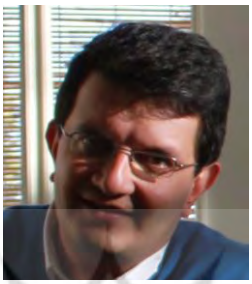
The Quarterly Journal of
PHILOSOPHICAL INVESTIGATIONS
University of Tabriz

Vol. 15/ Issue: 36/ Autumn 2021

Philosophy of Science Meets Scientific Research: Metatheorizing expertise theories in Cognitive Psychology



Alireza Monajemi
Associate Professor of Philosophy, Institute for Humanities and Cultural Studies, Tehran- Iran
Monajemi.alireza@gmail.com

Abstract

An obvious feature of the development of the philosophy of science during the past decades is an increasing specialization and fragmentation that have led to reduced impact of philosophy of science outside the sphere of its own discipline. It seems that philosophy of science and scientific research are moving away from each other. The major question of this article is how can reconnect these two?To answer this question I will try to highlight some events especially in the fields of social sciences that researchers are involved in discussions, generally related to philosophy of science, not in an abstract and isolated way, but in a way that is completely intertwined in their research practices. Unfortunately, this phenomenon has not been properly considered by philosophers of science and has remained more as a subject in the field of social sciences, specifically research methodology. It seems that if philosophy of science enters into dialogue with social sciences, we can expect the revival of the philosophy of general science. In this article, I try to show the signs of this phenomenon in cognitive psychology. I will first turn to one of the most influential theories in the cognitive sciences, expertise theory. After reviewing the important theories of expertise and their differences, in the next step I will discuss the seemingly opposing theories in this field and their efforts to find common ground. Then I will review the current movement in cognitive psychology, which I call the "integration model" stream. After a critical review and categorization of these models, I will show that in a broader view in social science, we can realize the meta-theoretical issues that are a good room for a dialogue between philosophy of science and scientific research. In the end, I will point out the horizons that this view opens to the revival of philosophy of general science.

Keywords: General Philosophy of science, cognitive psychology, expertise theory, metatheory, meta-science

Received date: 2021.10.8
Accepted date: 2021.10.30
DOI: 10.22034/jpiut.2021.48331.3006
Journal ISSN (print): 2251-7960 ISSN (online): 2423-4419
Journal Homepage: www.philosophy.tabrizu.ac.ir

Introduction

An obvious feature of the development of the philosophy of science during the past decades is an increasing specialization and fragmentation that have led to reduced impact of philosophy of science outside the sphere of its own discipline. In the past, quite a few scientists and educated members of the general public had some knowledge of the general insights of the prominent philosophers of science (Radder, 2012).

Furthermore, the concern of modern philosophy of science is mostly the theoretical disciplines, and neither with the applications of their results nor with practical sciences. This is neither a coincidence, nor simple negligence. This is because philosophy of science sees itself as logic of the natural science, which preferably deals with issues of concept formation and methods of justification in those areas (Wieland, 2002).

Now that philosophy of science and scientific research seem to be moving away from each other, how can this connection be re-established? How can we talk about the general philosophy of general science again?

Some events are happening in some areas of scientific research that can be promising. In these events, which are taking place especially in the fields of social sciences, researchers are involved in discussions, generally related to philosophy of science, not in an abstract and isolated way, but in a way that is completely intertwined in their research practices. This is a very remarkable phenomenon that shows us that the impact of philosophy of science outside its specialized departments. Unfortunately, this phenomenon has not been properly considered by philosophers of science and has remained more as a subject in the field of social sciences, specifically research methodology. It seems that if philosophy of science enters into dialogue with social sciences, we can expect the revival of the philosophy of general science. Here, we try to show that the idea of general philosophy of science increase its relevance to broader audiences.

In this article, I try to show the signs of this phenomenon in cognitive psychology. I will first turn to one of the most influential theories in the cognitive sciences, expertise theory. The reason for choosing this theory is that one of the theorists in this field, Kahneman, has won the Nobel Prize in Economics, which highlights the great impact of this theory outside the discipline. After reviewing the important theories of expertise and their differences, in the next step I will discuss the seemingly opposing theories in this field and their efforts to find common ground. Then I will review the current movement in cognitive psychology, which I call the "integration model" stream. After a critical review and categorization of these models, I will show that in a broader view in social science, we can realize the meta-theoretical issues that are a good room for a dialogue between philosophy of science and scientific research. In the end, I will point out the horizons that this view opens to the revival of philosophy of general science.

1- Expertise Theories in Cognitive Phycology

Expertise theory explore how people develops across specified fields or domains, focusing on cognitive task analysis (to map the domain), instruction and practice, and clearly specified the outcomes against which one can objectively measure the development of expertise. All expertise theories is primarily based on a dichotomy of two types of research paradigms which have been named in variety of terms ranging from Heuristics and Biases (i.e., HB) versus Lens Model, Heuristics and Biases versus Naturalistic Decision Making (i.e., NDM), Normative versus Descriptive, Analytical versus Non-Analytical, as well as Decision making versus Information Processing.

It should be noted that normative, HB and decision making approaches are the members of a family (i.e., coherence) whereas descriptive, NDM, or information processing belong to another family (i.e., correspondence).

Coherence paradigm differs from correspondence paradigm in many fundamental ways, e.g.., concepts, assumptions, methods and implications. First, the correspondence approach focuses on the successes of expert judgment, even though, in sharp contrast to correspondence, the coherence approach favors a skeptical attitude toward expertise (Kahneman & Klein, 2009). Second, the correspondence paradigm analyzes task accuracy between different levels of expertise while coherence compares probability the logic of decision and cognitive errors irrespective of the level of expertise (Hammond, 1996). Third, while Coherence focuses on rational reconstruction of the processes of clinical diagnosis and decision-making, correspondence deals with psychological account of the processes of clinical reasoning with a view to understanding the nature-based revision of actual clinical approaches. Fourth, while coherence theories articulate how one ought to think, offers recommendations on how clinicians ought to think and therefore are called prescriptive, correspondence theories are descriptive as they attempt to describe how clinicians actually do think in natural clinical settings (Stempsy, 2009). Finally the former is mostly based on quantitative methodology, while the latter has more often used a qualitative approach. This comparison clearly shows the differences between the two research paradigms.

2- Conflicting paradigms dialogue

Keeping these two different and conflicting research paradigms in mind, a very important event happened. Kahneman as a representative of the coherence paradigm and Klein as a representative of the correspondence paradigm wrote a joint paper trying to find common ground between the two seemingly conflicting paradigms. Starting from the obvious fact that professional intuition is sometimes marvelous and sometimes flawed; the authors attempt to map the boundary conditions that separate true intuitive skill from overconfident and biased impressions. They conclude that evaluating the likely quality of an intuitive judgment requires an assessment of the predictability of the environment in which the judgment is made and of the

individual's opportunity to learn the regularities of that environment. Subjective experience is not a reliable indicator of judgment accuracy."

Kahneman and Klein, following a discussion of areas of concordance and discordance among these perspectives, also proposed an integration model. Kahneman and Klein reject radical incommensurability of the two paradigms and deliberately underline many common areas between these two paradigms. In terms of methodological incommensurability, there is no logically necessary connection between these methodological choices and the nature of the hypotheses and models being tested (Kahneman & Klein, 2009). Correspondence and coherence paradigms are not completely conceptually incommensurable as they share the assumption that intuitive judgments and preferences have the characteristics of System 1 activity: They are automatic, arise effortlessly, and often come to mind without immediate justification. In addition, they also highlighted the areas of discordance. First, there is an obvious difference in the primary form of research conducted by the respective research communities. Second, conflicting generalizations about the utility of expert judgment exist. However, they found that the sharpest differences between the two of them were **emotional** rather than intellectual. Both accept that the approaches of their respective communities have built-in limitations. They hope, however, that their effort may help others do more than they have been able to do in bringing the insights of both **communities** to bear on their common subject (Kahneman & Klein, 2009).

In Kahneman and Klein's view, these two paradigms are in **sequence** as it is entirely possible for the predictions of experienced clinicians to be superior to those of novices but inferior to a linear model or an intelligent system. In addition, they place the common ground of these two paradigms in the context of learning. Therefore**, what should be taking into account is** the process of skill acquisition that supports the intuitive judgments and preferences of genuine experts, in terms of high-validity environments and an adequate opportunity to learn those (Kahneman & Klein, 2009).

3- Integration models analysis

Kahneman and Klein's article sparked what I call an integration process. In this process, researchers and theorists of cognitive psychology try to combine new theories to find new models that can better answer problems. In constructing many of these integration models, philosophy of science discussions about concepts, structure of theories, incomparability, etc. are underway.

The idea behind all these integrative models is that it does not hold rigidly onto a single paradigm or set of assumptions, but instead draws upon multiple theories, styles, or ideas to gain complementary insights into a subject, or applies different theories to each particular case. The inquiry is search for "a single conceptual framework to unify so- called false differences between two paradigms" and a

proposal for an integrated model that may come closer to describing how clinicians actually do reason.

The integration movements call us to appreciate more fully the multidimensional character of expertise itself and how expertise depends on context and on the relationships. They have further articulated the complexity of daily reasoning in a picture that is not easily captured in any one model and shown us new ways to think about it.

The advantages of the integrated models are found in its holism, awareness of levels, and inclusiveness of diverse perspectives. Its advocates argue for the necessity in thinking by pointing out that other factors play an obvious and major role, and that the reductionstic paradigm does not help in our understanding of these phenomena.

However, this does not mean that any integrated model is as good as any other. Some of the claims may seem unconvincing to those who seek greater precision. One of the major problems with the integrative model is that its inclusiveness results in an unscientific, "fluffy", pluralistic approach where, all perspectives have won and deserve prizes. The goal of research is analytic understanding, and that understanding requires intelligible frames that break the world into its component parts.

From the critics' perspective, the potentially confusing and convoluted aspect of the integrative models becomes particularly clear when we try to define these terms and their boundaries and interrelationships.

Another related criticism exists on the pragmatic side of things and specifically the fact that the model is too broad for understanding medical expertise. By being all inclusive the physician who adopts these integrative models is in real danger of losing clear boundaries regarding their knowledge and expertise.

The integrated models can build on the assumptions, metaphors and explanatory concepts in order to connect theories or paradigms within more integrative systems of sense-making. By reviewing integrative models mentioned in this paper, some models that scholars use to build an integrative model emerge.

The background of the scholars, their concerns and the goal of proposing the integrated model are all contributing factors.

3-1- Toolkit model

In toolkit model, theories are tools for organizing descriptions of phenomena, and for drawing inferences from past to future (Marcum, 2008). It is not concerned with truth but with the pragmatic results in practice and education. Unlike those of a master woodworker, however, the instruments presented by this model are conceptual – tools that can be used to analyze, manipulate and evaluate. So theories are chiefly acting more as instruments or tools for some practical purpose, rather than in absolute or ideal terms. The assumption behind both models is the inclusiveness that put all different concepts and theories together in order to fix a practical problem without

any theoretical concern. Both Woods-Myopoulos and Sober integrated models fall into this category.

In Woods & Myopoulos version of integrated models, one limitation of contemporary theories becomes highlighted: the concept of experts. They criticized the focus of clinical reasoning paradigms on expert-novice differences and the disregard for the differences between experts. They borrowed the theory of adaptive expertise in order to recognize the importance of experts' knowledge base and reasoning strategies, make distinctions between different types of expertise, focus attention on learned approaches to problem solving and expertise. So it seems that each of these paradigms explore different facets of medical expertise. By building an integrated model from the above-mentioned contemporary paradigms as well as adaptive expertise theory, they claim to examine expert development and performance more deeply and in a more nuanced, holistic fashion. In bridging the gap between different theories, the emphasis placed on the innovative dimension of practice and the importance of knowledge resources in expert clinical reasoning is the goal of this integrated model (Myopoulos & Woods, 2009).

As Elliott Sober indicates, both major expertise theories are based on false dichotomies between intuition and logic, the particular and the general, emotion and reason, the qualitative and the quantitative. He proposed a metaphor of clinical practice as ordinary everyday skills in problem-solving, consisting of a set of skills in problem-solving of our daily activities, that all social, psychological, and logical reasoning, are involved in the reasoning of individual clinicians (Sober, 1977). In the same sense, Førde argues that clinical reasoning is best characterized as a continuum between the two extremes of analytic thinking and intuition (Førde, 1998). Sober's concern is more practical, in particular with how we could learn to reason. He proposes that learning clinical judgment is like learning language. In his view, the best way to learn to be an expert physician is not merely to study some explicit and detailed material from textbooks. That would be as mistaken as to think that one learns to speak a language by studying its grammar alone. However, as with the acquisition of any language, it is important and helpful to know the essential characteristics of the grammar of good clinical judgments (Sober, 1977).

3-2- Body model

This model is a framework for model building that acknowledges expertise as a complex system whose parts work together to promote robustness and efficacy. A common analogy views these theories of integrative model as "organs" that work toward the proper functioning of the "body" as a whole. Each organ of the body has a function but all body organs together should save the life, so the function of each organ should be in accordance with the final goal. I think the Hammond and Pellegrino could be here. For Hammond the final goal is to empower research, while safe and efficient practice – that is patient care here- is the proper function in

Pellegrino's view. So in order to build an integrated model the proper function of whole as well as the balancing functions of each part should be defined.

Hammond is looking for a general research paradigm that encompasses both previously mentioned paradigms, that he called complementarily theory. Although he acknowledges the differences between the two research paradigms, i. e. different problems and appeal to different criteria for evaluating performance, in his view, the two paradigms do not contradict each other. In Hammond's view these two paradigms are conceptually and methodologically incommensurable[1], but functionally dependent and the gulf between the two should be filled in or overcome. Complementarity of these two research paradigms can be seen by placing them in the context of practice like diagnostic judgment. Hammond describes the process of diagnostic judgment as a set of inferences of a patient's signs and symptoms and their justifications. In this framework, correspondence paradigm focuses on the inference phase whereas coherence paradigm focuses on the justification phase. t is therefore clear that the two paradigms do not conflict, but they describe different phases of the process in incommensurable ways. In other words, these two research paradigms can be seen to be focusing on two different phases of the diagnostic judgment process (Hammond, 1996).

That said, Hammond does admit that no study has ever included both research paradigms or encompasses both phases of the diagnostic judgment process. This means that each phase of the diagnostic process should be studied in terms of the research paradigm that it is appropriate for. What Hammond proposes is a **constructive convergence** of two current research paradigms that leads to improvement of what we currently know about clinical reasoning in isolated research paradigms. Bringing the two into a constructive relationship to one another, however, will not only double the store of knowledge regarding diagnostic judgment and decision making, but also enhance efforts to achieve a cumulative discipline and doubles our research capacity (Hammond, 1996).

Distancing himself from psychology, in his philosophical reflections, Edmund Pellegrino demonstrated that clinical reasoning is in the end goal-oriented and it is aimed at clinical action, at restoration, healing, and prevention, at addressing the state of affairs of a particular patient. The integrated model he proposed, is a multi-step, end-oriented concatenation of decisions demanding different types of reasons and reasoning which will justify a particular course of action, for a particular patient, given that patient's particular existential situation at the time of the decision. Each step is shot through with uncertainties, some eradicable, some not. Selection of the "right" action requires optimization of these uncertainty states. Science, art, and the virtue of

[1] Incommensurable mean that these two paradigms are completely conceptually, they lack common ground for comparison, that inference cannot be compared with justification because each has its own criteria for legitimacy.

prudence infuse the various operations. The undeviating determination of the work to be done (art) is distinguished from the undeviating determination of what is to be known (science) and the undeviating determination of the act to be done (prudence). Medicine is then all three - science, art and virtue synergistically and integrally united in the clinician's daily activities.

3-3- Translation model

This model appreciates differences between paradigms and usually focuses on meaning in order to reflect different aspects of the issue. This model is to dedicate theories or theories as two different languages that could be translated to each other but still remained different. For understanding other theories or paradigms, we need to see the world through the eyes of the other paradigm. What emerges from a dialogue between Kahneman and Klein basically belongs to this category. This integration model explained previously (See Section 2).

4- Move a step forward: Metatheorizing

Although integrated models above mentioned advances our understanding of expertise and its impact on education, every perspective has its limitations**.** It is important to recognize that any integrated model comes with certain approaches and assumptions that narrow down its focus, which is the strength of a paradigmatic approach. However, if this is left unquestioned, this becomes a paradigm's weakness (Myopoulos & Regehr, 2007).

The research method for undertaking this integrative task will be crucial for many reasons. To this point almost all has been developed using traditional methods of scholarship. These traditional methods have largely been an idiosyncratic process based on extensive reading and research across multiple disciplines and the construction of some overarching frameworks through scholarly argument and personal insight.

Such approaches can result in important contributions but a much more systematic and defensible method of metatheorizing is needed if matatheoretical research is to be regarded as anything other than an anecdote (Edwards, 2014). As the emerging field of meta-theoretical studies grows, these perspectives will help to align and situate research, signposting ways to discuss discordant (even contradictory) empirical findings to inform and develop practice.

Our goal should not be to accept inherent limitations in meta-theoretical level as an excuse to avoid improving theoretical design. Instead, we should critically reflect on and strategically incorporate both the concordant and discordant views presented by each of these perspectives to enhance the quality of our medical education and practice.

More critical reflection is needed to bridge between paradigms or theories. It is called **overarching perspectives** in which the study of theory is oriented to the goal

of producing a perspective that overarches some part or all of theory. **Overarching perspectives** involve broad and general theoretical orientations regarding the study of the world (Zhao, 1991).

Concerning overarching perspective, if researcher and practitioners utilize various modes to solve problems, the insightful question could be concerning the appropriate time to use different methods. In developing more inclusive frameworks, it is important to recognize the contributions of extant theory and to integrate the store of knowledge that currently exists into whatever overarching framework we might end up building. Edwards calls the method used to do this Integrative Metatheorizing (Edwards, 2014). Integrative metatheory is conceptual research that responds positively to the challenges of theoretical pluralism—the diversity of theoretical perspectives (Bates, 2005).

Integrative metatheorizing constructs new and "roomier" conceptual frameworks that push the boundaries of our current conceptualizations. It does this while also accommodating the plurality of theoretical perspectives which characterizes many fields of social research (Edwards, 2014).

In this **integrative metatheorizing**, countless cycles of reflexive engagements between these sense-making strata are involve: we can try to understand its characteristics (the conceptual layer), we can model those characteristics and describe a system of relationships between them (the theoretical layer), we can reflect on how theories relate to each other (the paradigm layer) and we can try to link and separate those theories and paradigms in a coherent overarching way (the metatheoretical layer). This holarchy is not separate from everyday sense-making (Edwards, 2014).

5- Conclusion: philosophy of science meets scientific research

Although metatheory has been considered as a very important phenomenon in social science research, its ideas need to be shared with and reflected by the philosophy of science. It seems that of the major engines for integration model movement is how to fill in the gap between theory and practice. This is where general philosophy of science could be revived.

Dialogue in different fields of science requires acknowledgment of limitations and, in a way, requires epistemic humility. If every scientific discipline believes that it has all the truth and its field of work is so specialized manner that no one is allowed to enter it, neither dialogue nor the philosophy of science can be effective.

Rather than trying to overcome the discordances and fully integrate the different perspectives into a unified theory, it may be useful to identify circumstances in which the strengths of a particular perspective may be especially advantageous.

The suggested solutions is to adopt an epistemological view in which scientific knowledge (such as models) is understood as also shaped by the specificities of the discipline.

More effectively dealing with the specificities of scientific disciplines in interdisciplinary collaborations may be require meta-cognitive scaffolds (and the ability to use them) that enable analyzing how exactly a discipline generates and applies knowledge. Therefore, not integration of theories and disciplinary perspectives is the first task for interdisciplinary collaboration, but clarification of the specificities of the disciplines and of the way in which in discipline 'knowledge' comes about (Boon & Van Baalen, 2019).

In order to prepare the ground for dialogue, philosophy must also give up its misconceptions about science. Prescriptive approaches to science, such as the Vienna Circle, which seeks to teach scientists the correct way to conduct science and scientific research from top to bottom, will certainly block dialogue.

Although the classical philosophy of science is largely based on physics, meta-theoretical studies are more rooted in the social sciences. Perhaps the reason for this can be found in the diversity of theories and schools. This was considered a kind of weakness through the lens of classical philosophy of science. This is a great opportunity for the general philosophy of science to provide a basis for dialogue with science and, more broadly, with the public sphere, based on such studies. I believe this phenomenon, i.e. meta-theorizing, could be subject of Interest philosophy of science.

In his latest acclaimed work, The Enigma of Health, Hans-Georg Gadamer refers to a field of study, he calls meta-science. It is a comprehensive science aim at filling the gap between specialized filed of sciences and the context of practice. For this reason, from Gadamer's point of view, the process of specialization of the philosophy of science is undesirable because it eliminates the possibility of critical dialogue with science.

It should be noted that the meteorological debate raised here should not lead to the misconception that merely integrating theories can be helpful. Part of what I called the attempt to integrate the philosophy of general science will be discussed in methodological discussions. As Thoren and Persson pointed out methodological complementarity (rather than theoretical integration) seems to be a necessary condition of bilateral problem-feeding—which suggests that problem feeding entails practical unification. Disciplinary field as something that only sometimes includes theories, but always includes a number of other entities—central problems, tools, methods, etc.—the actual unification they describe flows from theories about the ontologies of the disciplinary fields in question. (Thorén & Persson, 2013).

It is time to take steps in this direction. This requires that researchers with diverse backgrounds get involved in metatheoretical studies. The facilitator of this dialogue should be the philosophy of science. The diversity has been welcomed to the extent that it has encouraged investigators to study more freely, however, lack of communication among researchers involved in different research programs should be taken into account.

References:

- Bates, M. J. (2005). An introduction to metatheories, theories, and models. In K. E. Fisher, S. Erdelez, & L. McKechnie (Eds.), Theories of information behavior (pp. 1–24). Medford, NJ: *American Society for Information Science and Technology.*
- Boon, M., Van Baalen, S. (2019) Epistemology for interdisciplinary research – shifting philosophical paradigms of science. *Euro Jnl Phil Sci* 9, 16.
- Edwards, M. G. (2014), Misunderstanding Metatheorizing, *Syst. Res.*, 31; pages 720– 744.
- Førde R. (1998). Competing conceptions of diagnostic reasoning--is there a way out?. *Theoretical medicine and bioethics,* 19(1), 59–72.
- Gadamer, H.G. (1996). *The Enigma of Health: The Art of Healing in a Scientific Age*, Stanford: Stanford University Press.
- Hammond, K (1996). *Human Judgment and Social Policy: Irreducible Uncertainty, Inevitable Error, Unavoidable Injustice.* Oxford University Press USA.
- Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: a failure to disagree. *The American psychologist*, 64 6, 515-26 .
- Matthews D. (2006) Epistemic Humility. In: van Gigch J.P. (eds) Wisdom, Knowledge, and Management. C.West Churchman and Related Works Series, vol 2. Springer, New York, NY.
- Mylopoulos M, Woods NN. (2009). having our cake and eating it too: seeking the best of both worlds in expertise research. *Med Educ.* May;43(5):406-13.
- Mylopoulos, M., & Regehr, G. (2007). Cognitive metaphors of expertise and knowledge: prospects and limitations for medical education. *Medical education*, 41(12), 1159–1165.
- Mylopoulos, M., & Woods, N. (2014). Preparing medical students for future learning using basic science instruction. *Medical Education*, 48(7), 667- 673.
- Radder, Hans (2012). What Prospects for a General Philosophy of Science? Journal for General Philosophy of Science / *Zeitschrift für Allgemeine Wissenschaftstheorie* 43 (1):89-92.
- Sober, E (1976). Mental representations. *Synthese* 33 (June):101-48.
- Stempsey, WE. (2009). Clinical reasoning: new challenges. *Theor Med Bioeth.* 30(3):173-9.
- Thorén, H., Persson, J. (2013) the Philosophy of Interdisciplinarity: Sustainability Science and Problem-Feeding. J *Gen Philos Sci* 44, 337–355.
- Wieland, W. (2002). The character and mission of the practical sciences, as exemplified by medicine, *Poiesis and Praxis*, 1:123-134.
- Zhao, S. (1991) Metatheory, Metamethod, Meta-Data-Analysis: What, Why, and How? *Sociological Perspectives.* 34(3):377-390.