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# Epistemic Challenges: Engaging Philosophically in Cognitive Science

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## Introduction*

Cognitive science (CS), with its interdisciplinary character[1] and internal diversity, poses a serious challenge to philosophical re-

* This paper was prepared for the special issue of "Ruch Filozoficzny" dedicated to professor Żeglen. Professor was advisor of my Master Thesis (on phenomenal consciousness) and PHD Thesis (on embodied cognition). With gratitude for her support and trust in my – sometimes a little bit slow – work, I want to dedicate her this paper. While working on PHD Thesis I had an opportunity work with professor Żegleń and Tomasz Komendziński (and colleagues such as Jacek Podgórski and many others) on the first program in cognitive science studies in Nicolaus Copernicus University in Toruń. Together with Tomasz Komendziński we proposed that an important part of this studies should be lectures in "Philosophy in Cognitive Science", and for two years, I had the great pleasure of conducting exercises for these lectures. Despite the fact that my approach to the relation between philosophy and cognitive science dramatically changed from that time, that period was extremely important for my thinking about issues which I describe in this article.

[1] Contrary to the opinion expressed in most of the papers providing an introduction to cognitive science (Keith Frankish, William Ramsey, *The Cambridge Handbook of Cognitive Science* (Cambridge University Press, 2012); Jay Friedenberg, Gordon Silverman, *Cognitive Science: An Introduction to the Study of Mind* (Sage, 2011)), the interdisciplinary nature of the field is not obvious or self-evident (Jamie Cohen-Cole, "Instituting the Science of Mind: Intellectual Economies and Disciplinary Exchange at Harvard's Center for Cognitive Studies", *The British Journal for the History of Science* 40, no. 4 (2007): 567–597; Harvey J. Graff, *Undisciplining Knowledge: Interdisciplinarity*

search,[2] as well as interdisciplinary studies.[3] The multiplicity and variety of fields, traditions and methodologies comprising the field of cognitive science makes its investigation difficult. Therefore, when I write about CS as a supra-discipline, I will not assume the internal unity or coherence of CS and will instead treat it as a pluralistic and multi-disciplinary area of inquiry.

The crucial challenge of CS as a supra-discipline is the effective communication and robust integration between the disciplines that comprise it. Without them, CS as a single field may cease to exist in not so distant future. However, I will deal with this topic only rather indirectly at the end of this work. Here, I will focus on the role that philosophy can **currently** play in CS. Nevertheless, the answer I propose is relevant to the question mentioned above, viz. the relationships (communication and integration) between sub-disciplines of CS.

I will start by accepting the neutral, though maybe not obvious, claim that in such a complex field as CS, it is difficult to rigidly or permanently establish a single, particular role that philosophy should play. The dynamics of CS development constantly change – not only which disciplines are part of CS, and to what extent they participate in it, but also which tasks they perform within it. For this reason, my answer can be considered as local and temporarily constrained: the **current** role of philosophy in CS. Thus, the answer I will give may not apply to the role that the philosophy has played in the past or will play in the future of CS.

The proposed answer is partially inspired by the nascent philosophical-methodological awareness among cognitive scientists.[4] This aware-

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*in the Twentieth Century* (JHU Press, 2015)). This work will not further develop this issue, but it is important here to point out that the interdisciplinary nature of cognitive sciences requires a more detailed elaboration than it receives in the current literature.

[2] William Bechtel, "How Can Philosophy Be a True Cognitive Science Discipline?", *Topics in Cognitive Science* 2, no. 3 (2010): 357–66; William Bechtel, *Integrating Scientific Disciplines: Case Studies from the Life Sciences*, vol. 2 (Springer Science & Business Media, 2012); Andrew Brook, "Introduction: Philosophy in and Philosophy of Cognitive Science", *Topics in Cognitive Science* 1, no. 2 (2009): 216–30; Paul Thagard, "Being Interdisciplinary: Trading Zones in Cognitive Science", *Interdisciplinary Collaboration: An Emerging Cognitive Science*, 2005, 317–39; idem, "How to Collaborate: Procedural Knowledge in the Cooperative Development of Science", *The Southern Journal of Philosophy* 44, no. S1 (2006): 177–196.

[3] Sharon J. Derry, Christian D. Schunn, Morton Ann Gernsbacher, *Interdisciplinary Collaboration: An Emerging Cognitive Science* (Psychology Press, 2014); Thagard, "Being Interdisciplinary: Trading Zones in Cognitive Science"; Julie Thompson Klein, "A Taxonomy of Interdisciplinarity", *The Oxford Handbook of Interdisciplinarity* 15 (2010): 15–30; Uskali Mäki, "Philosophy of Interdisciplinarity. What? Why? How?", *European Journal for Philosophy of Science* 6, no. 3 (2016): 327–342.

[4] Danilo Bzdok, John PA Ioannidis, "Exploration, Inference, and Prediction in Neuroscience and Biomedicine", *Trends in Neurosciences*, 2019; Danilo Bzdok, BT Thomas Yeo, "Inference in the Age of Big Data: Future Perspectives on Neurosci-

ness is evidenced by the publication of philosophical papers in scientific journals regarding the relationship between explanation and predictions, and whether stronger focus on predictions than explanations should be considered as more promising for gaining more understanding of issues under investigation, at least for some of the disciplines constituting CS.[5]

Researchers in CS, motivated by recent failures (e.g., the replication crisis) start focusing on the nature of theoretical and philosophical assumptions underlying the methods used in cognitive neuroscience,[6] and investigate the new ways of conducting research, for example, exploring and making reliable inferences from increasingly available massive amounts of data (i.e. big data).[7] This shows it is not only possible to include philosophers in research in CS, but also desirable.

What is not yet sufficiently described and appreciated are the differences between sub-disciplines of CS. More specifically, although the interdisciplinary character of CS is widely accepted, the theoretical and practical constraints or problems faced by these sub-disciplines in mutual interactions or their eventual integration are less often noticed. I will focus on this issue in the final part of this paper.

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ence", *Neuroimage* 155 (2017): 549–564; Frederick Eberhardt, David Danks, "Confirmation in the Cognitive Sciences: The Problematic Case of Bayesian Models", *Minds and Machines* 21, no. 3 (2011): 389–410; Rick O. Gilmore et al., "Progress toward Openness, Transparency, and Reproducibility in Cognitive Neuroscience", *Annals of the New York Academy of Sciences* 1396, no. 1 (2017): 5–18; Eshin Jolly, Luke J. Chang, "The Flatland Fallacy: Moving Beyond Low-Dimensional Thinking", *Topics in Cognitive Science*, 2018; Christopher T. Kello et al., "Scaling Laws in Cognitive Sciences", *Trends in Cognitive Sciences* 14, no. 5 (2010): 223–232; John W. Krakauer et al., "Neuroscience Needs Behavior: Correcting a Reductionist Bias", *Neuron* 93, no. 3 (2017): 480–90; Monica D. Rosenberg, B. J. Casey, Avram J. Holmes, "Prediction Complements Explanation in Understanding the Developing Brain", *Nature Communications* 9, no. 1 (2018): 589; Tal Yarkoni, Jacob Westfall, "Choosing Prediction over Explanation in Psychology: Lessons from Machine Learning", *Perspectives on Psychological Science* 12, no. 6 (2017): 1100–1122.

[5] Bzdok, Ioannidis, "Exploration, Inference, and Prediction in Neuroscience and Biomedicine"; Yarkoni, Westfall, "Choosing Prediction over Explanation in Psychology: Lessons from Machine Learning".

[6] Thomas Carlson et al., "Ghosts in Machine Learning for Cognitive Neuroscience: Moving from Data to Theory", *NeuroImage* 180 (2018): 88–100; Marcin Miłkowski, Witold M. Hensel, Mateusz Hohol, "Replicability or Reproducibility? On the Replication Crisis in Computational Neuroscience and Sharing Only Relevant Detail", *Journal of Computational Neuroscience* 45, no. 3 (2018): 163–172; J. Brendan Ritchie, David Michael Kaplan, Colin Klein, "Decoding the Brain: Neural Representation and the Limits of Multivariate Pattern Analysis in Cognitive Neuroscience", *The British Journal for the Philosophy of Science*, 2017.

[7] Bzdok, Yeo, "Inference in the Age of Big Data: Future Perspectives on Neuroscience".

## 1. What Is the Role of a Philosopher in Cognitive Science?

The role of philosophers and philosophy in cognitive science has been previously examined. The most comprehensive paper about this issue is probably that of van Gelder.[8] The author distinguished seven roles for a philosopher in cognitive science: *pioneer, building inspector, Zen monk, cartographer, archivist, cheerleader and gadfly*.[9] That taxonomy has not been widely discussed since; however, it appears to exhaustively present the spectrum of possibilities for philosophical involvement in cognitive science, beginning from passively observing and describing results *(cheerleader*, *archivist*) through inspecting methodological soundness (*building inspector*, *Zen monk*, *gadfly*) or conceptual assumptions (*cartographer*) to proposing new concepts and solutions (*pioneer*). As we will see, here I focus on the role similar to that of a *building inspector*.

A decade later, an interesting debate took place in *Topics in Cognitive Science*.[10] In this debate, two basic and relatively independent roles for philosophy have been indicated: (a) philosophy *in* cognitive science; (b) the philosophy *of* cognitive science. The first is essentially the philosophy of mind, perception, language or action. Such philosophy involves issues that are also of interest for other disciplines of CS, for example the problem of knowing other minds or the role of emotions in cognition. However, here a philosopher proceeds by using purely philosophical

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[8] Tim Van Gelder, "The Roles of Philosophy in Cognitive Science", *Philosophical Psychology* 11, no. 2 (1998): 117–136.

[9] Van Gelder (1998) describes these roles as follows: (1) "the *pioneers:* to tackle problems that nobody else knows how to handle yet, in the hope of transforming them into scientifically tractable questions" (p. 126); (2) "the *building inspector* (…) is (...) inspecting foundations" (p. 128); (3) "the Zen monk – a figure supported by the community to ponder those imponderable issues that everyone thinks should be thought about by someone, but for which nobody else has time or patience" (p. 129); (4) philosophers "produce large-scale conceptual maps of the discipline; we can thus think of philosophers as the *cartographers* of cognitive science" (p. 130); (5) "*archivist.* It is the philosopher who, more than anyone else in cognitive science, is expected to be the repository of accumulated wisdom" (p. 131); (6) "*The cheerleader:* philosophers [which PN] have acquired a certain measure of both authority and responsibility in determining what counts as a good idea. (p. 133) (7) "philosopher as gadfly (…) often advance[s] positions that are so strongly and provocatively stated that other cognitive scientists feel compelled to respond" (p. 134).

[10] See: Bechtel, "How Can Philosophy Be a True Cognitive Science Discipline?"; Brook, "Introduction: Philosophy in and Philosophy of Cognitive Science"; Daniel C. Dennett, "The Part of Cognitive Science That Is Philosophy", *Topics in Cognitive Science* 1, no. 2 (2009): 231–36; see also Sebastian. Kołodziejczyk, "Po co filozofia kognitywistyce?: preteorie, metateorie i translacje," in: *Metodologiczne i teoretyczne problemy kognitywistyki*, ed. Jan Woleński, Andrzej Dąbrowski (Kraków: Copernicus Center Press, 2014), 219–270.

methods, such as thought experiments or conceptual analysis.[11] The second is part of the philosophy of science, focused on the field of cognitive science as its object, addressing the issue of justification, confirmation, evaluation or falsification[12] in CS and ultimately, the integration or unification of the entire supra-discipline.[13]

Although I admire van Gelder's taxonomy, I will start in my considerations from the simpler distinction developed from the debate, modifying it slightly. My suggestion results from the two mentioned roles. As I have already pointed out, in each of the roles mentioned above, the authors refer to different philosophical disciplines. Philosophy in cognitive science is, for the most part, a philosophy of mind or language, whereas philosophy of cognitive science is part of the philosophy of science. In this paper, I suggest that philosophy of science should play a key role in cognitive science. In other words, I sketch the role of the philosophy of cognitive science within the field of cognitive science.

The modification I propose here is not completely new, although it was not considered in the context of cognitive science. Here, I rely on the study of Kaiser and colleagues[14] regarding the cooperation of philosophers of a particular science with researchers representing the disciplines they examine. This is an interesting and promising approach and allows us to capture two important issues: (1) the role of the philosophy of cognitive science within cognitive science; (2) the interdisciplinary character of cognitive science.

When describing the interdisciplinary role of the philosophy of science, Kaiser et al.[15] distinguish it from role played by the general philosophy of science (they call this general role *synoptic*). Further, they distinguish the synoptic philosophy of science from the philosophy of particular sciences.[16] Following Boden,[17] they assume that authentic

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[11] Brook, "Introduction: Philosophy in and Philosophy of Cognitive Science"; Dennett, "The Part of Cognitive Science That Is Philosophy".

[12] Stefano Palminteri, Valentin Wyart, Etienne Koechlin, "The Importance of Falsification in Computational Cognitive Modeling", *Trends in Cognitive Sciences* 21, no. 6 (2017): 425–433.

[13] Marcin Miłkowski, "Unification Strategies in Cognitive Science", *Studies in Logic, Grammar and Rhetoric* 48, no. 1 (2016): 13–33.

[14] Marie I. Kaiser, Maria Kronfeldner, Robert Meunier, "Interdisciplinarity in Philosophy of Science", *Journal for General Philosophy of Science* 45, no. 1 (2014): 59–70; Marie I. Kaiser, Maria Kronfeldner, Robert Meunier, "Problems and Prospects of Interdisciplinarity: The Case of Philosophy of Science", *Interdisciplinary Science Reviews* 41, no. 1 (2016): 61–70.

[15] Kaiser, Kronfeldner, Meunier, "Interdisciplinarity in Philosophy of Science".

[16] Kaiser, Kronfeldner and Meunier considered the interdisciplinary role of philosophy of science in the context of individual sciences, such as CS.

[17] Margaret A. Boden, "What Is Interdisciplinarity", *Interdisciplinarity and the Organisation of Knowledge in Europe*, 1999, 13–23.

interdisciplinary investigations require cooperation, and therefore they call for collaborative interdisciplinarity. However, different forms of collaboration are possible. They distinguish between reflexive and embedded philosophy of science. The embedded philosophy of science – similar to philosophy *in* cognitive science – is involved in solving the problems of particular sciences, with the requirement that in this case, a philosopher should have the competence of a member of the discipline community whose problems she or he attempts to solve. Therefore, it does not seem possible that his or her involvement would be limited to the use of purely philosophical competences.

While writing about reflexive philosophy of science, Kaiser et al.[18] distinguish cooperation on a reflective level from that in relation to reflective problems. Here, reflexivity means referring to the science itself, its theories, hypotheses, and research methods, but not to subjects studied within it. Integration at the reflective level means integration with other reflexive disciplines,[19] such as sociology of science, history of science, and science studies.[20] Reflexive integration is integration focused on reflective problems of particular sciences, such as the problem of explaining or collecting data or the ethical consequences of the algorithms used for data analysis in individual sciences and many other issues. In addition, Kaiser and colleagues[21] indicate, and I acknowledge here, that the philosophy of science always has a certain normative baggage. The more normative it is, the less cooperative it becomes, the more normativity, the less interdisciplinarity and vice versa. Therefore, my proposal ascribes a descriptive rather than normative role of philosophy in cognitive science.

I am of opinion that the current situation of cognitive science, with its increasing theoretical and methodological diversity (e.g., the emergence of new methods like optogenetics[22] or dynamical causal modeling[23]), increased availability of various types of data, especially massive datasets provided by big data[24] and its interdisciplinary character, is leading us to appreciate that the most desirable form of cooperation between

[18] Kaiser, Kronfeldner, Meunier, "Interdisciplinarity in Philosophy of Science".

[19] The history and philosophy of science can be treated as an example of such reflexive integration.

[20] See: Hauke Riesch, "Philosophy, History and Sociology of Science: Interdisciplinary Relations and Complex Social Identities", *Studies in History and Philosophy of Science Part A* 48 (2014): 30–37.

[21] Kaiser, Kronfeldner, Meunier, "Interdisciplinarity in Philosophy of Science".

[22] John Bickle, "From Microscopes to Optogenetics: Ian Hacking Vindicated", *Philosophy of Science* 85, no. 5 (2018): 1065–1077; Jacqueline A. Sullivan, "Optogenetics, Pluralism, and Progress", *Philosophy of Science* 85, no. 5 (2018): 1090–1101.

[23] Frances Egan and Robert J. Matthews, "Doing Cognitive Neuroscience: A Third Way", *Synthese* 153, no. 3 (2006): 377–391.

[24] Sabina Leonelli, "What Counts as Scientific Data? A Relational Framework", *Philosophy of Science* 82, no. 5 (2015): 810–821.

philosophers and representatives is focused on reflective problems. This type of cooperation is focused on the problems of cognitive science as a science, not on topics examined by CS itself. Of course, this does not mean that the philosophy embedded in cognitive science is undesirable or unnecessary. However, currently the reflective problems seems more urgent, and requires more philosophical attention. The work of Laplane and colleagues[25] in a general way supports the views presented above. The authors convincingly show the importance of philosophy for scientific research. Although what they write about CS seems to be the least convincing in their paper,[26] it is noteworthy that the philosophical but reflective analyses, analyzing concepts as used in a specific science (*stemness* in biology or *self* in immunology) allow us not only to develop new concepts or approaches, but also to generate predictions and formulate new research questions and experimental designs.

Before discussing selected examples of the reflective role of philosophy in cognitive science, I would like to point to a more practical issue concerning philosophical works in cognitive science, inspired by Laplane et al.[27] They argue that these studies should be made widely available to researchers and published in non-philosophical outlets: in our case, these will be cognitive science, psychological, or neuroscientific journals.[28] This suggestion is not as trivial as it seem. A paper published in a neuroscientific or psychological journal becomes not only available to scientists, but also more accessible for them, thanks to the process of review by neuroscientific or psychological specialists.

## 2. Epistemic Challenges for Philosophers in CS

Now, I will present examples of some epistemic challenges for CS in which a philosopher can fruitfully participate. Naturally, it is difficult

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[25] Lucie Laplane et al., "Opinion: Why Science Needs Philosophy", *Proceedings of the National Academy of Sciences* 116, no. 10 (2019): 3948–3952.

[26] These authors refer only to two, mostly historical, examples of research on mindreading and modularity, inspired by philosophers (Daniel Dennett and Jerry Fodor). However, I believe that it is possible to find more recent examples of involvement of philosophers in CS research.

[27] Laplane et al., "Opinion: Why Science Needs Philosophy".

[28] For such attempts, see: Carlson et al., "Ghosts in Machine Learning for Cognitive Neuroscience: Moving from Data to Theory"; Miłkowski, Hensel, Hohol, "Replicability or Reproducibility? On the Replication Crisis in Computational Neuroscience and Sharing Only Relevant Detail"; Ritchie, Kaplan, Klein, "Decoding the Brain: Neural Representation and the Limits of Multivariate Pattern Analysis in Cognitive Neuroscience".

to give an exhaustive or even satisfactorily ordered set of such challenges. I will present only some of those I find particularly intriguing.

## 2.1. Phenomena

At least since the appearance of the classic work of Bogen and Woodward,[29] there has been an ongoing discussion regarding the role of data in inferences about phenomena, as well as the theory of these phenomena, and, more controversially, the theory of data itself. It turns out that these considerations become even more interesting when we transfer them to the CS domain.

We will go to the subject of data later; let's stop for a moment with the phenomena relevant to CS. What are the phenomena described by CS? Do different sub-disciplines deal with the same phenomena? The work of Feest seems to be a good start for such considerations. She analyzed the phenomenon of working memory,[30] its stability (validity, interoperability and robustness), and basic properties. She showed that it is still uncertain that many effects unfolding the memory properties are really memory or attention-related effects. Thus, the relationship between effects and objects of research in CS still merits deeper investigation.

Feest[31] then addressed these issues even more directly; she argues that the main task of scientific research is not explanation, but above all a good distinction and description of investigated objects. In other words, before an explanation is possible, it is necessary to indicate in advance what will be explained. There is still much controversy about how to properly characterize an object of research in general, and this general debate is relevant for CS. For example, Feest investigates the distinction between phenomena and objects more carefully. She indicates that in psychology, memory or attention are objects of research, unfolded by studying their specific effects.[32] And these effects, she argues, we should call phenomena. Therefore, we study phenomena to unfold properties of objects of research. Until we are able to properly differentiate objects, phenomena and data, we will not be able to avoid confusion in CS research.

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[29] James Bogen, James Woodward, "Saving the Phenomena", *The Philosophical Review* 97, no. 3 (1988): 303–352.

[30] Uljana Feest, "Remembering (Short-Term) Memory: Oscillations of an Epistemic Thing", *Erkenntnis* 75, no. 3 (2011): 391–411; Uljana Feest, "What Exactly Is Stabilized When Phenomena Are Stabilized?", *Synthese* 182, no. 1 (2011): 57–71.

[31] Uljana Feest, "Phenomena and Objects of Research in the Cognitive and Behavioral Sciences", *Philosophy of Science* 84, no. 5 (2017): 1165–1176.

[32] Feest, "Remembering (Short-Term) Memory: Oscillations of an Epistemic Thing".

Another issue, not addressed directly by Feest,[33] is the status of tasks in psychological research (appreciating the key role of psychological research for CS). Are they objects, phenomena or data? This is a question worth answering, especially when we notice recent work of Sullivan[34] on the issues emerging from ambiguities of task use in psychological and interdisciplinary research (in integration of psychological and neuroscientific or psychiatric research). Although these are just the beginnings of these analyses, it seems that they are important because they allow us to systematize knowledge and to structure research in behavioral and cognitive sciences. Of course, in the case of cognitive science, there are additional issues, such as the interdisciplinary relationship between objects and phenomena.

## 2.2. Data

Let us return to the problem with data alluded to above.[35] There are more problems with data than whether our descriptions of objects and phenomena are accompanied (or not) by theories of data (as discussed by Bogen & Woodward[36]). The most basic issue is the very determination of what data really are: material artifacts or abstract strings of symbols.[37]

The recent philosophical treatment of these issues by Leonelli helps us see in new light the question of data reliability, accessibility and usability. More attention is drawn to the problem of data's locality, the relationship of the obtained data with their the time of creation and time of use. Another difficulty is data transmission, storage and archiving, without losing availability and durability.[38] Leonelli has described in relation to the biological sciences,[39] however there is no reason to doubt that there are similar problems in CS, especially given its interdisciplinary nature. There are different approaches to data in various disciplines,

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[33] However, see Jacqueline A. Sullivan, "Coordinated Pluralism as a Means to Facilitate Integrative Taxonomies of Cognition", *Philosophical Explorations* 20, no. 2 (2017): 129–145.

[34] Sullivan.

[35] Samuel Schindler, "Bogen and Woodward's Data-Phenomena Distinction, Forms of Theory-Ladenness, and the Reliability of Data", *Synthese* 182, no. 1 (2011): 39–55.

[36] Bogen, Woodward, "Saving the Phenomena".

[37] Leonelli, "What Counts as Scientific Data? A Relational Framework".

[38] Sabina Leonelli, "On the Locality of Data and Claims about Phenomena", *Philosophy of Science* 76, no. 5 (2009): 737–749; eadem, "What Counts as Scientific Data? A Relational Framework".

[39] Eadem, *Data-Centric Biology: A Philosophical Study* (University of Chicago Press, 2016).

like computer science, neuroscience or psychology; in CS, so we face the problem of interdisciplinary data sharing and storing.

## 2.3. Theory

The question of theory in cognitive science is at the same time non-trivial and almost completely overlooked. In a series of articles, Gigerenzer[40] notes that in psychology, it is quite common to replace theory by theoretical surrogates, where instead of theory there are re-descriptions of hypotheses or tools used to study phenomena or objects. That is why psychology is rendered almost a-theoretical.[41] For example, statistical tools used to analyze data about phenomena are then indicated as concepts or theories of these phenomena. To what extent do we deal in CS with the same situation? For example, in the case of probabilistic theories, or in the more recent case of predictive coding. In other words, perhaps these theories are only a re-description of theoretical tools previously used to study behavior, perform tasks, or to analyze the activity of the central nervous system.

## 2.4. Hidden Assumptions

Ritchie and collaborators[42] analyzed the assumptions underlying multivariate pattern analysis (MVPA), the method of decoding of signals obtained through fMRI. Researchers have shown that, with these methods, it is often possible to decode mental contents from the activity of the nervous system. The basic assumption underlying this method is the following: since the linear analysis used in MVPA is biologically plausible, this indicates that decoded information is the content of neural states or neural representations. However, as Ritchie et al. point out, it is far from obvious what is actually read from fMRI signals. They show that very often, this system can read information about, for example, perceptions of movement, from area of central nervous system which, according to our current knowledge, is less involved in the perception of movement (the primary visual cortex, V1), than area that is much more involved in perception of movement (middle temporal visual area, V5/+MT).

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[40] Gerd Gigerenzer, "From Tools to Theories: A Heuristic of Discovery in Cognitive Psychology", *Psychological Review* 98, no. 2 (1991): 254; idem, "Surrogates for Theories", *Theory & Psychology* 8, no. 2 (1998): 195–204; idem, "Personal Reflections on Theory and Psychology", *Theory & Psychology* 20, no. 6 (2010): 733–743.

[41] Denny Borsboom, "Theoretical Amnesia", *Open Science Collaboration Blog* (blog), 2013, http://osc.centerforopenscience.org/category/misc6.html.

[42] Ritchie, Kaplan, Klein, "Decoding the Brain: Neural Representation and the Limits of Multivariate Pattern Analysis in Cognitive Neuroscience".

They also indicate that the common reference to predictions is also not really helpful and cannot convincingly support thesis that using MVPA. With MVPA, we are reading the contents of neuronal representations, because we are not able to show what signals the system uses for these predictions.

We have seen here how a philosophical analysis uncovers epistemic gaps in empirical cognitive neuroscience. Ritchie et al. propose extremely interesting solutions regarding the integration of neuroscientific and psychological models; however, time will tell if their solution will be free from epistemic gaps or dubious assumptions. These investigations can be related to more general research of the epistemic status of evidence about functioning and structure of the central nervous system as supplied by experimental techniques, tools, or equipment, as already developed by Bechtel.[43]

## 3. Can Philosophers Track Blind Integration?

Almost every example discussed above leads to one issue: the relationship between sub-disciplines of CS. Although studies of interdisciplinarity have addressed the issue of integration or interaction between sub-disciplines in different interdisciplinary projects,[44] research on the relationships between sub-disciplines that make up CS is neither rich nor too advanced.[45] This lack of work is surprising in the face of widespread acceptance of the interdisciplinary character of CS. However, it should be noted that there is some work devoted to the dubious nature of the interdisciplinary nature of cognitive science,[46] and

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[43] William Bechtel, "The Epistemology of Evidence in Cognitive Neuroscience", *Philosophy and the Life Sciences: A Reader*, 2004; William Bechtel, Robert S. Stufflebeam, "Epistemic Issues in Procuring Evidence about the Brain: The Importance of Research Instruments and Techniques", *Philosophy and the Neurosciences: A Reader*, 2001, 55–81; William Bechtel, "Deciding on the Data: Epistemological Problems Surrounding Instruments and Research Techniques in Cell Biology", in: *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, vol. 1994 (Philosophy of Science Association, 1994), 167–178.

[44] Till Grüne-Yanoff, "Interdisciplinary Success without Integration", *European Journal for Philosophy of Science* 6, no. 3 (2016): 343–360; Klein, "A Taxonomy of Interdisciplinarity".

[45] For an exception, see Thagard, "Being Interdisciplinary: Trading Zones in Cognitive Science"; idem, "How to Collaborate: Procedural Knowledge in the Cooperative Development of Science".

[46] Jamie Cohen-Cole, "Instituting the Science of Mind: Intellectual Economies and Disciplinary Exchange at Harvard's Center for Cognitive Studies", *The British Journal for the History of Science* 40, no. 4 (2007): 567–597; Harvey J. Graff, *Undisciplining Knowledge: Interdisciplinarity in the Twentieth Century* (JHU Press, 2015).

to the conflict or divergence between disciplines and within disciplines forming at least part of sub-disciplines of CS,[47] and to the negative assessment of research outputs (as trivial or not precise enough) that occurs between disciplines of different depth and breadth.[48]

We can indicate noticeable research on compatibility of experimental protocols and procedures between research groups, even from the same disciplines,[49] as well as stabilizing constructs assessed by various disciplines, from psychology through psychiatry to neuroscience.[50] However impressive, these are still single studies and do not apply to many disciplines within CS. It is worth noting that issues such as the nature and degree of interdisciplinarity are important. In other words, does CS create one integrated discipline or rather a mosaic of diverse, only locally integrated sub-disciplines? Is this integration strong, based on the mutual recognition of reciprocal limitations and ways on conducting research and acquire knowledge, or superficial, based only on a shallow combination of results without critical evaluation?

Many works on interdisciplinary research points to the slowness of reaching mutual understanding.[51] Regardless of whether the integrating teams are from closely related disciplines (not even as distant as computer science and anthropology in CS), it often takes cooperating researchers over six months to recognize that although they use the same terms, they mean something completely different by them.

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[47] Feest, "Phenomena and Objects of Research in the Cognitive and Behavioral Sciences"; David Peterson, "The Baby Factory: Difficult Research Objects, Disciplinary Standards, and the Production of Statistical Significance", *Socius* 2 (2016): 2378023115625071; idem, "The Depth of Fields: Managing Focus in the Epistemic Subcultures of Mind and Brain Science", *Social Studies of Science* 47, no. 1 (2017): 53–74; Jacqueline A. Sullivan, "The Multiplicity of Experimental Protocols: A Challenge to Reductionist and Non-Reductionist Models of the Unity of Neuroscience", *Synthese* 167, no. 3 (2009): 511; eadem, "Coordinated Pluralism as a Means to Facilitate Integrative Taxonomies of Cognition".

[48] Peterson, "The Depth of Fields: Managing Focus in the Epistemic Subcultures of Mind and Brain Science".

[49] Sullivan, "The Multiplicity of Experimental Protocols: A Challenge to Reductionist and Non-Reductionist Models of the Unity of Neuroscience".

[50] Feest, "What Exactly Is Stabilized When Phenomena Are Stabilized?"; Jacqueline A. Sullivan, "Stabilizing Mental Disorders: Prospects and Problems", in: *Classifying Psychopathology: Mental Kinds and Natural Kinds*, by Jacqueline A. Sullivan and Harold Kincaid (Cambridge, Massachusetts, London,England: MIT Press, 2014), 257; Sullivan, "Coordinated Pluralism as a Means to Facilitate Integrative Taxonomies of Cognition".

[51] See Susann Wagenknecht, *A Social Epistemology of Research Groups* (Springer, 2016).

And that is with about half a year of intense, almost everyday cooperation.[52]

Why should we assume that the case is different in CS? Even if cooperation lasts for many years, in the absence of a daily effort at integration, it is possible to overlook many erroneous associations or terminological discrepancies. It is possible that although the same methods are used in different disciplines, these tools are not used in the same way, so without interdisciplinary awareness of these differences. The situation may be more difficult because there may be an (erroneous) sense of mutual understanding.

Can philosophers participate in solving problems with blind integration, the threat of which I have indicated here? I think the examples cited above show they are already doing so. Let us return to one of them, that has not yet been applied to interdisciplinary research.

As Feest's[53] findings show, while many general categories, such as data or phenomena seem obvious and well understand, the opposite is true. They are used in notoriously ambiguous and indeterminate way. Note that what is a phenomenon in one discipline can be data in another. In addition, in one discipline, data and phenomena can be precisely defined and separated, while in the other discipline they are blurry. Therefore, it seems that it is worth asking what the data are for and what phenomena are in CS. Are phenomena effects, as Feest writes? And if so, what is the role of such psychological constructs? Or are they research objects?

I think that this is where the role of the philosopher of science cooperating with cognitive scientists on reflective problems reveals itself. A philosopher analyzing the assumptions of individual disciplines can track and resolve superficial and ultimately erroneous integration that will prevent a further development of knowledge acquisition in CS.

## 4. Beyond Epistemic Gaps

It is worth noting that I have focused here only on the epistemic challenges faced by various disciplines that make up cognitive science, both in interdisciplinary and interdisciplinary struggles. I pointed to epistemic gaps, lack of terminology, or a lack of awareness of differences and discrepancies. However, this could leave an impression that phi-

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[52] Susan L. Epstein, "Making Interdisciplinary Collaboration Work", in: *Interdisciplinary Collaboration: An Emerging Cognitive Science*, ed. Sharon J. Derry, Christian D. Schunn, Morton Ann Gernsbacher (Lawrence Erlbaum Associates, 2005), 245–263.

[53] Feest, "Phenomena and Objects of Research in the Cognitive and Behavioral Sciences".

losophers participating in interdisciplinary research in CS face only epistemic challenges.

There are also social (e.g., public trust in the results of cognitive research) and ethical challenges that are extremely important and often central. Especially in CS, we are confronted not only with challenges arising within disciplines, as in the case of research involving humans or animals in psychology and neuroscience, or anthropology, but also challenges arising at the interface between disciplines. These include the ethical consequences of combining different disciplines, e.g., socially sensitive and culture-related anthropological data with neurophysiological research. An equally ethical and social challenge is the issue of collecting, processing, storing and sharing data, especially in connection with widespread and scientifically desired open data practices.[54] Of course, these topics are now analyzed and certainly will be thoroughly developed further by philosophers. However, I have mentioned them here to indicate that challenges faced by cognitive scientists working with cognitive scientists are more numerous than they may seem at a glance.

## Conclusion

In this work, I aimed to show that the involvement of philosophers in cognitive cooperation is not only possible and fruitful. At the end, I note two issues: first, I did not intend or attempt to show that philosophers of cognitive science are indispensable in solving CS problems, only that there are important CS problems, in solving which philosophies can participate with success. Secondly, philosophers engaged in CS research do not solve philosophical problems, but CS problems. Whether this has any impact on solving of philosophical issues is a separate issue.

In conclusion, therefore, the philosopher of cognitive science can face epistemic challenges, such as tracking gaps, discrepancies, and epistemic incompatibilities between research conducted by various sub-disciplines, and can do so successfully, by helping the cognitive scientists to reach research goals. What is very important, without vigilant philosophical eye, the integration between disciplines, and in consequence, the resulting research, may turn be aimless and futile in the long run.

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[54] Clifford S. Duke, John H. Porter, "The Ethics of Data Sharing and Reuse in Biology", *BioScience* 63, no. 6 (2013): 483–489; L. Floridi and M. Taddeo, "What Is Data Ethics?", *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374, no. 2083 (2016); Sabina Leonelli, "Locating Ethics in Data Science: Responsibility and Accountability in Global and Distributed Knowledge Production Systems", *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374, no. 2083 (2016): 20160122.

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## Summary

In this article, I show the role that the philosopher of cognitive science can currently play in cognitive science research. I argue for the important, and not yet

considered, role of the philosophy of cognitive science in cognitive science, that is, the importance of cooperation between philosophers of science with cognitive scientists in investigating the research methods and theoretical assumptions of cognitive science. At the beginning of the paper I point out, how the philosopher of science, here, the philosopher of cognitive science, can participate in interdisciplinary research. I am opting of the cooperation in investigating the so-called reflective problems. Then, I discuss four examples of issues important for the cognitive science, in which the competences possessed by the philosopher are useful. At the ending I point out wider landscape of possible cooperation of philosophers with cognitive scientists.

**Keywords**: epistemic challenges, cognitive science, philosophy of science, philosophy of cognitive science, interdisciplinarity

## Streszczenie

## Wyzwania epistemiczne: o filozoficznym zaangażowaniu w badania kognitywistyczne

W artykule pokazuję, jaką rolę może aktualnie odgrywać filozof w badaniach kognitywistycznych. Argumentuję za ważną, dotychczas nierozważaną, rolą filozofa nauk poznawczych w tychże naukach, w szczególności za współpracą pomiędzy filozofami nauki a kognitywistami w pracy nad metodami badawczymi i podstawowymi założeniami teoretycznymi kognitywistyki, czyli nad tzw. problemami refleksyjnymi. Artykuł rozpoczynam od wskazania, jak filozof nauki, tu filozof nauk poznawczych, może uczestniczyć w badaniach interdyscyplinarnych. Następnie omawiam przykłady problemów ważnych dla badań kognitywistycznych, w rozwiązywaniu których przydatne są kompetencje filozoficzne. Artykuł kończę, wskazując na szeroką paletę problemów, przy rozwiązywaniu których możliwa i pożądana jest współpraca między filozofami i kognitywistami.

**Słowa kluczowe**: wyzwania epistemiczne, nauki poznawcze, filozofia nauki, filozofia nauk poznawczych, interdyscyplinarność