SJS The Self-Journals of Science

Research article

Translating between Buddhism and neuroscience: Conceptual differences and similarities in epistemic cultures. Neuroscientific research on Vipassana meditation – a case study
Version 1

Mareike Smolka [1]

1. Faculty of Humanities and Sciences - University of Maastricht

Made public on Sep, 28th 2017 under Creative Commons 4.0 Attribution License
Reviewed and discussed at http://sjscience.org/article?id=647

Abstract Neuroscientists have been attracted to the study of meditation since the late 1960s, when the Dalai Lama was invited to Harvard University for the first time. Buddhism and neuroscience engage in a dialogue of sorts when neuroscientists appropriate meditation and re-conceptualize it for the purpose of their research. Yet, the two epistemic cultures speak different languages that originated in different traditions. According to the framework of a sociology of translation, when phenomena are discussed by different epistemic cultures, they loose some properties and gain others to be rendered compatible to the respective culture.
Investigating the process of translation from Buddhism to neuroscience, I selected Vipassana meditation (VM) in the tradition of Satya Narayan Goenka as a case study. I examined the conceptual differences and similarities in Goenka's expositions on his teachings of VM and neuroscientific research on VM practice. For this purpose, I conducted a conceptual analysis of key concepts in neuroscientific research articles on VM, in interviews with the first authors of these studies, and in primary sources by Goenka. To gain a deeper understanding of VM practice, I participated in a ten-day VM retreat at the meditation center Dhamma Mahi in France and joined regular VM meet-ups in Berlin, where VM practitioners meditate together and share their experience.
Based on my research, I identified four main concepts that demonstrate the conceptual differences and similarities between the exempla of neuroscience and Buddhism: (1) interoception, (2) reactivity, (3) pleasure and pain, and (4) the mind-body relation. Identifying the analyzed concepts as boundary objects – concepts that are flexible enough to adapt the needs of the respective epistemic cultures, but are also robust enough to maintain a common identity – it becomes evident that the ability of two fields to communicate and collaborate depends on the continuous management of these boundary objects.

Introduction

> This, really, is Vipassana: experiencing one's own reality, through the systematic and dispassionate observation of the ever-changing mind-matter phenomenon manifesting itself as sensations within oneself. This is the culmination of the teaching of the Buddha: self-purification through self-observation. (Goenka, 2002a, p. 59)

> Consistent with the focus of Vipassana on attention training and interoceptive awareness to achieve emotional stability, recent psychophysical research on the effects of Vipassana has specifically examined changes in the central and peripheral physiological indices of attention and autonomic regulation. (Delgado-Pastor, Perakakis, Subramanya, Telles, & Vila, 2013, p. 207)

Comparing the exposition of Vipassana meditation (VM) presented by its guru Satya Narayan Goenka with its description in a neuroscientific research article, both seem at first to describe the same practice simply using different languages.[1] Yet, can we maintain that the neuroscientific concept of "interoceptitve awareness" coincides with the self-observation of the "ever-changing mind-matter phenomenon manifesting itself as sensations within oneself"? Is emotional stability really the goal or "culmination" of the Buddhist practice of VM that Goenka pinpoints as "self-purification"? Those who have initiated the dialogue between Western neuroscience and Buddhism claim that the conceptual similarities between both bodies of knowledge enable mutual learning (i.e.: Koch, 2013; Ramon & Lester, 2012; Wallace, 2007).[2][3]

An actual dialogue between the American neuroscientist Christof Koch and the Dalai Lama has recently taken place in India. As Koch (2013) describes it, "what passed between these representatives of two distinct intellectual modes of thinking about the world . . . [was] knowledge about the more than two-millennia-old Eastern tradition of investigating the mind from the inside, from

[1] VM is the most ancient of Buddhist meditation practices. Developed by Gotama Buddha more than 2500 years ago, it has been handed down by a chain of teachers within Theravadan Buddhism to Goenka (www.dvara.dhamma.org). Yet, as numerous divergent kinds of VM have evolved from Buddha's original account in different Buddhist traditions over time (Buswell, 2004), it is important to point out that the present research only focuses on VM as taught by Goenka.

[2] Knowledge is here defined according to Bruno Latour (1999): "Knowledge does not reflect a real external world that it resembles via mimesis, but rather a real interior world, the coherence and continuity of which it helps to ensure" (p. 58). On these grounds, every body of knowledge pertains to a distinct interior world, a center of reference according to which statements about reality are made.

[3] Although I am aware that neuroscience is an interdisciplinary science comprised of various schools of thoughts and specializations, I refer to neuroscience rather than to the neurosciences throughout the research paper emphasizing that all these subdisciplines belong to the overarching neuroscientific discipline dedicated to the scientific study of the nervous system (Kandel, Schwartz, & Jessel, 2000).

an interior, subjective point of view, and the much more recent insights provided by empirical Western ways to probe the brain and its behavior using a third-person, reductionist framework" (p. 29). Neuroscientists' interest today in brain changes due to meditation practices began already three decades ago when Herbert Benson, one of the first Western physicians to bring spirituality and healing into medicine, invited the Dalai Lama to Harvard University (Dalai Lama, Benson, Thurman, Gardner, & Goleman, 1991). Benson was convinced at the time that Western science was awakening to the fact that there had been a more ancient science of mind, perhaps wiser than its Western counterpart, and that its fullest articulation was in Buddhism.

Calling Buddhism a "science of mind", rather than a religion, appears to foreground certain commonalities of Western science and Buddhism although they represent two different bodies of knowledge, two different modes of seeing the world, grounded on different epistemological and ontological underpinnings. Moreover, both neuroscientists and the guru of VM seem to perceive themselves as "scientist[s] who research[es] the relationship of mind, body and matter" (Goenka, 2002a, p. 9), or else as scientists who study how physical activities in the brain give rise to the human mind (Slagter et al., 2007).

These two groups of "scientists" have thus begun to focus on VM as the object of their research. Goenka, who re-introduced VM in India in 1969 and subsequently spread it across the world by erecting numerous VM centers, established an actual research institute (www.vridhamma.org).[4] The institute investigates the scientific underpinnings for both VM practice and its application.[5] Neuroscientists investigate what happens in the brain when individuals practice VM.[6] Their studies are based on the assumption that regular practice of VM can change both the physical structure of the brain and its mental functions.[7] Thus, one could say that neuroscientific researchers and Goenka engage in a dialogue of sorts by examining VM; each reaching out to the other body

[4]According to the homepage www.dhamma.org, there were 67 Vipassana meditation centers in 23 countries in 2007. In these centers, ten-day meditation courses are offered to introduce to Goenka's teaching of the practice.

[5]Research on VM focuses on its application in the improvement of physical and mental health (Al-Hussaini et al., 2001), ranging from chronic pain patients (Patil, 2009), to its impact on prisoners (i.a.: Ronel, Frid, & Timor, 2013), drug addicts (Simpson et al., 2007) and government officials (Parihar & Maharashtra Cadre, 2002).

[6]Several neuroscientific studies, for instance, compare the brain activity measured in the state of meditation to one measured in the non-meditative state of mind-wandering (Cahn, Delorme, & Polich, 2010; Cahn & Polich, 2009; Delgado-Pastor, Perakakis, Subramanya, Telles, & Vila, 2013; Hölzel, et al., 2007).

[7]The neuroscientists Hölzel et al. (2007) conclude from their studies that gray matter concentration in the right anterior insula of the brain is greater for meditators than for non-meditators. The results of the neuroscientists Lazar et al. (2005) confirm that meditation practice might result in changes to the brain's physical structure. They observed more pronounced cortical thickness in meditators in comparison to non-meditators. With regards to VM's influence on mental functions, Slagter et al. (2007) report that meditation affects the distribution of limited attentional resources. Research subjects regularly practicing VM were better able to detect both of the two stimuli presented in close temporal proximity, whereas non-meditators more often did not perceive the first but only the second stimulus of the sequence.

of knowledge for their own benefit. Whereas Goenka attempts to legitimate VM by means of scientific research, neuroscientists study VM to gain a deeper understanding of the brain (Chiesa, 2010).

The historians of science Welsh und Willer (2008) regard the transgression of boundaries between epistemic cultures as a product of the beginning 21st century – the product of a century in which epistemic cultures are highly differentiated and interconnected in a multimedial network.[8] Contemporary research questions even require that different epistemic cultures collaborate.[9] Yet, when Western science and Buddhism, neuroscientific research and VM practice, enter into a "dialogue", multiple translations occur between different languages, different bodies of knowledge, and between different historical states of language. According to Bruno Latour (1999), who coined the sociology of translation, when phenomena are discussed by different bodies of knowledge, they circulate "all along the reversible chains of transformation, at each step losing some property to gain others that render them compatible with already established centers of calculation" (p. 71-72).[10] Thus, "anything put in another place becomes a different thing" because the movement from one context to another always implies a shift in meaning (Nicolini, 2010, p. 1013).

Central to the sociology of translation is the idea that translation is the result of the active work of heterogeneous intermediaries that carry meaning from one context to another, in particular concepts (Nicolini, 2010). On these grounds, it is worth investigating how, for instance, the concept of interoception in the above mentioned quote from a neuroscientific research article on VM corresponds to Goenka's description of VM practice as self-observation. Concepts might seem identical or similar but can reveal decisive differences only after examining their roots in the respective traditions. Is a fruitful dialogue between the traditions of Western science and Buddhism possible despite them coming from different epistemic cultures with distinct ontological assumptions? In order to shed light on the fate of concepts translated between different epistemic cultures, the present research will attempt to answer the research question: What are the differences and similarities of major concepts in neuroscientific research on VM and Goenka's expositions on his teaching of VM practice?

It ought to be pointed out, however, that I will mainly focus on concepts translated from Goenka's expositions on his teaching of VM *to* neuroscientific research. Thereby, I do not claim that neuroscientific researchers deliberately adopt Goenka's concepts. Yet, by choosing his practice of VM as an object of

[8]Epistemic cultures are defined according to Knorr-Cetina (1999) as machineries of knowledge production, "those amalgams of arrangements and mechanisms-bonded through affinity, necessity, and historical coincidence, which, in a given field, make up how we know what we know" (p. 1).

[9]The field of neuropsychoanalysis, a point of contact between neuroscience and psychoanalysis, represents an example for the attempt to enable a collaboration between different epistemic cultures. Psychoanalytic constructs are integrated with neuroscientific findings to gain a more complete understanding of the mental apparatus (www.npsa-association.org).

[10]The sociology of translation, also known as Actor-Network-Theory, extends beyond the scope of language. It is about living and non-living actors moving in networks of relationships to which the actors owe their positions and power (Latour, 2005).

study, I argue that they need to conceptualize what happens during VM, with or without profound engagement with the practice and its theoretical account, and verbalize it accordingly in their research articles. I will investigate whether, and in what way, their conceptualizations of VM correspond to Goenka's account of the practice, shedding light on the creation of surplus meaning or the loss of meaning in the process of translating from one body of knowledge to another, from the Buddhist to the scientific. This academic relevance of my research is supplemented by its societal relevance to render neuroscientific meditation research more accessible and comprehensible to meditators and those interested who are not intimately involved in the neuroscientific discipline.

VM is chosen as a case study to examine the fate of concepts translated between contexts because in the last decade, neuroscientific research on VM has increased (Chiesa, 2010).[11] Thus, there is now enough material available to compare the concepts used in neuroscientific research on VM with the concepts used in Buddhist literature on VM. With regards to the latter, only primary sources written by Goenka are used because VM practice is solely taught on the basis of his instructions and theoretical accounts. During the ten-day VM course, the first contact of all VM practitioners with this type of meditation practice, the practitioners only listen to recordings of Goenka's words, so that no individual teacher in the different VM centers can change the practice (Hart, 1987). For this reason, it is his account of VM that determines the Buddhist terminology and language used to spread the practice.

There is another reason to focus on one specific meditation praxis as a case study. When talking about the dialogue between Buddhism and neuroscientific research, it needs to be kept in mind that both bodies of knowledge respectively are comprised of various schools of thought who slightly differ in the concepts they use. With regards to Buddhism, there is for instance no general agreement on what classifies as mindfulness (Chiesa, 2010). Therefore, concentrating on the terminology used in the expositions of one specific Buddhist meditation practice published by its pioneer precludes the otherwise necessary comparison of concepts between the different streams within one body of knowledge. I am aware of the fact that the field of neuroscience also comprises various schools of thought and distinct approaches to study the brain. Yet, the limited amount of research published in the last decade in different journals of varying orientations does not permit to select one school of thought within neuroscience as my object of study.

In the following research, I will combine both historical and ethnographic research methods to compile data. I will gather neuroscientific research on VM and identify principal concepts that recur in the research articles. I will apply conceptual analysis to reconstruct their roots in the neuroscientific discipline and to examine a potential correspondence in Goenka's written expositions on the teaching of VM practice. My sample of neuroscientific research on VM

[11] VM's recent popularity as an object of scientific study might be due to the fact that it pertains to a particular subgroup of meditations called mindfulness meditations whose praxis has been shown to improve stress reduction (i.e.: Cohen-Katz et al., 2005; Shapiro, Schwartz, & Bonner, 1998).

comprises seven articles published in the last ten years (Cahn & Polich, 2009; Cahn, Delorme, & Polich, 2010; Delgado-Pastor, Perakakis, Subramanya, Telles, & Vila, 2013; Gard et al., 2012; Hölzel et al., 2007; Hölzel et al., 2008; Slagter et al., 2007) and my sample of primary sources by Goenka contains the discourses presented during the ten-day VM courses (1987), his publication "Meditation Now. Inner Peace Through Inner Wisdom" (2002a), and "For the benefit of many" (2002b), a collection of talks with VM students conducted between 1983 and 2000.[12]

Although with regards to both bodies of knowledge, that is neuroscientific research on VM and Goeanka's expositions on his teaching of VM, data is gathered over periods of time, the present research does not attempt to analyze a longitudinal shift in concepts. For this purpose, a bigger sample of neuroscientific research articles would be needed. However, during the last ten years there was not more research on VM as taught by Goenka published. Furthermore, my analysis of the primary sources by Goenka suggests that a significant shift in concepts over time in his expositions on his teaching cannot be detected. This coincides with Goenka's own concern not to change the practice of VM. He regards it as complete, which is why any addition to or taking out anything from the teaching will compromise its "purity" and benefits (2002b, p. 144).

I supplement the historical research with qualitative, semi-structured interviews with the first authors of the neuroscientific research articles on VM.[13] These will also be examined by means of conceptual analysis to gain a deeper understanding of "concepts in action" in neuroscientific research on VM.[14] Furthermore, an ethnographic layer is added to the investigation of the concepts used in Goenka's expositions on his teachings of VM by conducting field visits. I participated in a ten-day VM retreat at the meditation center Dhamma Mahi in France from July 27 to August 7, 2016. I furthermore participated in privately organized, weekly VM meet-ups in Berlin in October and November 2016, where practitioners who have completed the ten-day retreat meditate together for an hour and share their experiences afterwards. Although my conceptual

[12]Concerning the research articles published by Gard et al. (2012) and Slagter et al. (2007), it needs to be justified why they are part of the sample although they did not exclusively select practitioners of VM as taught by Goenka as subjects of their studies. In the study by Gard et al. the majority of subjects, twelve out of seventeen, were trained in the tradition of Goenka. Participants in the study by Slagter et al. were recruited from participants in retreats offered by the Insight Meditation Society. The description of the meditation these practitioners needed to perform during the study coincides with VM as taught by Goenka. Furthermore, Susan O'Brian, a VM teacher of the Insight Meditation Society, confirms that the practice she is teaching is similar to VM in the tradition of Goenka (e-mail communication, October 12, 2016). As both Gard et al. and Slagter et al. focus on subjects whose practice is similar to VM as taught by Goenka, I decided to include their research articles in my sample.

[13]In the case of the studies by Delgado-Pastor et al. (2013) and Gard et al. (2012) the first authors were not available for an interview. Therefore, I decided to interview Pandelis Perakakis, the second author of the study by Delgado-Pastor et al., and Alexander Sack, the third author of the study by Gard et al., whose second author Britta Hölzel is already part of the sample due to her first-authored studies on VM.

[14]The expression "concepts in action" follows from Latour's (1987) dictum that science must be studied "in action", meaning that scientific discoveries need to be studied where they are made in practice.

analysis focuses on the concepts mobilized by Goenka, his teaching of VM is not only examined by employing historical but also ethnographic research methods because Goenka (1987) stresses that VM cannot be understood to the fullest extent intellectually, but needs to be experienced. The distinction between intellectual and experiential knowledge is also made by Gilbert Ryle (1949) who differentiates between "knowing how", which is concerned with tacit practical knowledge, and "knowing that", a theoretical knowledge based on reasoning (p. 16). He deems both types of knowledge to be equally important when trying to grasp a certain practice. Therefore, I will underpin his conceptualizations with my own experiences and experiences from other meditators with whom I had informal conversations during the field visits. These experiences serve as illustrations. They are not intended to give evidence for neither the neuroscientific nor Goenka's account of VM practice.

In the following sections, the conceptual analysis of four main concepts identified in neuroscientific research on VM will be presented. The differences and similarities between (1) interoception, (2) reactivity, (3) pleasure and pain, and (4) the mind-body relation, as discussed in neuroscientific research, and corresponding concepts in Goenka's expositions on his teaching of VM will be examined. These four chapters will be concluded with a reflection on the possibility of a fruitful dialogue between the two epistemic cultures, Buddhism and neuroscience, in order to give recommendations for further collaboration between the two.

1 Interoception

The second introductory quote from a neuroscientific research article describes VM as focusing on "interoceptive awareness". The term interoception and its adjective, often in combination with its reference word awareness, recurs in almost all the neuroscientific research articles on VM that constitute the sample. The study by Hölzel et al. (2008), for instance, shows that meditators in comparison to non-meditators have a greater gray matter concentration in the right anterior insula, which they claim to be involved in interoceptive awareness. They deduce this result from "the specific training during Vipassana meditation, namely the awareness of bodily sensations" (p. 59). Thus, interoceptive awareness in this case corresponds to the awareness of bodily sensations. Similarly, Cahn and Polich (2009) suggest on the basis of their literature review of meditation research that long-term meditation practice may induce a trait effect in meditators as a consequence of "the purposeful engagement of attention that preserves neural sources of . . . interoceptive processing" (p. 58).[15] That is, meditation may increase one's capacity for interoception by changing the structure of the brain. Whereas Hölzel et al. relate interoception to "awareness

[15]Heleen A. Slagter, researcher in the domain of cognitive neuroscience with focus on attention, defines the trait effect as "a lasting change in how the brain works" as a consequence of a certain practice, whereas a state effect is only observable in the brain when the practice is performed (personal communication, October 7, 2016).

of bodily sensations", Cahn and Polich describe enhanced interoception as the consequence of "purposeful engagement of attention" which is performed during meditation. Therefore, before trying to grasp the neuroscientific definition of interoception as such, it needs to be analyzed how the neuroscientists that conducted studies on VM understand the practice of VM, as an engagement of attention or awareness, and whether this corresponds to Goenka's instructions to the practice.

In the report of the study by Delgado-Pastor et al. (2013) the VM technique taught by Goenka is described in detail because the electrical activity of the brain and heart rate were measured when experienced meditators were practicing VM and were compared to these measurements taken when they were resting in random thinking. According to Delgado-Pastor et al., the practice taught by Goenka is comprised of three types of meditation.[16] The first type called *Anapana* consists in focusing attention on breathing sensations, meaning the sensations induced by air entering and leaving the nostrils. In line with this description, Goenka instructs practitioners during the ten-day VM retreat: "To practice *Anapana* keep the attention in the area below the nostrils and above the upper lip. Remain aware of each breath as it enters or leaves".[17] The second type is *Vipassana*, whereby attention is focused on sensations from all parts of the body (Delgado-Pastor et al., 2013). Delgado-Pastor et al. do not specify though whether sensations from all parts of the body should be perceived simultaneously or by means of moving one's attention through the body. Goenka's instructions are more precise. He prompts the meditator: "Keep moving your attention systematically throughout the body . . . Keep the attention moving to maintain awareness of sensation in every part of the body" (1987, p. 30). Finally, the third type is *Metta*, the generation of feelings of love and compassion to all beings (Delgado-Pastor et al., 2013; Goenka, 1987).[18]

In the neuroscientific studies on VM, *Anapana* and *Vipassana* are generally distinguished by categorizing *Anapana* as "focused-attention" meditation and *Vipassana* as "open-monitoring" meditation (i.e.: Cahn, Delorme & Polich, 2010, p. 54). According to the cognitive neuroscientist Slagter, the meditator has an object of attention and continuously focuses on it during a focused-attention meditation.[19] During open-monitoring meditations, in contrast, the meditator "let[s] go of the object of attention and . . . [is] simply monitoring, noting what is happening without grasping on to it" (personal communication, October 7, 2016). When Cahn, Delorme and Polich (2010) describe *Vipassana*

[16]Random thinking is defined in the study as "allowing the mind to wander freely with the explicit instruction of not engaging in meditation" (p. 209).

[17]Quotation from the "Guidelines for Practising Vipassana Meditation" published by Goenka on the website for VM practitioners who have completed at least one ten-day VM retreat (www.suttama.dharma.org).

[18]When referring to VM, the compound of the three meditation types *Anapana*, *Vipassana* and *Metta* are meant. When referring to *Vipassana*, the second meditation type as described above is denoted.

[19]Slagter wishes it to be mentioned that she does not consider herself an expert on meditation, since she does not meditate herself and meditation is not her primary area of expertise (personal communication, October 7, 2016).

meditation as an "objectless state of mind", in which a "wide-open awareness" is adopted (p. 51), they are in line with Slagter. As the neuroscientist and physician B. Rael Cahn defines attention as "turning the faculty of awareness to something" (personal communication, October 12, 2016), it seems that there is no attention or at least no directed attention during an open-monitoring meditation, since there is no object of attention. Attention seems to be attracted by stimuli in the environment rather then being actively directed by its subject. One is simply aware of all the stimuli in and around the body, which is why this type of practice is also called "open-awareness" meditation (Cahn, Delorme, & Polich, 2010, p. 50).

The definition of open-monitoring meditation bears on the concept of awareness. Slagter points out that there is a debate among neuroscientists about how to conceptualize awareness (personal communication, October 7, 2016). Contemporary neuroscientists agree that we perceive much more stimuli via our sensory organs than we can report upon (Solms & Turnbull, 2002). Based on this assumption, some define awareness as the ability to perceive all these stimuli, whether one can report upon them or not, whereas others regard awareness as a "selection process that brings some of the information that you are aware of to other systems of the brain, so that you can report on it" (H. A. Slagter, personal communication, October 7, 2016). Thus, one is only aware of those stimuli that one can report upon. To distinguish between these views, the former is referred to as phenomenal awareness and the latter as access awareness.

Goenka also mobilizes the concept of awareness in relation to *Vipassana*. When practicing *Vipassana* according to Goenka (2002a), the meditator develops the ability to be aware of sensations in every part of the body. Although one might have the impression that in a part of the body there is no sensation, "in reality there is a sensation there, as in every particle of the body, but it is of such a subtle nature that your mind is not aware of it" (1987, p. 9). Goenka's notion of awareness thus corresponds to Slagter's presentation of access awareness. By suggesting that one is not aware of all the sensations that are actually there, his thoughts appear analogous to Slagter's metaphor of "bottlenecks" in the brain, "that certain regions of the brain can only handle this much information at the same time" (personal communication, October 7, 2016). Yet, according to Goenka, the purpose of *Vipassana* is to enhance the meditator's awareness. Translated into neuroscientific terminology, that means that the brain can learn, can develop so that it is able to process more information at the same time. For this purpose, Goenka adds the concept of attention.

As already mentioned when citing the instructions that Goenka gives to VM practitioners during the ten-day VM retreat, the practice of *Vipassana* involves moving one's attention from head to feet and feet to head through every part of the body, "observing the course of events within the body with full attention" (2002a, p. 91). By moving one's attention through the body, "practicing diligently, we gradually begin to experience gross or subtle sensations on every part of the body" (2002a, p. 91); the meditator becomes increasingly aware of sensations. The more the meditator advances in the practice, the easier it will become to move the attention from head to feet, experiencing a

"free flow" (2002b, p. 58). During my field visit at Dhamma Mahi participating in the ten-day VM retreat, my experience confirms Goenka's description of the practice:

> At the end of day seven at the center, I finally understood what Goenka meant when talking about the free flow. I focused again meticulously on every part of my body, inch by inch, during all the meditation sessions. Shortly before the afternoon-tea pause, I managed to feel a subtle sensation at the top of my head that had been a blind spot before. Even my left knee that had been in pain the last days was no obstacle anymore to guide my attention through the body. I had the impression that I could direct a subtle tingling, a flow of energy, through my entire body. (Field note from participation in the ten-day VM retreat at Dhamma Mahi, August 3, 2016)

The movement of one's attention through the body when practicing *Vipassana* resembles the expression of "body scanning" (i.e.: Cahn & Polich, 2009, p. 53) that is frequently used in neuroscientific descriptions of the practice. The allusion to a scanner represents an adequate analogy to the movement of attention through the body, since in order to scan a document a bright light slowly moves over the document bit by bit, it seems to sweep the paper detecting each letter, such as the attentional spotlight moves over every part of the body to become aware of every sensation.[20]

On these grounds, it becomes evident that whereas the neuroscientific description of *Vipassana* as "body scanning" and the conceptualization of access awareness are in line with Goenka's exposition on his teaching of VM, the distinction between *Anapana* and *Vipassana* as focused-attention and open-monitoring meditations is not supported by Goenka's account. According to Goenka, *Vipassana* is not conducive to an "objectless state of mind" characterized by not directing one's attention. Instead, to become increasingly aware of bodily sensations attention needs to be purposefully engaged. His writings are here in line with the neuroscientists adhering to a notion of awareness as access awareness that regard "attention as a gateway to awareness" (H. A. Slagter, personal communication, October 7, 2016). Drawing back upon the initial sketches of interoception in the neuroscientific studies by Hölzel et al. (2008) and Cahn and Polich (2009), both attention *and* awareness play an important role with regards to the practice of *Vipassana* and the concept of interoception when trying to understand the concept in relation to Goenka's account of his teaching of VM.

According to Alexander Sack, a cognitive neuroscientist specialized on attention, interoception deals with directing one's attention on the body inwardly

[20]The attentional spotlight is an expression that originates in the Global Workspace Theory proposed by the neuroscientist Bernard Baars (1997). It designates the direction of attention on its object, which brings the object into awareness, such as a spotlight in theater makes the actor visible on stage.

(personal communication, October 10, 2016). Cahn specifies this conceptualization by referring to interoception as "awareness of body processes that are happening internally, as opposed to exteroception which refers to the senses, sensory information channels that are coming from the external of the body" (personal communication, October 12, 2016).[21] Thus, the concept designates the inward direction of attention in order to develop awareness of internal bodily processes such as breathing, body temperature, heart beat and "awareness of the vibratory phenomena that one can experience by just paying attention to the physical sensations coming from the nervous system as it innovates the body" (B. R. Cahn, personal communication, October 12, 2016).

The experience of vibrations also obtains a special position in Goenka's expositions on his teaching of VM. He states that *Vipassana* will take the practitioner to a stage where he or she will start experiencing bodily sensations as vibrations (2002b). Gross sensations begin to dissolve into subtle sensations so that one becomes able to experience a "free flow of subtle vibrations throughout the body" (1987, p. 17). However, Goenka does not ascribe these vibrational sensations to the nervous system but to his assumption that the entire universe is composed of vibrations on a subatomic level.[22] By advancing in the practice of *Vipassana* one does not only learn to feel the vibrations that constitute the own body but also the vibrations of everything around oneself, of both animate beings and inanimate things. Therefore, when Goenka requests the meditator to move his or her attention through the body in order to develop bodily awareness, one might also say that the meditator will enhance both interoceptive and exteroceptive capacities. The practitioner of *Vipassana* develops the capacities to perceive both interior and exterior vibrations, that is, sensations arising from internal processes and external stimuli.

Thus, the neuroscientific concept of interoception plays a special role in relation to Goenka's account of VM. The practice of *Vipassana* focuses on the development of awareness of bodily sensations rather than of the contents of the mind. The latter refers to the concept of introspection, the examination of one's own thoughts and feelings, also referred to as self-reflection or the observation of one's own mental state (Smithies, 2012). Introspection does not need to be performed during meditation according to Goenka because "whatever arises in the mind is also accompanied by a physical sensation" (1987, p. 18). Hence, whether the meditator is exploring the mental or the physical realm, awareness of sensation is essential. Goenka explains this interaction between the mental and the physical as follows:

> The technique of Vipassana involves the basic law of nature that whenever any defilement arises in the mind, simultaneously, two things start happening at the physical level. One is that the breath

[21] The terms "interoception" in differentiation to "exteroception" were coined by the neurophysiologist Charles Scott Sherrington (1900), who received the Nobel prize in 1932 for his studies of the motor system and the spinal cord.

[22] This assumption relates to the string theory in physics, a theoretical framework that replaces the smallest detectable particles constituting matter with strings, whose vibrational states determine its mass, charge and other properties (Becker, Becker, & Schwarz, 2007).

> loses its normal rhythm. I start breathing hard whenever a negativity arises in the mind. This is a very gross and apparent reality that everyone can experience. At the same time, at a subtler level, a biochemical reaction starts within the body: I experience a physical sensation on the body. Every defilement generates some sensation or the other in some part of the body. (2002a, p. 43)

My participation in the ten-day VM retreat enabled me to experience the physical manifestation of a negativity in the mind – the emotion of panic. On the fourth day of the retreat when the *Vipassana* meditation technique is introduced, the practitioners are also requested to sit three times a day for one hour with "*aditthana*", with strong determination neither to open the eyes nor to change posture (www.vridhamma.org). The prospect not to change my position during one hour evoked a feeling of panic during my first practice of *Vipassana* that was not only accompanied by a dull sensation in my body but also by difficulties in breathing. I perceived the room temperature to be warmer than usual and had the impression not to receive sufficient air, which is why I breathed heavily until I managed to calm down. On the basis of the observation of my bodily sensations I could make inferences about my emotions. It is this correlation between bodily sensation and emotion that is central to the concept of interoception.

According to the neuroscientist Britta Hölzel, mainly engaged in the field of meditation research, humans are holistic "embodied systems", in which bodily sensations, emotions and thoughts influence each other (personal communication, October 10, 2016).[23] Not only Hölzel but also the studies by Cahn and Polich (2009) and by Gard et al. (2012) provide reference to the neuroanatomist A. D. Bud Craig when relating interoception to the physical manifestation of emotions. Craig's (2015) experiments demonstrated that the cortical processes in the brain, which enable humans to feel the interoceptive sensations of the body, also provide the basis for the awareness of emotional feelings.[24] Both emotions and interoceptive awareness of bodily sensations are localized in the same area in the brain.[25] Craig relates interoception to the feeling of the body's condition that is translated into emotions. Emotions, understood as the mental

[23]In philosophy, cognitive science and neuroscience the expression "embodiment" has become a key word in recent years. It alludes to the thesis that cognitive and mental processes of living beings are enabled and shaped by them being located in a body that is embedded in an environment. Consequently, it is assumed that the body's motor system influences cognition and emotions, just as the mind influences the body (Fingerhut, Hufendiek, & Wild, 2013).

[24]Interoceptive sensations of the body reach the brain through small-diameter fibers innervating all tissues of the body and terminating in the insula (Craig, 2015).

[25]The localization of interoception and emotions in the brain are based on experiments indicating brain activity in the same part of the insula that is activated in virtually every imaging study of human emotions and that is activated when subjects are asked to rate interoceptive stimuli, such as a cooling of body temperature (Craig, 2003). It needs to be pointed out though that the idea to localize mental functions is and has been contested within the neuroscientific discipline. Nowadays, emotions, for instance, are rather understood as originating from the interaction of different components of the limbic systems. Moreover, the same components are often involved in the realization of different mental functions, albeit in different ways (Roth & Strüber, 2014).

representation of the body's condition, facilitate choices to guide behavior in the most energy-efficient manner.[26] Similar to Goenka's (1987) claim that meditators enhance their awareness of bodily sensations if they practice diligently, Craig (2015) maintains that interoceptive awareness can be trained. Yet, Cahn (personal communication, October 12, 2016) and Slagter (personal communication, October 7, 2016) report that experiments with expert meditators do not support that they are better aware of the own heartbeat in comparison to non-meditators.[27] In that sense, although Craig's neuroscientific findings expressed in his re-coining of the concept of interoception appears to underpin Goenka's relation between bodily sensations and emotions, measures at the behavioral level do not support that meditation results in increased bodily awareness and, consequently, in increased emotional awareness. This relation can so far only be established on the experiential level, on the basis of reported experiences of VM practitioners, or on the basis of neural data, the measurement of increased brain activity in a certain region of the brain that is assumed to correlate with interoceptive awareness.

2 Reactivity

Although there appears to be no empirical support yet for the improvement of interoceptive awareness in meditators on the behavioral level, the results of several neuroscientific studies on VM suggest that meditation increases emotional awareness and, thus, emotional regulation (i.e.: Gard et al., 2012; Hölzel et al. 2008). The study by Hölzel et al. (2007) investigating the differences in brain activation during meditation between non-meditators and meditators demonstrates that meditators show greater medial prefrontal cortex activation while meditating. They assume that this activation implies that meditators are more strongly engaged in paying attention to their emotions and identifying them, which reflects their improved ability for emotional regulation. According to Britta Hölzel, emotional regulation results in encountering sensory or mental stimuli with acceptance rather than reactivity (personal communication, October 10, 2016).

The notion of reactivity is a central concept in neuroscientific research on VM. Cahn, Delorme and Polich (2010), for example, tested the hypothesis that increased frontal theta and alpha wave activity in the brain would be observed in Vipassana meditators during meditation on the grounds that "Vipassana meditation practice is thought to enhance the awareness of internal and external stimuli while reducing automated reactivity" (p. 40).[28] Moreover, Cahn and

[26] This thesis can be challenged with regards to addictions. It is debatable whether emotional cravings, such as the urge to smoke, guide behavior in the most energy-efficient way. This might be the case in the short-term, since no energy needs to be dispensed to resist the urge, but not in the long-term, considering smoking's negative impact on health.

[27] The feeling of heartbeat awareness is often used as a measure of the capacity for interoceptive awareness (Craig, 2015).

[28] Theta and alpha brain wave activity are examples of neural oscillations in different frequencies, rhythmic or repetitive neural activity in the central nervous system. A major area

Polich (2009) describe the aim of VM to "reduce cognitive and emotional reactivity" to interoceptive and exteroceptive stimuli (p. 51). This culminates in the study by Delgado-Pastor et al. (2013) who propose the final aim of VM to be the achievement of "emotional stability and happiness" (p. 207). In order to examine whether these ascriptions of aims to VM are similar to the purpose of the technique as intended by Goenka, the term reactivity needs to be analyzed both in the neuroscientific research on VM and in Goenka's expositions on VM practice.

According to Alexander Sack, the concept of reactivity is connected to the stimulus-response model. Human behavior reveals the reaction or response to a stimulus, which might be an inner state, a danger in the physical environment or a physical injury (personal communication, October 10, 2016). The latter refers to the stimulus-response model of pain that was coined by the French philosopher and natural scientist René Descartes in his "*Traité de l'Homme*" published posthumously in 1664 (Clerselier, 1664), which has had a significant impact on Western medicine up to now (Overlach, 2008). This model describes pain as a result of a stimulation of nerve cells that is transmitted to the brain via pathways from the periphery of the body to the brain. The person in pain consequently responds or reacts to the stimulus with a specific behavior. Whereas Sack, in line with the stimulus-response model, regards behavior as the manifestation of reactivity, Cahn explains, "in terms of reactivity you could describe every aspect of what the brain is doing in response to stimuli as reactivity" (personal communication, October 12, 2016). Incoming stimuli "kick off automated firing because, for example, something that is aversive has just occurred in the environment" (personal communication, October 12, 2016). Thus, Cahn locates reactivity at the level of brain activity, rather than at the level of behavior.

Heleen A. Slagter similarly defines reactivity as a neural response (personal communication, October 7, 2016). Yet, she elaborates on this account by distinguishing between a primary and a secondary response to a stimulus. When a human being encounters a stimulus, a piece of information is forwarded through the sensory organs to the brain. The primary response denotes the sensory processing of that information, whereas the secondary response refers to the brain's evaluative reaction to the sensorially processed information, "the judgments and affective responses about sensory or mental stimuli" (Slagter et al., 2007, p. 1228).[29] Slagter illustrates this distinction by explaining that when somebody says something to another person, the receiver of the message hears it. This is the result of the primary response of the brain, the sensory processing. Then, the receiver reacts to what he or she heard by evaluating and responding

of research in neuroscience involves determining how oscillations are generated and what their roles are (Haken, 1996). In the study by Cahn, Delorme and Polich (2010), it is assumed that theta and alpha oscillations reflect "increased purposeful attentional engagement" resulting in greater awareness of stimuli and "mental quiescence", which corresponds to reduced reactivity (p. 40).

[29] In the personal communication, Slagter did not specify the kind of sensory stimuli she referred to and whether awareness of stimuli represents a prerequisite for secondary responding. Besides, she did not define the nature of the primary response with regards to a mental stimulus, a thought or an imagination.

to it with a certain emotion, such as liking, disliking, anger, fear or affection. By means of the secondary response, a representation of the stimulus together with its evaluation is "encoded" or stored in working memory, so that it can be retrieved for future evaluations of stimuli (personal communication, October 7, 2016). That is why people develop habitual interpretations of stimuli. On these grounds, reactivity according to Slagter consists in the secondary response of the brain to a stimulus that is manifested in a judgment or emotion generated on the basis of comparison with former evaluations of a similar experience as stored in memory.[30]

When comparing the neuroscientific account of reactivity as secondary brain response to Goenka's understanding of reactivity, it seems that the process of translation of concepts from the Buddhist epistemic culture to the neuroscientific resulted in a reduction of meaning. Goenka embeds the concept of reactivity within his framework of "four aggregates of the mind" (1987, p. 11). The first aggregate or segment resembles Slagter's notion of primary response: "The function of this part of the mind is to cognize, simply to know, without differentiating" (p. 41). Slagter's concept of the secondary response of the brain is divided by Goenka over three segments of the mind. After the first segment of the mind has made one aware of the stimulus, the second segment compares the stimulus to past experiences and memories in order to evaluate it as good or bad. By means of the third aggregate of the mind, this evaluation induces the creation of a corresponding sensation in the body; a good valuation produces a pleasant and a bad valuation an unpleasant sensation. Yet, Goenka only locates reactivity in the fourth part of the mind: A reaction to a stimulus is created and stored in memory, so that in subsequent encounter with a stimulus it is consulted to create an evaluation. The same holds when a thought or imagination meets the mind. "In the same way a sensation arises on the body, pleasant or unpleasant, and one starts reacting with liking or disliking" (1987, p. 11). Goenka figuratively describes the reaction as a "knot" (p. 11) that is tight inside, revealing his negative opinion about reactivity.

Although both Goenka and Slagter define a reaction as an evaluation that is kept in memory for future evaluation of stimuli, there are two major differences between the two accounts. First, Goenka classifies the evaluation of stimuli

[30]However, Slagter emphasizes that it is problematic to capture the distinction between primary and secondary response in neuroscientific experiments. A problem arises when stimuli that a subject is not aware of, meaning those that cannot be reported upon, activate regions in the brain that correspond to the secondary response. This is for instance the case when an emotion is perceived without being able to determine why it arose. Here, the nature of the primary response is unclear. Furthermore, it is difficult to localize exactly which areas in the brain are involved in primary and which are involved in secondary responding (personal communication, October 7, 2016). Recent neuroscientific publications demonstrate that the hierarchical distinction between primary and secondary response is oversimplified. Interactions across this hierarchy, that is between brain areas deemed to be involved in primary responding and brain areas assumed to be related to secondary responding, have been discovered (i.e.: Schroeder & Foxe, 2005; Blakemore, Wolpert, & Frith, 2000). Despite these new findings, it seems to be intuitive to explain reactivity according to this hierarchy because even the names of brain areas, such as "primary auditory cortex" and "primary visual cortex", correspond to it (Kandel, Schwartz, & Jessel, 2000).

according to a simple good/bad binary. Slagter's notion of the secondary response, in contrast, leaves room for this evaluation being more complex. For instance, the expression 'sweet pain' makes evident that the generally unpleasant sensation of pain may be evaluated as good. Second, Goenka's account of reactivity in comparison to Slagter's is enriched by the integration of physical responses to stimuli. By becoming increasingly aware of bodily sensations when practicing VM, this gives some indication of one's reactivity. It is striking that although the concept of interoception pertaining to the awareness of bodily sensation and its relation to emotional evaluation has found its way into the neuroscientific discipline, sensations do not play a key role in the neuroscientific account of reactivity as presented in the neuroscientific studies on VM and by their interviewed authors.

However, Britta Hölzel's illustrative example of reactivity alludes to its physical component. She gives the example of amygdala activation as a cerebral reaction to a stimulus that is threatening to survival (personal communication, October 10, 2016).[31] This response in the brain is manifested as an emotion of anxiety or stress, which consequently induces the impulse to flee or fight. This stimulus-response mechanism needs to function quickly to secure survival. According to Hölzel, reactivity means to immediately respond to a stimulus without being aware of the chain of causalities, that a certain stimulus evoked an emotion as a consequence of a specific brain activation, which induced a certain physical response in turn. The anxiety experienced in the face of a threatening stimulus might cause the muscles to become tense and the body to go into fighting position. Hölzel annotates that it is the "whole physiology that proceeds without awareness being interposed" (personal communication, October 10, 2016).[32] It is the awareness of one's physiology that is developed when practicing VM in order to reduce "automated reactivity" (Cahn & Polich, 2009, p. 51).

After comparing the concept of reactivity as developed by neuroscientists conducting research on VM to Goenka's notion of the term in his expositions on his teaching of VM, not only the object of VM as defined in the respective bodies of knowledge but also how it is achieved can be examined and contrasted. The underlying consensus of neuroscientific research on VM regards the practice as reducing reactivity. Hölzel et al. (2008) describe *Vipassana* and its purpose as follows:

> The practice . . . requires attentiveness to the internal experiences that arise at each moment, adopting an attitude of non-judgmental acceptance . . . The detached observation of bodily sensations, emotions and thoughts is assumed to interrupt automatic responding and to increase behavioral flexibility. (p. 55)[33]

[31]The amygdalae are two almond-shaped nuclei located deep within the cerebral cortex. They are considered to be part of the limbic system, a theoretical concept about a group of structures that features prominently in emotion and memory (Solms & Turnbell, 2002).

[32]Translation of the German original: "Meine ganze Physiologie läuft ab ohne, dass ich Gewahrsein dazwischen geschaltet habe".

[33]It needs to be re-emphasized here that, according to Goenka's instruction, thoughts and

When characterizing the practice of *Vipassana* as "detached observation", the adjective "detached" refers to the detachment from "analysis, judgment, and expectation", an "inhibition of brain appraisal systems" (Cahn, Delorme, & Polich, 2010, p. 48). That is, the secondary brain response as defined by Slagter is inhibited when practicing *Vipassana*.

Slagter et al. (2007) also denote this "non-reactive form of sensory awareness" as "'bare' attention" (p. 1228). If the secondary brain response is inhibited, "bare" attention means that there is merely a primary response, that one "stays at the level of sensory processing . . . because it would be just attending to things as they are without this reaction" (H. A. Slagter, personal communication, October 7, 2016). This means that, according to Slagter, the final aim of *Vipassana* is to eliminate any evaluative cerebral reaction to interoceptive and exteroceptive stimuli. In consequence, no representation of these incoming stimuli would be stored in memory because the encoding of stimuli in relation to their evaluation is part of the secondary response. As remaining in a "bare" attention mode is not only the objective during meditation, but is supposed to be endorsed in life, it seems that the elimination of reactivity is accompanied by dysfunctionality in daily routine, because nothing could be remembered. Yet, Slagter points out that this final goal of meditation is barely reached by anyone. Most meditators do not eliminate but reduce reactivity, which enables them to observe the secondary response to a stimulus, which emotion arises, instead of directly reacting upon the emotion with a certain behavior. In that sense, VM practitioners do remember stimuli and their evaluation but become slower in associating a stimulus with a certain evaluation.[34] This generates the behavioral flexibility mentioned above (H. A. Slagter, personal communication, October 7, 2016). An alternative interpretation of behavioral flexibility as a consequence of reduced reactivity assumes that detached observation of bodily sensations and their corresponding emotions results in an improved ability to accept an emotion, which is why the emotion does not create the urge to react upon it (B. Hölzel, personal communication, October 10, 2016).

Goenka denotes this behavioral flexibility as the ability to "act", rather than to "react":

> People who . . . apply this technique [*Vipassana*] in their daily life by their morning and evening meditation and by continuing to observe themselves throughout the day and night in different situations . . . The first thing they will try to do is to observe the sensation. Because of the particular situation, maybe a part of the mind has started reacting, but by observing the sensation, their minds become equanimous. Then whatever action they take is an action: it is not

emotions are not observed when practicing VM. The attention is solely directed at bodily sensations because they are directly connected to the other two, as discussed in the chapter on interoception.

[34]Slagter adds the example of a "priming effect" in meditators, whose automatic association between two terms, such as "nurse" and "hospital", is slower in comparison to non-meditators (personal communication, October 7, 2016).

a reaction. (2002a, p. 111)[35]

The idea of an equanimous mind resembles Hölzel's proposition that meditators are better able to accept emotions. Furthermore, Goenka uses the adjectives "equanimous" and "detached" interchangeably in relation to the observation of bodily sensations, which suggests their equivalence. However, whereas neuroscientific research on VM solely mobilizes the concept of detachment, Goenka predominantly makes use of the concept of equanimity. This might be the case because detachment and equanimity have different connotations after all. Whereas detachment resembles indifference, equanimity rather evokes serenity. Britta Hölzel establishes a conformable distinction when translating equanimity with the German "*Gleichmut*" rather than "*Gleichgültigkeit*" (personal communication, October 10, 2016). While "*Gleichgültigkeit*" would refer to an absence of any emotion, "*Gleichmut*" signifies that one maintains "a balanced mind, remaining peaceful and happy within oneself" no matter what type of bodily sensations and related emotions one experiences, whether pleasant or unpleasant (Goenka, 1987, p. 20). Goenka stresses that by practicing VM "one does not become like a vegetable, with no emotion in one's life" (2002a, p. 27). One experiences the joy of a peaceful and balanced mind, which is much greater than the joy that arises from sensations and emotions.[36] "But to the person who has not experienced this, it looks like illusion" (2002a, p. 27), which is why this person doubts the possibility of such a peace of mind and deems enjoying sensations and emotions as more important.

Similarly, some meditators that I had informal conversations with during my participation in VM meet-ups in Berlin reported doubts about practicing VM because they started to experience life as something to be observed, as something they are disassociated from rather than being fully involved.[37] Yet, Goenka (1987) might argue that this is merely a stage before one is able to experience inner peace to the fullest reaching the final aim of VM: the experience of "*nirvana*", that is, "full enlightenment" (p. 7). The neuroscientific characterization of enlightenment might relate to what Slagter calls "'bare' attention": the eradication of any evaluative secondary response to a stimulus in the brain (personal communication, October 7, 2016). However, the neuroscientific researchers studying VM do not assume that participants of their studies experience this state (i.e.: Hölzel et al., 2008). According to Slagter (personal communication, October 7, 2016) and Hölzel (personal communication, October 10, 2016), the experience of this state should not even be considered as

[35] In the aftermath of the field visit to the ten-day VM retreat, I tried to apply the technique in daily life. In line with Goenka's description of its benefits, I had the impression that I was able to observe negative emotions, such as jealousy, and let them pass away. I managed not to be drawn into negative thought spirals that had previously induced me to artificially cling onto negative emotions, such as Hölzel describes the effect of *Vipassana* (personal communication, October 10, 2016).

[36] Goenka seems to distinguish between two kinds of emotions, those that arise from sensations when reacting to a stimulus, and the emotion of inner joy experienced as a consequence of practicing *Vipassana*.

[37] This is one of the dominant critiques of VM, such as discussed in the monograph by Singh (2007) on the basis of his own experiences with and thoughts about the practice.

the goal of VM, since it is assumed to be accompanied by dysfunctionality in daily life as described above and by a disassociation from life such as criticized by some meditators. Goenka (2002b), in contrast, does regard the experience of enlightenment as the main objective of VM, for it represents his frequently praised state of inner peace and "true happiness" (2002a, p. 94).

However, in order to make sense of Goenka's account of enlightenment, another concept that is omitted in neuroscientific studies on VM, revealing the reduction of meaning in the process of translation, needs to be analyzed. This is the concept of "*anicca*" (Goenka, 1987, p. 8). According to Goenka:

> If you continue to maintain equanimity, sooner or later you will reach the stage described by the Buddha, in which throughout the physical structure, the meditator experiences nothing but arising and passing . . . throughout the body there is nothing but subtle vibrations. (1987, p. 19)

This is the experience of the free-flow, mentioned in the first chapter, that meditators attain by enhancing their awareness of bodily sensations. Understanding that everything arises and passes away on an experiential level, detecting the process of change by one's senses, is necessary in order to grasp the concept of *anicca*, that everything is ephemeral or impermanent. Goenka explains this as follows:

> Everyone knows that the entire universe is constantly changing, but mere intellectual understanding of this reality will not help; one must experience it within oneself. Perhaps a traumatic event, such as the death of someone near or dear, forces one to face the hard fact of impermanence, and one starts to develop wisdom, to see the futility of striving after worldly goods and quarrelling with others. But soon the old habit of egotism reasserts itself, and the wisdom fades, because it was not based on direct, personal experience. One has not experienced the reality of impermanence within oneself. (1987, p. 8)

That is why the core of the technique of VM is to develop the awareness of bodily sensations. It is only by understanding *anicca* experientially that the practitioner of VM becomes able to observe any type of sensation with equanimity, without developing preferences or prejudices towards any sensation, that is, refraining from reactivity. "In every case one understands the impermanent nature of all sensations; then one can smile, when they arise and when they pass away" (1987, p. 18). Even sensations that seem permanent, such as those arising from a chronic disease, can be understood as impermanent, when taking into account the Buddhist believe in rebirth. If a sensation is permanent in this life, it might change in the next. Although the belief in rebirth helps to understand the concept of *anicca*, it is not necessary in order to benefit from VM, because one comes to understand the concept experientially during practice (Goenka, 2002b).

The cycle of death and rebirth ends when the meditator reaches enlightenment. In the state of *nirvana*, "nothing arises, and therefore nothing passes away" (1987, p. 19). The "law of impermanence" (2002a, p. 51), *anicca*, does not apply anymore, because all reactivity has been eliminated. There is no pleasant or unpleasant bodily sensation that arises in consequence of a stimulus being evaluated as good or bad in accordance with past experience. From a neuroscientific perspective, no evaluation occurs because one maintains the mode of "bare" attention, solely engaging in sensory processing of a stimulus. Thus, Goenka considers the goal of VM to be the eradication of all reactivity, which contrasts the neuroscientific view that VM results in reduced reactivity, in "emotional stability" (Delgado-Pastor et al., 2013, p. 207), rather than being emotionless, in a state of inner peace that can only be grasped when being experienced.

3 Pleasure and pain

How does one eradicate all reactivity by means of practicing VM according to Goenka? Why does observing bodily sensations with an equanimous mind lead to enlightenment? That is, in neuroscientific terminology, how does one eliminate the secondary evaluative response to stimuli? In order to answer that question another concept central to Goenka's expositions on his teaching of VM needs to be presented. Goenka seems to refer to the neuroscientific concept of secondary response when mobilizing the concepts "mental reaction" or *"sankara"* (1987, p. 11). It is the evaluation of a bodily sensation as pleasant or unpleasant that arises when one encounters a stimulus and has compared it to former evaluations, former mental reactions, to similar stimuli. In that sense, the concept *sankara* relates to both the reactions stored in memory that one retrieves when encountering a stimulus *and* to the reaction that is created as a result of this process and which is also stored in memory accordingly. Over the course of life one develops a stock of *sankara*, a stock of memories of how one perceives certain stimuli as pleasant or unpleasant. For this reason, Goenka (1987) also uses the metaphor of a seed in order to illustrate the concept *sankara*. Every mental reaction can be seen as a seed because its storage in memory bears the fruit of another mental reaction when confronted with a similar stimulus.

When a stimulus is evaluated as pleasant, "the mind starts reacting, 'Oh, very good, I want more of it, I want more of it.' And this habit – wanting, wanting – continues all the time" (Goenka, 2002a, p. 6). Goenka calls this habit "craving" (p. 6). The opposite happens when a stimulus is evaluated as unpleasant. Then, the mind reacts with the continuous habit of "not wanting", which Goenka calls "aversion" (p. 6). Pleasant and unpleasant bodily sensations are translated into the emotions of craving and aversion, which result in the multiplication of *sankara*, because, for example, by craving for pleasant stimuli one acts towards experiencing more of these pleasant stimuli, which creates more mental reactions, more memories of these pleasant sensations, intensifying the craving in turn.

Britta Hölzel similarly mobilizes the concepts craving and aversion as the impulses to act in a way that Goenka's *sankara* multiply: "Craving and aversion would be something reactive, something that happens automatically, reactive to an external stimulus, what drives me unconsciously to act" (personal communication, October 10, 2016).[38] Hölzel's introduction of the unconscious fits in with Goenka's concept of *sankara*. According to Goenka (1987), storing mental reactions in memory, such as the neuroscientists researching VM would equally describe it, means planting seeds or *sankara* in the unconscious. Goenka's idea of the unconscious seems to be in line with Sigmund Freud's emphasis on the significance of the unconscious for human behavior.[39] Freud (1915), neurologist and the founder of psychoanalysis, uses the analogy of an iceberg to develop a topographical model of the mind. He describes conscious mind, all the mental processes of which we are aware, as the tip of the iceberg.[40] The unconscious mind, in contrast, comprises the major part of the iceberg that is under water and, thus, cannot be seen. It refers to the mental processes that are inaccessible to conscious mind, but still influence judgments, emotions and behavior. Goenka similarly illustrates:

> If you look at a burning ember covered by a thick layer of ash, it appears as if the characoal is not burning, as if there is no fire. In the same way ninety-nine percent of your mind is burning and the one percent at the surface might be distracted by enjoying this or that sensual pleasure. Because you have not seen inside you do not know that you are burning. (2002b, p. 36)

Ninety-nine percent of the mind can be considered unconscious according to Goenka. His topography of the mind suggests that the stronger a reaction to a stimulus, the deeper the *sankara* is stored in the unconscious, and the more difficult its eradication.

Although Goenka does not provide a clear definition of the unconscious, he is in need of the concept in order to explain how VM results in the eradication of *sankara*. Employing the expression "mental defilement" (i.e.: 1987, p.23) or "impurity" (i.e.: 1987, p. 17) as a synonym for *sankara* and depicting it as a burning inside, it becomes evident that Goenka regards *sankara* as the obstacles on the path to enlightenment that need to be removed. According to Goenka

[38] Translation of the German original: "'*Craving*' und '*aversion*' wäre ja was Reaktives, was automatisch Passierendes, Reaktives auf einen äußeren Stimulus Kommendes, was mich unbewusst zu verhalten weiter antreibt."

[39] Freud is considered to be the discoverer of the unconscious because nobody before him has been concerned with the phenomenon in such a systematic way when developing psychoanalysis at the end of the 19th and the beginning of the 20th century (Roth & Strüber, 2014).

[40] It needs to be pointed out that the dichotomy of conscious and unconscious mind is still negotiated in the psychological and neuroscientific disciplines. This becomes evident, for instance, with regards to Freud's equation of consciousness and awareness that relates to Slagter's distinction between phenomenal and access awareness (personal communication, October 7, 2016). It is thus debatable whether the experience of stimuli that cannot be reported have reached the conscious mind.

(1987), when the seeds of *sankara* fall on unfertile ground, an equanimous mind that does not react, they stop multiplying. When refraining from evaluating a sensation as pleasant or unpleasant, one stops reacting with the feelings of craving or aversion to the stimulus. This means that there is not another *sankara* created and "buried" in the unconscious mind (p. 29). If the practitioner of VM manages to do so during meditation, one can start to gradually eradicate the stock of defilements in the unconscious that has piled up over life. This proceeds as follows:

> As one develops awareness [of bodily sensations] and equanimity, naturally one penetrates deeper into the unconscious mind, and uncovers impurities hidden there . . . The only way to eliminate them is to allow them to come up to the surface of the mind and pass away. When such deep-rooted *sankara* arise on the surface, many of them may be accompanied by unpleasant, gross sensations or blind areas within the body. If one continues to observe without reacting, the sensation passes away, and with it the *sankara* of which it is a manifestation. (pp. 17-18)

Goenka considers the development of awareness of bodily sensations during VM as the key to the elimination of all *sankara* because they provide access to the mental defilements.

A painful sensation, for instance, need not, but may be the physical manifestation of an old *sankara* that comes up when the surface of the mind is not distracted by other sensual pleasures or emotions, instead remaining equanimous (2002b).[41] The deeper the *sankara*, the more unpleasant or even painful is the process of its eradication.[42] Accordingly, a VM practitioner, who I talked to informally previous to my field visit to the VM center Dhamma Mahi, reported on an experience during a ten-day VM retreat that resembles Goenka's description of an arising *sankara*. He illustrated a burning sensation on his shoulders with the image of fire or burning embers pouring down his neck during meditation. Crying quietly in the meditation hall, he realized that he relived childhood experiences of shame via the sensation in order to be relieved from them (Field note from informal conversation in Maastricht, February 28, 2016).[43] The account of this meditator renders comprehensible why Goenka also uses a surgical operation as a metaphor for VM. When the surgery of the mind has started, "some

[41] According to Goenka (2002b), the experience of pain may have many causes of which a *sankara* is one. Besides, it may also be the consequence of an injury or a disease for instance.

[42] Similarly to Goenka, neuroscientific studies on VM and their interviewed authors relate an unpleasant sensation to pain (i.e.: Gard et al., 2012; B. Hölzel, personal communication, October 10, 2016). Yet, according to the International Association for the Study of Pain, the threshold between unpleasantness and pain and its measurement are still debated in pain research (www.iasp-pain.org).

[43] One could argue that Goenka's (1987) description of bodily sensations as *sankara* in the evening discourses that are presented daily to the meditators during a ten-day VM retreat influences their actual bodily feeling. Meditators might actively attempt to identify bodily sensations with past experiences and emotions on the basis of Goenka's account. Moreover, Goenka's depiction of *sankara* as a burning inside might induce meditators to perceive burning sensations during meditation.

of the underlying pus has started to come out of the wound" (2002a, p. 72). That is why practicing VM may be experienced as unpleasant or even painful. Yet, according to Goenka, only by continuing the practice and eradicating more and more *sankara* until all reactivity is eliminated, one manages to overcome these sensations and to reach the state of enlightenment.

In contrast, some meditators report that they do not feel unpleasant sensations or pain during VM. For instance, on the tenth day of my field visit at the VM retreat at Dhamma Mahi, when participants are finally allowed to talk to each other, a women stated that she did not feel pain while meditating. She only experienced pleasant subtle sensations (Field note, August 7, 2016). This is what B. Rael Cahn represents as a risk of VM:

> People feeling these pleasant waves of sensations over and over and essentially orienting their practice to experience more and more of it, which is really thought to be a dangerous sidetrack, because you are essentially just reinforcing a kind of running-after-pleasure principle. (personal communication, October 12, 2016)

When referring to a "running-after-pleasure principle", Cahn names Goenka's understanding of craving. Goenka equally warns not to play the "game of sensations" (2002b, p. 106), craving for pleasant sensations during meditation and feeling aversion when experiencing unpleasant sensations, for he understands craving and aversion as "two sides of the same coin" (2002b, p. 99). Both result in the creation of *sankara*, which ought to be eliminated by maintaining a balanced and equanimous mind during meditation.[44]

The theoretical framework of basic emotional brain systems, postulated by the psychologist Jaak Panksepp (1998), provide neuroscientific underpinnings for Cahn's notion of a "running-after-pleasure principle" and, similarly, Goenka's concept of craving for pleasant sensations. Based on the distinction between emotional brain systems, different emotions are localized in different areas of the brain and are connected to specific neurochemicals (Solms & Turnbell, 2002).[45] It is the interaction of the SEEKING system and the LUST system that resembles the causal relationship between pleasant sensations and craving as established by Goenka.[46] Whereas the LUST system identifies a sensation

[44]Goenka's representation of the emotions of craving and aversions as two sides of the same coin resembles the conceptualization of pleasure and pain as part of a continuum, which dates back to ancient Greek philosophy and has become a dominant assumption in Western philosophy (Fenner, 2007). Aristotle (translated by W. R. Roberts, 1924) described pain and pleasure in reference to a push-pull concept, assuming that human beings move away from what causes pain and towards what causes pleasure. Similar to Goenka, he rejected sensual pleasure as a source of true happiness, for the longing for a pleasant experience generates pain if it is not fulfilled. Thus, his thoughts are in line with Goenka's claim that "sooner or later every pleasant sensation turns into an unpleasant one" (2002a, p. 99).

[45]Besides the classical neurotransmitters that enable the communication between brain cells, neuromodulators, neuropeptides and neurohormons change the effect of neurotransmitters and classify as neurochemicals (Roth & Strüber, 2014).

[46]The nomenclature of Panksepp (1998) is used in order to refer to the emotional brain systems: SEEKING and its subsystem LUST, RAGE, FEAR, PANIC and its subsystem CARE.

as pleasant, the SEEKING system fills the mind with craving so that one starts searching for the things one craves (Panksepp, 1998). However, the psychophysiologist Pandelis Perakakis warns that, as with the whole theoretical framework of basic emotional brain systems, the idea of "pleasure centers" in the brain may be overly simplistic (e-mail communication, October 18, 2016). Although he is trained as a researcher in psychophysiology, a branch in neuroscience that attempts to identify the interdependencies between psychological concepts and physiological observations, he refrains from making direct inferences from one to the other. He states that, firstly, there are no satisfying definitions for emotions. Their conceptualization remains an issue of debate in psychophysiology in particular and neuroscience in general. Secondly, the processes in the brain that may be observed when a certain emotion is evoked are so complex that they cannot be localized precisely in the brain, especially because in humans there are higher cognitive influences that can modify or inhibit them and their associated behaviors in multiple ways.

Nevertheless, the notion of emotional brain systems raises the question whether it is even possible by means of VM to inhibit the evaluation of a sensation as pleasant or unpleasant in the first place. Emotional brain systems are regarded as based on an evolutionary layering of the brain at both anatomical and chemical levels. According to Panksepp (1998), the basic emotional brain systems exist because they produce emotions that provide ways of reacting which increase the likelihood that an organism will survive and reproduce. As these mechanisms have such potent survival value, they seem to be "hardwired" in the brain. Goenka, by contrast, is convinced that even sexual passion can be eradicated by means of practicing VM:

> A sexual relationship is actually designed by nature for reproduction, but it is human beings' weakness to go against nature and use it only for passion. Slowly, if you keep working with Vipassana, you will come out of passion and reach a stage where there is a natural celibacy. (2002b, pp. 137-138)

Although Goenka describes sexuality as "designed by nature", which may mean that it is in line with evolution, he regards sexual passion referring to sexual craving as a mental defilement. From a neuroscientific perspective, this is a paradox. On the grounds of the theory of emotional brain systems, it is sexual pleasure evoked by the LUST system that induces sexual craving via the activation of the SEEKING system, so that one actually searches for the other sex to reproduce. Without these systems being activated, no reproductive behavior would be exercised.

Yet, Goenka's suggestion that the practice of VM might reduce sexual craving, or even eliminate it, is in line with the more recent neuroscientific theory of neuroplasticity, the idea that the brain's structure and the interactions of its compounds may change by means of external influences throughout an individual's life course (Turnbell & Solms, 2002). Consequently, the basic emotional systems in the brain are open to learning mechanisms. Although they may be

innate, they are by no means "hard-wired" in the sense of being unmodifiable (Panksepp, 1998). On these grounds, it may be assumed that the loss of sexual craving might be attained by means of practicing VM. However, whereas Goenka (2002b) describes sexual craving as a mental defilement that needs to be eradicated in order to advance on the path of enlightenment, neuroscientists, such as illuminated in the chapter on reactivity, would rather regard the aim of VM to be emotional regulation, a reduction of reactivity and, consequently, better control of sexual craving and conduct. Despite the neuroscientific assumption that the brain is plastic, it remains questionable though whether not merely a reduction of reactivity but its complete eradication is possible. Britta Hölzel proposes to conduct further research with those VM practitioners claiming to be enlightened to find out whether their brain activity suggests eliminated reactivity, whether their LUST system and SEEKING system interact in a different way in comparison to non-enlightened controls (personal communication, October 10, 2016).

There is an underlying assumption of the relation between the LUST system and the SEEKING system corresponding to the causation of craving and aversion by pleasant and unpleasant sensations respectively as established by Goenka. This is the idea that bodily sensations translate into emotions. The study by Gard et al. (2012) underpins this assumption by emphasizing the shared cerebral mechanisms of emotion and pain modulation, that is, the coping mechanisms to deal with both an emotion or pain, making it endurable.[47] Gard et al. postulate that VM represents an alternative pain modulation mechanism that makes pain better endurable than well-known coping strategies of pain. This finding is in line with Goenka's proposal that when practicing VM, the meditator refrains from judging sensations as pleasant or unpleasant, which makes pain easier to endure. By contrast, conventional coping mechanisms entail a distraction from pain, the attempt not to concentrate on it, or a reappraisal of pain, telling oneself that it is not that unpleasant. These coping strategies are also considered "top-down" modulations of pain because one attempts to gain control over the pain, which is reflected by the activation of the lateral prefrontal cortex (A. Sack, personal communication, October 10, 2016). Goenka (2002b) describes such strategies as a diversion of attention when confronted with unpleasant sensations, or the suppression of emotions by reappraising them. He holds them in low esteem because they do not eradicate the *sankara* in the unconscious mind:

> If you work at only the superficial level of the mind and either give it a good layer or else divert the attention to some other object in the attempt to come out of this pattern of reaction, you do find that the mind becomes calm. But this is only at the surface of the mind. Deep inside the same inclination towards reaction is still going on.

[47] According to Craig (2003), pain can even be understood as both a distinct sensation and a specific emotion that reflects the behavioral drive to maintain health in the body. This might be the reason why pain and emotions are modulated by the same mechanisms in the brain.

(p. 99)

Only when observing sensations equanimously, reactivity is reduced or eliminated, alleviating pain that results from unpleasant sensations and their corresponding emotions. This technique was applied by those practicing VM in the study by Gard et al. (2012). When confronted with electrical stimuli, they applied a "bottom-up" modulation of pain (p. 2692). They did not attempt to gain control over the pain but rather concentrated on it, explored the bodily sensation without evaluating. This is reflected in Gard et al.'s measurements of decreased activity in the lateral prefrontal cortex and increased activation in regions involved in sensory processing. These measurements are opposed to the brain activities observed in those applying top-down mechanisms of pain modulation. This supports the consideration of VM as an alternative pain modulation mechanism.[48] Laurence J. Kirmayer (2007), researcher on psychiatric practice, who recalls his own experience with VM, provides additional experiential material to describe how VM functions as an alternative pain modulation mechanism:

> As I sat immobile for an hour, my knees began to ache terribly . . . I had been instructed to keep coming back to simply watching my experience without judging. When my attention was drawn to the pain . . . [s]uddenly, my experience was radically transformed. The pain in my knees was still there – I could have described its sensory qualities in great detail – but instead of crowding in on me, it fell back to become just a phenomenon I was watching. Sensation was separated from emotional response . . . [T]he pain . . . lost its "in your face" urgency, unbearable intensity, and harrying quality. There was no rush to move, no concern that pain would go on building in intensity forever. (pp. 385-386)

All in all, one could identify two processes of translation between Goenka's expositions on his teaching of VM and neuroscientific research on the practice. First, the causal relation between pleasant and unpleasant sensations evoking the emotions of craving and aversion according to Goenka is underpinned by the neuroscientific theory of emotional brain systems connecting the LUST system and the SEEKING system. Whereas Goenka describes this causality as modifiable by means of practicing VM, the concept of neuroplasticity, recently developed in the neuroscientific discipline, supports that the workings of emotional brain systems can be altered by means of learning. Second, one could argue that the practice of VM as such is translated into neuroscientific research as a pain modulation mechanism. Whereas Goenka (1987) underlines that the alleviation of pain might be a side effect of VM but ought not to be the objective of its practice, the study by Gard et al. (2012) examines the practice exactly for

[48] Meditation does not represent the only alternative "bottom up" strategy to alleviate pain. Similarly, the clinical use of hypnosis for pain control, for example, allows people to experience themselves as separate from their pain, merely observing it (Bowers, 1979).

this purpose. A shift in meaning with regards to the aim of VM has taken place in the process of translation. The neuroscientific research in question reduces this meaning to the side effect of VM, neglecting its full potential.

4 The mind-body relation

Kirmayer's quote at the end of the last chapter discloses his altered perception of the relationship between his body and his mind when practicing VM. There is a gap between the sensation of pain in his body and its observation. Visual perception, including observation, can be understood as a cognitive capacity that is generally attributed to the mind (Roth & Prinz, 1996). The concept of the mind and its relationship to the body is one of the most complex in intellectual history and science. The different conceptualizations of the mind-body relation represent ontological assumptions that underlie all religions, worldviews and cultures (Roth & Strüber, 2014). In that sense, it has also been debated in neuroscience and Goenka's position on the mind-body relation equally shines through in his expositions on his teaching of VM. Therefore, I would like to conclude my analysis by illuminating the ontological assumptions about the mind-body relation pertaining to the neuroscientists conducting research on VM, and then compare these to Goenka's position.

As the discussion of the mind-body relation has been a dominant theme in Western intellectual history, it is essential to provide an overview on the approaches that have had a major influence on contemporary neuroscientific positions. The modern discussion about the relationship between body and mind begins with René Descartes and his work "*Traité de l'Homme*" (Clerselier, 1664). He is considered to be the main representative of the mind-body dualism (Roth & Strüber, 2014). According to Descartes, there are two substances in the universe: *res extensa*, which refers to matter succumbed to physical laws, and *res cogitans*, which relates to the mind and exists beyond the laws of nature. The brain pertaining to the body and, thus, being material in nature was understood as a complex machine. He described the pineal gland, located near the center of the brain, as the interface between body and mind. Yet, Descartes did not manage to explain *how* body and mind interacted via the pineal gland.

The problem "how do body and mind interact" or "how does mind emerge from the brain" is called the mind-body problem, a philosophical conundrum dating back to classical antiquity (Turnbell & Solms, 2002). Since the middle of the 20th century, there has been a concerted scientific effort to solve the problem. Involving neuroscientists, psychologists, philosophers, and even computer scientists, the discipline of cognitive science have modeled the brain according to the hardware of a computer, and its mental processes as the software running on this hardware (Fingerhut, Hufendiek, & Wild, 2013). Somewhat maintaining the Cartesian idea of brain and body being machine, they have denied the existence of an immaterial substance. Contemporary cognitive science subscribes to an ontological monism, a materialist position according to which everything is ultimately reducible to matter (Turnbell & Solms, 2002). Consequently, it is

assumed that all mental processes could be described in algorithms, and that the compounds of the mind could be considered as functional unities localizable in specific brain areas.

According to Alexander Sack, the computer model of the brain still remains the most attractive model in neuroscience today (personal communication, October 10, 2016). However, not only Sack but also Pandelis Perakakis are aware of its limitations. As already mentioned in the third chapter, Perakakis points out that mental functions are the products of complex systems, the component parts of which may be distributed throughout the structures of the brain (e-mail communication, October 18, 2016). Therefore, Sack's allusion to the brain as a "network" (personal communication, October 10, 2016) reveals that he has departed from the computer model of the brain towards a networking model. Regarding the brain as a connectionist network includes the idea of the brain's plasticity as mentioned above. The network can be re-structured continuously on the basis of trial and error. This means that the brain's structures and processes can change by means of learning (Fingerhut, Hufendiek, & Wild, 2013). Some of the neuroscientific studies on VM provide evidence for or suggest that the brain may change due to the practice of VM (i.e.: Hölzel et al., 2008).

Yet, these studies also relate the measurement of brain activity in specific brain areas to certain mental functions, which alludes to a notion of localization as mentioned above. For example, the study by Gard et al. (2012) refers mental control to activity in the lateral prefrontal cortex and sensory processing to activity in the right posterior insula. Despite new attempts in neuroscience to model the brain according to a network rather than a computer, the experimental set-ups in neuroscientific studies on VM appear to be based on the computer model of the brain. It seems that brain imaging needs to be adapted or replaced by new research methods and technologies in order to incorporate the networking model of the brain that is already acknowledged by researchers, such as Sack, but has not been translated into research on VM yet.[49]

Moreover, Slagter et al. (2007) describe their neuroscientific research endeavor as a "study of the human mind" (p. 1228). Slagter explains this expression by stating that the research project attempts to disclose how the mind functions by looking at the neural level (personal communication, October 7, 2016). The expression arises from her ontological assumption that "the mind arises from the brain". She describes mind and brain as "two levels of study, two sides of the same coin" (personal communication, October 7, 2016). In that sense, she is in line with a monist materialism, such as developed in the cognitive science discipline together with the proposition of a computer model of the brain that assumes a material basis for mental processes.

[49]The observation that research methods are not in line with new models of how to conceptualize the brain in neuroscience may be an evidence for the neuroscientific discipline being immersed in a paradigm shift as identified by the American physicist and philosopher Thomas Kuhn (1962). He considers a paradigm shift as a fundamental change in the basic concepts and experimental practices of a scientific discipline. The process of a paradigm shift seems to be observable in neuroscience because of the discrepancy between changed conceptualizations that have not been met yet by a change in experimental practices. The two will ultimately be aligned when the new paradigm's dominance is established in the field.

Although Sack agrees that the consensus in neuroscience today assumes that the mental originates from the material, he takes the view that the neuroscientific discipline is not able to solve the "intellectual dilemma" of translating from the material to the mental, to bridge the gap between processes on the molecular level and the subjective perception.

> One never manages to explain the essence of the perception of a color by saying that this is based on ion channels that open and calcium enters . . . but at the end there is the subjective experience that this is red.[50] (A. Sack, personal communication, October 10, 2016)

Due to this "unsolvable problem", Sack's position on the mind-body relation is that "everything mental originates from the material but cannot be referred back to it. It has a certain own quality that is not equivalent with the material anymore" (personal communication, October 10, 2016).[51] On these grounds, it seems that Sack's ontological position approximates a dualism, for he ascribes an own quality to the mind. It remains a subject of debate in neuroscience whether the mind, despite its neuronal origin, has an effect of its own on brain processes, or whether the mind is merely an ineffective attachment to the brain, that can be completely explained on the grounds of its material basis.

Both material monism as well as a dualism of sorts, based on the problem of how to explain the interaction between body and mind, become evident ontologies when analyzing the accounts of the neuroscientists researching VM. Similarly, the analysis of Goenka's ontological assumptions manifests ambiguity. At first sight, Goenka seems to adhere to a dualist interactionism. Accordingly, the relationship between mind and body is described in interactionist terms, asserting that physical events have mental effects and vice versa (Turnbell & Solms, 2002). Goenka's description of VM reveals this position: "It is a pure science of mind and matter – of how they interact, how they keep on influencing and being influenced by each other" (2002a, p. 12). Due to the interaction between the two, Goenka describes them as "two aspects of the human phenomenon: material and mental, body and mind" (1987, p.18). He even refers to the "mental-physical structure" (p. 27). Implementing the mental and the material in a structure underlines the interdependency of the two; both aspects support and rest on each other in order to secure the structure from falling apart.

According to Goenka, the key to understanding this structure can be found in training the awareness of one's sensations. "Sensation is of central importance for experiencing the reality of both body and mind" because it is at the point where reactivity can be observed and, thus, be encountered with equanimity

[50] Translation of the German original: " . . . weil man es nie schafft die Essenz der Wahrnehmung einer Farbe zu erklären, dadurch dass man sagt, dem geht zugrunde wenn sich Ionenkanäle öffnen und Kalzium kommt rein . . . aber am Ende steht ja doch das subjektive Erleben 'das ist jetzt rot'."

[51] Translation of the German original: "Alles Mentale entsteht aus dem Materiellen, aber es ist nicht mehr darauf zurückzuführen an sich. Es hat dann auch eine gewisse eigene Qualität, die nicht mehr gleich ist mit dem Materiellen."

(p. 18). As explained in the first chapter, any defilement arising in the mind is accompanied by a physical sensation. Consequently, one's physical sensations give some indication of one's mental state. That is why Goenka reverts to the same expression as Slagter when describing the mental-physical phenomenon like "a coin with two sides" (2002a, p. 43). Yet, in his case the expression discloses a dualist rather than a monist position because the metaphor of a coin illustrates the interface of what Goenka, similar to Descartes, relates to the pineal gland. He explains the physical sensation as the perception of a biochemical flow of a glandular secretion that is induced by *sankara* arising in the mind (2002a, p. 107).

Yet, Goenka differs from Descartes with regards to the hierarchical relationship of body and mind. Descartes followed the Western tradition of disprizing the body as the locus of passion (Fingerhut, Hufendiek, & Wild, 2013). According to Goenka (1987), passions, that is, *sankara*, arise in the mind. Therefore, it is the mind, rather than the body, which needs to be mastered or tamed "like a wild bull or elephant" (p. 5). The body assists in developing mastery over the mind – the complete opposite of Descartes' notion – because it renders *sankara* observable due to their physical manifestation as sensations. In that sense, the notion of the body assisting the mind also points out that the two substances of the human phenomenon interact.

As humans are nothing but the interaction between body and mind, Goenka states that there is no self. Referring back to the quote at the end of the last chapter, Kirmayer claims to have perceived a distance created between the observing 'I' and the pain when practicing VM. Goenka contradicts this interpretation of Kirmayer's experience by emphasizing that there is only observation but no observer (p. 75). The dissolution of the self can be experienced when one transgresses the state of the "free flow" and reaches the state of "*bhanga*, total dissolution" (2002b, p. 58). As already mentioned in the chapter on interoception, Goenka claims that when developing one's awareness of sensations by means of practicing VM, one manages to feel the vibrations that represent the ultimate substance out of which everything is composed, both animate and inanimate. The 'I' dissolves because the meditator cannot distinguish anymore between the vibrations pertaining to the own mental-physical being and the vibrations of what is around him or her. Goenka's assumption that "the true nature of the physical and mental structure" (1987, p. 8) is vibrational at the subatomic level manifests that his ontological position can also be interpreted as monist. In essence, there is no distinction between the mental and the material; both are nothing but vibrations.

Goenka's ontology appears to be even more ambiguous when taking into account his concept of enlightenment. He contrasts the experience of subtle vibrations as a phenomenon in the field of mind and matter to "the ultimate reality that is beyond mind and matter" (1987, p. 3). This reality can only be experienced when reaching *nirvana*, "the stage beyond mind and matter" (p. 18). According to Goenka, "when you reach that stage you find that the entire mind-matter structure is essenceless" (2002b, p. 32). The idea that there is something beyond mind and matter suggests that Goenka adheres in fact to a

trialism, since he proclaims the existence of a third substance in addition to the mental and the physical. Yet, denying the essence of the mind-matter structure, it seems that mind and matter, such as the notion of a self, are an illusion. Only what is beyond mind and matter is real and what that consists in can solely be known experientially. For this reason, the experience of enlightenment cannot be verbalized. If only what is beyond mind and matter really exists, then Goenka's ontology can once more only be interpreted as pertaining to monism. However, this monist position is very abstract, for Goenka cannot describe what the real substance beyond mind and matter consists in.

On these grounds, it is evident that Goenka's expositions on his teachings of VM do not permit a clear identification of his ontological assumption regarding the mind-body relation. Whereas his position can be attributed to monism, dualism and trialism, neuroscientific researchers studying VM agree that the mental arises from the material, the mind arises from the brain. Yet, they are also concerned with the problem of how to translate material processes into mental functions or vice versa. Recent developments in neuroscience suggest that the key to solve this problem might consist in a departure from neurocentrism, a mere focus on the brain in research (Fingerhut, Hufendiek, & Wild, 2013). Instead of asking which processes in the brain yield certain mental states, it might be fruitful to consider which processes in the whole body are involved in producing these mental states. This new tendency in neuroscience resembles Goenka's approach to gain insights into the depths of the mind by investigating one's bodily sensations. Therefore, the neuroscientific investigation of concepts such as interoception, entailing the examination of the relationship between bodily sensations, emotional mental states and brain processes, represents a promising attempt to model human mental phenomena on an embodied system rather than reducing it to a machine with a computational control center. Thus, the recurrence of the concept of interoception in neuroscientific studies on VM suggests that researchers have already taken up the notion of embodiment. This also becomes visible in the study by Delgado-Pastor et al. (2013) who do not only correlate brain activity but also heart rate variability with the sensory processing of stimuli in meditators. Goenka's dualist interactionism stressing the interdependency of body and mind might thus provide another way of thinking for neuroscientific research. According to Alexander Sack, reaching out to another body of knowledge when studying VM supports neuroscience in appropriating new concepts and paradigms, which might help to overcome its limitations (personal communication, October 10, 2016).

Conclusion

Putting Goenka's (2002a) and Delgado-Pastor et al.'s (2013) accounts of VM side by side at the beginning of this study introduced the reader into two different worlds, two epistemic cultures, that speak in different languages when conceptualizing the practice. I questioned whether these two worlds relate on the basis of their conceptual similarities. Based on the results of my research

project, I conclude that there are both conceptual similarities and differences between the two. Goenka's description of VM as the "dispassionate observation of the ever-changing mind-matter phenomenon" corresponds in many ways to the neuroscientific concept of interoceptive awareness. However, Goenka's description alludes to several other concepts that do not find an equivalent in neuroscientific studies on VM. For instance, Goenka's notion of the "ever-changing" nature of the entire universe including all its phenomena is not represented in neuroscientific accounts. As this concept is necessary for the comprehension of Goenka's idea of enlightenment, its omission might be the reason why neuroscientists do not grasp the concept of enlightenment either. Consequently, their idea of the purpose of VM is to attain emotional stability, rather than enlightenment.

The epistemic cultures behind Buddhism and neuroscience, exemplified by Goenka and neuroscientific researchers studying VM, thus attribute different aims to the practice of meditation. This makes evident that a shift in meaning, a translation, has taken place between the two. The translation of concepts is exemplified throughout the four chapters of this research. If concepts can be translated from one epistemic culture to another they are also called boundary objects. The idea was coined by the social scientists Susan Leigh Star and James R. Griesemer (1989), drawing upon works by Bruno Latour, Michel Callon and John Law in the field of Science and Technology Studies (i.e.: Callon & Law, 1982; Latour, 1986; Law, 1987). They determine boundary objects as

> both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites . . . They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is key in developing and maintaining coherence across intersecting social worlds.[52] (Star & Griesemer, 1989, p. 393)

The concepts translated from Goenka's expositions on VM practice to neuroscientific research on VM can be considered as boundary objects. The notion of reactivity as mobilized in Goenka's account in comparison to its conceptualization in neuroscientific studies reveals that its core meaning is similar in both bodies of knowledge, but that a reduction in meaning has occurred in its translation from Buddhism to neuroscience. A reaction to a stimulus is commonly defined in neuroscientific research on VM as an evaluation kept in memory for future evaluations of stimuli. Yet, Goenka's idea of reactivity is enriched by the integration of physical sensations inducing emotional or judgmental responses to stimuli. However, this surplus meaning may slowly be integrated in neuroscientific approaches to the concept because ideas of interoception and embodiment

[52]Star and Griesemer define the term "coherence" as the degree of consistency between different translations and social worlds.

relating to the interdependency of physical and mental processes, such as emotions or judgments, have recently been developed in the field.

Thus, the management of boundary objects is a continuous work in progress, which can be observed in the field of neuroscience. Yet, in the case of Goenka's account on his teaching of VM, the management of boundary objects, for instance incorporating recent neuroscientific insights, cannot be observed anymore because Goenka passed away in 2013. For this reason, to identify the concepts discussed in this research as boundary objects and determine whether they contribute to the "coherence across intersecting social worlds", the epistemic cultures of neuroscience and Buddhism, I suggest that further research needs to be conducted. It needs to be investigated how VM practitioners mobilize the concepts developed by Goenka and whether the meanings they attribute might have been influenced by neuroscientific research on VM. This seems probable because neuroscientific research results supporting the benefits of VM provide a legitimization for its practice. Qualitative interviews with VM practitioners on their understanding of VM practice represent a promising future research endeavor.

Moreover, identifying the concepts analyzed in this research as boundary objects underlines that mutual understanding between different epistemic cultures and, thus, a fruitful dialogue between neuroscience and Buddhism is possible. As these concepts are common enough to be recognized in both worlds due to a similar basic meaning, both are able to understand the other's language. Yet, they need to be willing to profoundly engage with it, making an attempt to comprehend the roots of conceptualizations in the respective traditions. I take the view that in the case of neuroscientific research on VM, this attempt leaves something to be desired. The interviewed authors of the neuroscientific studies on VM informed me that none of them deeply engaged with Goenka's primary sources. This might be the reason why misunderstandings of the practice occur in neuroscientific research. For instance, the distinction between focused-attention and open-monitoring meditation differentiating *Anapana* from *Vipassana* does not correspond to Goenka's instructions to the practices. Whereas Goenka stresses that *Vipassana* is based on directing one's attention through the body, neuroscientific research assumes that the practice is based on refraining from the direction of attention. This diverging conceptualization of practicing *Vipassana* in neuroscientific research might distort neuroscientific results concerning VM, since VM practitioners might perform a different meditation than researchers expect. Similarly, the neuroscientist Maxwell Bennett and the philosopher Peter Hacker (2003) stress that conceptual clarity is a prerequisite for empirical research. For any unclarity regarding the relevant concepts will be reflected in the unclarity of research questions and hence in the designs of experiments as well as in the interpretations of their results intended to answer them. On these grounds, I recommend that neuroscientists conducting research on VM study Goenka's primary material to gain a profound understanding of the practice and create boundary objects that secure consistency or coherence between the two epistemic cultures, which would ensure the basis for a fruitful dialogue.

Besides, I recommend that neuroscientists aiming to investigate VM conduct

qualitative interviews with VM practitioners before establishing their research projects. Translating from VM practice to neuroscientific research also means translating from experience to discourse. As already mentioned in the introduction, VM practice requires not only an intellectual but also an experiential understanding to be grasped completely – Ryle's (1949) "knowing that" and "knowing how" need to supplement each other. Therefore, it might be beneficial for researchers to either engage in practicing VM themselves or to interview meditators. The interviewed neuroscientists, Hölzel (personal communication, October 10, 2016), Cahn (personal communication, October 12, 2016) and Perakakis (personal communication, October 17, 2016) all practice meditation, while Hölzel and Cahn also participated in the ten-day VM meditation retreat. Hölzel points out that her research benefitted from her practice of VM, since she generated her research hypotheses grounded in her own experience during meditation. Yet, she also emphasizes that neuroscientists conducting meditation research are often biased, being deeply convinced of the positive effects of meditation. For this reason, it might be advisable for neuroscientists not interested in practicing meditation to interview VM practitioners, making sense of their experiences for the purpose of their research. This might also shed light on questions discussed in this research paper. For instance, practitioners may confirm or negate that VM practice reduces or even eliminates sexual craving, which might provide impetus for new research questions and projects in neuroscience. Tying in with the recent conversation between the Dalai Lama and the neuroscientist Christof Koch mentioned in the introduction, the actual dialogue between neuroscientists and meditation practitioners needs to continue.

Overall, I take the view that focusing on VM in neuroscience, translating from the Buddhist to the neuroscientific body of knowledge, does not merely generate new ideas for research but has an impact on the field of neuroscience as such. As mentioned in the fourth chapter, the neuroscientific discipline currently undergoes a paradigm shift towards a networking model of the brain implying a conceptualization of the human mind as an embodied system. Boundary objects originating in Buddhism and applied in the framework of neuroscientific research on VM might support this paradigm shift. The concept of interoception alluding to the notion of embodiment can be further developed by means of neuroscientific research on VM practice and by engaging with Goenka's expositions on his teaching of VM that explain the relation of physical sensations and emotions.

However, it is important to point out that my positive opinion about the possibility and benefits of translating from Buddhism to neuroscience might result from my own interest in the practice of VM. Participating in the ten-day VM retreat has convinced me of the benefits of VM, which has made me a regular practitioner. Furthermore, as a researcher with an interdisciplinary background, I am confident of the prosperity of the collaboration of different bodies of knowledge. As long as boundary objects are continuously managed to be consistent among the epistemic cultures that mobilize them, these epistemic cultures will be able to enter into a dialogue, be it an actual dialogue or a dialogue of sorts, which was the object of this case study. In that sense, translation

can be considered as "the task of reconciling [the] meanings" (Star & Griesemer, 1989, p. 388) of objects, methods, and concepts across different social worlds so that representatives of these worlds can "work together" (p. 389). The present research reveals where meanings diverge indicating a need for reconciliation in order to secure a fruitful dialogue between Buddhism and neuroscience.

References

Personal communication

B. Rael Cahn, October 12, 2016
First author of the research articles "Meditation (Vipassana) and the P3a event-related brain potential" (2008) and "Occipital gamma activation during Vipassana meditation" (2010)

Britta Hölzel, October 10, 2016
First author of the research articles "Differential engagement of anterior cingulate and adjacent medial frontal cortex in adept meditators and non-meditators" (2007) and "Investigation of mindfulness meditation practitioners with voxel-based morphometry" (2008)

Pandelis Perakakis, October 17, 2016
Second author of the research article "Mindfulness (Vipassana) meditation: effects on P3b event-related potential and heart rate variability" (2013)

Alexander Sack, October 10, 2016
Third author of the research article "Pain Attenuation through Mindfulness is Associated with Decreased Cognitive and Increased Sensory Processing in the Brain" (2012)

Heleen A. Slagter, October 7, 2016
First author of the research article "Mental Training Affects Distribution of Limited Brain Resources" (2007)

E-mail communication

Pandelis Perakakis (Follow-up on the personal communication), October 18, 2016
Susan O'Brian (VM teacher of the Insight Meditation Society), October 12, 2016

Primary sources

1. Cahn, B. R., & Polich, J. (2009). Meditation (Vipassana) and the P3a event-related brain potential. *International Journal of Psychophysiology, 72*, 51-60.

2. Cahn, B. R., Delorme, A., & Polich, J. (2010). Occipital gamma activation during Vipassana meditation. *International Quarterly of Cognitive Science, 11*(1), 39-56.

3. Delgado-Pastor, L. C., Perakakis, P., Subramanya, P., Telles, S., & Vila, J. (2013). Mindfulness (Vipassana) meditation: effects on P3b event-related potential and heart rate variability. *International journal of psychophysiology: official journal of the International Organization of Psychophysiology, 90*(2), 2017-214.

4. Gard, T. et al. (2012). Pain Attenuation through Mindfulness is Associated with Decreased Cognitive and Increased Sensory Processing in the Brain. *Cerebral Cortex, 22*, 2692-2702.

5. Goenka, S. N. (1987). *The Discourse Summaries.* Onalaska, Washington: Pariyatti Publishing.

6. Goenka, S. N. (2002a). *Meditation Now. Inner Peace Through Inner Wisdom.* Onalaska, Washington: Pariyatti Publishing.

7. Goenka, S.N. (2002b). *For the benefit of the many.*Vipassana Research Institute. Retrieved on September 21, 2016, from http://www.vridhamma.org

8. Hölzel, B. K. et al. (2007). Differential engagement of anterior cingulate and adjacent medial frontal cortex in adept meditators and non-meditators. *Neuroscience Letters, 421*, 16-21.

9. Hölzel, B. K. et al. (2008). Investigation of mindfulness meditation practitioners with voxel-based morphometry.*SCAN, 3*, 55-61.

10. Slagter, H. A. et al. (2007). Mental Training Affects Distribution of Limited Brain Resources. *PLoS Biology, 5*(6), 1228-1235.

Secondary sources

1. Al-Hussaini, A. et al. (2001). Vipassana meditation: A naturalistic, preliminary observation in Muscat. *Journal for scientific research. Medical sciences, 3*(2), 87-92.

2. Baars, B. J. (1997). *In the Theater of Consciousness.* New York: Oxford University Press.

3. Becker, K., Becker, M., & Schwarz, J. (2007). *String theory and M-theory: A modern introduction.* Cambridge: Cambridge University Press.

4. Bennett, M. R., & Hacker, P. M. S. (2003). *Philosophical Foundations of Neuroscience.* Oxford: Blackwell Publishing.

5. Blakemore, S., Wolpert, D., & Frith, C. (2000). Why can't you tickle yourself? *NeuroReport, 1*(11), 11-16.

6. Bowers, K. S. (1979). Time distortion and hypnotic ability: underestimating the duration of hypnosis. *Journal of Abnormal Psychology, 88*, 435-439.

7. Buswell, R. E. (2004). *Encyclopedia of Buddhism.* New York: Macmillian Referemce USA.

8. Callon, M., & Law, J. (1982). On Interests and Their Transformation: Enrolment and Counter-Enrolment. *Social Studies of Science, 12*(4), 615-625.

9. Chiesa, A. (2010). Vipassana meditation: systematic review of current evidence. *Journal of alternative and complementary medicine, 16*(1), 37-46.

10. Clerselier, C. (Ed.) (1664). *L'Homme de René Descartes et un Traité de la Formation du Foetus du mesme autheur, Avec les Remarques de Louys de la Forge, Docteur en Medicine, demeurant à La Fleche, sur le Traité de René Descartes; & sur les Figures par luy inventées.* Paris: Charles Angot.

11. Cohen-Katz et al. (2005). The effects of mindfulness-based stress reduction on nurse stress and burnout: A qualitative and quantitative study. *Hol Nurs Pract, 19*, 26-35.

12. Craig, A. D. B. (2003). Interoception: the sense of the physiological condition of the body. *Current Opinion in Neurobiology, 13*, 500-505

13. Craig, A. D. B. (2003). A new view of pain as a homeostatic emotion. *TRENDS in Neuroscience, 26*(6), 303-307.

14. Craig, A. D. B. (2015). *How do you feel?: an interoceptive moment with your neurobiological self.* Princeton, New Jersey: Princeton University Press.

15. Dalai Lama, Benson, H., Thurman, R. A. F., Gardner, H. E., & Goleman, D. (1991). *Mindscience: an east-west dialogue.* London: Wisdom Publications.

16. Fenner, D. (2007). Das gute Leben. In D. Birnbacher, P. Stekeler-Weithofer, & H. Tetens (Eds.): *Grundthemen Philosophie.* (Vol. 8). Berlin: Walter de Gruyter.

17. Fingerhut, J., Hufendiek, R., & Wild, M. (2013). *Philosophie der Verkörperung. Grundlagentexte zu einer aktuellen Debatte.* Berlin: Suhrkamp.

18. Freud, S. (1915). The unconscious. In J. Strachey (Ed.) (2001): *The Standard Edition of the Complete Psychological Works of Sigmund Freud, Volume XIV (1914-1916), On the History of the Psycho-analytic Movement Papers on Metapsychology and Other Works.* London: Vintage.

19. Haken, H. (1996). *Principles of brain functioning. A Synergetic Approach to Brain Activity, Behavior and Cognition.* Berlin: Springer-Verlag.

20. Hart, W. (1987). *The Art of Living: Vipassana Meditation as taught by S.N. Goenka.* Onalaska, WA:Pariyatti Publishing.

21. Kandel, E. R., Schwartz, J. H., & Jessel, T. H. (Eds.). (2000). *Principles of Neuroscience.* New York: Mc-Graw-Hill Companies, Inc.

22. Kirmayer, L. J. (2007). On the cultural mediation of pain. In K. Shelemay & S. Coakley (Eds.): *Pain and Its Transformations: The Interface of Biology and Culture.* Cambridge: Harvard University Press.

23. Knorr-Cetina, K. (1999). *Epistemic Culture.* Cambridge, Mass.: Harvard University Press.

24. Koch, C. (2013). The Brain of Buddha. An encounter with His Holiness the Dalai Lama and the scientific study of meditation. *Scientific American Mind*, 28-31.

25. Kuhn, T. S. (1962). The Structure of Scientific Revolutions. *International Encyclopedia of Unified Science, 2*(2). Chicago: The University of Chicago Press.

26. Latour, B. (1986). Visualization and cognition: Thinking with eyes and hands. *Knowledge and society: Studies in the sociology of culture past and present, 6,* 1-40. Greenwich, CT: JAI Press Inc.

27. Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers through Society.* Harvard: Harvard University Press.

28. Latour, B. (1999). *Pandora's Hope. Essays on the reality of scientific studies.* London: Harvard University Press.

29. Latour, B. (2005). *Reassembling the Social. An Introduction to Actor-Network Theory.* Oxford: Ocford University Press.

30. Law, J. (1987). Technology, Closure and Heterogeneous Engineering: The Case of the Portuguese Expansion. In W. Bijker, T. Pinch & T. P. Hughes (Eds.) (1988): *The Social Construction of Technological Systems.* Cambridge, MA: Harvard University Press.

31. Lazar, S. W. et al. (2005). Meditation experience is associated with increased cortical thickness. *NeuroReport, 16*(17).

32. Nicolini, D. (2010). Medical Innovation as a Process of Translation: A Case from the Field of Telemedicine. *British Journal of Management, 21*, 1011-1026.

33. Overlach, F. (2008). *Sprache des Schmerzes – Sprechen über Schmerz. Eine grammatisch-semantische und gesprächsanalytische Untersuchung von Schmerzausdrücken im Deutschen.* Berlin: Walter De Gruyter GmbH & Co.

34. Panksepp, J. (1998). *Affective Neuroscience: The Foundations of Human and Animal Emotions.* New York: Oxford University Press.

35. Parihar, D. R., & Maharashtra Cadre, I. F. S. (2002). *Impact of Vipassana in Government.* Research report submitted to Government of Maharashtra and Vipassana Research Institute Dhamma Giri, Igatpuri. Retrieved on September 13, 2016, from http://www.vridhamma.org/Impact-of-VipassanainGovernment

36. Patil, S. G. (2009). Effectiveness of mindfulness meditation (Vipassana) in the management of chronic low back pain. *Indian journal of anaesthesia, 53*(2), 158-163.

37. Ramon, C., & Lester, L. (2012). Conceptual Similarities in Buddhism, Science and Neuroscience. *Dialogue Between Buddhism and Science.* Venue Conference at the Tibet House in New Dehli.

38. Roberts, W. R. (Trans.). (1924). *Rhetorica: The Works of Aristotle.* Oxford: Clarendon Press.

39. Ronel, N., Frid, N., & Timor, U. (2013). The practice of positive criminology: a Vipassana course in prison. *International journal of offender therapy and comparative criminology, 57*(2), 133-153.

40. Roth, G., & Prinz, W. (1996). *Kopfarbeit. Kognitive Leistungen und ihre neuronalen Grundlagen.* Heidelberg: Spektrum.

41. Roth, G., & Strüber, N. (2014). *Wie das Gehirn die Seele macht. Stuttgart: Klett-Cotta.*

42. Ryle, G. (1949). *The Concept of the Mind.* New York: Routledge.

43. Schroeder, C. E. & Foxe, J. (2005). Multisensory contributions to low-level, 'unisensory' processing. *Current Opinion in Neurobiology, 15*(4), 454-458.

44. Shapiro, S. L., Schwartz, G. E., & Bonner, G. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. *Journal of Behavioral Medicine, 21*, 581-599.

45. Sherrington, C. S. (1900). Cutaneous sensations. In E.A. Schäfer (Ed.): *Text-book of Physiology* (pp. 920-1001). Edinburgh: Pentland.

46. Simpson, T. L. et al. (2007). PTSD symptoms, substance use, and vipassana meditation among incarcerated individuals. *Journal of Traumatic Stress, 20*(2), 239-249.

47. Singh, H. (2007). *A Critique of Vipassana Meditation as taught by Mr S N Goenka.* Retrieved on October 30, 2016, from http://harmanjit.Googlepages.com/vipassana_critique.pdf

48. Smithies, D. (2012). *Introspection and consciousness.* New York: Oxford University Press.

49. Solms, M., & Turnbell, O. (2002). *The Brain and the Inner World.* New York: Other Press.

50. Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science, 19*, 387-420.

51. Wallace, B. A. (2007). *Contemplative science: where Buddhism and neuroscience converge.* New York: Columbia University Press.

52. Welsh, C., & Willer, S. (2008). *Interesse für bedingtes Wissen. Wechselbeziehungen zwischen den Wissenskulturen.* München: Wilhelm Fink Verlag.