Philosophy and Brain: The World Brain Relationship as Non-Reductive Neuro-philosophy –Interview with Georg Northoff

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Xiangqun Chen: Hello, Professor Northoff. Thank you for bringing us a lively academic lecture. This is your second time to give lectures in the school of Humanities of Nanchang University. On behalf of the students of the school of Humanities of Nanchang University, I would like to thank you for your presence. In order to let scholars in China understand your concepts of neuro-philosophy more deeply, I'd like to make an interview with you here, it is mainly to discuss your views on brain, philosophy, neuroscience, consciousness and other topics. Is that ok?

Georg Northoff: Thank you so much for the kind invitation. I always appreciate speaking here for the good discussion and the high interest and openness among the students, always a pleasure.

Xiangqun Chen: As far as I know, Professor Northoff's research mainly involves neuroscience, philosophy and psychiatry, as you said in your homepage, you are a neuroscientist, a philosopher, and a psychiastrist. Why do you think the three disciplines are interrelated and can build a dialogue between each other?

Georg Northoff: Thank you for giving me the opportunity for this interview which I very much appreciate. When you look into the history of philosophy combining philosophy with science was rather the norm than the exception. Moreover, physics in the 20th century and nowadays strongly touches upon both ontological and epistemological issues. Only some parts in philosophy of the 20th century denting strongly into our time conceived a split between science and philosophy along the divide of the conceptual-logical vs the observational-empirical dimensions. I consider myself to stand on the shoulders of my predecessors in both the earlier philosophy and 20th century physics rather than on those of the 20th century dichotomy of philosophy vs science. What is currently lacking is a systematic and valid method for linking conceptual-logical and observational-empirical dimension and thus, more generally, philosophy and science. This is indeed one of my major aims. You can see such

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methodology, e.g., non-reductive, already developed in my earlier book "philosophy of brain" (2004) and more elaborated in my textbook "Minding the brain" (2014) (especially chapter 4). In short, I claim for a methodological strategy I designate as "concept-fact iterativity" as a continuous methodological and iterative movement between philosophical concepts and empirical data/facts. Historically, such concept-fact iterativity stands on the shoulders of Kant who argued that "concepts without intuitions are empty and intuitions without concepts are blind" – one can conceive my method of concept-fact iterativity as development towards a systematic relationship between concepts and facts/intuitions in methodological regard. And obviously, you can see that method applied in my various neurophilosophical writings especially in "Unlocking the brain" (Vol II, 2014) and "The spontaneous brain" (2018). Hence, to answer your question, I conceive a solid and valid method a first and indispensable, e.g., necessary step for a sound interdisciplinary dialogue something which our predecessors in philosophy and physics did more on an intuitive (and not always systematic) basis. And, even more, important and reaching beyond methodological issues, I conceive it almost a necessity to tackle the basic question in ontology, epistemology and ethics in the terms of such interdisciplinary methodology. Following the motto of Kant, our epistemological limitations will only yield to shortcomings and further limitations when we conceive these questions in only empirical or conceptual terms. My empirical background may thus serve, so I hope, to make me a better philosopher in the same way my philosophy, as I think, makes me a better neuroscientist.

Xiangqun Chen: So, in your opinion, the new concept of neuro-philosophy originates from the dialogue between neuroscience and philosophy, right? But we all know that neuroscience is about the research of facts, while philosophy is the about the research of concepts, why the two has relationship but seems opposite?

Georg Northoff: As said above, philosophy is about the conceptual realm while neuroscience is about the observational realm. Both cannot be conceived in isolation, though as Kant already pointed out. When I practice neuroscience, it is incredible how much conceptual issues arise. When we, for instance, discuss about experimental paradigm how to investigate the psychological and neuronal mechanisms of self, we immediately get into the conceptual realm: what is the self? What are the criteria that must be met to speak of a self? How do the current data on self stand in relation to the different historical philosophical determinations of self? And so forth…as said: intuitions without concepts are blind – we need conceptual guidance for our empirical research. Ask the physicists, they know only too well…and good science requires theory and conceptual work, otherwise it is ultimately not good science. And, hold your

breath, the same applies on the other side of the divide too. As said above, the exclusively conceptual characterization of philosophy is a relatively recent introduction, in 20th century western philosophy. Before philosophy and science were closely linked…conceptual and observational realms were not mutually exclusive but continuous – as said, concepts natural flow into observation and, conversely, observations naturally flow into concepts. Hence, there is a continuum, a conceptual-observational continuum – only the two ends are purely conceptual and purely observational, they are extremes of an otherwise hybrid conceptual-observational continuum and relationship. We can be located on that continuum either more towards the conceptual pole or the observational pole….

Xiangqun Chen: In your lecture today, you specifically mentioned the two concepts of neuro-philosophy, that is, reductive neuro-philosophy and non-reductive neuro-philosophy, what's the concept difference? And what's the different relationship in them regarding philosophy and neuroscience?

Georg Northoff: The concept of neurophilosophy can be understood in different ways. It can be understood in a reductive vs non-reductive way – that is a methodological characterization about the relation between concepts and facts. As it is clear from my concept-fact iterativity, I opt for a non-reductive approach. Then one can distinguish narrow vs wide neurophilosophy: this is about the view and model of the brain. Narrow neurophilosophy conceives the brain in a purely empirical way, in the same way, neuroscience conceives it. Wide neurophilosophy, in contrast, conceives the brain is not only an empirical but also ontological and epistemological context – this amounts to what I call "philosophy of brain" in my early book (2004). I agree that Churchland's reductive narrow neurophilosophy is a dead end; but that is something I already said 10-20 years ago, for that one does not require much philosophical insight.

Reductive neurophilosophy favors a reduction of philosophical, e.g., ontological and epistemological and ethical concepts to the empirical facts of the brain. This amounts to concept-fact reduction or even stronger concept-fact elimination. Conversely, concepts and facts may stand in a parallel relationship – concept-fact parallelism - as it espoused by Bennett and Hacker and major lines in current philosophy of mind. Non-reductive neurophilosophy opts against both concept-fact reduction and concept-fact parallelism by providing methodological tools for their systematic investigation in dependence and mutual constraint – this amounts to concept-fact iterative as a non-reductive methodological strategy.

So, standing on the shoulders of both the history of philosophy and neuroscience, wide non-reductive neurophilosophy has, as I would say, a rather bright future as it

allows to raise novel questions and problems like the world-brain problem replacing traditional ones like the mind-body problem. Again, developing and applying such wider non-reductive neurophilosophy, I am standing on the shoulders of my philosophical predecessors like Schopenhauer and Bergson who, being neurophilosophers 'avant le mot', conceived the brain in an epistemological and ontological context.

Xiangqun Chen: As you answered to the above question, the relationship between philosophy and neuroscience in reductive and non-reductive neuro-philosophy is different, then, are there any other relations between philosophy and neuroscience except that currently?

Georg Northoff: Yes, you can assume parallelism between the two disciplines. In that case, both philosophy and neuroscience are principally different without any interaction. Philosophy is then about the conceptual-logical realm while neuroscience is about the empirical-observational realm. They do then cover two logical spaces, the logical space of reason and the logical space of nature which both do not interfere nor interact. The dichotomy of logical spaces, that goes back to Wilfried Sellars and John McDowell, is then transferred to the dichotomy of philosophy and neuroscience. Such model of parallelism has been strongly suggested by Bennett and Hacker who claim that they stand on the shoulders of Wittgenstein. That, as I think, is a rather narrow understanding of Wittgenstein though. And it shall be noticed that both Sellars and McDowell tried to overcome such parallelism of the two logical spaces by linking them through a Kant'ian like transcendental approach, transcendental empiricism as McDowell says in his paper on Sellars (McDowell 1998).

Xiangqun Chen: In your book "spontaneous brain: from mind body problem to world brain problem", you proposed the concept of world brain relationship. What is the world brain relationship? Can we regard it as non-reductive neuro-philosophy?

Georg Northoff: Yes indeed, it is a book where I practice non-reductive neurophilosophy. The general line is that the encounter of neuroscience and philosophy with respect to brain and consciousness leads us to a new view of an old philosophical problem, the mind-body problem. Let me briefly elaborate the line of reasoning in that book. In that book, I do not intend to provide an answer to the mind-body problem. Instead, I aim to question and, even stronger, dissolve (rather than answering and solving) the mind-body problem by questioning its tacit presuppositions; this resembles the kind of methodological approach Kant designated as transcendental. One such

presupposition consists in the possible existence and reality of mind: only if one presupposes the mind, one can raise the question for its possible relationship to the body, the mind-body problem. If, in contrast, one no longer presupposes the mind, the question for its relationship to the body, the mind-body problem, becomes non-sensical as one cannot raise the question for a relation of something, e.g., the body, to something that remains impossible, e.g., the mind. Yet another usually tacit presupposition is that the mind exhibits necessary relationship to mental features like consciousness – that connection is necessary as the mind is supposed to account for the ontological substrate of mental features. This, by itself, presupposes distinction of mind and mental features: mental features are consciousness, self, etc. while the mind is their supposedly underlying ontological (or metaphysical) substrate. That distinction entails that something else other than the mind may provide the ontological substrate for mental features. Moreover, the distinction entails that the rejection of mind (as ontological substrate) does not entail the rejection of mental features – absence of mind is well compatible with the presence of mental features.

Based on various lines of empirical (chapter 1-8), ontological (chapter 9-12), and epistemological (chapter 12-14) evidence, I argue that the world-brain relation (taken in an ontological rather than empirical sense) is necessarily related or connected to mental features like consciousness and can therefore serve as their underlying ontological substrate. The world-brain relation can thus take over the ontological role the mind is traditionally supposed to play for mental features. Now, given the fact that the mind is the presupposition of the possible mind-body problem, replacing the mind in its role for mental features by world-brain relation entails that the mind-body problem becomes non-sensical and can thereby be dissolved – it simply becomes non-sensical and meaningless to even raise the question for the mind's relationship to the body as there is no mind anymore. One can then replace the mind-body problem by the world-brain problem as the more plausible (on ontological, conceptual, and empirical grounds) problem to address the question for the existence and reality, e.g., the ontological substrate of mental features. Accordingly, rather than providing an answer to the mind-body problem, I replace its presupposition of mind by the one of world-brain relation as the more plausible ontological substrate of mental features. One can then speak of a world-brain problem that, as I hope, provides a novel ontological framework for discussing mental features like consciousness (as I discuss in the 2018 book) and others like self and personal identity (on which I am currently working).

Xiangqun Chen: What is the model of spontaneous brain? And what is it different from active brain model and passive brain model? You said that philosopher Kant also has mentioned this concept, right?

Georg Northoff: Yes indeed that is the first chapter of the book. Though not explicitly mentioned there, it is strongly based on the history of philosophy – current models of brain in neuroscience stand on the shoulders of past models of mind in philosophy. Let me elaborate.

One of the main discoveries in neuroscience is that the brain exhibits an elaborate spontaneous activity, that is, neural activity that remains independent of external stimulation. This obviously provides empirical evidence against a purely stimulus-response based model of brain, a passive model of brain that could be compared to the concept of mind suggested by Locke and Hume and past times and behaviorism in more recent times. One may then want to complexify such model then by introducing cognitive functions. However, even that is still based on the traditional stimulus-response model with sandwiching of cognitive functions in between – hence, even that somewhat falls under the passive model of brain. Kant, answering to Hume, suggested that our mind displays an intrinsic spontaneity. That obviously plays well with the observation of an intrinsically spontaneous activity in the brain itself – hence, I speak of an active model of brain, a Kant'ian -like model of brain. However, empirical reality teaches us that that both external stimulus-related responses and spontaneous activity cannot be clearly separated from each other within the brain's neural activity – what is spontaneous? What is externally-induced? We do not really know and it remains impossible to separate the two. Instead, there are specific interactions between them – non-linear and dynamical which, by default or in a necessary way, makes it impossible to separate the two components of neural activity. Therefore, I speak of a spectrum model of brain – this is the empirically plausible answer for a model of brain to Hume's passive model and Kant's active model. You can thus see how past philosophical models of mind help us developing our present models of brain and, even more important, to test for empirical plausibility which led me develop the spectrum model of brain. That can be considered as answer to an old philosophical problem and dichotomy in western philosophy, the relationship of activity vs passitivity. Hence, old philosophical problems surface in disguise in neuroscience in our times…..in the western world we say "old wine in new bottles"…..

Xiangqun Chen: In world-brain relationship, you argue that the brain and the world are interconnected under the form of space and time, that is, spatiotemporal relationship between world and brain, why and how?

Georg Northoff: Yes, that is the project of my research if not of my life. In one sentence. My aim is to find out where and how subjectivity comes from in our world. Hence, I

conceive the mental features like self and consciousness to be paradigmatic instances of a more basic and broader sense of subjectivity. Given my ontological framing, it is then only natural to raise the question how processes and relations in the world relate to the brain, e.g., the world-brain relation, in such way that the brain's neuronal activity can transform into mental activity. What do I mean by world-brain relation and how is it related to mental features like consciousness? I propose that their relationship is ontological and, specifically, temporo-spatial with time and space constituting relation of world and brain in such way that consciousness becomes possible. The brain is spatiotemporally nested within the world just like the smaller Russian doll or the smaller Chinese crystal ball is nested within the next larger one and so forth. Nestedness is here thus understood in an ontological and spatiotemporal sense.

Taken in such sense of spatiotemporal nestedness, I conceive the world-brain relation as a necessary ontological (and empirical) condition of possible neuro-mental transformation. This may sound strange in your ears as the question for mental features and their neuronal basis is usually not framed in this way. Rather than asking for neuro-mental transformation, we usually asked for the neural correlates of mental features like in the neural correlates of consciousness (NCC). Methodologically, this presupposes directionality from mental to neuronal which I reverse as I prefer to methodologically start from the neuronal (and ultimately the neuro-ecological) and from there to proceed to the mental – only when presupposing the latter directionality one can raise the question for neuro-mental transformation whereas it is non-sensical in case one presupposes methodological directionality from mental to neuronal-like in the NCC. This may all sound even more strange. However, consider other disciplines like biology, physics, and chemistry. They focus on processes of transformation, that is, how state A transforms into state B. In order for such transformation from A to B possible, A and B must share some common features as without that A could not transition to and thus transform into B. This is what I call in a recent paper "Common currency" of neuronal and mental features as it must underlie their transformation, e.g., neuro-mental transformation. In my more optimistic moods, I would claim that the identification of the "common currency" of neuronal and mental features should provide one central piece in the puzzle of our search for the neuronal (and ontological) basis of mental features and, more generally, subjectivity.

Now the answer to your question. I hypothesize that temporo-spatial dynamics provides the "common currency" of neuronal and mental features: neuronal features show temporo-spatial dynamics which, as I postulate, is transformed into and manifest in the subjective experience of time and space in consciousness, e.g., "spatiotemporality' like William James' 'stream of consciousness' and Husserl's conception of 'inner time consciousness' with protention, presentation, and retention. To grasp and account for

such spatiotemporality on the mental level of consciousness and self (and other mental features), we require a first-person account. To link that first-person account of spatiotemporality to the brain's temporo-spatial dynamics, we require first-person neuroscience – the latter (and related conceptions as you indicate) is thus a methodological tool to investigate my hypothesis of temporo-spatial dynamics providing the "common currency" of neuronal and mental features. And, as I postulate, finding out and identifying the "common currency" will provide a consistent or, as I say, a plausible conception of consciousness in both ontological and empirical (and also epistemological) terms.

Xiangqun Chen: You mentioned "common currency" and "nestedness" in the above question, could you explain the two concepts in detail?

Georg Northoff: Imagine water. Water can be frozen, fluid and vaporous. How is that possible that one and the chemical substance, i.e., H_20 or water, can transform into such different states? The only for that to be possible is that they must share something, a "common currency", as I say. The same now applies to the relationship of neuronal and mental states. How is possible that neuronal states can transform into mental states? Why do we experience a particular phenomenal state or consciousness rather than perceiving the neuronal states by itself, that is, as such? I suggest that, analogous to the different states of water, the neuronal state transforms into a mental state. How is that possible? That is possible only on the basis of some shared feature, a "common currency". As in the case of water, i.e., H_20 such shared feature or "common currency" must allow transforming different states into each other. I now assume that what the chemical formula is for water, i.e., H_20, is spatiotemporal dynamics in the case of the neuro-mental transformation: water is present in both frozen and liquid states and, analogously, space-time dynamics is present in both neuronal and mental states. Hence, spatiotemporal dynamics provides the so far missing "common currency" of neuronal and mental/phenomenal states – this is the main claim in my 2018 book and a more empirical paper on explicitly the "common currency" (Physics in Life Review, northoff 2019).

What is nestedness? Look at the Russian dolls. The smaller doll is nested within the next larger one which, in turn, is again contained and nested within the next larger one and so forth. The different Russian dolls show differences in their spatial scales but similarity in their basic shape – the same holds for the beautiful crystal ball in the Chinese tradition. Analogously so with respect to different scales of time which also nest within each other – I therefore speak of spatiotemporal nestedness. Now, the same applies to the relationship of consciousness, brain, and world: consciousness may nest

within the brain as a smaller Russian doll within the next larger one which, in turn, nests within the world as the largest Russian doll. Hence, spatiotemporal nestedness is an ontological concept for me, one feature of a spatiotemporal ontology that describes existence and reality in the world in spatiotemporal terms. At the same time, one measure such nestedness empirically by the so-called scale-free activity. And indeed our and various others data lend strong support to the assumption that the brain's degree of scale-free activity, i.e., the spatial and temporal nestedness of its neuronal activity is directly related to consciousness.

Xiangqun Chen: As you argue, the spatiotemporal relationship between the world and the brain is the key to our consciousness. How about the situation in some unwell brains, such as depression, schizophrenia, mania patients, are their brain also interconnected with world in spatiotemporal relationship?

Georg Northoff: Let me briefly explain how the neuro-ecological approach conceives mental disorders. Mental disorders are world-brain disorders in both ontological and empirical regard. The brain shows abnormalities in these patients but, equally, one can see the strong dependence of the brain's neuronal function on the contextual changes, e.g., the environmental context as for instance in terms of life events and neuro-developmental changes. The same kind of world-dependence holds for the symptoms themselves. Psychiatric patients do not experience their symptoms in their head, they experience them as part of a wider world of which they and their symptoms are part. You can see that I here dwell on yet another historical line in philosophy, phenomenology, which provides an excellent account of the structure of our experience of ourselves, time and space, body, and most importantly, the world. Hence, we see the necessary dependence on the world in both brain and symptoms in psychiatric disorder – they are thus disorders of world-brain relation and, more succinct, neuro-ecological disorders (rather than neuronal or neuro-cognitive disorders). This is not only theoretically important but leads to novel research approaches and, even more important, novel ideas for therapeutic intervention which are currently testing.

Xiangqun Chen: You claim that world-brain relationship is temporo-spatial theory of consciousness (TTC), what's the difference from other forms of consciousness theory, such as Integrated Information Theory (IIT) and Global Neuronal Workspace Theory (GNWT)?

Georg Northoff: Note that I do not say that IIT or GNWT are wrong; both describe specific aspects of consciousness and their underlying neuronal correlates. However, I say that they miss something, a "missing ingredient" as Victor Lamme recently said. That "missing ingredient" consists in the temporo-spatial dynamics and how it shapes

the brain's distinct neuronal activities, i.e., spontaneous, pre-stimulus, and stimulus-induced activity. Why? Because I assume that the brain's temporo-spatial dynamics in its neuronal activity is manifest in consciousness, that is, 'temporality and spatiality' as the phenomenologists say – temporo-spatial dynamics thus provides the "common currency" of neuronal and mental activity.

Therefore, I assume that the TTC, the temporo-spatial theory of consciousness, provides a larger and more comprehensive view on consciousness than IIT and GNWT that are more limited. If I am right, the temporo-spatial dynamical measures of the TTC should predict the ones of IIT and GNWT; we are currently resting exactly that and the preliminary results are extremely promising.

Xiangqun Chen: We all know that consciousness is one of the main topics in philosophy of mind, and the world brain relationship as a theory of neuro-philosophy explains the consciousness from the perspective of spatiotemporal relationship between brain and world. What is the relationship between philosophy of mind and neuro-philosophy?

Georg Northoff: For me, philosophy of mind is about the conceptual, ontological, metaphysical, and epistemological investigation of the mind. Philosophy of mind in this sense can be complemented by wide non-reductive neurophilosophy – this, as I claim in my 2018 book, can lead to the replacement of the mind-body problem by the world-brain problem. Taking my proposal seriously, one would then ultimately replace philosophy of mind by what I describe as 'philosophy of brain' in an earlier book of mine (2004). Philosophy of brain would then conceive the brain in conceptual, ontological, and epistemological regard which can then be linked to the empirical data through non-reductive neurophilosophy and its specifically inter-disciplinary methodological strategies.

Philosophy of cognitive science is for me like the application of philosophy of science to cognitive science. As such philosophy of cognitive science concerns, among other issues, the models of mind and cognition presupposed in cognitive science. I would say that we desperately need a proper philosophy of neuroscience (as a branch of philosophy of science) that, for instance, discusses the sometimes rather naïve models of the brain we most often tacitly presuppose in both neuroscience and philosophy of mind.

Xiangqun Chen: As we all know, cognitive science also emphasizes the interaction of body, brain and external environment, such as embodied cognition, embedded cognition, enactive cognition, extended cognition, etc., can we say that the spatiotemporal interpretation of consciousness by the world brain relationship is the same as these

theories?

Georg Northoff: Indeed, I suggest, that consciousness is not in the head but it is a relational feature between the brain and the world. This immediately brings to mind associations with the context of 4E cognition (embodied, embedded, enactive, extended). How then does my position stand in relation to this current? The answer to this question leads me to yet two further tacit assumptions we usually presuppose in our account of mind. Descartes postulated the existence and reality of mind as distinguished from the world we live in and observe. The concept of mind is thus necessarily isolated from the world as otherwise, he could have no longer distinguished mind and world. Since mental features like consciousness are assumed to be necessarily dependent upon the mind, they inherit the isolation from the world of the concept of mind. To account for the relation of mind to the world on the basis of the assumption of such world-isolated mind, one can then pursue different strategies. One such strategy is suggested by John McDowell who conceive the mind's conceptual capacities and rationality as "second nature of man" and integrates it in what one can describe as "conceptually-extended logical space of nature". Yet another strategy to account for the relation of mind and world are the 4E's you mention. Now the primarily world-isolated mind is related to body and world. While this is a very laudable attempt, it nevertheless cannot overcome its primary birth-defect, as I say, the necessity of the isolation of mind from the world by means of which the mind is defined. Put simply. One first excludes the world from the mind (when defining it) and then tries to bring back world into mind. However, as we all know, that what is excluded once on a necessary basis, e.g., the world in the definition of mind, cannot be brought in through the backdoor as that cannot remedy the initial birth deficit. In other words, we need something more radical than the 4E's to overcome the birth deficit in our definition of mind, that is, the necessary exclusion of the world. Importantly, when I speak of world, I do not mean the world of our higher-order cognition as in rational conceptions or the world of consciousness as in phenomenological approaches. I mean the world as it is by itself independent of our rationality, consciousness, or otherwise, that is, in a mind-independent way. Recruiting Kant, Husserl, and others, one may now be inclined to argue that such mind-independent concept of world may remain impossible; the only way, we can approach and conceive the world is in relation to us. That is the moment where the brain comes in: our brain aligns us to the world by means of which we become part of the world – this amounts to what I describe as world-brain relation (as distinguished from brain-world relation where the brain imposes itself upon the world (rather than aligning and adapting itself to the world).

Together with my repudiation of the first two presuppositions (see above), I argue that the world-brain relation, framed in an ontological sense, can overcome the birth

deficit of the exclusion of world in our definition of mental features. To fully understand my point, one need to conceive yet another a fourth tacit presupposition in our account of mind. We usually presuppose properties like mental or physical properties as the basic units of existence and reality – this amounts to what I describe as "element-based ontology" (Northoff 2018). The concept of mind is based very much on such element-based ontology as it is accounted for by substance (Descartes) or properties (nowadays). However, this is to neglect alternative forms of ontology that have been more developed on the side-lines than the mainstream of philosophy. Such alternative ontologies emphasize the priority of a process, relation, and transformation over elements and properties – these lines of ontology can be traced to Cassirer, Whitehead, Bergson, and nowadays structural realism. I presuppose such relation-based ontology, that is, structural realism, in my account of the world-brain relation – it is the relation of world and brain as an integration or alignment of a part, e.g., the brain, to the whole, e.g., the world, that constitutes and provides the necessary ontological condition of possible mental features like consciousness. Hence, I conceive mental features ontologically to be relation- rather than property-based as they can be traced to the world-brain relation. This, as I hope, makes it clear that I am much more radical than the 4E's; mental features are necessarily and thereby intrinsically relational and thereby neuro-ecological.

Xiangqun Chen: In the last chapter of "spontaneous brain: from mind-body problem to world-brain problem", you proposed that we should replace mind-body problem by world-brain problem as part of truly post-copernican approach to the mind. Why?

Georg Northoff: Correct. In the pre-copernican geo-centric view, we took a viewpoint or vantage point from within earth which let us assume that the earth is the center of the world around which the world revolves. That changed once Copernicus took a vantage point form beyond earth, as I say. This allowed him to take into view that the earth may be just one planet among others in the universe rather than being its centre; that made then also possible to assume that the sun rather than the earth is the centre of the universe around which the earth revolves. This resulted in a heliocentric view of the world which as confirmed by subsequent discoveries by Kepler, Gallileo and Newton (see Northoff 2019, Frontiers).

Same here. I presuppose a vantage point from beyond brain that replaces the current vantage point from within brain. The currently rather neuro-centric view of brain, consciousness, and even the world is then replaced by a neuro-ecological view where the brain is part of the wider world: rather than the world adapting the brain, we can now take into view how the brain is part of the wider world and must actively align to it or participate in its ongoing space-time dynamics. For instance, when we listen to

music, we most often unconsciously tap our feet or finger in the rhythm of the music – our brain thus aligns us to the ongoing rhythm of the world in a temporal (and spatial way. I therefore speak of temporo-spatial alignment. Such temporo-spatial alignment is, as I show in my 2018 book, central for consciousness and mental features in general. This replaces the current neuro-centric view of brain and consciousness by a neuro-ecological view. Consciousness and other mental features can the be traced to the world-brain relation as their underlying necessary condition, their ontological predisposition, as I say. The question for the relation of mind and body is then transformed into the question of the relationship of world and brain, the world-brain problem.

That, as I claim, can only be taken into view when presupposing a post-copernican vantage point from beyond brain. And as I show in my 2018 book, such post-copernican view leads us to and allows us taking into view novel philosophical problem as we can then replace the mind-body problem by the world-brain problem. I currently work on analogous pre-post-copernican shifts in our concepts of self and personal identity.

Xiangqun Chen: Also in the book, you mentioned that the world-brain problem replacing the mind body problem is meaningful in neuro-philosophy. Just as heliocentrism replacing the geocentrism in astronomy, it will lead to a Copernican Revolution in the field of neuro-philosophy, right?

Yes, as said above, we can then replace the current neuro-centrism in our view of brain and mind by an eco-centric view of mental features as being traced to and based on the world-brain relation as their underlying necessary non-sufficient ontological condition, i.e., ontological predisposition of consciousness (OPC), as I say. That can be complemented on the empirical, i.e., neural side, by the neural predispositions of consciousness (NPC), the necessary non-sufficient neural conditions of possible consciousness. The NPC are highly relevant in the clinical realm as we lose them in states where we cannot wake up anymore as in coma or surgical anesthesia (without relieve form the drug we cannot wake up here). Without shifting our vantage point from within brain to a vantage point from beyond brain, we would not have been able to take into view the eco-centric model of brain and consciousness but would have remained within the current neuro-centric models. That, as I claim, carries major reverberations also for other philosophical concepts like self and personal identity which then also need to be conceived in an ecological or better neuro-ecological way. Hence, non-reductive neurophilosphy, employing a post- rather than pre-copernican vantage point can here pave the way also for a novel view on traditional philosophical problems like mind-body problem, self, personal identity, etc.

Xiangqun Chen: If it is a Copernican Revolution in neuro-philosophy that the world brain problem replaces the mind body problem, can we also understand it from the paradigm concept that Thomas Kuhn proposed in his book “the structure of the scientific revolution”? That is to say, the replacement of mind body problem by world brain problem is a shift from one paradigm to another. If so, how should we view the relationship between neuroscience and philosophy of science?

Georg Northoff: Yes, indeed, I would speak of a paradigm shift. We can then also take into view the continuum between neuroscience and philosophy of science. Let me elaborate. Briefly put, philosophy of science is about the models and theories implied in the practice of science. That also includes reflection about the methodological strategies and their validity. The Copernican revolution and its shift in vantage point is exactly that, a comparison of two different vantage points as methodological strategies which carry different epistemological implications. Hence, if you want to make the distinction, the discussion of the Copernican revolution as methodological strategy is part of philosophy of science while it is practiced and implicitly presupposed in neuroscience. Importantly, the two different vantage points lead to different kinds of experimental paradigms and research strategies in neuroscience in more or the same way Copernicus’ mathematical formalization made possible the empirical paradigms and discoveries of Gallileo, Kepler, and Newton.

Xiangqun Chen: We have noticed that you also mentioned Zhuangzi and Leibniz's views on time in today's lecture. What do they have to do with the time in the world brain relationship?

Georg Northoff: As you figured, time is of essence for me. The notion of time can be understood in different ways. Neuroscientists most often understand it as perception and cognition of events at specific points in time and space. However, one can also understand time in terms of construction of time. Such more construction-based view of time is suggested by Leibniz and also by the old Daoist philosopher Zhuangzi. Here, the world is featured by the continuous construction of time, the passage of time or temporality. Imagine a river. There is continuous flow of water and that very same flow of water constructs or is time by itself, time here is intrinsically dynamic, dynamic time. Such dynamic time is continuously constructed within the world and also within the brain itself; however, the range of such dynamic time is obviously much larger and more extended in the world than the brain – brain-based time is thus nested within world-based time. In our paper on time in Leibniz and Zhuangzi (Philosophy east and

west 2019), we compare their notions of time and distinguish different levels of time – a beautiful convergence between eastern and western notions of time whereby Zhuangzi can provide a missing link in Leibniz.

Note that such dynamic view of time in terms of temporality has long been suggested in phenomenology. Husserl elaborated the structure of inner time consciousness (protention, presentation, retention) in amazing detail and Heidegger described existential time and how the time of our self is linked to the time of the world. These are rich sources. I aim to link such model of dynamic time on the phenomenological level of consciousness (Husserl: consciousness-based time) and the existential level of Dasein (Heidegger: existence-based time) to the neuronal (brain-based time) and ultimately ontological (world-based time) levels. Dynamic time in such thus provides the glue between ontological, neuronal, existential, and phenomenological levels….the world-brain relationship is thus shaped by dynamic time and, specifically, how the different levels of time on world, brain, consciousness etc. are related to each other - that is why I am interested in Zhuangzi and Leibniz…..and phenomenology which was my original starting point in philosophy but, as I see it now, needs to be converged with an ontology of the world that, unlike in Heidegger and Sartre, is not based on consciousness or existence as it must remain mind-independent, that is, independent of our specific ways of investigating the world and its existence and reality, i.e., ontology.

Xiangqun Chen: Thank you Professor Northorff. Through your answers, we have a better understanding of the significance of the interdisciplinary study of brain and philosophy to the problem of consciousness. We hope that under the non-reductive neuro-philosophy represented by the world brain relationship, the mystery of human consciousness will be solved eventually.