

WHAT IS NEUROPHILOSOPHY? A METHODOLOGICAL ACCOUNT

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'There is no impassable gulf between those cognitive scientists who are philosophers and those who belong in the other disciplines, and there is no sharp line between the issues proper to the respective areas. A good deal of important philosophical work is done by scientists who are temporarily taking on one or more of the roles described above. Indeed, the best philosophy of cognitive science will be standardly be done by those whose thinking is thoroughly grounded by familiarity with empirical work, just as the best empirical research will be that which is informed and shaped by philosophical perspective and rigor' (van Gelder 1998, 134).

SUMMARY. The term "neurophilosophy" is often used either implicitly or explicitly for characterizing the investigation of philosophical theories in relation to neuroscientific hypotheses. The exact methodological principles and systematic rules for a linkage between philosophical theories and neuroscientific hypothesis, however, remain to be clarified. The present contribution focuses on these principles, as well as on the relation between ontology and epistemology and the characterization of hypothesis in neurophilosophy. Principles of transdisciplinary methodology include the 'principle of asymmetry', the 'principle of bi-directionality' and the 'principle of transdisciplinary circularity'. The 'principle of asymmetry' points to an asymmetric relationship between logical and natural conditions. The 'principle of bi-directionality' claims for the necessity of bi-directional linkage between natural and logical conditions. The 'principle of transdisciplinary circularity' describes systematic rules for mutual comparison and cross-conditional exchange between philosophical theory and neuroscientific hypotheses. The relation between ontology and epistemology no longer is determined by ontological presuppositions i.e. "ontological primacy". Instead, there is correspondence between different 'epistemological capacities' and different kinds of ontology which consecutively results in "epistemic primacy" and "ontological pluralism". The present contribution concludes by rejecting some so-called 'standard-arguments' including the 'argument of circularity', the 'argument of categorical fallacy', the 'argument of validity' and the 'argument of necessity'.

Key words: epistemology, neurophilosophy, neurophilosophical hypothesis, ontology, principles, standard-arguments



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1. INTRODUCTION: DEFINITION OF “NEUROPHILOSOPHY”

The term “neurophilosophy” is often used either implicitly or explicitly for the characterization of an investigation of philosophical theories in relation to neuroscientific hypothesis.

According to Breidbach, “neurophilosophy” has already been implicitly practiced at the turn of last century by, for example W.Wundt (Breidbach 1997, 393–4). Yet, it was P. Churchland who explicitly introduced the term “neurophilosophy” (Churchland 1986). Since then it has often been used almost inflationary without delineating a specific thematic field and developing a specific methodology (see Northoff 1997, 2000, 2001a,b).

One may distinguish the following approaches to neurophilosophy (see Northoff, 2001b): “Phenomenal or Cognitive Neurophilosophy” focuses predominantly on anthropological phenomena, such as free will (Walter, 1998), personal identity (Northoff, 2001a), subjectivity (Metzinger, 1993), action (Hurely, 1998, Northoff, 1997, 1999), phantom sensations (Heinzel, 1999), etc. Descriptions of these phenomena are linked with both philosophical theories and a scientific description of their possible potentially underlying neuronal and cognitive mechanisms.

“Empirical Neurophilosophy” focuses on ‘empirical consistency’ and ‘empirical falsification’ of philosophical theories. For example, criteria for personal identity, as discussed in philosophy, can be transformed into a self-rating scale for empirical assessment of personal identity before and after brain surgery (see Northoff, 1996, 2001a). Phenomenal and epistemic characteristics of the First-Person Perspective may also be translated into an activation paradigm used in functional imaging of the brain (Northoff, 2003a, b; Northoff *et al.*, 2003). This may ultimately result in the investigation of the neural mechanisms underlying philosophical concepts.

In the recent literature the term ‘neurophilosophy’ “concerns the application of neuroscientific concepts to traditional philosophical questions” (Bickle and Mandik, 2001, 1). Since “neurophilosophy” in this sense aims at revealing the neural correlates of originally philosophical terms (like, for example, free will, personal identity, consciousness, etc.), one may also speak of a “neuroscience of philosophy”. Both “Phenomenal or Cognitive Neurophilosophy” and “Empirical Neurophilosophy” may be considered as crucial parts of such a “neuroscience of philosophy”. Rather than being mutually exclusive, both must be considered as complementary and should therefore be elaborated in conjunction.

“Theoretical Neurophilosophy” focuses predominantly on the development of a definition and methodological principles and strategies for linkage between philosophical theory and neuroscientific hypothesis. These methodological principles may differ from the ones that are presupposed in philosophy and neuroscience respectively as well as from the ones that are applied in the linkage of philosophical concepts with concepts from other sciences (like, for example, physics or chemistry).

“Theoretical Neurophilosophy” is closely related to the “philosophy of neuroscience” as it is reflected in the recent literature (see Bechtel *et al.*, 2001; Bickle and Mandik, 2001): Like philosophy of psychology and philosophy of physics, the “philosophy of neuroscience” represents an “attempt to address foundational issues in neuroscience” (see Bechtel *et al.*, 2001, 7). For example, the question of the sort of explanation in neuroscience is raised, like whether neuroscientific explanation are in accordance with the deductive-nomological model as suggested by Hempel. Moreover, other questions like the ones for induction, causality, etc. in neuroscience in particular are investigated. Another central question concerns the problem of ‘naturalization’. Can neuroscience apply the same strategies for ‘naturalization’ of philosophical terms as other disciplines (like, for example, physics and chemistry)? Are the general methodological principles for ‘naturalization’ valid in neuroscience too or is there a need to develop special strategies for neuroscience in particular?

The latter issues do not only concern philosophical problems in neuroscience but in “neurophilosophy” itself. One may therefore speak not only of a “philosophy of neuroscience” but, in addition, of a “philosophy of neurophilosophy”. “Theoretical Neurophilosophy”, as defined in the above mentioned sense, includes both “philosophy of neuroscience” and “philosophy of neurophilosophy”.

While numerous investigations these days may qualify as “Phenomenal and Cognitive Neurophilosophy” or “Empirical Neurophilosophy,” an exact definition and description of the methodological principles and strategies in neurophilosophy are still lacking. In the following an attempt is made to investigate the specific aspects of neurophilosophical methodology, which distinguishes neurophilosophy from both philosophy and neuroscience. Various principles of transdisciplinary methodology for the linkage between philosophical theories and neuroscientific hypothesis are suggested. The arguments and the principles themselves are cast on a general level that they may be regarded as methodological strategies for linkage of philosophical theories with scientific hypothesis in general rather than with neuroscientific hypothesis in particular.

One crucial distinctive feature in the linkage of philosophical theories with neuroscientific hypothesis in particular, as opposed to scientific hypothesis in general, may concern the issue of ‘self-referentiality’. For example, neurophilosophy links philosophical theories about the mind with neuroscientific hypothesis about the brain. While, depending on the respective epistemic-ontological presuppositions, the mind or the brain is at least a necessary condition by itself for the epistemic possibility of this linkage. The epistemic possibility of the linkage itself thus depends on one of the relata of the linkage. While this is not the case in the linkage of philosophical theories with scientific hypothesis in general.

The linkage between philosophical theories and neuroscientific hypothesis in particular does therefore require special principles for transdisciplinary methodology in order to avoid ‘logical circularity’ (see below). Since this is the case in our principles, as developed in the following, they may be regarded as specific for the linkage between philosophical theories and neuroscientific hypothesis in particular.

The present arguments and principles prepare the ground for application in ‘neurophilosophy’. While the question of their specificity for

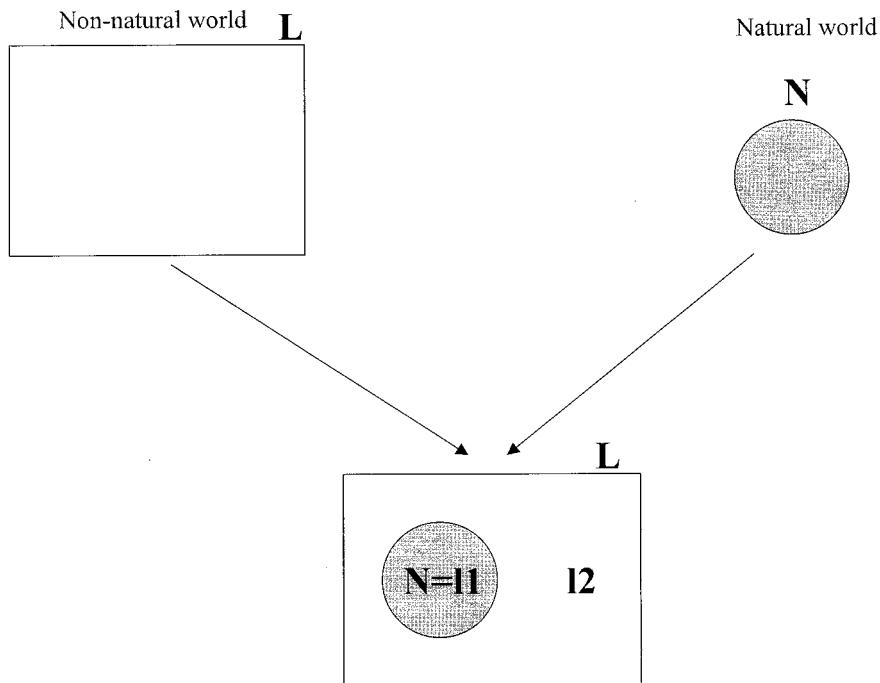


Figure 1a. Logical (L , l_1 , l_2) and natural (N) conditions.

the linkage of philosophical theories with neuroscientific hypothesis in particular remains open which should be discussed separately. As such, this contribution may be conceived as a preliminary stage in the development of a “philosophy of neurophilosophy” as part of a “Theoretical Neurophilosophy”.

I discuss various principles of transdisciplinary methodology. The term ‘transdisciplinary’ shall indicate the systematic linkage between philosophical theory and neuroscientific hypothesis in orientation on well-defined methodological principles. Since these principles, as described in the first part, allow for ‘cross-disciplinary’ i.e. ‘transdisciplinary’ exchange, interaction and linkage, they must be distinguished from mere synthesis and addition between philosophical theory and neuroscientific hypothesis as described by the term ‘interdisciplinary’. The second part investigates the relation between ontology and epistemology in neurophilosophy. I emphasize the distinct character of neurophilosophy from philosophy. The third part focuses on characterization of ‘neurophilosophical hypothesis’ pointing out their definition, range of experiments necessary for falsification and possible kinds of judgements. The fourth and final part illustrates some ‘standard arguments’ against the possibility of neurophilosophy as a distinguished methodological approach. These arguments are rejected on the basis of the above demonstrated neurophilosophical methodology.

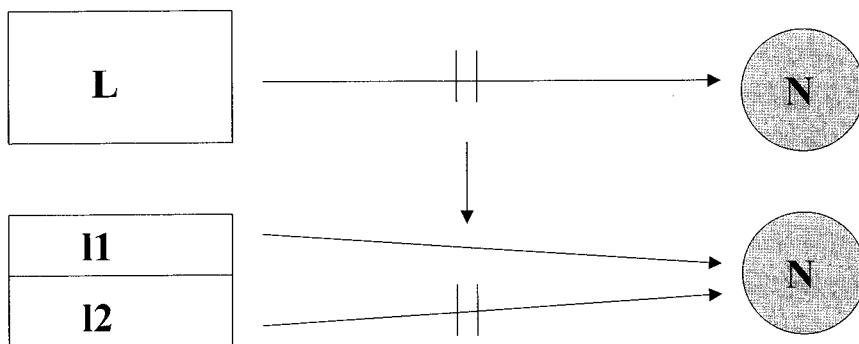


Figure 1b. “Conditional fallacy” from logical (L, l1, l2) to natural (N) conditions.

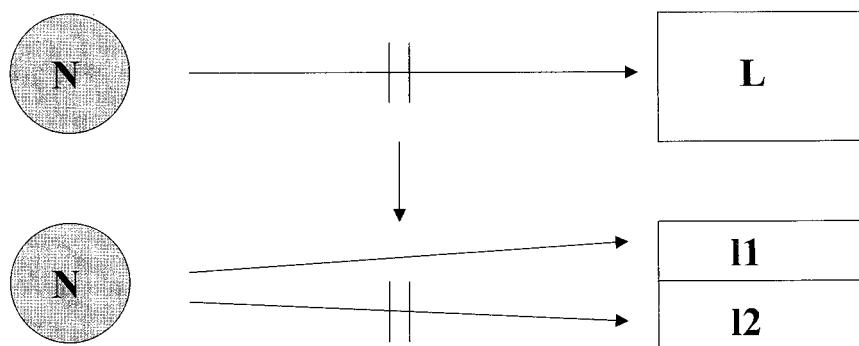


Figure 1c. “Conditional fallacy” from natural (N) to logical conditions (L, l1, l2).

2. PRINCIPLES OF TRANSDISCIPLINARY METHODOLOGY

2.1. *Principle of Asymmetry*

„Transdisciplinary methodology“ in neurophilosophy links logical and natural conditions of which the relation can be characterized by the “principle of asymmetry” (see Figure 1a).

Due to the asymmetric nature in the relationship between logical and natural conditions, any attempts in eliminating the former in favour of the latter must necessarily fail. Such attempts of elimination are described by McCauley (2001, 439–441), who in turn relies on the theories by the Churchlands (see Churchland and Churchland 2001), as “co-evolution s” with “little intertheoretic mapping”. In our case, this implies the consecutive and complete elimination of the logical conditions and thus of any kind of philosophical theory in favour of natural conditions and neuroscientific hypotheses. However, such an elimination would only be possible in the case of a symmetric relationship between logical and natural conditions – since this is not the case, elimination in this radical sense remains a priori impossible. Logical conditions refer to all possible i.e. logically conceivable worlds. They include both natural and non-natural worlds with only the former underlying our physical

and biological laws. Natural conditions, in contrast, refer only to the natural world and thus to the respective physical and biological laws. Since logical conditions comprise both natural and non-natural worlds, they necessarily include natural conditions (Chalmers 1998). Natural conditions, which reflect the natural world exclusively, do not include logical conditions. The relation between natural and logical conditions can thus be characterized by “asymmetry” the latter including the former while the former exclude the latter (see Figure 1).

This “principle of asymmetry” has the following implications with respect to inference between natural and logical conditions.

First, direct inference from logical to natural conditions remains impossible. Since logical conditions include a wider range of conditions than natural conditions, direct inference from the former to the latter may confuse non-natural i.e. logically conceivable worlds with the natural i.e. actual world.

Second, direct inference from natural to logical conditions remains impossible as well. Since natural conditions include a smaller range of conditions than logical conditions, direct inference from the former to the latter may falsely equate non-natural worlds with the natural world.

The “principle of asymmetry” is reflected in the following formulas (P = premise, C = conclusion, L = Logical conditions, l1 and l2 = different subsets of logical conditions, N = Natural conditions).

- | | |
|----|-------------|
| P1 | L = l1 + l2 |
| P2 | l1 = /l2 |
| P3 | l1 = N |
| C1 | l2 = /N |
| C2 | L = /N |

Ignoring the principle of asymmetry will lead to a “conditional fallacy” (see Figure 1b, c). “Conditional fallacy” refers to inferences between logical and natural conditions that, due to their inclusion of different though overlapping conditions, are not allowed. As such “conditional fallacies” may lead to false assumptions about the relationship between natural and non-natural worlds.

For example, the mind-brain problem has been regarded as a philosophical problem, which as such presupposes logical conditions (see also Praetorius 2000, XVII for giving another example i.e. with respect to intentionality). Recent advances in neuroscience, however, have promoted efforts to solve this problem from a neuroscientific point of view, which presupposes natural conditions. Subsequently, it is often claimed that the mind-brain problem can be solved completely by neuroscience and thus by consideration of natural conditions (see, for example, Churchland, 1986).

However, this claim may be considered as an instance of a “conditional fallacy” which confuses natural and logical conditions. The mind-brain problem refers to logical condi-

tions including both natural and non-natural worlds. In contrast, neuroscience refers to natural conditions including the natural world only. Direct application of and inference from empirical findings in neuroscience to the mind-brain problem may thus falsely equate non-natural worlds with the natural world. This, however, may lead to false conclusions since non-natural worlds include a wider range of conditions than the natural world. The neuroscientist therefore commits a “conditional fallacy” when he directly applies and infers from his empirical findings to the mind-brain problem.

Conversely, solutions of the mind-brain problem, as suggested in philosophical discussions, may not necessarily apply to our actual brain and mind, as investigated in neuroscience. Logical conditions may not necessarily “match” with natural conditions. Direct inference from philosophical mind-brain solutions to our actual brain (and mind) remains therefore impossible as well since it leads to confusion between non-natural and natural worlds. The philosopher remains subsequently trapped in a “conditional fallacy” when he directly applies his mind-brain solutions to our actual brain (and mind).

In addition to their asymmetry, overlap between natural and logical conditions should be considered as well (see Figure 1). Logical conditions refer to both natural and non-natural worlds and include therefore the natural world to which natural conditions refer. There is subsequently an overlap between natural and logical conditions with respect to the natural world. Accordingly, criteria for the distinction between different kinds of logical conditions and their subsequent linkage with natural conditions are needed. The transdisciplinary methodology, which characterizes neurophilosophy, can thus be located on the border between natural and logical conditions. As such it allows for both differentiation and linkage between natural and logical conditions and thus between neuroscientific hypothesis and philosophical theory.

For example, logical conditions, as presupposed in philosophical mind-brain solutions, may indeed apply to the actual brain (and mind) which reflects natural conditions. This, however, remains true only if the logical conditions, to which the philosopher refers to, are identical to natural conditions (see Figure 1a) – the possibility of a “conditional fallacy” is excluded. If, however, the logical conditions are not identical to the natural conditions, the possibility of a “conditional fallacy” is given.

2.2. *Principle of Bidirectionality*

The “principle of bi-directionality” consists in the necessity of bi-directional linkage between philosophical theories and neuroscientific hypotheses and thus between logical and natural conditions.

Due to the bi-directional nature in the relationship between logical and natural conditions, any attempts in reducing philosophical theories to neuroscientific hypotheses remains impossible. Such attempts of reduction are described by McCauley (2001, 439–441), who in turn relies on the theories by the Churchlands (see Churchland and Churchland 2001), as “co-evolution m” with “extensive intertheoretic mapping”. He is certainly right that, due to the overlap between natural and logical conditions, “intertheoretic mapping” between philosophical theories and neuroscientific hypotheses is possible. However, in contrast to

his claim, the “intertheoretic mapping” must necessarily remain incomplete since there is no complete overlap between logical conditions i.e. the philosophical theories and the natural conditions i.e. the neuroscientific hypotheses. A complete “intertheoretic mapping” in the sense of McCauley would thus be possible only in the case of a unidirectional relationship between logical and natural conditions – since this is not the case complete reduction remains a priori impossible.

On one hand, philosophical theories can be linked with a neuroscientific hypothesis which allows for investigation of ‘empirical consistency’ (see below) of the former.

If the respective philosophical theory remains ‘empirically consistent’, one may assume that it reflects those logical conditions, which are identical (i.e. l1) to natural conditions.

If the respective philosophical theory is revealed as ‘empirically inconsistent’, one may assume that it reflects those logical conditions, which are non-identical (i.e. l2) to natural conditions. In this case, one may either accept a gap between philosophical theory and neuroscientific hypothesis with consecutive impossibility of development of neurophilosophical hypothesis or one may modify the philosophical theory in orientation on the respective neuroscientific hypothesis which implies ‘definitorial shifting’ and ‘conceptual re-clarification’ (see below).

On the other hand, a neuroscientific hypothesis can be linked with a philosophical theory which allows for investigation of ‘logical consistency’ (see below) of the former.

A neuroscientific hypothesis may be investigated in regards to its respective ontological and epistemic presuppositions i.e. its ‘net implications’ (Quine, 1969, 80–2). As such natural conditions may be linked with logical conditions by revealing those that are identical (i.e. l1) to natural conditions. Moreover, one may vary these natural/logical conditions by imaginative variation (see 1.4.4. for definition and chapter 2 for application) in order to elucidate those logical conditions, which are non-identical (i.e. l2) with natural conditions.

As a result, the “principle of bidirectionality” can be considered a mutual comparison between philosophical theory and neuroscientific hypothesis with respect to their respective conditions i.e. logical and natural conditions. The general framework for the possibility of comparison between philosophical theory and neuroscientific hypothesis can be provided.

Within this general framework, one (philosophical theory or neuroscientific hypothesis) of them provides the “background theory” as the “reference system”/“coordinate system” (Quine, 1969, 48–50) for the respective other. Within this general framework, the “principle of transdisciplinary methodology”, as described in the following, can be applied.

2.3. Principle of Transdisciplinary Circularity

The “principle of transdisciplinary circularity” describes systematic processes of oscillation and circulation between philosophical theory and neuroscientific hypothesis (see also Figure 2a) with the consecutive development of a neurophilosophical hypothesis (see below for exact definition).

Philosophical theory *Neuroscientific hypothesis*

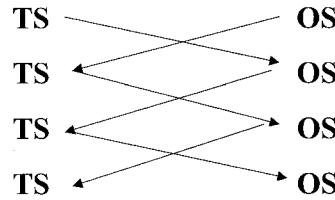


Figure 2a. ‘Disciplined circularity’ between philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences).

Philosophical theory *Neuroscientific hypothesis*

TS 1	OS 1
TS 2	OS 2
TS 3	OS 3
TS 4	OS 4

Figure 2b. Characterization of philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences).

The need for the development of the “principle of transdisciplinary circularity” stems from the failure of both elimination and reduction of logical conditions i.e. philosophical theories in favour of natural conditions i.e. neuroscientific hypotheses (see below). Since neither elimination nor reduction remains possible both have to be considered. This amounts close to what McCauley (2001, 439–441), who in turn relies on the theories by the Churchlands (see Churchland and Churchland, 2001), calls “co-evolution p” where the primacy of the natural conditions i.e. the neuroscientific hypotheses is weakened in the interests of “epistemic pluralism”. If, however, both logical and natural conditions have to be considered in a pluralistic way, the question for their relationship i.e. the “intertheoretic and intratheoretic relations” arises. It is at this point where the “principle of transdisciplinary circularity” claims to provide a systematic methodological strategy for the linkage between logical

Philosophical theory *Neuroscientific hypothesis*

TS 1 → OS	OS 1 → TS
TS 2 → OS	OS 2 → TS
TS 3 → OS	OS 3 → TS
TS 4 → OS	OS 4 → TS

Figure 2c. ‘Empirical implication’ in philosophical theory (TS – theoretical sentences) and ‘theoretical explication’ in neuroscientific hypothesis (OS = observation sentences).

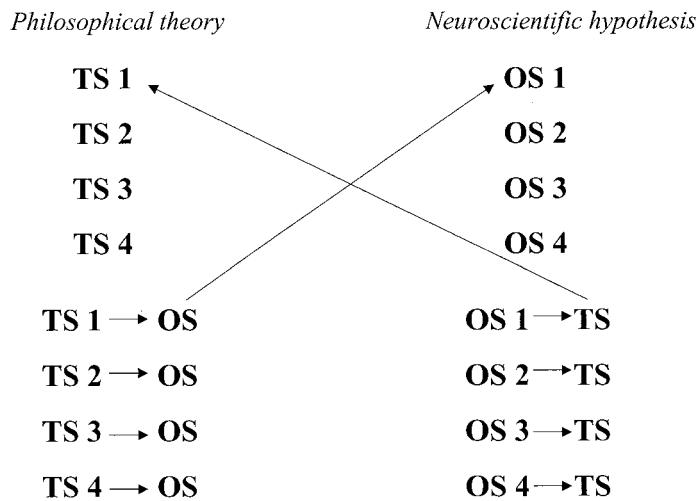


Figure 2d. Investigation of ‘empirical consistency’ in philosophical theory (TS = theoretical sentences) and ‘logical consistency’ in neuroscientific gypothesis (OS = observation sentences).

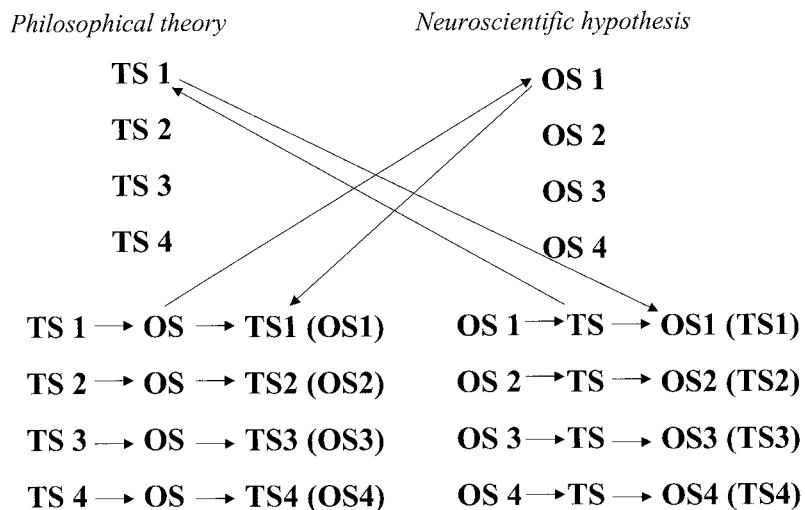


Figure 2e. ‘Analogization’ and ‘homogenization’ between philosophical theory (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences).

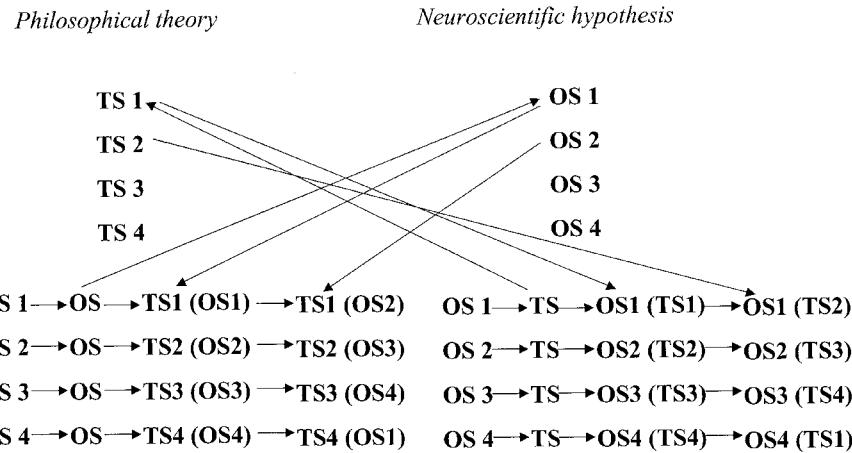


Figure 2f. ‘Inverse illustration’ and ‘cross-disciplinary comparison’ between philosophical theor (TS = theoretical sentences) and neuroscientific hypothesis (OS = observation sentences).

conditions i.e. philosophical theories in favour of natural conditions i.e. neuroscientific hypotheses (see however Churchland and Churchland, 2001).

Due to methodological differences with respect to natural and logical conditions, direct comparison and linkage between philosophical theory and neuroscientific hypothesis remains impossible. Instead, methods for indirect comparison and linkage, which are reflected in the processes of oscillation or circulation, have to be developed. Since these processes follow certain systematic and predefined methodological steps, one may speak of a “disciplined circularity” (Varela 1998, 342).

One may consider this “disciplined circularity” between philosophical theories and neuroscientific hypotheses as a linkage between “theoretical sentences” and “observation sentences”. “Theoretical sentences” refer to logical conditions and are thus independent from the actual world (see Figure 2b). They reflect ontological and epistemological assumptions which are discussed explicitly in philosophical theory. “Observation sentences”, in contrast, refer to natural conditions and empirical observations within the actual world: “... an observation sentence is one on which all speakers of the language give the same verdict when given the same concurrent stimulation” (Quine, 1969, 86–7).

First, ‘explications’ and ‘implications’ shall be revealed. ‘Explications’ refer to ontological and epistemic presuppositions, which are implicitly presupposed in neuroscientific hypotheses. ‘Implications’, in contrast, refer to potential empirical consequences of philosophical theories. Accordingly, the first step consists of revealing the ‘theoretical explications’ in a neuroscientific hypothesis and ‘empirical implications’ in philosophical theory (see Figure 2c).

Particular “observation sentences” may involve specific “theoretical sentences” while excluding others. This linkage between explicit “observation sentences” and implicit “theoretical sentences” may be revealed by ‘theoretical explication’. ‘Empirical implication’ points out the possibility and impossibility of inferring “observation sentences” from “theoretical sentences”. Certain “observation sentences” may be excluded while others may be likely to infer. Subsequently, mutual ‘theoretical explication’ and ‘empirical implication’ of “theoretical sentences” and “observation sentences” may be considered as a necessary condition for generating a specific framework for comparison and linkage between neuroscientific hypothesis and philosophical theory.

Second, ‘logical and empirical consistency’ shall be tested for. ‘Theoretical explications’ i.e. the respective ontological and epistemic presupposition in a neuroscientific hypothesis shall be compared with ontological and epistemic theories as discussed in philosophy. It is then possible to test for relation and linkage of neuroscientific hypothesis with philosophical theories and logical conditions i.e. their ‘logical consistency’. Conversely, ‘empirical implications’ of philosophical theories shall be compared with empirical findings as reflected in neuroscientific hypotheses (see Figure 2d). One can then test for plausibility and compatibility of philosophical theories with a neuroscientific hypothesis and natural conditions i.e. their ‘empirical consistency’. The second step consists of comparison of ‘theoretical explications’ and ‘empirical implications’ with neuroscientific hypotheses and philosophical theories respectively in order to test for their ‘logical and empirical consistency’ (see also below for further definition of both terms).

Comparison between “theoretical sentences” and “observation sentences” may refer to ontological/epistemological presuppositions, empirical observations or the respective concepts. If one wants to compare the concepts themselves, ‘logical and empirical inconsistencies’ i.e. differences between “theoretical sentences” and “observation sentences” in both ontological/epistemological presuppositions and empirical observations shall be excluded. Otherwise, the origin i.e. source of similarities and/or differences between “theoretical sentences” and “observation sentences” remains unclear. Subsequently, mutual comparison of “theoretical sentences” and “observation sentences” with respect to ‘logical and empirical consistency’ may be regarded as a necessary condition for the possibility of comparison between philosophical theories and neuroscientific hypotheses.

Third, ‘analogisation’ and ‘homogenisation’ shall be performed. ‘Logical inconsistency’ in neuroscientific hypotheses may be transformed into ‘logical consistency’. This may be accounted for by modification of either ‘theoretical explications’ i.e. ontological/epistemological presuppositions in neuroscientific hypotheses or ontological/epistemological theories themselves, as discussed in philosophy. Ontological/epistemological assumptions are ‘analogised’ and ‘homogenized’ between neuroscientific hypothesis and philosophical theory (see Figure 2e).

Conversely, ‘empirical inconsistency’ in philosophical theory may be transformed into ‘empirical consistency’. This may be accounted for by modification of either ‘empirical implications’ i.e. empirical consequences of philosophical theory or neuroscientific hypotheses themselves. As such empirical hypotheses are ‘analogised’ and ‘homogenized’ between neuroscientific hypothesis and philosophical theory. Accordingly, the third step includes mutual ‘analogisation’ and ‘homogenisation’ between philosophical theory and neuroscientific hypothesis, which is necessary to achieve ‘logical and empirical consistency’.

The ‘net implications’ of both “observation sentences” and “theoretical sentences” are thus not only compared with each other but, in addition, modified in orientation on the respective other. Differences between “observation sentences” and “theoretical sentences” can then no longer be traced back to differences in either ontological/epistemological assumptions i.e. logical conditions or empirical hypothesis i.e. natural conditions. Comparison and linkage between “observation sentences” and “theoretical sentences” and thus between natural and logical conditions becomes possible. Subsequently, mutual analogisation’ and ‘homogenisation’ between “observation sentences” and “theoretical sentences” may be considered as a necessary condition for the possibility of linkage between neuroscientific hypothesis and philosophical theory.

Fourth, ‘inverse illustration’ and ‘cross-conditional disciplinary comparison’ shall be created. One may investigate the influence and consequences of modified ‘theoretical explications’ i.e. ontological/epistemological presuppositions on/for the neuroscientific hypothesis themselves. The neuroscientific hypothesis itself may remain either independent from the modified ontological/epistemological presuppositions or it may have to be modified in order to be compatible with the modified ontological/epistemological presuppositions that, consecutively, may result in the development of a neurophilosophical hypothesis. The relevance of ontological and epistemological presuppositions for neuroscientific hypothesis can be determined (see Figure 2f).

Conversely, one may investigate the influence and consequences of modified ‘empirical implications’ i.e. empirical hypothesis on/for the philosophical theories themselves. The philosophical theory itself may remain either independent from the modified empirical hypothesis or it may have to be modified as well in order to be compatible with the modified empirical hypothesis that, consecutively, may result in the development of a neurophilosophical hypothesis. The relevance of empirical hypotheses for philosophical theories can be determined. Accordingly, in order to investigate the need for mutual modification with consecutive development of neurophilosophical hypotheses, the fourth step consists in mutual ‘inverse illustration’ and ‘cross-disciplinary comparison’ between philosophical theory and neuroscientific hypothesis.

'Net implications' of both "observation sentences" and "theoretical sentences" are not only modified but the influence and consequences of these modifications on/for the original "observation sentences" or "theoretical sentences" is investigated which may reveal the need for modification of the respective "observation sentence" or "theoretical sentence" itself. The relevance of the modifications, which reflects the direct interaction between ontological/epistemological assumptions and empirical hypothesis within both, "theoretical sentences" and "observation sentences", can be accounted for. Subsequently, 'inverse illustration' and 'cross-disciplinary comparison' may be considered a necessary condition for revelation of direct interaction between ontological/epistemological assumptions and empirical hypothesis within philosophical theory and neuroscientific hypothesis.

The "principle of transdisciplinary circularity" shall be illustrated by the example of Parfit's (1989) 'spectrum arguments', which deal with the relation between personal identity and the brain (see Northoff, 2000 and 2001a). In his philosophical theory about personal identity, he makes implicit presuppositions about the brain i.e. empirical hypothesis. These implicit empirical hypotheses are, however, not in accordance with current neuroscientific hypotheses about the function of the brain. Parfit's empirical hypothesis about the brain must therefore be modified which, in turn, may make modification of his philosophical theory of personal identity necessary.

An 'empirical implication' (step 1) of Parfit's account of the brain is that there is a linear relation between brain cells and cognitive function. This is reflected in his assumption about a one-to-one relationship between brain cells and personal identity. However, comparing (step 2) his view of the brain with current neuroscientific hypotheses about the function of the brain, differences are revealed so that Parfit's assumption must be characterized by 'empirical inconsistency'. One may therefore modify Parfit's assumption about the brain in orientation on a current neuroscientific hypothesis, which reflects 'analogisation' and 'homogenisation' (step 3). Accordingly, one may assume either one-to-more or more-to-one relation between brain cells and cognitive function. The implications of this modified view of the function of the brain for his theory of personal identity can then be investigated by relying on 'inverse illustration' and 'cross-conditional comparison' (step 4). As a result, the interaction between empirical hypothesis of brain function and Parfit's philosophical theory of personal identity can be accounted for. This may consecutively result in the development of an 'empirical and logically consistent' neurophilosophical hypothesis about the relation between brain and personal identity (see Northoff, 2001a).

“Ontological Primacy”**“Epistemic Primacy”**

Figure 3a. “Ontological and Epistemic Primacy”.

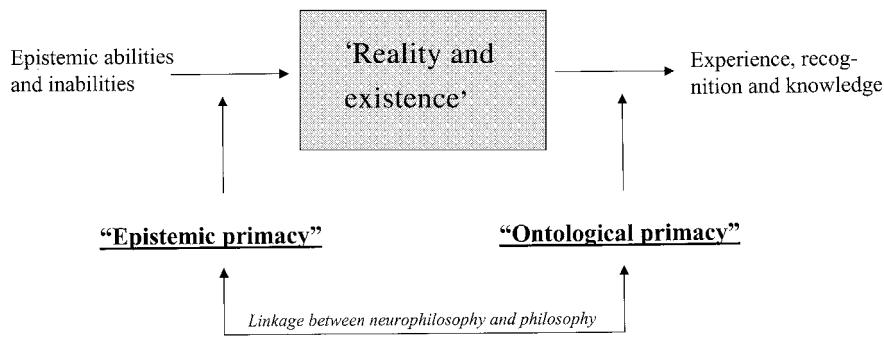


Figure 3b. Linkage between “epistemic primacy” and “ontological primacy”.

3. ‘ONTOLOGY’ AND ‘EPISTEMOLOGY’ IN NEUROPHILOSOPHY

3.1. *Ontological and Epistemic Primacy*

The methodological strategy, as presupposed in philosophy, relies on either implicit or explicit ontological presuppositions i.e. “ontological intuitions” (van Gelder, 1998, 122). These ontological presuppositions are assumed to provide the broader and foundational framework for epistemology, which shall be characterized as “ontological primacy” and “unilateral dependence” (see also Figure 3a).

Since epistemic abilities like experience, recognition and knowledge, as investigated in epistemology, remain impossible without presuppositions about ‘reality and existence’ i.e. ontology, ontology is broader and foundational for epistemology. Moreover, epistemology is necessarily dependent on ontology since epistemology remains ‘empty’ without ‘reality’

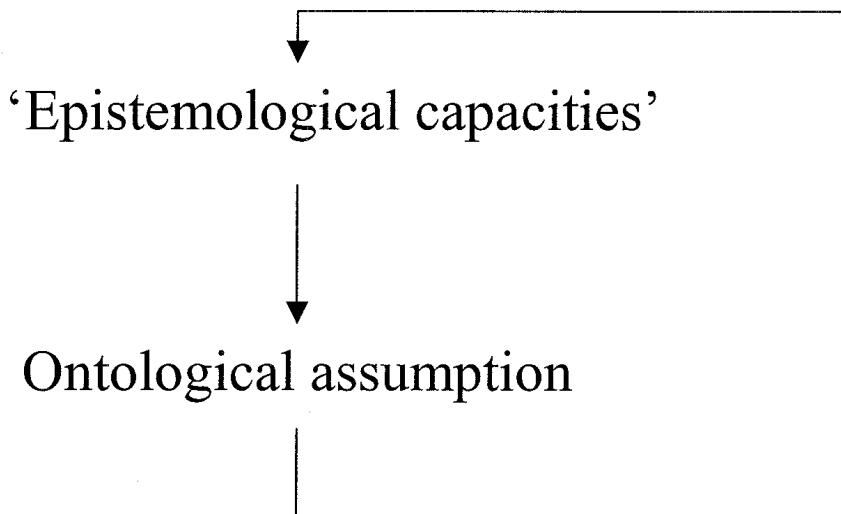


Figure 3c. “Ontological circularity”.

(d) “Ontological pluralism”

‘Epistemological capacities’: Different epistemic abilities and inabilities

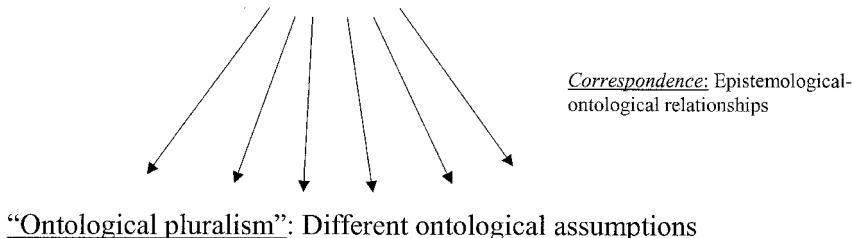


Figure 3d. “Ontological pluralism”.

and existence’. Meanwhile, presuppositions about ‘reality and existence’ seem to be independent from their experience, recognition and knowledge. Consequently, epistemology is unilaterally dependent on ontology.

The term ‘ontology’ characterizes what really exists, differences between distinct kinds of existences, and conditions for the possibility of existences. ‘Ontology’ reflects ‘reality and existence’ within the present context. Ontology as a philosophical discipline can therefore be characterized by ontological assumptions about ‘reality and existence’. Since both ‘reality and existence’ and ontological assumptions about ‘reality and existence’ may differ i.e.

dissociate from each other, both should be distinguished. Finally, it should be noted that the term ‘ontology’ is not distinguished from the term ‘metaphysics’ in the present context (see also Walter, 1998, footnote 16 on p.125).

The term ‘epistemology’ characterizes our abilities and inabilities to account for the world and may therefore investigate our relation to the world. In this context, epistemology reflects ‘epistemic abilities and inabilities’ i.e. ‘epistemological capacities’.

Ontological assumptions about ‘reality and existence’ presuppose epistemological presuppositions by themselves i.e. they “presuppose that we have knowledge and language for what is ontologically to be determined” (Praetorius, 2000, 293).

‘Epistemological capacities’ are necessary to access ‘reality and existence’ which, in turn, remains necessary for making presuppositions about it. If there are no ‘epistemological capacities’ for accessing ‘reality and existence’, ontological assumptions about it can no longer be made. Subsequently, the possibility of ontological assumptions about ‘reality and existence’ depends on the respective ‘epistemological capacities’ or, as W. James puts it, on our “perspective”: “What we say about reality thus depends on the perspective into which we throw it” (James, 1975, 118).

In the case of humans, for instance, ‘epistemological capacities’ are closely related with the brain as it is, for example, reflected in the recent development of ‘neuroepistemology’ (Kuhlenbeck, 1965; Hedrich, 1998; Northoff, 2000, 2001, 2002). If our brain were different, we would probably have different ‘epistemological capacities’. Different ‘epistemological capacities’ would provide us with a different access to ‘reality and existence’ which consecutively would lead to different ontological assumptions about ‘reality and existence’. For example, First- and Third-Person Perspective lead to different kinds of ontology. The First-Person Perspective is characterized by mental states and consecutively implies “mental ontology”. Meanwhile, the Third-Person Perspective shows rather physical states and is consecutively rather related with “physical ontology”. This shows that, different ‘epistemological capacities’ give us a different ‘perspective’ on ‘reality and existence’ and lead subsequently to different ontological assumptions.

Consideration of epistemological presupposition for ontological assumptions requires “epistemic primacy” as a methodological strategy. Epistemological presuppositions provide a broader and foundational framework for ontological assumptions which shall be described by “epistemic primacy”. Moreover, ontological assumptions are necessarily dependent on epistemology since ontology remains ‘blind’ without ‘epistemological capacities’. In the meantime presuppositions about ‘epistemological capacities’ seem to be independent from ontological assumptions about ‘reality and existence’. Accordingly, ontological assumptions i.e. ontology are unilaterally dependent on epistemology.

It should be noted that both methodological strategies “ontological primacy” and “epistemic primacy” are rather complementary than contradictory.

While epistemology does not necessarily presuppose ontological assumptions about ‘reality and existence’ “ontological primacy”, which concerns ‘reality and existence’ is necessarily presupposed by epistemology. Conversely, “epistemic primacy” concerns the necessity of ‘epistemological capacities’ for ontological assumptions about ‘reality and existence’. It does not concern ‘reality and existence’ as such i.e. by itself. “Ontological primacy” remains true for ‘reality and existence’ while “epistemic primacy” is valid for ontological assumptions about ‘reality and existence’. Accordingly, “ontological primacy” and “epistemic primacy” must be regarded as complementary rather than contradictory.

As pointed out above, philosophy relies predominantly on “ontological primacy” since it considers ‘reality and existence’ as the broader and foundational framework for epistemology. On the basis of “ontological primacy”, philosophy infers that ontology as a discipline, which makes ontological assumptions about ‘reality and existence’, provides the broader and foundational framework for epistemology. In contrast to “ontological primacy”, this inference can, however, not be considered as true since ontological assumptions about ‘reality and existence’ necessarily presuppose ‘epistemological capacities’ (see above). Philosophy, as a result, confuses ‘reality and existence’ i.e. ontology as such and ontological assumptions about ‘reality and existence’ i.e. ontology as a discipline.

Philosophy considers therefore only the relation between ‘reality and existence’ and epistemology while it remains unable to account for the relationship between ontological assumptions about ‘reality and existence’ and ‘epistemological capacities’. In order to account for the relationship between ontological assumptions about ‘reality and existence’ and ‘epistemological capacities’, “epistemic primacy” remains necessary and the specific linkage between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’ can be investigated. This is the strategy that is pursued and suggested by neurophilosophy as it is, for example, reflected in neuroepistemology and neuroontology.

Since “epistemic and ontological primacy” show distinct referents (see above), neurophilosophy and philosophy cannot be considered as mutually exclusive and thus as contradictory. Philosophy concerns the relationship between ‘reality and existence’ and epistemology. Neurophilosophy on the other hand focuses more on the relationship between ontological assumptions about ‘reality and existence’ and ‘epistemological capacities’. Accordingly, philosophy and neurophilosophy concern distinct relationships and must therefore be regarded as mutually necessary and complementary.

This is, for example, reflected in the mind-brain problem. The mind-brain problem is discussed in philosophy as an ontological problem which focuses on mind and brain as either different or identical ontological ‘realities and existences’. The focus is put on the ontological-epistemological relationship i.e. the ontological characterization of both mind and brain, from which the respective kinds of epistemology are inferred. In neurophilosophy, the mind-brain problem is discussed with respect to its necessary conditions which, in turn, reflect the ‘epistemological capacities’. Neurophilosophy focuses therefore on elucidation of epistemic abilities and inabilities in relation to the brain as a necessary

condition for the possibility of the mind-brain problem as an ontological problem (see Northoff, 2000, 2002). If we have different ‘epistemological capacities’, we would potentially no longer be able to raise the mind-brain problem as an ontological problem. The focus is thus put on the epistemological-ontological relationship.

Finally, the relationship between “epistemic primacy” and naturalism shall be discussed briefly. One may distinguish between different kinds of naturalism: “ontological naturalism”, “epistemological naturalism” and “methodological naturalism”.

First, “epistemic primacy” does not imply “ontological naturalism” because it is well compatible with the co-occurrence of different kinds of ontology i.e. “ontological pluralism”. “Epistemic primacy” accounts for the linkage between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’. Different kinds of ontological assumptions about ‘reality and existence’ i.e. naturalistic and non-naturalistic may be related with different ‘epistemological capacities’. Accordingly, “epistemic primacy” is not necessarily associated with “ontological naturalism”.

Secondly, “epistemic primacy” does not imply “epistemological naturalism”. “Epistemic primacy” determines only a methodological strategy while it cannot be regarded as an epistemological position on its own as, for example, “epistemological naturalism”. “Epistemic primacy” as a methodological strategy may be applied within both naturalistic and non-naturalistic frameworks. “Epistemic primacy” is therefore not necessarily associated with “epistemological naturalism”.

Thirdly, “epistemic primacy” implies “methodological naturalism”. “Methodological naturalism” refers to the inclusion of empirical observations in epistemological and ontological investigations (see also Kopelberg, 2000). An investigation of ‘epistemological capacities’ requires consideration of empirical observations since otherwise (i.e. in purely logical ways) they may not be accessible. The linkage between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’ remains therefore impossible without empirical observations. Accordingly, “epistemic primacy” necessarily requires “methodological naturalism” which is nicely reflected in the famous quote from Quine (1969, 126): “I see philosophy not as an a priori propaedeutic or groundwork for science, but as continuous with science. I see philosophy and science as in the same boat – a boat which, to revert to Neurath’s figure as I so often do, we can rebuild only at sea while staying afloat in it. All scientific findings, all scientific conjectures that are at present plausible, are therefore in my view as welcome for use in philosophy as elsewhere”.

It should be noted that the term “naturalism” itself can be defined in different ways. “Ontological naturalism” can refer to the physical world or the biological world. “Epistemological naturalism” may refer to ‘epistemological capacities’ of brains, machines,

etc.. “Methodological naturalism” may refer to different kinds of empirical observations physical, biological, phenomenological etc.

3.2. *Ontological Pluralism*

From a philosophical point of view, one may argue that “epistemic primacy” nevertheless presupposes ontological assumptions which results in “ontological circularity” (see Figure 3c).

While ‘epistemological capacities’ are a necessary condition for the possibility of ontological assumptions about ‘reality and existence’, the possibility of ‘epistemological capacities’ already presupposes ontological assumptions about ‘reality and existence’ by itself. Accordingly, “epistemic primacy” must be characterized by “ontological circularity” since the necessary conditions, presupposed by itself, are those ontological assumptions for which it is considered to be necessary.

“Ontological circularity” can be avoided by the methodological strategy of “ontological tolerance” and “ontological pluralism” (see Figure 3d).

“Epistemic primacy” focuses on the epistemological conditions for the possibility of ontological assumptions. It investigates the relation between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’. Which epistemological capacities are necessary in order to make what kind of ontological assumption? Instead of predefining and predetermining the field of possible potential ontological assumptions, as in “ontological primacy”, different ontological assumptions may be related with different epistemological capacities. The specification of ontological assumptions is no longer predefined and predetermined but rather oriented on the respective ‘epistemological capacities’. The field of potentially possible ontological assumptions remains open and “tolerant” for different kinds of ontological assumptions (Pihlstroem, 1996, p. 65). Different kinds of ontological assumptions about ‘reality and existence’ may co-occur and co-exist which reflects “ontological pluralism”. Since the different ontological assumptions depend on different ‘epistemological capacities’, no particular ontological assumption can be considered as “pre-eminent and all-inclusive” anymore: “Many different world versions are of independent interest and importance, without any requirement or presumption to a single base. The pluralist, far from being anti-scientific, accepts the sciences at value. His typical adversary is the monopolistic materialist or physicalist who maintains that one system, physics, is pre-eminent and all-inclusive, such that every other version must eventually be reduced to it or rejected as false or meaningless” (Goodman, 1978, 4).

Due to “ontological pluralism”, “ontological circularity” can be avoided. Even if the possibility of ‘epistemological capacities’ in general presupposes ontological assumptions, they may nevertheless differ from the ones which are inferred from particular ‘epistemological

capacities'. If, however, the inferred ontological assumptions differ from the ones which are presupposed, the argument of "ontological circularity" can no longer be maintained. In contrast, "ontological monism", as often presupposed in philosophy, leads necessarily to "ontological circularity" when one applies the strategy of "epistemic primacy". "Ontological pluralism" must subsequently be regarded as a necessary condition for avoiding "ontological circularity" in "epistemic primacy".

"Ontological pluralism" may be characterized in further detail in the following ways.

First, "ontological pluralism" does neither imply elimination of ontology as such nor of ontology as a discipline. Elimination of ontological predefinition and predetermination i.e. 'ontological fixation' should not be confused with elimination of any kind of ontology in general (see also Pihlstroem, 1996, 68–72). "Ontological pluralism" preserves the possibility of ontological assumptions about 'reality and existence' while avoiding their predefinition and predetermination. The field of potentially possible ontological assumptions is enlarged. Accordingly, "ontological pluralism" enlarges the field of ontology rather than eliminating it.

In contrast, "ontological monism", as presupposed in "ontological primacy", restricts the field of ontology by claiming a particular kind of ontology as a starting point for further philosophical investigation.

Second, analogous to "ontological pluralism", "epistemic primacy" can be characterized by "epistemic pluralism". "Epistemic pluralism" (see 3.2.1. for further definition) points out that all distinct kinds of epistemic abilities and inabilities should be considered in an equal way without giving preference to any of one. There should be no 'epistemic hierarchy' because then one particular epistemic perspective would be regarded as the 'absolute' vantage point. This is nicely expressed in the following quote: "Because of our humanly restricted situations, we cannot step outside all possible human viewpoints and decide which one of our different conceptual schemes and ways of structuring the world (...) is the only 'absolutely' true one or closer to the truth than all others. These different purposeful ways of structuring the world are needed for different 'spheres of life'. (...). In short, the world can be approached from many different points of view, through many conceptual schemes" (Pihlstroem 1996, 65).

Epistemic abilities and inabilities of both First- and Third-Person Perspective for example, should be considered in the same way without giving more or less weight to any of them. The First-Person Perspective may be regarded as a necessary epistemological presupposition for the possibility of "mental ontology" (see Praetorius 2000, XIV–XV) while the Third-Person Perspective may rather be regarded as a necessary condition for the possibility of "physical ontology". Subsequently "epistemic pluralism" and "ontological pluralism" are closely related with each other.

Third, the question of an ‘independent existence of the world’ remains open and unsolved in “ontological pluralism”. “Ontological pluralism”, as defined in the above mentioned sense, does not focus on an “all-inclusive” ontological explanation of the world but rather on an epistemological-ontological relationship. Instead of arguing either for or against an ‘independent existence of the world’, “ontological pluralism” focuses on the investigation of the ‘epistemological capacities’ which are necessary for raising this problem. Accordingly, the focus is shifted from the ‘independent existence of the world’ itself to the necessary conditions for its possibility as such.

The ontologist may then argue that such a strategy presupposes at least some kind of ‘ontological realism’. However, even if “ontological pluralism” presupposes some kind of ‘ontological realism’, it nevertheless leaves open the question for an ‘independent existence’: “No sort of realist can escape the problem of ‘independent’ existence of the world – or the problem of explaining what this independence is. The realist might simply mean that the independence of reality amounts to the bare, unconceptualized existence of a reality which we never created. However, even if she affirms that there is an unconceptualized reality which we did not make but which we attempt to represent and describe rightly, she is not speaking about an unconceptualized reality any more. The pragmatic realist sees that this kind of reality cannot be spoken about; yet she must also accept that all reality is not man-made. No easy solution to this tension is available”. (Pihlstroem, 1996, 161–2).

Fourth, it is important to note that “ontological pluralism” should not be considered as an “ontological position” by its own since it is rather a methodological strategy. As such it provides the methodological tools for the possibility of linkage between ‘epistemological capacities’ and ontological assumptions about ‘reality and existence’.

“Ontological pluralism” should for example neither be confused with “ontological neutrality” (Heil 1998) nor with “ontological pluralism” which both are specific “ontological positions”. The main feature of “ontological pluralism” as a methodological strategy is that it allows for a variety of different ontological positions which may co-occur and co-exist.

Fifth, “ontological pluralism” remains open for both ‘internal validation’ and ‘external validation’.

‘Internal validation’ refers to investigation of ‘logical consistency’ as a so-called “analytic self-consistency” (Hedrich, 1998, 117–8). The relation between the ontological input, which reflects ontological presuppositions, and ontological output, which reflects the respective philosophical theory, is investigated in logical regard. ‘Logical inconsistency’ reflects discrepancy and discordance between ontological input and output while they remain concordant in the case of ‘logical consistency’.

“External validation” refers to investigation of ‘empirical consistency’ as a so-called “synthetic context-consistency” (Hedrich, 1998, 117–8). Compatibility and plausibility of ontological input is investigated with respect

to empirical hypothesis. ‘Empirical inconsistency’ reflects discrepancy and discordance between ontological input and empirical hypothesis while they remain concordant in the case of ‘empirical consistency’.

In the case of either ‘logical or empirical inconsistency’, one may modify the ontological input and/or the empirical hypothesis in orientation on the principles of transdisciplinary methodology. The ontological input should thus be validated with regard to both ‘logical and empirical consistency’. Unlike in philosophy and “ontological primacy”, the ontological input can therefore no longer be considered as independent from the respective context. “Analytic self-consistency” is only a necessary but not sufficient condition for validation since it has to be accompanied by “synthetic context-consistency”.

Since the ontological input has to be coordinated and harmonized with the respective context, ontological input and ontological output may differ from each other. ‘Ontological identity’, as presupposed in “analytic self-consistency”, is replaced by ‘ontological iterativity’ between ontological input and output (see also Walter, 1998, 63; Hedrich, 1969, 116) which characterizes a conjunction between “analytic self-consistency” and “synthetic context-dependency”.

4. NEUROPHILOSOPHICAL HYPOTHESIS

4.1. *Definition*

A ‘neurophilosophical hypothesis’ can be defined as an assumption about the linkage between philosophical theory and neuroscientific hypothesis (see Figure 4).

The linkage between philosophical theory and neuroscientific hypothesis follows certain methodological principles i.e. ‘principle of asymmetry’, ‘principle of bidirectionality’ and ‘principle of transdisciplinary circularity’. These methodological principles provide a ‘systematic relation’ rather than a ‘intuitive relation’ between philosophical theories and neuroscientific hypotheses.

Since a neurophilosophical hypothesis can be defined by systematic linkage between philosophical theory and neuroscientific hypothesis, it remains open for three distinct types of falsification (see Figure 4).

First, there is ‘logical falsification’ which aims at ‘logical consistency’ as a means for ‘internal validation’. Second, there is ‘empirical falsification’ which aims at ‘empirical consistency’ as a means for ‘external validation’. Third, there is ‘transdisciplinary falsification’ which aims at ‘link consistency’ as a means for ‘cross-disciplinary validation’.

‘Cross-disciplinary validation’ focuses on the way philosophical theory and neuroscientific hypothesis are related and linked with each other. One may speak of ‘link consistency’ when their linkage is in full accordance of the principles of transdisciplinary methodology. For example, differentiation between natural and logical conditions as well as between the different kinds of logical conditions shall be made. Moreover, the interaction between

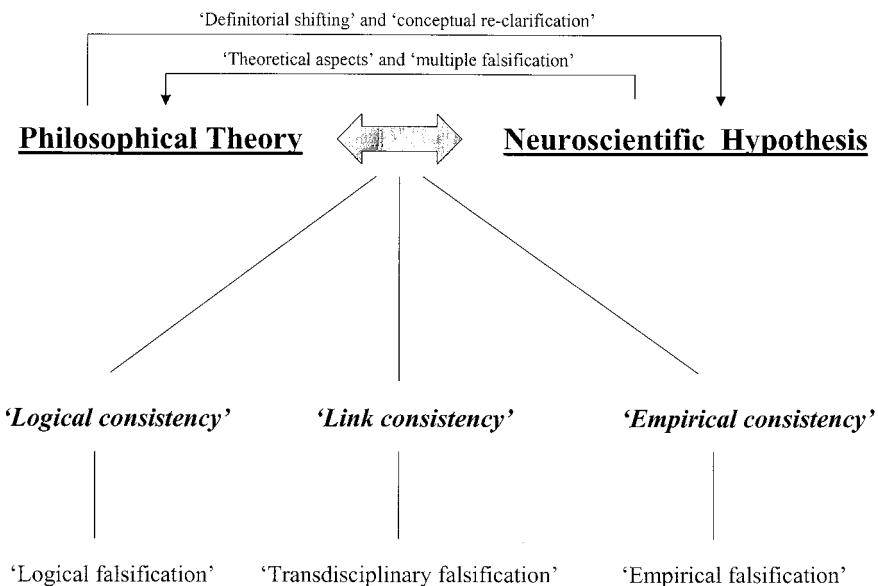


Figure 4. ‘Neurophilosophical hypothesis’.

ontological/epistemological assumptions and empirical hypothesis shall be investigated within both philosophical theory and neuroscientific hypothesis. If, in contrast, the linkage is not in accordance with the principles of transdisciplinary methodology, one may speak of ‘link inconsistency’.

First, ‘neurophilosophical hypotheses’ must be distinguished from ‘empirical hypotheses’, as presupposed in science i.e. neuroscience.

Empirical hypotheses as, for example, ‘neuroscientific hypotheses’ are subjected to ‘empirical falsification’ only. The focus is put predominantly on ‘empirical consistency’ while ‘logical consistency’ and ‘logical falsification’ are rather neglected. Accordingly, ‘neurophilosophical hypotheses’ must be distinguished from empirical hypotheses by inclusion of explicit ontological/epistemological assumptions which makes investigation of ‘logical consistency’ and thus ‘logical falsification’ necessary.

Due to inclusion of ontological/epistemological assumptions i.e. theoretical aspects, the meaning of the term ‘hypothesis’ is broadened in the case of ‘neurophilosophical hypothesis’, as compared to ‘empirical i.e. neuroscientific hypothesis’. This broadened meaning is reflected in the necessity of consideration of both types of falsification, ‘empirical and logical falsification’.

Second, ‘neurophilosophical hypothesis’ must be distinguished from ‘philosophical theory’ as well.

Ontological/epistemological assumptions are subjected to ‘logical falsification’ only. The focus is put predominantly on ‘logical consistency’

while ‘empirical consistency’ and ‘empirical falsification’ are rather neglected. Accordingly, ‘neurophilosophical hypothesis’ must be distinguished from philosophical theory by inclusion of explicit empirical hypothesis which makes investigation of ‘empirical consistency’ and thus ‘empirical falsification’ necessary.

In contrast to philosophical theories, ‘neurophilosophical hypotheses’ do not predefine and predetermine the terms. Instead the definition itself may be subject to modification and revision on empirical grounds which may lead to so-called “definitorial shifting” (Northoff, 2000). Definition and determination of terms may be adjusted to empirical hypothesis (see also Praetorius, 2000, 30) which allows for ‘empirical consistency’ and ‘link consistency’. Accordingly, ‘neurophilosophical hypothesis’ must be distinguished from philosophical theory by the possibility of “definitorial shifting” and ‘empirical falsification’.

For example, D. Parfit (1989) presupposes a definition of the brain in his “spectrum arguments” which is not consistent with current empirical data (see Northoff, 2001). He implicitly presupposes a one-to-one relation between cells and function in the brain. However, numerous empirical studies demonstrated that several cells might subserve one particular function. Moreover, the same cells could subserve different functions. There is subsequently no clear-cut one-to-one relation between cells and function as presupposed by D. Parfit.

Even though his definition of the brain may be ‘logically consistent’, it nevertheless remains ‘empirically inconsistent’. Such ‘empirical inconsistency’ may be irrelevant for his ‘philosophical theory’ about personal identity because both terms, brain and personal identity, are predefined and predetermined. In contrast, ‘empirical inconsistency’ is important to consider in a ‘neurophilosophical hypothesis’ about personal identity (see Northoff, 2001). Accordingly, Parfit’s definition of the brain must be modified and adjusted in accordance with empirical data which, in turn, may make corrections in the theory of personal identity necessary. Subsequently, definition of both terms ‘brain’ and ‘personal identity’ may be subjected to the process of ‘definitorial shifting’ in ‘neurophilosophical hypothesis’.

Third, ‘neurophilosophical hypothesis’ must be distinguished from both empirical hypothesis and philosophical theory.

‘Conceptual clarification’ focuses on explication of hidden i.e. implicit presuppositions and definitions in terms and theories which are then subjected to ‘logical analysis’ and/or ‘linguistic analysis’ (see also van Gelder, 1998, 120–2). ‘Neurophilosophical hypotheses’, in contrast, focus on hidden i.e. implicit empirical hypothesis in ‘philosophical theories’ as, for example, with respect to the function of the brain (see above the example with D. Parfit). Mutual adjustment between philosophical theory and empirical hypothesis requires not only ‘logical and linguistic analysis’ but also ‘conceptual clarification’. In addition, modification of both definitions and concepts with consecutive ‘conceptual re-clarification’ is necessary (see also D. Chalmers, 1996, 51, whose distinction between

‘explication’ and ‘explanation’ parallels more or less with our distinction between ‘conceptual clarification’ and ‘conceptual re-clarification’). ‘Conceptual re-clarification’ may allow for investigation of ‘link consistency’ as a test for systematic interaction between philosophical theory and empirical hypothesis. ‘Neurophilosophical hypothesis’ must be distinguished from both empirical hypothesis and philosophical theory by the possibility of ‘conceptual re-clarification’ with consecutive investigation of ‘link consistency’ and thus ‘transdisciplinary falsification’.

Due to the inclusion of ‘link consistency’ and ‘transdisciplinary falsification’, philosophical theory and empirical hypothesis can be linked and related in systematic ways. This, in turn, opens the possibility for the development of ‘neurophilosophical hypothesis’ where empirical hypothesis and philosophical theories may be combined and linked in different though systematic and consistent ways.

4.2. *Experiments*

We pointed out that ‘neurophilosophical hypothesis’ may be characterized by the conjunction of ‘logical, empirical and ‘transdisciplinary falsification’. According to the distinct types of falsification, different kinds of experiments are necessary.

The ‘unit of neurophilosophical significance’ (see Quine 1953, 39, who uses an analogous expression ‘unit of empirical significance’) consists in linkage between philosophical theory and neuroscientific hypothesis. Philosophical theories reflect logical conditions while neuroscientific hypothesis can rather be accounted for by natural conditions. Subsequently, the ‘unit of neurophilosophical significance’ consists in linkage between logical and natural conditions. Logical conditions are considered within the context of natural conditions which accounts for the investigation of ‘empirical consistency’ of philosophical theory. Natural conditions are considered within the context of logical conditions which accounts for the investigation of ‘logical consistency’. The kind of linkage between natural and logical conditions is considered as well which accounts for the investigation of ‘link consistency’.

Falsification of the ‘unit of neurophilosophical significance’ should aim predominantly at the linkage between natural and logical conditions. Traditionally, ‘empirical consistency’ is tested for by ‘empirical experiments’ which rely on manipulation of natural conditions. ‘Logical consistency’ is tested for by ‘logical experiments’ i.e. ‘thought experiments’ which rely on imaginative variation of logical conditions.

In addition to these traditional ways, falsification of the ‘unit of neurophilosophical significance’ can be characterized by a third form of falsification i.e. ‘transdisciplinary falsification’ (see above). ‘Transdisciplinary falsification’ aims at ‘link consistency’ which reveals the kind of linkage i.e. either “systematic” or “intuitive” between logical and natural conditions.

How can we test the ‘logical consistency’ of natural conditions? How can we test the ‘empirical consistency’ of logical conditions?

Both ‘empirical experiments’ and ‘logical experiments’ should be applied in a novel way. ‘Empirical experiments’ should be applied to logical conditions in order to test their ‘empirical consistency’. Since logical conditions refer to philosophical theories, they have to be transformed into neuroscientific hypothesis which, in turn, are accessible to ‘empirical experiments’.

The concept of personal identity for example refers to philosophical theory rather than neuroscientific hypothesis (see Northoff, 2001a for full detail). Subsequently, personal identity itself remains inaccessible to empirical investigation. However, the theory of personal identity may refer to certain criteria which reflect necessary and/or sufficient logical conditions for personal identity. As revealed in philosophical discussions these criteria may include psychological and physiological criteria.

These criteria may then be transformed into psychological and physiological hypotheses i.e. empirical hypotheses which as such are accessible to ‘empirical experiments’, e.g. personal identity before and after brain tissue transplantation in Parkinson’s disease may be investigated empirically by transformation of these criteria into subjective visual-analogue questionnaires (see Northoff, 2001a). One may therefore consider such an approach as an ‘empirical experiment’ for investigation of ‘empirical consistency’ of the philosophical theory of personal identity.

‘Logical experiments’ on the other hand should be applied to natural conditions in order to test their ‘logical consistency’. Accordingly, natural conditions should be varied imaginatively in ‘logical experiments’ i.e. ‘thought experiments’. Distinction between natural and logical conditions as well as between necessary and non-necessary conditions may be revealed.

The ventromedial prefrontal cortex (i.e. VMPFC), for example, receives input from all sensory modalities and may as such account for integration of heterogenous stimuli into a homogenous event of experience (Northoff, 2003b). To put it into philosophical terms: Sensory integration in VMPFC may potentially be regarded as a necessary natural condition for the possibility of subjective experience and thus for First-Person Perspective.

One may now construct the ‘logical experiment’ i.e. ‘thought experiment’ of imaginative variation of the input structure of the VMPFC. How would it be, if the VMPFC does not receive input from all sensory modalities? Would we then experience only heterogenous stimuli instead of homogenous events in First-Person Perspective? Or would perception of stimuli in First-Person Perspective no longer differ from observation of stimuli in Third-Person Perspective? Necessary natural conditions for philosophical theories can be revealed. Moreover, the application of ‘logical experiments’ to natural conditions allows for distinction between natural and logical conditions.

4.3. *Judgements*

‘Neurophilosophical hypothesis’ may be characterized by rejection of the semantic distinction between purely ‘analytic’ judgements and purely ‘synthetic’ judgements.

‘Neurophilosophical hypothesis’ can be characterized by consideration of ‘empirical consistency’ which accounts for ‘synthetic context-consistency’. If, however, the respective empirical context is considered in definition of terms, ‘neurophilosophical hypothesis’ can no longer be regarded as purely ‘analytic’. Unlike philosophical judgements, ‘neurophilosophical hypothesis’ therefore implies ‘rejection of analyticity’ (Quine, 1969, 86) and consecutively inclusion of a ‘synthetic’ component. Conversely, due to inclusion of theoretical aspects and ‘logical consistency’ (see above), ‘neurophilosophical hypothesis’ can not be regarded as purely ‘synthetic’. Unlike neuroscientific judgements, ‘neurophilosophical hypothesis’ therefore implies ‘rejection of synthicity’ and consecutively inclusion of an ‘analytic’ component.

Due to the conjunction between ‘analyticity and synthicity’, the ‘absolute’ distinction between philosophical theories and neuroscientific hypothesis is blurred in ‘neurophilosophical hypothesis’: “Carnap has recognized that he is able to preserve a double standard for ontological questions and scientific hypothesis only by assuming an absolute distinction between the analytic and synthetic; I need not say again that this is a distinction which I resist” (Quine, 1953, 43).

‘Neurophilosophical hypothesis’ may subsequently be characterized by inclusion of both ‘analytic’ and ‘synthetic’ components which may be linked and balanced in different ways. Certain ‘neurophilosophical hypotheses’ may show a stronger ‘analytic’ component (“more or less analytic”) while the ‘synthetic’ component remains in the background. The latter may be stronger than the former (“more or less synthetic”). However, both ‘analytic’ and ‘synthetic’ components must necessarily be present since otherwise ‘neurophilosophical hypothesis’ degenerate into either ‘philosophical judgements’ or ‘neuroscientific judgements’.

In addition to inclusion of both ‘synthetic’ and ‘analytic’ components, ‘neurophilosophical hypothesis’ may be characterized by rejection of the epistemic distinction between ‘a priori’ and ‘a posteriori’ (see also Kripke, 1972).

Since ‘philosophical theories’ are subjected to ‘empirical consistency’, they may be modified throughout further investigation by means of “definitorial shifting” and “conceptual re-clarification”. Subsequently, ‘neurophilosophical hypotheses’ can no longer be regarded as purely ‘a priori’ judgements.

Neuroscientific hypothesis on the contrary are linked with theoretical aspects and are thus subjected to ‘logical consistency’. Definition and determination of ‘neurophilosophical terms’ is therefore pre-structured so that the field of potentially possible ontological/epistemological assumptions is restricted. Meanwhile it still remains variable and open for ‘definitorial shifting’ and ‘conceptual re-clarification’. Subsequently, ‘neurophilosophical hypotheses’ can no longer be regarded as purely ‘*a posteriori*’ judgements.

‘Analytic’ judgements are traditionally regarded as ‘*a priori*’ judgements. This refers to their determination on purely logical grounds. They remain consecutively pre-defined and pre-determined and thus fixed so that ‘definitorial shifting’ and ‘conceptual re-clarification’ remain impossible. ‘Analytic’ judgements refer predominantly to theories i.e. ‘philosophical theories’. ‘Synthetic’ judgements, in contrast, are traditionally regarded as ‘*a posteriori*’ judgements since they are determined by the respective empirical context. ‘Synthetic’ judgements therefore refer predominantly to hypothesis i.e. ‘neuroscientific hypothesis’. They consecutively remain open for modification by means of ‘definitorial shifting’ and ‘conceptual re-clarification’.

‘Neurophilosophical hypotheses’ may thus be regarded as ‘mixed’ judgements as they include both ‘*a priori*’ and ‘*a posteriori*’. Depending on their balance, ‘neurophilosophical hypotheses’ may subsequently be characterized as either ‘more or less *a priori*’ or ‘more or less *a posteriori*’. Accordingly, ‘neurophilosophical judgements’ may be characterized by the conjunction of ‘*a priori*’ and ‘*a posteriori*’ components.

Due to the conjunction between ‘*a priori*’ and ‘*a posteriori*’ components, novel kinds of judgement may be developed in ‘neurophilosophical hypotheses’. Due to the necessity of ‘empirical consistency’, ‘more or less analytic’ judgements may show a strong “*a posteriori*” component. Conversely, due to the necessity of ‘logical consistency’, ‘more or less synthetic’ judgements may show a strong ‘*a priori*’ component.

In addition to semantic and epistemic distinctions, the ontological distinction between necessary and contingent judgements is undermined in ‘neurophilosophical judgements’ as well. ‘Neurophilosophical judgements’ may subsequently be considered as “more or less necessary” and “more or less contingent”. Accordingly, ‘neurophilosophical judgements’ can be characterized by ‘relativization’ of epistemic, semantic and ontological distinctions.

This ‘relativization’ leads to the possibility of dissociation between semantic, epistemic and ontological characterization (see also Nagel, 2000, 434) in ‘neurophilosophical judgements’. The ‘*a priori*’ component is for example related with necessity and ‘analyticity’ in ‘philosophical judgements’ while the ‘*a posteriori*’ component is related with contingency and ‘synthicity’ in ‘neuroscientific judgements’. This specific linkage between the epistemic, semantic and ontological characterization is disrupted in ‘neurophilosophical judgements’ which allows for novel, variable and flexible combinations among them.

5. ‘STANDARD ARGUMENTS’ AGAINST NEUROPHILOSOPHY

5.1. *Argument of Logical Circularity*

Neurophilosophy relies on the methodological strategy of “epistemic primacy” and therefore considers ‘epistemological capacities’ of the brain as a starting point for further epistemological and ontological investigation. From a purely philosophical point of view, one may argue that the neurophilosopher infers ontological assumptions from the ‘epistemological capacities’ of the brain which are already necessarily presupposed by the brain itself as its ontological presuppositions. The methodological strategy in neurophilosophy remains therefore circular and can thus be considered as an instance of “ontological circularity”. Neurophilosophy is logically inconsistent with regard to its methodological strategy which should therefore be replaced by “ontological primacy”, as presupposed in philosophy. Accordingly, the ‘argument of circularity’ can be considered as an argument against the possibility i.e. validity of neurophilosophy as a methodological strategy distinct from philosophy.

The ‘argument of circularity’ assumes the identity between the brain, as investigated in neuroscience, and the brain, as considered in neurophilosophy. The brain, as investigated in neuroscience, must be regarded as a “physical brain” which as such presupposes particular ontological assumptions about ‘reality and existence’ i.e. “physical ontology”. In addition to characterization of the brain as a “physical brain”, it may also be regarded as a “mental brain” (Northoff, 2000, 2001, 2003b). Similar to the “physical brain”, the “mental brain” too presupposes certain ontological assumptions i.e. “mental ontology”.

However, both characterizations of the brain as “physical brain” and “mental brain” may be related with different ‘epistemological capacities’ i.e. Third- ad First-Person Perspective. Different ontological assumptions correspond to distinct ‘epistemological capacities’. Instead of focusing on one particular ontological presupposition i.e. either “physical ontology” or “mental ontology”, neurophilosophy rather aims at elucidation of correspondences between ‘epistemological capacities’ and ontological assumptions. Accordingly, the brain, as considered in neurophilosophy, does no longer presuppose particular ontological assumptions, as in neuroscience, but rather a variety of different epistemological-ontological correspondences (see above). As such the ontological inferences, which are drawn from the ‘epistemological capacities’ of the brain in neurophilosophy, are not necessarily identical with those that are presupposed by the brain, as investigated in neuroscience. “Ontological circularity” is subsequently replaced by “ontological iterativity”.

Moreover, the ‘argument of circularity’ presupposes inclusion between natural and logical conditions and makes no differentiation between distinct subsets of logical conditions. The brain is characterized by natural conditions which must be considered as part of the larger field of logical conditions. Since natural conditions are included within logical conditions, the former necessarily presuppose the latter while inference of the latter from the former remains impossible and thus ‘circular’. Accordingly,

neurophilosophical investigation of the natural conditions underlying the brain remains superfluous since they are already covered by philosophical investigation of logical conditions.

There are two distinct subsets of logical conditions (i.e. L), the ones being identical with natural conditions (i.e. l1) and the ones being non-identical with natural conditions (i.e. l2). Investigation of natural conditions consecutively allows for indirect inference on at least those logical conditions (i.e. l1) which are identical with natural conditions. Moreover, investigation of natural conditions allows for negative characterization of those logical conditions (i.e. l2) which are non-identical with natural conditions by describing what they are not. The brain, as characterized by natural conditions by itself, may therefore serve as a starting point for investigations of the differentiation between distinct subsets of logical conditions. Accordingly, a neurophilosophical investigation of the natural conditions of the brain is not superfluous since they are not covered completely by philosophical investigations of logical conditions.

5.2. Argument of Categorical Fallacy

From a philosophical point of view, one may argue that the neurophilosopher relies on false characterization i.e. categorization of the brain. The brain is characterized as a “physical object” with natural conditions which are accessible to empirical i.e. neuroscientific investigations. The brain must be distinguished from a “mental subject” i.e. a mind which accounts for logical conditions. As such the mind may be subjected to philosophical investigations. Since “physical object” and “mental subject” reflect different categories, the brain as a “physical object” cannot be investigated in philosophy. The claim for the principal possibility of philosophical investigation of the brain presupposes therefore confusion between distinct categories i.e. between “physical object” and “mental subject” and consequently between natural and logical conditions (see also Keil and Schnaedelbach 2000). One cannot infer from the one category to the other without committing a “categorical fallacy”. Accordingly, the ‘argument categorical fallacy’ can be considered as an argument against the principal possibility of philosophical investigation of the brain with the consecutive development of a “philosophy of the brain” (see Northoff 1999, 2000, 2003a).

The ‘argument of categorical fallacy’ presupposes mutually exclusive distinction between natural and logical conditions with respect to brain and mind. Only if there is no overlap between natural and logical conditions, characterization of brain and mind as different categories can be maintained. However, there is some overlap between natural and logical conditions with respect to brain and mind. The brain as a “physical brain”, underlying natural conditions by itself, must be considered as a necessary natural condition for the possibility of generating logical conditions. We remain unable to perform philosophical reasoning and thus unable to account for logical conditions without our brain. While logical conditions may remain independent from the brain by themselves, the brain must at least

be regarded as a necessary natural condition for the possibility of their creation. The brain may then serve as a ‘bridge between natural and logical conditions’ and thus as a ‘window to the mind’.

The distinction between natural and logical conditions with respect to brain and mind can therefore no longer be considered as mutually exclusive. If, however, the distinction between natural and logical conditions is not mutually exclusive, brain and mind can no longer be regarded as different categories. Accordingly, philosophical investigation of the brain i.e. a “philosophy of the brain” does not presuppose confusion but rather linkage between different categories. The ‘argument of categorical fallacy’ should thus be reformulated as an ‘argument of categorical linkage’.

5.3. Argument of Principal Validity

The possibility of “definitorial shifting” and “conceptual re-clarification” in ontological/epistemological assumptions makes ‘neurophilosophical hypothesis’ rather contingent which undermines their necessity in ontological regard. Moreover, by introducing ‘*a posteriori*’ components within purely ‘*a priori*’ arguments, consideration of empirical data renders ‘neurophilosophical hypothesis’ invalid in epistemic regard. The ‘argument of principal validity’ can thus be considered as an argument against the principal possibility of ontological and epistemic validity of ‘neurophilosophical hypothesis’.

The ‘argument of validity’ equates introduction of contingency with complete elimination of necessity i.e. necessity and contingency are thus regarded as mutually exclusive. Introduction of traces of contingency eliminates necessity completely and renders ‘neurophilosophical hypotheses’ invalid. However, ‘neurophilosophical hypotheses’ cannot be characterized by ‘empirical consistency’ exclusively but, in addition, by ‘logical consistency’. ‘Empirical consistency’ reflects contingency while ‘logical consistency’ rather accounts for necessity. Since ‘neurophilosophical hypothesis’ requires ‘empirical and logical consistency’, contingency and necessity may co-occur and co-exist so that they are no longer mutually exclusive. Introduction of traces of contingency does therefore not necessarily eliminate necessity completely -‘neurophilosophical hypothesis’ cannot be regarded as necessarily invalid in ontological regard. Since the same remains true in the case of ‘*a priori*’ and ‘*a posteriori*’, ‘neurophilosophical hypothesis’ cannot be regarded as necessarily invalid in epistemic regard either.

5.4. Argument of General Irrelevance

The development of ‘neurophilosophical hypotheses’ may be regarded as irrelevant and non-necessary for both philosophy and neuroscience. Since ‘neurophilosophical hypotheses’ are ‘crude and arbitrary mixtures’ between empirical hypotheses and theoretical assumptions, they remain unable to make significant contributions to either philosophy or neuroscience. If, however, ‘neurophilosophical hypothesis’ cannot contribute to either discipline, they must be regarded as irrelevant in general. Accordingly, the ‘ar-

gument of general irrelevance' must be considered as an argument against the general relevance and necessity of neurophilosophy as distinguished from both neuroscience and philosophy.

The philosophical characterization of 'neurophilosophical hypothesis' as 'crude and arbitrary mixtures' between empirical hypothesis and theoretical assumptions must be rejected and replaced by 'fine-grained and systematic linkages'. 'Neurophilosophical hypothesis' may indeed contribute to both philosophy and neuroscience so that they can no longer be considered as irrelevant in general.

First, empirical hypotheses and theoretical assumptions are not 'mixed' together but rather 'linked' with each other. 'Mixture' implies that both are thrown together into one pot while 'linkage' refers to selective coupling between those parts that both (i.e. empirical hypothesis and theoretical assumptions) have in common. 'Mixture' for example indicates that ontological/epistemological assumptions of philosophical theories are directly put together with empirical observations of neuroscientific hypothesis. 'Linkage', in contrast, remains possible only between ontological/epistemological assumptions of philosophical theories and ontological/epistemological 'explications' of neuroscientific hypothesis. 'Linkage' between ontological/epistemological assumptions of philosophical theories and empirical observations of neuroscientific hypothesis remains impossible because of their principal differences.

Second, the 'linkage' between empirical hypothesis and theoretical assumptions cannot be considered as 'crude' but rather as 'fine-grained'. 'Crude' implies that neither differentiation between distinct kinds of conditions in general i.e. natural and logical conditions nor between distinct subsets of logical conditions in particular i.e. those being identical and non-identical with natural conditions is considered. However, the linkage between empirical hypothesis and theoretical assumptions considers their different conditions i.e. natural and logical conditions respectively which is reflected in the "principle of asymmetry". Furthermore, the differentiation between distinct subsets of logical conditions is considered which is reflected in the "principle of bidirectionality". Accordingly, the 'linkage' between empirical hypothesis and theoretical assumptions can be characterized as 'fine-grained' rather than 'crude'.

Third, the 'linkage' between empirical hypothesis and theoretical assumptions cannot be considered as 'arbitrary' but rather as 'systematic'. 'Arbitrary' implies that there are no rules and strategies that serve as guidance for the generation of 'linkage'. There are however various principles i.e. the principles of transdisciplinary methodology which establish concrete strategies for 'linkage' between empirical hypothesis i.e. natural conditions and theoretical assumptions i.e. logical conditions. This is reflected best in the "principle of transdisciplinary circularity" which defines specific steps for their 'linkage'. Accordingly, the 'linkage' between empirical hypotheses and theoretical assumptions may be regarded as 'systematic' rather than 'arbitrary'.

5.5. Argument of Transitory Relevance

'Neurophilosophical hypothesis' may be regarded only as an intermediate stage from a neuroscientific point of view. As soon as the mind can be accounted for completely by the brain, all 'neurophilosophical hypothesis' can be replaced by 'empirical hypothesis' i.e. 'neuroscientific hypothesis'. 'Neurophilosophical hypothesis' may therefore be relevant only for the

transition from philosophy to neuroscience. Neurophilosophy can be considered as a transitory stage in the process of replacement of philosophy by neuroscience. Accordingly, the ‘argument of transitory relevance’ can be considered as an argument against the principal relevance of neurophilosophy as distinguished from neuroscience.

The ‘argument of relevance’ relies on a rather narrow definition of the ‘brain’. The ‘brain’ is regarded as a “physical brain” since otherwise it could not be accounted for completely by neuroscience. Moreover, the brain as a “physical brain” can be characterized by natural conditions exclusively.

This definition of the brain however neglects the possibility of generating logical conditions by the brain itself which as such have to be distinguished from natural conditions. Purely empirical and thus neuroscientific approaches to the brain cannot account for this linkage between natural and logical conditions within the brain because they do not differentiate between natural and logical conditions. If, however, the linkage between natural and logical conditions is neglected, the brain itself cannot be accounted for completely. Accordingly, a purely neuroscientific account of the brain remains necessarily incomplete and thus insufficient.

Logical conditions are not reflected in empirical hypotheses but rather in theoretical assumptions. If logical conditions need to be considered in investigation of the brain, the brain may subsequently be accounted for by a conjunction of empirical hypothesis and theoretical assumptions. It is this conjunction between empirical hypothesis and theoretical assumptions which is provided by ‘neurophilosophical hypothesis’. ‘Neurophilosophical hypothesis’ may subsequently be able to account for the linkage between natural and logical conditions within the brain itself. Accordingly, ‘neurophilosophical hypotheses’ cannot be replaced by empirical i.e. neuroscientific hypotheses and remain therefore principally relevant for the investigation of the brain.

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