in favour of an epistemological reductionist explanation of mental events, meaning that these scientists see the neuron doctrine as the most reliable explanation of mental events until science has proven otherwise. These neuroscientists will argue that the neuron doctrine has been related to several mental events and disorders, but the causal mechanism behind other mental events and disorders, such as bipolar disorder (Institute of Medicine, 2001), remains unknown. Other neuroscientists endorse the view that the neuron doctrine will eventually explain all mental processes and provide a successful theory of mind, arguing in favour of an ontological reductionist view. This view is formulated by philosophers Paul M. and Patricia S. Churchland. They argue that neuro-reductionism is good because of several reasons, such as correcting or simplifying knowledge, and that eventually all mental processes will be understood in neuroscientific terms (Churchland & Churchland, 1994). Psychology will therefore likely be reduced to neuroscience, and a successful theory of mind will only include a neuroscientific theory, such as the neuron doctrine (Gold & Stoljar, 1999). This view is an example of ontological reductionism, in which the brain consists of only neurons and ultimately molecules and mental states and activity is produced only by the physical or chemical processes between those neurons. Supporters of this theory, including Paul and Patricia Churchland, but also other philosophers such as Daniel Dennett and

neuroscientists such as Dick Swaab, are called materialists. A materialist theory of mind has been met with lots of critiques, which is the subject of the next section.

2.3: Neuro-reductionism and mind-body dualism

As outlined above, materialism, also known as physicalism, is the idea that everything consists of matter. In the case of psychiatry, materialists argue that the brain consists of only matter, more specifically neurons which are, in turn, made of molecules and ultimately atoms. Critiques on materialism often come from dualists. Dualism is the idea that everything in the world can be divided into one of two categories. In the philosophy of mind, this concerns mind-body dualism (within psychiatry often called 'mind-brain dualism'), according to which those two categories are matter and mind. Throughout history, philosophers have argued for different aspects of the mind to be defined as 'mind' in the 'mind-body problem'. Ancient philosophers, as well as medieval philosophers, for example, focussed mainly on the intellect as being substantially different from a materialistic account of the brain, whereas Descartes and later philosophers focussed on consciousness as opposed to the materialistic brain (Robinson, 2020). This section will further elaborate on dualism in the philosophy of mind and some influential theories about the mind-body problem in order to illustrate the position of neuro-reductionism in the mind-body debate and the relation between neuro-reductionism and mind-body dualism.

2.3.1: DIFFERENT CONCEPTUALIZATIONS OF MIND-BODY DUALISM

Early accounts on dualism are described by Plato, who argued that one's identity is determined by one's soul, which he calls 'Form', and that this Form is imprisoned in the body (Gerson, 1986). In addition, this Form is immortal and 'strives to leave the body in which it is imprisoned and to dwell in the realm of Forms' (Robinson, 2020). The main argument behind this immortality is that Forms are invisible and it is most likely that all invisible things are immortal (Gerson, 1986). A similar idea of an immortal and invisible soul 'imprisoned' within the physical body can be found in the works of Descartes. Painting an image of the soul being solely responsible for someone's identity, Descartes used terminology that Gilbert Ryle, in his critiques on Descartes' mind-body dualism, would later refer to as the 'ghost in the machine' (Ryle, 1949). The ghost (or the mind) in this case is the immaterial power behind the actions of the material machine (the body).

Throughout history, scientists and philosophers have come up with a lot of different conceptualizations of the mind based on Descartes' idea of dualism (Cartesian dualism) or its refutation. Examples include the 'tacit cogito' of Maurice Merleau-Ponty (Hung, 2005) and 'the impersonal' of Simone Weil (Hermsen, 1999), but also the 'God' of many religious people (Hermsen, 2011). Numerous arguments have been put forward by proponents and opponents of (Cartesian) dualism. A detailed account of these arguments is beyond the scope of this thesis, but a brief overview of the main arguments in favour of mind-body dualism and their counterarguments is relevant in order to understand the position of materialism in the mind-body debate. These main arguments include the religious argument, free will, Leibniz's law and the 'real distinction' argument, which will be the subject of the next section.

2.3.2: ARGUMENTS RELATED TO MIND-BODY DUALISM

Dualism has been shaped over the years by religious thinking and religious scientists and philosophers. The religious argument in favour of mind-body dualism is still very much alive. Dutch philosopher Bert Keizer for example, referring to the mind as 'the soul', also uses religious arguments to support mind-brain dualism (Keizer, 2013). The theory behind the religious argument is that a materialist explanation of the brain rules out the possibility of a soul, and since religious people belief in the existence of a soul within the body that survives after the death of the body, arguments in favour of mind-brain dualism are often religious. In reality, however, the situation is more nuanced. Although there is, indeed, a strong correlation between religiosity and dualism (as well as afterlife beliefs) (Riekki et al., 2013), religious arguments against dualism have also been proposed. These arguments are mainly focussed on the fact

that body and soul do not necessarily have to be separated in order to survive after death. This is illustrated by examples from the Bible and the Koran: both the resurrection as present in the Bible as well as the survival after death as present in the Koran can be seen as a resurrection or survival of one unitary (bodily) organism (Baker, 1995; Rahman, 1984).

Another argument in favour of mind-brain dualism is based on the idea of free will. As I illustrated before, neuro-reductionists have argued that neural activity precedes the conscious idea of volition. The causal mechanism behind conscious choice is then still not explained, because it is unknown what the cause of the neural activation is. Materialists argue that, since all events are physical events, all choices can be explained in physical terms (Worley, 2014). A choice is then the sum of a number of physical interactions and therefore completely determined by 'the prior state of our brains plus the laws of nature' (Worley, 2014, p. 2). In this case, materialism and physical determinism exclude the existence of free will. Alternative explanations have been suggested, such as the idea that there is freedom when the brain is determined in a way that its 'choices' are based on the actual (physical) input, and that a different outcome was possible had there been a different input (Fischer, 1994). Dualists, however, argue that people have more substantial freedom to make choices, which shows that people are not determined (Swinburne, 2013). This free will therefore does not adhere to the laws of physics, which proves, according to dualists, the existence of the mind.

A next argument that is often used by mind-brain dualists is Leibnitz's law. According to this law, two things are identical if they simultaneously share all the same properties, and mind and brain are different because the mind has properties (such as privacy or intentionality) that the brain has not and vice-versa (having a certain temperature or electrical charge) (Calef, 2005). Materialists argue that Leibnitz's law is based on assumptions, because privacy or intentionality can only be ascribed to a mind if it is assumed that the mind is not the same as the brain. A materialist view considers mind and brain the same, and therefore the properties of the mind and the brain are exactly the same, although a dualist would answer that since the properties of the mind can only be known by introspection and not by physical observation they cannot be identical (Worley, 2014). Elaborating on Leibniz's law is Jackson's knowledge argument (Jackson, 1982). This argument is about a super-scientist, named Mary, who knows everything about the neurophysiology of colour perception but has been raised in a black-and-white room and therefore never experienced colour. Dualists argue that since Mary will learn something new when she sees the colour red for the first time, this knowledge cannot be physical (she already knew everything physical about colour perception). The knowledge argument has been criticized by several materialists, of which I will mention two. Daniel Dennett, for example, argued that Mary could not have known everything about the colour red due to language limitations. According to him, the complex neurophysiology of colour perception cannot be explained with language yet (Dennett, 2001). Paul Churchland argued that Mary would not be able to experience colour when leaving the room since she has not developed the brain area responsible for seeing colour (Churchland, 2004). This shows that the knowledge argument has not been settled yet.

A last argument in favour of mind-brain dualism is the 'real distinction' argument, which is Descartes' idea that two things are separate if the one is conceivable without the other (Calef, 2005). Because Descartes believed that God can facilitate the existence of a mind without a body, those were two independent things according to him (Worley, 2014). David Chalmers further developed this argument to include phenomenal ('felt' or 'lived') experience (Chalmers, 1996). He argued that since 'we can coherently conceive of creatures which are physically exactly like human beings, down to the subatomic level, but which do not have any phenomenal experience' (Worley, 2014, p. 4), phenomenal properties cannot be the same as physical properties. Important for this argument is that, as opposed to materialists, dualists would argue that phenomenal experience is not just the result of neurophysiological activity. Bert Keizer, for example, following philosopher Alva Noë, uses the experience of the colour red to explain that no neurophysiological explanation matches the phenomenal experience of seeing the colour red (Keizer, 2013). Materialists argue that this 'explanatory gap' will be explained by science in the future, whereas dualists such as Chalmers believe that phenomenal experience can never be explained neurophysiologically, which makes physically identical human beings without phenomenal experience perfectly conceivable (Worley, 2014). According to the real distinction theory, physical and mental properties are then two different things.

As illustrated in this section, the discussion between materialism and dualism about the existence of matter and mind is an ongoing debate. Particular concepts such as the explanatory gap inspire both philosophical and neuroscientific research to this day. Both perspectives have important implications for the conceptualization of the mind. Endorsing a dualist perspective opens the possibilities of having a mind next to a brain, which is either controlled by one's free will or a god. Materialism generally rejects both. Taking a different perspective, in this case either a materialist or dualist perspective, might also influence the conceptualization and stigmatization of mental disorders. The consequences of a neuro-reductionist or materialist narrative, as opposed to a dualist perspective, for the stigmatization of mental disorders is the subject of the next chapter.

2.4: Conclusion

Reductionism in general, and neuro-reductionism in particular, are very broad concepts. Reductionism can be divided into three categories: ontological, methodological and epistemic reductionism. As we have seen in this chapter, most neuroscientists have endorsed either epistemic reductionism (more specifically explanatory reductionism) or ontological reductionism, which has provided both with extensive theoretical underpinnings and numerous counter-arguments in response. These categories, however, also consist of multiple different conceptualizations of reductionism. For the remainder of this thesis, I will use a broad definition of reductionism as one entity being 'brought back' to a more basic or fundamental entity (Riel & Gulick, 2014). Applied to neuro-reductionism, this definition includes the following 'more fundamental entities': brain parts – nerve cell collectives – nerve cells – nerve cell parts – macromolecules – molecules – atoms – subatomic particles (Jacobson, 1993). In the next chapter of this thesis, I show how explanatory models relate to different types of neuro-reductionism by referring to one or more of those entities. As a result, usage of these explanatory models has varying consequences for the stigmatization of mental disorders. Additionally, I analyse the current literature on the relation between neuro-reductionism in general and mental health stigma in order to draw any generalized conclusions about how neuro-reductionism influences the stigmatization of mental disorders. Both specific explanatory models and neuro-reductionist explanations in general and their consequences for mental health stigma are the subject of the next chapter.

CHAPTER 3: NEURO-REDUCTIONISM AND MENTAL HEALTH STIGMA

As I argued in the previous chapter, neuro-reductionism has multiple ascribed advantages. By equating the mind with the brain, and therefore mental disorders with brain disorders, neuro-reductionists aim at explaining and exchanging new knowledge about the brain and its disorders in a coherent way (de Haan, 2020b). In order to do so, neuro-reductionists argue that the language of psychiatry should be more in line with the language of other branches of medicine, more specifically neurology (Banner, 2013). This does not only improve the understanding of the pathophysiology of brain disorders and potentially the treatment of these disorders (Insel & Quirion, 2005), but might also help reducing the stigma that is associated with psychiatric disorders (Banner, 2013). After all, if psychiatric disorders are considered brain disorders, there is no difference between psychiatric disorders and other medical disorders. According to supporters of neuro-reductionism within psychiatry, this would eliminate stigmatization of mental disorders.

In this chapter, I combine findings from previous studies to see if neuro-reductionist explanations of mental disorders really eliminate the stigmatization associated with mental disorders, and what other possible consequences of a neuro-reductionist narrative are for the stigmatization of mental disorders. In order to do so, I focus on three topics in particular. Firstly, I define stigmatization in the context of psychiatry and mental disorders. I describe how stigmatization occurs and what causal factors for stigmatization of mental disorders are. Secondly, I introduce influential explanatory models and explain how they relate to neuro-reductionism. Furthermore, I show the consequences of these specific neuro-reductionist explanatory narratives for the stigmatization of mental disorders. Thirdly, I analyse the relation between neuro-reductionism and mental health stigma. I illustrate how neuro-reductionism in general influences stigmatization of mental disorders.

3.1: Stigmatization of mental disorders

Stigmatization of mental disorders is defined as ‘the negative effects of a label placed on any group, such as a racial or religious minority, or, in this case, those who have been diagnosed as `mentally ill’’ (Hayward & Bright, 1997, p. 346). Stigma therefore involves stereotypes, in which members of devalued groups are characterized by blanket terms, prejudice (the negative affect of society towards individuals of the minority group based on these blanket terms) and discrimination (the ‘curtailing of rights and life opportunities’ (Hayward & Bright, 1997, p. 368) of minority groups). Multiple causes of stigmatization of mental disorders have been described in the literature. These causes include dangerousness, attribution of responsibility, poor prognosis and disruption of social interaction (Hayward & Bright, 1997). In this section, I will illustrate the causal factors of mental health stigma in more detail, and show how they contribute to the increasing stigmatization of mental disorders.

The first causal explanation of stigmatization of mental disorders is dangerousness. According to this explanation, people with mental disorders are feared by other people because mentally ill people are believed to be more violent (Hayward & Bright, 1997). Previous studies, for example, showed that when ‘former mental patients’ are perceived to be dangerous, there is a strong ‘labelling effect’ (or stigmatization), which does not occur when former mental patients are not considered dangerous (Link et al., 1987). In this case, former mental patients were considered dangerous because of a ‘former hospitalization’ label, which resulted in more social distance towards these people. Another study showed that mental patients are considered more dangerous when they are ‘active’ (defined as rapid movement, for example when fleeing from the police), because this movement ‘might rapidly increase their perceived proximity to us’ (Riskind & Wahl, 1992, p. 349). The label of dangerousness of people with mental disorders is often enhanced by media representations (Ward, 1997), resulting not only in more social distance from these people, but also in policy that is centred around restraints for these people to provide the idea of risk prevention to the general public (Hewitt, 2008).

The second causal explanation of mental health stigma is the attribution of responsibility. The idea that mental/behavioural problems are more controllable than physical problems, and that people with mental problems therefore have more responsibility for their problems compared to people with physical problems, originates from a study by Bernard Weiner and colleagues (Weiner et al., 1988). People with mental disorders were consequently likely to be met with anger instead of pity, and ignored instead of helped. This shows a public belief that people with mental disorders deliberately behave the way they do, and are therefore responsible for their actions (Hayward & Bright, 1997). The idea of responsibility of people with mental disorders is also widely debated in philosophy, law and politics. Examples include the 'just world hypothesis', which states that 'people have a need to believe that their environment is a just and orderly place where people usually get what they deserve', and that unfortunate people are therefore responsible for their misfortune (Lerner & Miller, 1978). Another example can be found in the implementation of responsibility of mentally ill into legislation, such as a complete denial of responsibility of mentally ill in jurisdictions such as the United States and the United Kingdom, and total responsibility for everyone in Sweden (Grossi & Green, 2017; Hummelen et al., 2018). Representations of these debates by the media can influence public perceptions of people with mental disorders and therefore reinforce stigmatization of mental disorders (Olstead, 2002).

A third possible explanation of stigmatization of mental disorders is the idea that stigmatization increases when the public perception is based on the assumption that a mental disorder is chronic, appropriate treatment is not available and the prognosis is poor (Goldin, 1990). Additionally, the idea that a mental disorder has a poor prognosis was negatively related to the social acceptance of people with these disorders (Norman & Malla, 1983). Other studies have also shown that stigmatization of people with mental disorders decreases when it is known that someone is getting treated for this mental disorder (Huxley, 1993). Beliefs about the treatability and prognosis of mental disorders are therefore crucial for the stigmatization of these disorders. At the same time, research has shown that public beliefs about treatability and prognosis of mental disorders are generally realistic, which has been argued to be a possible starting point of future anti-stigma campaigns (Crisp et al., 2005).

The last causal explanation for mental health stigma is the disruption of normal social interaction based on social role. This explanation is based on the idea that 'those who suffer from mental illness do not fit into normal patterns of social interaction, and people do not feel comfortable in situations in which the normal rules of social interaction do not work smoothly' (Hayward & Bright, 1997, p. 351). Graham Scambler described social order as a 'tendency to habitualize […] actions', and stigmatized groups, such as people with mental disorders, violate these routines of social intercourse by being unpredictable (Scambler, 1984, p. 206). Important here is that, in addition to the violation of smooth social interaction, there is an ontological part to this explanation, namely that people with mental disorders are imperfect in nature by not being able to confirm to expected social and cultural norms. Where Scambler focussed on the ascribed deviance from social norms by the general public, other studies showed that as a result of public perceptions about mental disorders, people suffering from mental disorders can internalize these perceptions and change their behaviour accordingly (Corrigan & Rao, 2012). This is process is called self-stigmatization. Both ascribed deviance and deviance as a result of self-stigma can result in social avoidance (Corrigan & Rao, 2012; Goffman, 1968).

As illustrated above, stigmatization of mental disorders is highly related to public perceptions, and therefore heavily affected by explanatory models, especially when used in the media (Hinshaw & Stier, 2008). These perceptions have resulted in an increasingly negative public opinion about mental disorders compared with fifty years ago (Hinshaw, 2009). Lots of research has therefore been conducted on this subject, and several campaigns against stigmatization of mental disorders have been launched (Crisp, 1999). This stresses the importance of explanatory models that reduce mental health stigma, while at the same time are understandable enough to be used by a significant number of people, including lay people. Neuro-reductionism has often been cited as a promising source for explanatory models with beneficial effects on mental health stigma (Hinshaw & Stier, 2008). In the next section, I will analyse the relation between different frequently used explanatory models and neuro-reductionism and describe how these explanatory models influence the stigmatization of mental disorders.

3.2: The relation between neuro-reductionism, explanatory models and mental health stigma

As I illustrated in the last chapter, neuro-reductionism is a complex concept which can be divided into multiple different types of neuro-reductionism. In this section, I show how specific influential explanatory narratives on mental disorders relate to these different types of neuro-reductionism. When looking at the main three categories of neuro-reductionism as introduced in section 2.1.1, ontological, methodological and epistemic reductionism, we will see that explanatory models make use of either ontological or epistemic reductionism. Methodological reductionism and the ongoing discussion about the use of methodological reductionism in science will therefore not be part of this chapter. In this section, I describe how four frequently used explanatory models (genetic, biomedical, the chemical imbalance and psychological/biopsychosocial) relate to neuro-reductionism and the different subtypes of neuro-reductionism. Additionally, I show how these explanatory models have different consequences for the stigmatization of mental disorders and analyse the possible causes for this difference, based on a difference in reference to subtypes of neuro-reductionism.

3.2.1: THE GENETIC NARRATIVE

According to a genetic narrative, mental disorders are caused by genetics or heredity. As stated earlier, neuro-reductionism can encompass multiple levels of entities: brain parts – nerve cell collectives – nerve cells – nerve cell parts – macromolecules – molecules – atoms – subatomic particles (Jacobson, 1993). With its reference to genes and DNA, a genetic narrative focusses on the entity 'macromolecules', of which DNA is an example. The genetic narrative describes DNA, on which all genetic information is recorded, and genes, the parts of DNA that encode for certain cellular processes, as the smallest entity determining all mental processes and mental disorders. This narrative is an ontological reductionist narrative. It regards genes as the smallest and only source of all mental activity. In studies on mental health stigma, this is often called 'genetic essentialism'. Genetic essentialism can be seen as ontological reductionist, since it refers to genes as an unchangeable cause of all mental processes which forms the basis of our identities and behaviour (Phelan, 2005). The degree of genetic essentialism and corresponding ontological reductionism within a genetic narrative can vary. Some narratives leave open a possibility for other factors to influence mental processes and disorders, such as environmental factors, whereas others do not. As we will see, the degree of ontological reductionism of a genetic narrative is important for its influence on mental health stigma.

The aim of a genetic narrative is not to reduce mental health in general to genetic predisposition, but rather to explain one mental disorder with genetics, without providing a full explanatory theory. This is an example of explanatory reductionism (see 2.1.2), and, more specifically, abstract hierarchical reduction (idem), since according to this narrative a mental disorder does not consist of a specific combination of genes, but is caused by a more abstract mechanism in which genes are involved (variations, mutations and epigenetics, among others). Explanatory reductionist narratives can explain only one phenomenon, such as a specific mental disorder, without having to explain the full theory behind the phenomenon in genetic terms.

Two theories have been suggested to explain the relation between the genetic narrative and stigmatization of mental disorders: attribution theory and the earlier mentioned genetic essentialism (Phelan, 2005). The first one refers to the idea that attribution of mental disorder symptoms to an underlying genetic cause reduces stigma through 'reduced blame, anger, and punishment and increased sympathy and helping' (Phelan, 2005, p. 310). The idea is that if deviant behaviour and mental disorders can be attributed to a fixed and unchangeable cause, namely genes, people will not blame or punish the individual, but instead try to help him or her. At the same time, these references to an unchangeable cause of mental disorders may result in more stigmatization through 'increased perceptions of differentness, and - indirectly through increased perceptions of seriousness, persistence, and risk to family members - via increased social distance and reproductive restriction' (Phelan, 2005, p. 310). In other words, genetic essentialism might enhance the idea that people with mental disorders are different,

dangerous and untreatable and should therefore be avoided or their reproduction restricted. While both theories, the attribution theory and genetic essentialism, could be co-existing, studies have suggested that genetic explanations are mostly associated with increased stigmatization, suggesting a greater role for genetic essentialism (Cheng, 2015; Phelan, 2005). There are, however, also studies that show positive effects of genetic explanations for the stigmatization of mental disorders based on the attribution theory (Phelan et al., 2002). At the same time, research shows that less essentialist genetic explanations, such as explanations that are partly genetic and partly environmental, have totally different implications for stigmatization of mental disorders (Phelan, 2005). In conclusion, it is clear that genetic explanations are associated with increased stigma through genetic essentialism, but the total influence of genetic explanations, especially different degrees of essentialism, on stigmatization of mental health requires further research.

3.2.2: THE CHEMICAL IMBALANCE NARRATIVE

With regard to depression, another narrative has been widely used to describe its causal mechanisms, known as the chemical imbalance. This narrative of a chemical imbalance in the brain as a cause of mental disorders is very relevant, since one study showed that more than sixty percent of the respondents believed that a chemical imbalance contributed to the development of a mental disorder (Khan et al., 2011). Experimental studies on the influence of the chemical imbalance narrative on mental health stigma have used multiple different versions of this narrative. Some studies have described a mental disorder as being caused by an imbalance of brain chemicals (Cheng, 2015), whereas other studies specifically named these chemicals (Kemp et al., 2014). In both cases, the chemical imbalance narrative refers to the interaction of brain parts or nerve cells through the entity 'molecules'. This implies a reference to ontological reductionism, similar to the genetic narrative.

Ontological reductionism in the case of a genetic narrative, as I have explained before, is also called 'genetic essentialism'. The chemical imbalance narrative, however, does not refer to genes as the smallest causal entity behind mental processes and disorders, but to molecules instead. This way of explaining mental disorders by reference to the brain and its activity from chemical, biological or neuroscientific perspectives is called 'neuro-essentialism' (Schultz, 2018). Neuro-essentialists believe that 'a deep-seated hidden essence is shared by all members of a category, giving rise to its observable properties and determining its identity' (Loughman & Haslam, 2018, p. 2). In a biogenetic narrative, for example, this 'deep-seated hidden essence' refers to genes, whereas in the case of the chemical imbalance narrative, it refers to molecules. The genetic narrative and the chemical imbalance narrative are therefore very similar in referring to ontological reductionism, although there might be important differences between specific types of both explanations in the extent to which they leave open the possibility of other (additional) causes of mental disorders, such as environmental factors. Just like the genetic narrative, the chemical imbalance narrative can be explanatory reductionist when other causal factors are included in the narrative, next to the chemical imbalance. Most studies, however, explicitly exclude other factors in their description of the chemical imbalance.

The similarities in terms of essentialism are reflected in the influence of the genetic and chemical imbalance narratives on stigma. While the attribution theory has also been suggested to play a role in the relation between the chemical imbalance narrative and mental health stigma, the fact that this narrative is associated with increased stigma suggests a greater role for neuro-essentialism (Schultz, 2015). Similar to the genetic narrative, the chemical imbalance narrative results in reduced blame at the cost of increased prognostic pessimism (Deacon & Baird, 2009). Some studies have suggested a positive effect of the chemical imbalance narrative on self-stigma (Deacon & Baird, 2009). Later studies, however, did not observe a reduction of self-stigma in relation to the chemical imbalance narrative (Kemp et al., 2014). This, too, is comparable with the mixed findings concerning the influence of a genetic narrative on self-stigma (Easter, 2012).

3.2.3: THE BIOMEDICAL NARRATIVE

The biomedical narrative combines a biological explanation, such as the genetic or chemical imbalance narrative, with treatment information (Lebowitz & Ahn, 2012). As I have argued in the previous sections, the genetic narrative and the chemical imbalance narrative were associated with reduced blame, but increased prognostic pessimism, resulting in an overall increase of mental health stigma. A biomedical narratives aims at combining the positive effects of a biogenetic explanation (the reduction of blame) with information about the prognosis, which has been shown effective in eliminating the idea of a poor prognosis as a cause of mental health stigma (Lebowitz & Ahn, 2012). Prognostic information about psychiatric disorders is, however, multifactorial. Treatment of psychiatric disorders can depend, for example, on socio-economic status, quality and continuity of occupational care and level of education (Cornelius et al., 2011). Prognostic information can therefore not be explained by a reductionist explanatory narrative.

A decrease of stigma related to a decrease of prognostic pessimism has also been observed when information about gene-environment interactions relevant for specific mental disorders was included in a biogenetic narrative (Ojio et al., 2020). Although studies on the influence of a biomedical narrative on mental health stigma are limited and often focus on one aspect of stigma only, these results suggest that moving away from reductionism reduces the stigmatizing effects of an explanatory narrative. Including additional causal or influential factors in an otherwise biogenetic explanation, thereby making the explanation less reductionist and more holist, seems to have beneficial effects on mental health stigma. A biomedical narrative, including treatment information, is therefore likely to be more effective in reducing mental health stigma than genetic or chemical imbalance narratives alone. More research on the influence of a biomedical narrative on the different aspects of mental health stigma is still needed, however, because one study presented conflicting results, with no positive effects of a biomedical narrative on the stigmatization of mental disorders (Schreiber & Hartrick, 2002). More research is also needed on the relation between prognostic information and self-stigma. Knowledge about a (poor) prognosis of mental disorders is associated with increased self-stigma in some disorders (Lien et al., 2018), but unknown for a lot of other mental disorders.

3.2.4: THE PSYCHOLOGICAL AND BIOPSYCHOSOCIAL NARRATIVE

The reductionist explanatory models above are often compared to psychological or biopsychosocial explanations. Biopsychosocial explanations are typically holist, as opposed to the reductionist narratives above. Although one could imagine reductionist models within psychology, such as reduction of behaviour to feedback loops and stressors, studies that focus on the effect of psychological explanations on mental health stigma are often limited to terms like ‘environmental risk factors’ as the main cause of psychologically based mental problems. These studies show that psychological explanations are associated with less stigmatization compared to biological explanations (such as the genetic or chemical imbalance narrative), which can mostly be attributed to better perceived treatment possibilities (Lam et al., 2005) and less desire for social distance (Martin et al., 2000). Although an increase of stigmatization related to a biological explanation could not be observed, biological explanations did not have any positive effects on stigmatization except for reducing blame (Mehta & Farina, 1997). These findings suggest that theoretically, a combination of a biological and a psychological explanation would be the most effective in reducing stigmatization of mental disorders. Unfortunately, however, in practice there is a tension between both explanatory models, with the biopsychosocial model being ‘eclectic and descriptive’ (Lam et al., 2005) and subject to numerous methodological challenges.

As I discussed in the section above, the effects of a reductionist narrative on the stigmatization of mental disorders depends on the type of explanation. Ontological reductionist explanations, such as the genetic narrative and the chemical imbalance narrative, are associated with less blame, but more prognostic pessimism, resulting in an increase of stigmatization. The narratives above are, however, only a small part of the total number of neuro-reductionist explanations for mental disorders. Other narratives include brain dysfunction, brain disease, virus or infection, brain damage, disease with biochemical effects and

brain disorder caused by changes in brain metabolism (Loughman & Haslam, 2018). In the next part, all these narratives will be taken together to assess the influence of neuro-reductionist explanations in total on the stigmatization of mental disorders. We will see if there are any patterns between certain types of neuro-reductionism and consequences for specific aspects of mental health stigma.

3.3: Consequences of neuro-reductionism for the stigma of mental disorders

As I explained before, stigmatization of mental health disorders is based on four causes, being attribution of responsibility, dangerousness, disruption of social interaction and poor prognosis. Two causes of mental health stigma in particular, namely that people with mental disorders are responsible for their disorder and that mental disorders are difficult to treat, are suggested to be influenced by a difference in explanatory model, notably the difference between a biological model, such as the aforementioned genetic and chemical imbalance narratives, and a 'psychiatric' model (Hayward & Bright, 1997). A study by Socall and Holtgraves, for example, showed that respondents tended to reject people with a psychiatric label significantly more than people with the same behaviour but a physical label (Socall & Holtgraves, 1992). Additionally, the psychiatric label was associated with expectations of a poorer outcome and more unpredictable behaviour (Socall & Holtgraves, 1992). In this section, I have a closer look at the influence of neuro-reductionist narratives in general on these and other specific aspects of mental health stigma. In order to do this, I look at the influence of all neuro-reductionist narratives combined on specific aspects of mental health stigma. These neuro-reductionist narratives include the aforementioned chemical imbalance narrative and genetic narrative, but also narratives focussing on different levels of entities, such as brain dysfunction, brain disease, virus or infection, brain damage, disease with biochemical effects and brain disorder caused by changes in brain metabolism. I will also analyse some practical consequences related to the use of neuro-reductionist narratives, resulting in more or less stigmatization indirectly.

3.3.1: BLAME

The first cause of mental health stigmatization which is influenced by a neuro-reductionist explanation is the attribution of responsibility or blame. The idea is that a neuro-reductionist explanation shows that a mental disorder is caused by an underlying mechanism of which the individual has no control, therefore the individual is not responsible for this mental disorder (Corrigan et al., 2000). As I have described earlier, this is called 'neuro-essentialism'. Neuro-essentialism corresponds with ontological reductionism, both focussing on one underlying entity that is the causal entity behind all mental processes and disorders. Several explanatory narratives refer to neuro-essentialism or ontological reductionism, but to a very different degree. This seems especially relevant for the influence of such a narrative on blame as a cause of mental health stigma.

In section 3.2, I analysed the relation between (ontological) reductionist explanations and the attribution of responsibility for specific narratives, such as the chemical imbalance and the genetic narratives. This can be done for many other related neuro-reductionist narratives, such as narratives focussing on biological entities (virus or infection) or neurological entities (brain damage). Because these studies show very different results, the most coherent picture has been painted by a meta-analysis that included the results of multiple studies based on these so-called 'biogenetic explanations', in which all biological, neurological, chemical and genetic narratives are combined. This study shows that biogenetic explanations, similar to the chemical imbalance and genetic narratives, are associated with reduced blame (Kvaale, Haslam, et al., 2013). A possible explanation for this association is the fact that biogenetic explanations are, just like the genetic and chemical imbalance narratives that they include, 'essentialist' or ontological reductionist. Biogenetic explanations refer more or less explicitly to a fixed and unchangeable pathological cause of mental disorders, which might result in less control over a mental disorder by the affected individual and therefore less ascribed responsibility or blame (Kvaale, Gottdiener, et al., 2013; Kvaale, Haslam, et al., 2013).

Another meta-analysis that focussed on neurobiological explanations only, excluding genetic causes of mental disorders, did not find an association between these explanatory models and reduced blame. This study showed that such a neurobiological explanation of mental disorders is not related to increased ascribed responsibility or blame, but is also not related to a decrease in blame (Loughman & Haslam, 2018). A possible explanation for this difference is a difference in the type of reductionism. The cause of mental disorders in the separate studies in this meta-analysis is described in terms of 'brain disease', 'brain dysfunction', 'neurochemistry' or 'chemical imbalance' (Loughman & Haslam, 2018). These descriptions do not all refer to ontological reductionism to the same extent. While the chemical imbalance and neurochemistry narratives can be interpreted as ontological reductionist (if a chemical imbalance is the only cause of the disorder), the other descriptions are explanatory reductionist, because they refer to specific processes being caused by a neurobiological cause (which is not per se the ultimate cause), but at the same time leave open the possibility for other types of influences, such as social or environmental influences (Loughman & Haslam, 2018). Leaving open a possibility for other known or unknown influential factors is not only the most common perception among scientists, it is also increasingly endorsed by the general public (Schomerus et al., 2012). By excluding genetic causes of mental disorders, neurobiological explanations might refer less to ontological reductionism or neuro-essentialism, and might therefore have less influence on reducing blame compared to explanatory models that include genetic causes of mental disorders.

3.3.2: DANGEROUSNESS

The clearest results in terms of correlation between explanatory models and causes of mental health stigma have been shown for dangerousness. Multiple studies, including the aforementioned meta-analyses, have illustrated an association between explanatory models and an increased perceived dangerousness of people with mental disorders by laypeople (Jorm et al., 2012; Kvaale, Gottdiener, et al., 2013; Kvaale, Haslam, et al., 2013; Loughman & Haslam, 2018). These studies included both neurobiological and biogenetic (neurobiological plus genetic or non-neurological biological) explanations, representing varying degrees of references to essentialism. The results suggest that there is no difference in perceived dangerousness related to a difference in essentialism. Neurobiological and biogenetic explanations of mental disorders are both related to increased perceived dangerousness of people with these mental disorders because of an unchangeable essence that is present in these people (Kvaale, Gottdiener, et al., 2013; Loughman & Haslam, 2018). With regard to perceived dangerousness, both ontological and more explanatory reductionist explanatory models therefore have similar outcomes. The often presented idea that neuro-reductionist explanatory models might reduce fear of people with mental disorders and corresponding stigmatisation of mental disorders (see e.g. Buchman et al., 2011) is therefore not in accordance with the literature.

3.3.3: DISRUPTION OF SOCIAL INTERACTION

The third and most extensively studied consequence of neuro-reductionist narratives for the stigmatization of mental disorders is based on the effect of such a narrative on disruption of social interaction as a cause of mental health stigma. This effect has mainly been studied in terms of desire for social distance from people with mental disorders. The results are somewhat contradictory. Where one meta-analysis shows that biogenetic explanations are positively associated with desire for social distance (Kvaale, Gottdiener, et al., 2013), another meta-analysis found no relation between biogenetic explanations and desire for social distance (Kvaale, Haslam, et al., 2013). The explanatory models that were positively related to desire for social distance in the first study (neurochemical and 'general' biogenetic explanations) were not separately studied in the second study. When only studies focussing on the relation between neurobiological explanations (excluding genetic explanations) and desire for social distance were included, a positive association was found (Loughman & Haslam, 2018).

The difference in disruption of social interaction between meta-analyses suggest that the effect of a neuro-reductionist explanatory model on desire for social distance depends on the type of explanatory model, but neurobiological explanations seem to be related to increased desire for social

distance. Some studies have suggested that essentialism, as present in genetic explanations, decreases desire for social distance because of its reference to an unchangeable essence (e.g. Martin et al., 2007). Others have argued that the opposite is true, based on increased perceived dangerousness of people with uncontrollable mental disorders (e.g. Lee et al., 2013). With these conflicting studies, it is hard to say whether a difference in desire for social distance reflects a difference of the degree in which an explanatory model refers to neuro-essentialism or ontological reductionism, but it can be concluded that at least explanatory models that did not refer to genetic explanations and could therefore be labelled as having little reference to neuro-essentialism were associated with increased desire for social distance.

3.3.4: POOR PROGNOSIS

Lastly, the effect of neuro-reductionist narratives on a perceived poor prognosis as a cause of mental health stigma has been studied. Studies on this effect are limited. Biogenetic explanations have been associated with increased prognostic pessimism (Kvaale, Haslam, et al., 2013). For neurobiological explanations in specific, however, a significant correlation could not be observed (Loughman & Haslam, 2018). This difference could be caused by a difference in the degree of essentialism, since biogenetic explanations refer more to an unchangeable essence (genes) than neurobiological explanations. Several studies have argued that such a belief in a deep-seated and fixed cause of mental health problems can indeed reinforce a belief that these problems are unlikely to improve (Farina et al., 1978; Haslam, 2011; Phelan, 2005). This way, neuro-essentialism or ontological reductionism results in increased perceptions of a poor prognosis of mental disorders.

Prognostic pessimism can also be experienced by people suffering from mental health problems themselves. It is then associated with a loss of hope, which is central in the recovery process from these mental health problems (Leamy et al., 2011), as well as less adaptive coping behaviour (Scheier & Carver, 1985). Genetic explanations in particular can have this effect, possibly based on the degree in which they refer to essentialism. A study by Michele Easter, for example, showed how a belief that a disease was genetic in nature resulted in a belief that the corresponding behaviour could not be changed (Easter, 2012). It is not clear whether a purely neurobiological explanation differs from biogenetic explanations with regard to self-stigma. Understanding mental disorders in terms of 'brain diseases', rendering them similar to, for example, dementia, or chemical imbalances, might lead people to believe that the course of these disorders can be altered with medication, but never cured (Loughman & Haslam, 2018).

3.3.5: MENTAL HEALTH STIGMA IN HEALTHCARE

A last consequence of neuro-reductionist narratives on the stigmatization of mental disorders is a practical one. Several studies have shown that mental health stigma creates barriers for the access to and quality of healthcare for people with mental disorders (e.g. Knaak et al., 2017). Due to these barriers, more people will suffer from mental disorders and corresponding stigmatization of these disorders. One of the reasons mentioned for these barriers are pessimistic views of healthcare professionals about the reality and likelihood of recovery. The solution for this problem might be implementation of a neuro-reductionist narrative among healthcare professionals. For example, implementation of neuroscience within psychiatry has resulted in big improvements of mental health treatment (Wojtalik et al., 2018). Another study suggested that healthcare professionals 'have begun to re-conceptualize mental illness with a neuroscience gaze' (Borgelt et al., 2011). This way, a neuro-reductionist narrative within psychiatry might enhance knowledge of healthcare professionals about treatment possibilities and reduce prognostic pessimism. This in turn could lead to better access and better quality of care for people with mental health disorders, resulting in less people suffering from mental disorders and stigmatization of their disorders. Such an improvement of access and quality together with a decrease in people suffering from mental disorders and corresponding stigmatization of mental disorders, however, has yet to be observed.

The results above confirm the findings from earlier in this chapter that the influence of an explanatory narrative highly depends on the type of explanatory narrative. Explanations that include genetic

references, such as biogenetic explanations (which include all kinds of biological explanations, including neurobiological and genetic explanations) are associated with increased prognostic pessimism, whereas pure neurobiological explanations are associated with increased social distance. These findings might at least partly be explained by a difference in essentialism or ontological reductionism. Genetic explanations might refer more to a fixed underlying cause of mental disorders compared to neurobiological explanations. This could reflect a difference between ontological reductionism and explanatory reductionism, but it is hard to draw any conclusions because of the design of the studies included. Most of these studies are vignette studies, in which participants are given a description in the form of 'person X has a disorder Y which is caused by a chemical disbalance in the brain/genes/miscommunication between neurons' and consequently fill in a questionnaire measuring stigma-related attitudes of the participant towards the described person. Depending on the formulation of these 'vignettes', a difference in stigmatization could reflect a difference between ontological and explanatory reductionism, but this could also reflect a difference between different types of explanatory reductionism, such as Sarkar's spatial hierarchical reduction and abstract hierarchical reduction. In the discussion, I will elaborate on these limitations and suggest directions for future research.

3.4: Conclusion

The causes of mental health stigma (attribution of responsibility, dangerousness, disruption of social interaction and poor prognosis) are explicitly mentioned in scientific literature. The type of reductionism, however, is not. Multiple factors, which will be extensively described in the discussion of this thesis, make it hard to draw any consistent correlations between a specific type of reductionism and mental health stigmatization. The overall image, however, is that the relation between explanatory models and mental health stigma is nuanced, with positive consequences for certain causes of mental health stigma and negative consequences for others, with negative consequences outweighing the positive consequences in almost every study. I will discuss these results and the limitations in more detail in the remainder of this thesis. The results of this chapter showed that the stigmatization of mental disorders is complex and multifactorial, but can be influenced by the way in which a mental disorder is described or explained, which is important to keep in mind reading the next two chapters.

CHAPTER 4: DISCUSSION

The goal of this thesis was to provide an overview of neuro-reductionism and its influence on the stigmatization of mental disorders. Both neuro-reductionism and mental health stigma as concepts, however, are incredibly complex, requiring a more nuanced exploration. Firstly, as I argued in chapter two, several conceptualizations of neuro-reductionism co-exist, and different explanatory models for mental disorders refer to different conceptualizations of mental disorders. As a result, these explanatory models have totally different implications for mental health stigma based on a difference in the degree in which they refer to ontological reductionism or essentialism. Secondly, mental health stigma consists of multiple causal factors, which are explained in chapter three. Explanatory models for mental disorders have varying influence on different causal factors of mental disorders, making it hard to relate an explanatory model to mental health stigma in general. The main conclusion of this thesis therefore is that, while specific explanatory models for mental disorders might have positive consequences for certain aspects of mental health stigma, neuro-reductionist narratives in general are not associated with any clear positive consequences for the stigmatization of mental disorders. This corresponds with the main studies on the influence of neuro-reductionist narratives on mental health stigma in general, included in this thesis (Kvaale, Gottdiener, et al., 2013; Kvaale, Haslam, et al., 2013; Loughman & Haslam, 2018), as well as later studies focussing on specific disorders (Carter et al., 2019; Valery & Prouteau, 2020; Yao et al., 2020).

Although an overall positive effect on mental health stigma shared by all neuro-reductionist narratives could not be observed, specific neuro-reductionist narratives seem to be related to positive consequences for specific causes of mental health stigma. The clearest results in terms of reducing one aspect of mental health stigma, in this case blame, has been shown for (bio)genetic explanations, although these explanations were also associated with an increase of all other aspects of stigma. These conflicting results of both de-stigmatizing and stigmatizing consequences of an explanatory model has been explained by the 'mixed-blessings model' (Haslam & Kvaale, 2015). This model proposes that genetic causes are more essentialist, thereby reducing 'one form of stigma by promoting attributions of personal uncontrollability' (Loughman & Haslam, 2018, p. 2). The value of this model for eliminating mental health stigma, however, seems limited. As I illustrated in this thesis, the mixed-blessings model is only true for specific narratives, such as the genetic and chemical imbalance narratives. However, as I argued in this thesis, these narratives have more negative consequences outweighing the positive ones. Additionally, less essentialist narratives do not have the beneficial consequences of the mixed-blessings model, although one could argue whether these narratives are in fact regarded as less essentialist by lay people, given the similarities in terms of negative consequences with essentialist models.

Altogether, this thesis confirms the conclusions from recent literature that the value of neuro-reductionism for de-stigmatizing narratives in the case of mental disorders is very limited, if present at all, and does not outweigh the negative consequences. In addition, this thesis raises new questions, because the attribution theory, genetic essentialism and the mixed-blessings model insufficiently explain the complex relation between explanatory models and certain causal factors of mental health stigma. These questions require more research focussing on different aspects of the relation between explanatory narratives and mental health stigma, because while the significant number of relevant studies included in this thesis provided valuable insights in the causal factors of mental health stigma and were able to refute frequently used arguments about neuro-reductionism as the ultimate solution for eliminating this stigmatization, they did not provide a correlation between certain types of neuro-reductionism and their influence on specific causal factors of mental health stigma. These limitations and their implications for future studies are the subject of the remainder of this discussion.

The goal of this thesis was to analyse the relation between neuro-reductionist narratives in general and mental health stigma. Most studies on the consequences of neuro-reductionism for mental health stigma, however, study different aspects of neuro-reductionism. These aspects include definitions such as '(bio)genetic', 'chemical imbalance', 'biological' and 'brain disease'. As I have argued in this thesis, these definitions refer to ontological reductionism or essentialism to a different degree, which makes it impossible to draw any generalized conclusions about the relation between neuro-reductionism and mental health stigma based on these studies. To overcome this problem, a few studies have tried to

combine different definitions in one meta-analysis. I could identify only two studies on the consequences of a biogenetic explanation for the stigmatization of mental disorders (Kvaale, Gottdiener, et al., 2013; Kvaale, Haslam, et al., 2013), and one meta-analysis on the influence of a neurobiological explanation (excluding all studies on (bio)genetic explanations) on mental health stigma (Loughman & Haslam, 2018). All three studies had generally similar conclusions, although there were significant differences in terms of influence on some aspects of mental health stigma. Since I could identify only three studies with significantly different outcomes on the influence of neuro-reductionist narratives in general on certain aspects of mental health stigma, I was unable to draw any generalized conclusions about this influence based on these studies.

Given the lack of unequivocal studies into the relation between neuro-reductionist narratives in general and specific causes of mental health stigma, it can be argued that studies on the relation between specific neuro-reductionist narratives, such as the chemical imbalance, and the different causal factors of mental health stigma are more valuable. This idea is supported by the fact that the only meta-analysis on the influence of neurobiological explanations in general on mental health stigma (Loughman & Haslam, 2018) mainly included studies focussing on the chemical imbalance narrative specifically. Additionally, in practice only one narrative will be used at the same time, ideally the least stigmatizing narrative. To determine the stigmatizing effects of a certain narrative, studies on the relation between this narrative and specific causes of mental health stigma are necessary. Unfortunately, these studies are significantly flawed by their design in three ways.

As stated earlier in this thesis, the design of studies on the relation between causal explanations and stigma is often based on vignettes, short descriptions of a patient with a certain disorder and its causes which are given to participants before answering a questionnaire on stigma-related attitudes towards the described patients. These vignettes are not necessarily similar in type of neuro-reductionism. Studies on the effect of the chemical imbalance narrative had significant differences in the degree in which they referred to neuro-essentialism, and since different levels of essentialism might be related to differences in stigmatization, these studies might have different effects on individual aspects of mental health stigma based on the difference in essentialism in the vignettes. For example, a study using the description of depression symptoms ‘largely due to the imbalance of brain chemicals’ (Cheng, 2015) showed different results in terms of blame and prognostic pessimism compared to a study describing depression as ‘no different from any other disease’ (Deacon & Baird, 2009).

Another influential factor for the relation between causal explanations and mental health stigma are pre-existing biases regarding the aetiology of mental disorders. The earlier mentioned study on the influence of a chemical imbalance narrative on stigma (Deacon & Baird, 2009) used many psychology majors as participants, resulting in 80 percent of the sample believing that depression is caused largely by psychological or environmental factors, although the authors argued that the influence of this bias on perceptions of the vignettes was little. Other studies included university students, the general public or people experiencing mental disorders. It is likely that these groups have different pre-existing neuro-reductionist biases based on their education or work. The differences in results between these studies might be at least partly caused by a difference in pre-existing biases about the causal factors of mental disorders. This theory is supported by studies that have examined differences in attitudes towards mental disorders after reading vignettes between groups with varying pre-existing beliefs about mental disorders. One study (with a limited sample size) found ‘higher levels of perceived stigmatization in medical students and medical doctors than in other groups based on their social experience or background’ (Serafini et al., 2011, p. 576).

Lastly, the relation between explanatory models and stigmatization of mental disorders seems to be disorder-specific. Studies on this topic are often focussed on disorders like depression, schizophrenia, substance abuse and eating disorders. Differences between these studies might be explained by differences in examined disorders. A study on the influence of the chemical imbalance narrative on stigmatization of mental disorders, for example, showed differences in results for depression and schizophrenia compared to alcohol dependence (Speerforck et al., 2014). According to the authors, these differences might be caused by ‘strong moralistic, personality- and guilt-related stereotypes resulting in a high disburdening potential of biogenetic explanations in this disorder’ (Speerforck et al., 2014, p. 226).

While this thesis confirms recent findings that neuro-reductionist narratives are not related to an overall decrease of mental health stigma, it also raises new questions and directions for future research. As this thesis showed, both (reductionist) explanatory narratives and mental health stigma consist of multiple individual aspects, and in order to understand the complex relation between them, it is necessary to identify and define these aspects and their interaction. For this reason, an interdisciplinary approach is crucial for future research. An exchange of knowledge about different types of neuro-reductionism between neuroscientists, philosophers and social scientists, for example, might result in studies using vignettes with corresponding levels of ontological reductionism or 'essentialism'. When, for example, a disorder is described using explanatory reductionism, is the disorder then the result of the combination of physical elements only (spatial hierarchical reduction), or can other elements play a role (abstract hierarchical reduction)? If we can link properly defined explanatory models to changes in certain aspects of mental health stigma, we might be able to say something about influence of the level of essentialism or type of reductionism expressed in these explanatory models on mental health stigma. Instead of combining different types of explanatory models to draw generalized conclusions about their relation with mental health stigma, philosophers, neuroscientists and social scientist should work together to relate certain types of reductionism as present in specific explanatory models to individual aspects of mental health stigma.

Although neuro-reductionism in general is not related to a decrease of mental health stigma by lay people, and specific types of neuro-reductionism or essentialism might also show to not be related to less stigmatization of mental disorders in the general public, certain types of reductionism might be related to a decrease of certain aspects of mental health stigma in specific social groups or in the case of specific mental disorders. As I have shown, specific neuro-reductionist narratives might have a different effect on mental health stigmatization by, for example, healthcare workers or members of specific cultural groups, compared to the general public (although the influence of the latter seems limited, see Dietrich et al., 2004). Even if we were to use vignettes with perfectly defined types of neuro-reductionism in studies on the relation between neuro-reductionism and mental health stigma, these types of reductionism might be regarded differently based on pre-existing knowledge of participants. An explanatory reductionist explanation, for example, might be interpreted as theory reduction by medical students with an advanced pre-existing theory about the functioning of the brain. The influence of neuro-reductionism on stigmatization of mental disorders might also vary between different mental disorders, such as schizophrenia or depression. To determine the influence of a specific narrative on a certain aspect of mental health stigma, we must therefore take into account any differences in mental disorder or social group. Ideally, vignettes with a clear definition of a mental disorder, corresponding to a well-defined type of reductionism or level of essentialism, are used in an experimental study with a specific group of participants, such as medical students or nurses, to determine the influence of this narrative on the social group included. Such research can help identify which narrative is needed in a specific social group to reduce the stigmatization of a certain mental disorder within this social group.

For now, it seems clear that neuro-reductionist narratives are inferior compared to biopsychosocial narratives in terms of reducing mental health stigma. This implies that if scientists want to contribute to de-stigmatization of mental disorders, they should avoid using neuro-reductionist explanations of mental disorders towards people who do not have a pre-existing biopsychosocial theory in which such a narrative can be embedded. This also means that, as long as the scientific challenges for research on the influence of neuro-reductionist narratives on mental health stigma are not solved, (medical) education on mental disorders should stay away from purely neuro-reductionist narratives. Since the influence of neuro-reductionist narratives on specific groups, including patients (self-stigma) and their families, is largely unknown, neuro-reductionism at this point should not be used in medical communication, such as psychoeducation. Future research should determine whether neuro-reductionist narratives have any advantages over biopsychosocial narratives in any situation or towards a specific public, but for now it seems important to emphasize the limitations of neuro-reductionism with regard to mental health stigma as explicitly as possible.

CHAPTER 5: CONCLUSION

The main question of this thesis was: What is the influence of neuro-reductionism on stigmatization of mental disorders? In order to answer this question this thesis aimed at providing an overview of different conceptualizations of neuro-reductionism and the different aspects of mental health stigma. This overview showed that (neuro-)reductionism and mental health stigma are both complex concepts consisting of multiple interacting aspects. Different types of reductionism seem to influence the individual aspects of mental health stigma in different ways, although the literature on this is not unequivocal. Most consequences of neuro-reductionist narratives on individual aspects of mental health stigma are negative, as well as the overall influence of neuro-reductionism on mental health stigma. There is, however, a small number of possible positive consequences of neuro-reductionist narratives on specific aspects of mental health stigma, although the literature on most of these positive consequences is divided. Regarding literature, there still is an enormous gap between neuroscientific, sociological and philosophical analyses of mental processes, despite the efforts of previous authors. It seems that, in order to understand the philosophical position of neuroscientists and neuroscientific theories and the implication of these positions for the understanding of the brain and mental processes, including mental health, interdisciplinary research is highly needed. This thesis might provide a starting point, positioning neuro-reductionism within both a philosophical as well as a neuroscientific framework and evaluating its influence on mental health narratives and the stigmatization of mental disorders.

The main question remaining at the end of this thesis is whether more research on the relation between neuro-reductionism and mental health stigma might be relevant, since this thesis showed that nor the most frequently used neuro-reductionist narratives, nor neuro-reductionism in general, measured as several neuro-reductionist narratives combined, have an overall positive influence on mental health stigma. Although specific reductionist narratives might have positive consequences for certain aspects of mental health stigma, these positive consequences are outweighed by the negative ones, and the literature on these positive effects is not as clear as the literature on the negative effects. Future research might therefore be mostly focussed on new (reductionist) narratives that do not exist yet. With this regard, the inclusion of treatment information within explanatory narratives seems promising, as well as reductionist narratives in specific groups, such as healthcare workers. On both topics, however, more research is needed to confirm the preliminary findings as described in this thesis. Until then, it seems best to restrain from using neuro-reductionist narratives outside the scientific literature, where it is accompanied by its shortcomings, to prevent an increase in mental health stigma.

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