Implicit and explicit metaphysics in conceptualising transfer and transformation

Børsen Hansen, Stig

Published in:
Designing for situated knowledge transformation

DOI:
10.4324/9780429275692-5

Publication date:
2020

Document version:
Accepted manuscript

Citation for pulished version (APA):
Børsen Hansen, S. (2020). Implicit and explicit metaphysics in conceptualising transfer and transformation. In N. B. Dohn, S. B. Hansen, & J. J. Hansen (Eds.), *Designing for situated knowledge transformation* (1. ed., pp. 75-90). Routledge. Routledge Research In Education https://doi.org/10.4324/9780429275692-5

Chapter 5. Implicit and explicit metaphysics in conceptualizing transfer and transformation

Stig Børsen Hansen
https://orcid.org/0000-0003-0856-5631

Karl Popper once remarked: "…it cannot be denied that along with metaphysical ideas which have obstructed the advance of science there have been others … which have aided it." (Popper, 1959, p. 16). After decades of disrepute beyond the narrow borders of philosophy (Dummett, 2012), metaphysics is again being considered as a discipline that can, in different ways, contribute substantially and constructively to scientific pursuits: Some speak of applied metaphysics (cf Hawley, 2016), while others propose what they call a viking approach to metaphysics: see what you can find among quietly working metaphysicians in your own scientific pursuits and simply steal it (French, 2014). This chapter makes a case for seeing metaphysics as an important resource for understanding transfer and transformation in educational science.

Rather than seeking to unearth implicit assumptions and discuss them – an approach typical of much applied philosophy – this chapter enters the fray in a slightly different manner. It takes as its starting point existing and explicit appeals to what is reasonably understood to be reference to general metaphysical outlooks in theory construction and arguments concerning learning transfer and its inherent transfer and transformation of knowledge. On that background, the chapter discusses what can be called implicit ontologies in learning theory. This focus on transfer distinguishes the approach of this chapter from existing reliance on of metaphysics, such as those found in discussion of metaphysical considerations for instruction (*e.g.* Chi, Slotta, & De Leeuw, 1994).

To highlight the relevance of metaphysics for theories of transfer and transformation, and to explore the relevance of metaphysics to theory construction in educational science, this chapter firstly demonstrates and critically discusses how existing theories already draw on metaphysics in their treatment of knowledge transfer. After offering an exposition of what metaphysics is, my own case for drawing on the discipline of metaphysics is cumulative: I indicate how drawing on analytical metaphysics for concepts and taxonomies can prove fruitful in the task of developing theories of knowledge transfer. I offer two suggestions for actively and more systematically working with metaphysics in educational science. One suggestion is based on taking "learning" as a unitary phenomenon across varying subject fields and emphasizes alignment between one's views of the reality concerning learning and one's language used in theorizing. The other suggestion invites inspiration from standing discussions of the metaphysics of what the knowledge is about, when offering an account of learning. Finally, I discuss the idea of "choosing" a metaphysics when engaging in scientific thinking.

1. Metaphysics in educational science?

In this section, I survey claims of a metaphysical nature, made in discussion of knowledge transfer. To identify such claims, an exposition of metaphysics is required and takes its beginning with a seemingly innocent first shot at describing transfer: taking something learnt in one context and putting it to use with success in another. To introduce the topic of metaphysics, I want to suggest one way in which the above description of transfer is anything but innocent. I can simply insert a space in my brief description: taking *some thing* out of one context and putting it to use in another. This serves to highlight what is the default line of thinking when it comes to both transfer and in fact, thought and knowledge quite generally: we need to identify relevant things or objects (I make no distinction for present purposes), and consider their nature and workings. Being the default, ingrained line of thinking, it is predominantly identified and discussed by proponents of one of the two main competing approaches: those that emphasize either structures or processes in description and theory building.

Exactly the notion of a thing was picked up by Martin Packer in his treatment of Greeno's (1997) discussion of situativity and learning: "Only when we assume that we're dealing with something thing-like in learning does the issue arise of whether or not it 'transfers'" (Packer, 2001, p. 503). Reasoning in a similar manner, Dall'alba & Barnacle have also seen a close relation between themes in metaphysics and the question of transfer: "…ontology has tended to be subordinated to epistemological concerns. This has meant the flourishing of notions such as transfer and acquisition of knowledge and skills…" (Dall'Alba & Barnacle, 2007, p. 679). Focusing on Packer's claim, it immediately raises two questions. The first is firmly rooted in ongoing discussions of transfer of learning and knowledge: is Packer right in what he says about the implications of a metaphysical outlook in theory building for the question of learning transfer? The second is really a set of questions: what is there, if not things, and what are both things and "non-things" like? We need to offer some sort of answer to these question in order to begin to think clearly and systematically about Packer's claim. With the second group of questions that arises from Packer's remarks, we are approaching one of the central questions in metaphysics: what is there, really?

Answering this question is the age-old task of metaphysics. It is also the starting point for a scientifically fruitful application of metaphysics to ongoing science, including educational science. The first step in such an application is getting clearer on what metaphysics is. There is no unanimous agreement, and there are affinities between what is currently called meta-ontology (see van Inwagen, 1998) and metaphysics. One starting point is to notice a range of questions that are characterized by exhibiting a sufficiently high level of generality. To Aristotle, this was the question of being qua being, in contrast with, say, being qua price (economics) or being qua living (biology). Something very similar was more recently also suggested by logician Quine, and in the following sections, I shall take Quine as the point of departure:

> *The question of what there is is a shared concern of philosophy and most other non-fiction genres… What distinguishes the ontological philosopher's concern*

> *and the [zoologists', physicists' and mathematician's] concern is breadth of categories.* (Quine, 1960, p. 275)

Quine here identifies a discipline which addresses the questions that immediately arose from Packer's contention. The discipline shares relevant goals with science, and ought in those respects to allow for fruitful interaction, in so far as the more general aspects of scientific categories are explored by metaphysics. For instance, metaphysics investigates the nature of "structures" or "things", rather than "giraffes" (biology), "mountains" (geology) or "communities of practice" (educational science).

Another example of emphasis on metaphysics is found in the writings of Jean Lave. She suggested that *e.g.* mathematical problem solving in "non-laboratory" settings should be understood as processes embedded in social practices. Lave (1988) initiated a scathing critic of transfer experiments and their wider learning theoretic assumptions, by asking: "Why does the mind with its durable cognitive tools remain the only imaginable source of continuity across situations for most cognitive researchers?" (Lave, 1988, p. 76). At no point in her extended authorship has she explicitly subscribed to any metaphysics. Yet, she can on more occasions be seen to speak against thing-based approaches:

> *A second challenge to the practice of deriving experimental tasks from normative models is that they foster a static, objectified conceptualization of processes of reasoning, a transformation that occurs between their initial formulation and their incorporation into experimental procedures. It is hard to avoid the conclusion that while skills, mental maps and analogies may be conceived of as processes by the experimenters, they are treated for experimental purposes as objects... as a process of taking a given item and applying it somewhere else.* (Lave, 1988, p. 37)

In addition to repeated use of the word "process", one can register a general reluctance to accept the permanence of things in her account of learning.

2. Three metaphysics

We turn now to a more systematic discussion of the metaphysical themes we have unearthed in the discussion of transfer of learning and knowledge. When learning scientists zoom out to the broadest of categories, as suggested by Quine, what do they find? At the most general level of metaphysics, the default answer is "things!". Paradigmatic objects would be human beings, rocks and trees. Describing reality in terms of objects is a very dominating outlook that Western thinking has been shaped by to an extent that it only becomes visible against proposed alternatives, ancient as well as contemporary. Nurtured by the structure of Indo-European languages in which traditional, thing-based metaphysics were developed with its formal analysis in terms of proper names, definite descriptions and predicates, we are accustomed to think that the world at a fundamental level consists of static things. Of course, the world we inhabit is complex, changing and dynamic in a

number of ways, but to object-metaphysics, this is to be accounted for in terms of the formation of complex objects out of simpler ones.

Another way of thinking about what there is in the world takes its start with noticing that things come in and out of existence and change, sometimes drastically. They are ever in a *process* of *becoming*, and what it means to exist should fundamentally be seen as something dynamic. Paradigmatic instances of processes are discussions, rainstorms and headaches, and these beings are thought to be more aptly described by verbs rather than nouns. According to this approach, our description and understanding of reality will be more adequate if we approach it with process metaphysics and its conceptual tools. The fundamental metaphysical question now is "what is occurring?" rather than "what is there?", and persistently existing objects are something to be explained in terms of process and dynamicity: processes are both ontologically and epistemologically more fundamental than objects. Indeed, some processes exist without being somehow clearly associated with an object (the processes are "unowned"), such as the pounding of the surf or the fluctuation of a gravitational field (cf. Rescher, 2000, pp. 7, 28). Generally, where both things and processes are involved, processes are taken to be ontologically primary – the existence of objects is at bottom a matter of the existence of processes. The diverse range of thinkers who have subscribed to process metaphysics will disagree on the choice of paradigmatic instances. Henri Bergson was inclined to see biological processes as paradigmatic. William James focused on human psychology as key to understanding process, while Whitehead was more rooted in physics in his understanding of processes. Popper offered a helpful account of the change in perspective that process metaphysics can achieve: "Stars, incidentally, are good examples of the general rule that things are processes… a star is, in a sense, a 'mere' accumulation, a 'mere heap' of its constituent atoms. Yet it is a process - a dynamic structure" (Popper & Eccles, 1981, p. 20).

The epistemology of object-metaphysics is often depicted by process theorists as a kind of snapshot picture of reality. Some objects, such as natural numbers, are atemporal (cf. Wright & Hale, 2001), while those that aren't offer deep challenges of accounting for their persistence – the topic that concerned Lave in her reflection above about duration, things and processes. If one has at one's disposal in explaining phenomena only something comparable to static images, accounting for the movement of an arrow, the permanence of the self, or continuity of learning across contexts throws up fundamental, philosophical problems. To the process theorists, this amounts to a breaking up of reality that no theory can successfully put back together again. Better leave it intact: in so far as a process is something that occurs, extension in time is already a part of the fundamental metaphysical outlook. "Even as there can be no instantaneous wail or drought, so there is no such thing as an instantaneous process… it is of the very essence of an ongoing process that it combines existence in the present with tentacles reaching into the past and future" (Rescher, 1996, p. 38f.).

Finally, to introduce a third kind of metaphysics, we focus on a question which is similar to that of knowledge transfer. According to structuralism, structures are the basic makeup of reality, and structuralism often defines itself against an object-based metaphysics. The similarity with knowledge consists in the attempt to see continuity in, and accumulation of, knowledge, in spite of

what appears to be drastic change. In short, the motivation consists in the attempt to reconcile two observations: firstly, that a simple reading off of the ontologies of past sciences reveals that "things have changed". The history of science is the graveyard of theoretical entities, such as those found in humoral theory of medicine, spontaneous generation and gravitational, optical and electromagnetic ether. This raises a question about the role of such entities, if any, in the continued progress of science. This progress is the second observation. Structuralists in philosophy of science insist that science is somehow successful in tracking the truth about reality, it is getting better at it and something is preserved across theories that appeal to different kinds of things in their account of a given phenomenon, such as light or electromagnetic radiation. So, what is preserved and transferred from one theory to one following it, if not objects? "Structures" is an increasingly well supported answer to that question (French, 2014; Frigg & Votsis, 2011; Worrall, 1989). Rather than think of the world as a matter of entities or processes, structuralists insist we should resist being led by the everyday appearance of physical reality, and instead consider structures to be the best way of reconciling the two observations. While objects go by very different names and are thought to have different properties, the relations they enter into with other objects are what is significant about our description and knowledge of reality, and such structures in many cases been shown to remain in spite of what appears to be drastic theory change in terms of entities.

These are the three kinds of metaphysics that make up most discussion of the fundamental make-up of reality. All three positions have internal disagreements and are continuously developed. Yet, the point is that these metaphysical outlooks in their generality and the discussions they entertain have been and should continue to be considered intellectual resources also for theories about learning, as I now go on to argue in more details.

3. Transfer and processes

Packer's contention that the problem of transfer disappears once one subscribes to process metaphysics clearly lies in extension of Lave's focus on situativity of learning and her criticism of transfer studies. She shared with process metaphysics a strong aversion to the idea of a social world consisting of permanent "blocks" of any kind, whose operations are repeatable and in principle predictable. Understanding learning in terms of some kind of re-identifiable blocks, a-temporal or "frozen in time", readily lends itself to theories of transfer. Processes are stretched in time and process theorist insist that:

> *"the specious present [is] the moveable entryway separating a settled and determinate past from an open and (as yet) unrealized and indeterminate future. And since this future always brings new situations to realization, the present is ever the locus of novelty, innovation and creativity…Things are never quite the same second time round"* (Rescher, 1996, pp. 74, 77).

However, I suggest that *pace* Packer and Lave, shunning talk of objects in favor of talk of processes in theory building cannot of itself justify a wholesale rejection of talk of transfer. Quite the contrary, I suggest that the process metaphysics they appeal to indeed has the resources to assist

theorizing about transfer. To substantiate this point, we begin by asking the very general, metaphysical question: "what is a process?". The first thing that is regularly brought up in an answer to this question is the marked difference between a chaotic, unrelated sequence of events and a process. Few are inclined to call the sequential occurrence of rainfall in the Amazons and a pay-rise among Australian actuaries one process. They are two processes, that are rarely, if at all, related. In contrast, the occurrence of such a pay-rise together with the occurrence of sophistication of legal frameworks in Australia can reasonably be described as one economic process, with different, related sub-processes. Legal frameworks have generally been thought to support economic development, particularly among those who operate in a highly regulated environment, such as actuaries. What sets the two scenarios apart would seem to be that of a structure, as also emphasized by process theorists: "A process, after all, is nothing other than a temporally structured manifold of spheres or stages" (Rescher, 2000, p. 130). Elsewhere, Rescher maintains: "As the process philosopher sees it, what is at bottom at issue here is a matter of lawful modus operandi… Processes can, do and must have a structure of patterns and periodicies that render them in-principle repeatable" (Rescher, 1996, p. 71). Some of the original critics of transfer studies shared with process theories an emphasis on change, novelty and creativity as a fundamental part of the reality they studied - learning. Still, a process metaphysician "… insists that processes themselves both instantiate and transmit structural patterns. What process metaphysics denies is the exclusive prevalence of inevitable pre-established patterns that make prediction unfailingly possible (Rescher, 1996, p. 76). One would certainly want to inquire about the notion of transmission that Rescher has in mind. Yet, if processes can be described, understood and partaken in as cases of the same kind of process that is being transmitted, this would allow for an account of transferring learning, described in terms of processes.

Lave, Packer and other theorists that emphasize situativity of learning and wish to do away with the notion of transfer of learning are likely to take exception to theories of transfer for other reasons than those that can be explicated in terms of process metaphysics. Still, contrary to Packer's suggestion, it is theoretically viable to accept those insights that Lave and others convey through appeals to process metaphysics, and yet remain committed to offering an account of knowledge transfer in terms of processes: process metaphysicians argue that fundamentally, processes have the prerequisite qualities. They are identifiable and repeatable.

Should one begin this theoretical work, one could look to metaphysics and see how processes are identifiable as processes of a more general kind. In metaphysics, taxonomies are being developed which might well assist in conceptualizing transfer in ways that Lave would be reluctant to: if we can identify a learning process and re-identify something as the same kind of process being instantiated, repeated and possibly transmitted, we have the metaphysical backbone of a process-based theory of transfer. Kinds of *activities*, a category that was central in Lave's theorizing and emphasized in this volume as well, have for decades been subject of analysis in process metaphysics. Vendler's (1957) distinction between states, activities, accomplishments and achievements has been the starting point for analyses that seek to capture the different kinds of dynamics of a situation, and would serve as a suitable entry point for the varieties of transfer,

conceptualized as a matter of processes. In metaphysics, the various relations between processes and things has been explored by *e.g.* Mourelatos (1978), and since then, "…analytical process ontologists have offered various criteria sets for the classification of occurrences and their relationships to other categories" (Seibt, 2015, par. 29; cf. Seibt, (2004). The result of this work is a patchwork of theories and classificatory schemes that serve to understand general aspects of processes and their relations to things. As well as being ripe for inspiration to educational scientists, this is an field of inquiry where educational scientists can contribute to an area of metaphysics under rapid development, in virtue of empirical studies of processes involving humans, knowledge and social entities like schools and businesses.

I have only surveyed one example at a high level of abstraction. I believe more examples of potential cross-fertilization abound, for example in the notion of a structure: as mentioned, this is relied upon by metaphysics, but also in studies of transfer, for example when Wagner suggests:

> *The transfer-in-pieces perspective, however, does not require that individuals perceive or construct the same structure for knowledge transfer to occur. To the contrary, it suggests that the use of different concept projections results in a variety of context-sensitive ways of structuring situations, yet still supporting the conclusion that they are (mathematically) "the same".* (Wagner, 2010, p. 475)

The question of the conditions for structures being the same, as well as being able to rely on well developed, descriptive resources for talking about structures hold promise for another avenue of seeking inspiration in metaphysics. Rather than attempting to make good this suggestion, I now go on to suggest two ways that metaphysics may be more systematically explored in the task of understanding transfer and transformation.

4. Putting metaphysics to use: two kinds of alignment

Having argued that metaphysics is clearly present in and relevant to discussions of transfer, I now present two sets of guidance for those seeking to work more systematically with metaphysics. Both concern alignment: one at a general level that abstracts from the contents of learning, and one more specific that encourages consulting metaphysical analyses of the subject area in question.

With his notion of alignment, Thompson (2011) has offered one way in which the discipline of metaphysics can systematically enter theorizing about learning. He outlines two of the three metaphysics we have presented (thing- and process-based metaphysics) and suggests that it is of fundamental importance that one achieves alignment between the metaphysical concepts that one implicitly or explicitly relies on in a given study of learning, and what metaphysical conception one has of what one seeks to investigate.

For example, Lave underscored activity descriptions and verbs in her way of talking about learning, and accordingly, saw the reality of learning as exhibiting the following qualities: "duality, dynamic, unpredictable, in space and time and emergent / contingent" (Thompson 2011, p. 758). At the other

end of what Thompson sees as an entity-process spectrum, he can similarly praise Brown & Duguid (2000) for having secured alignment between their theoretical constructs and their metaphysical outlook. While the process oriented word "practice" is retained in their theoretical construct "network of practice", Brown and Duguid have managed to maintain alignment: to them, networks of practice are, very briefly but, more like sets than communities – "markedly more entitative in nature" (Thompson 2011, p. 654) - in so far as their members do not have to interact directly for them to be members of a network of practice. For example, 25.000 Xerox representatives constitute a network of practice, which is contrasted with the more process-oriented community of practice (Lave & Wenger, 1991). But rather than maintaining the practice- and process-oriented language from their intellectual ancestor, Lave, their way of describing reality has followed suit. According to Thompson, "[a]lthough a network of practice evolves, it clearly 'exists' in a more concrete, more entitative sense than the [legitimate peripheral participation] dynamic from which [communities of practice] are constituted, in a way that suggests, for example, that it might be mapped." (Thompson, 2011, p. 766).

In theory building, Thompson suggests that things can go awry by exhibiting ontological drift: the conception of reality and metaphysical concepts in the theory drift apart. This can take place when one brings process-based metaphysics to the task of describing something one otherwise holds to be of an entitative nature. In matters of theory building, one can locate an example of drift in the notion of "virtual communities of practice" (Dubé, Bourhis, & Jacob, 2006). While the "practice" epithet remains, virtual communities "no longer bears any trace of its roots in Lave & Wenger's work… the emergent, process oriented ontology of Lave and Wenger's original concept has been replaced completely with an entitative ontology" (Thompson, 2011, p. 765).

Finally, one can perform a shift, rather than drift, when moving both language and view of reality in a given direction towards entitative or process based metaphysics. This is what Lave originally did when emphasizing processes, and another shift was successfully achieved by Wenger (1998). He operates with a spectrum of processes and things, and explores the reification, "understood as the process of giving form to our experience by producing objects that congeal this experience into 'thingness'" (Wenger, 1998, p. 58). Performing a shift is one way of beginning a more systematic reliance on metaphysics in learning theory. Shifting metaphysical perspective towards any of the three metaphysics is a potentially fruitful move, as long as it is done consistently, *i.e.* so that metaphysics outlook on reality and concepts follow suit in unison, as it were. In Wenger's case, the move was partially in the opposite direction of that originally emphasized by Lave, in so far as he located things as well as processes in his account of learning.

So far, we have discussed metaphysics in terms of alignment between one's view of learning – conceived with full generality – and the language with which one theorizes about learning, and the possibility of performing a scientifically fruitful metaphysical shift. In doing so, we have followed Packer and others in thinking about learning as a unitary phenomenon. One can also speak of a different kind of alignment: between the reality of what the domain of learning is, and the language with which we theorize. For example, much discussion of teaching, learning and transfer has been

carried out in the context of the subject of mathematics and closely related fields. Examples are Lave's reliance on the data from the American Adult Math project (Lave, 1988), Lobato's exploration of transfer of calculus and algebra (2008) and Wagner's (2010) exploration of transfer of the law of large numbers. These choices have the strength that they keep important variables near-fixed in the empirical study of learning, reasoning, transfer and transformation: pure mathematics remains one of our most fixed epistemic practices, with strong agreement on a range of topics and applications. Educational scientists are more likely to agree on what ought to transfer from a study based on the law of large numbers, than a study of transfer of learning, say, from reading a piece of literature on dealing with grief or transfer from an introduction of deontology in ethics to the practice of caring.

In the case of the metaphysics of mathematics, when one consults textbook introductions (*e.g.* George & Velleman, 2002; Shapiro, 2000), appeal to processes are absent, while objects and structures take up most of the discussion. Before Whitehead became a key proponent of 20th century process metaphysics, he wrote extensively on mathematics (*e.g.* Whitehead, 1898; Whitehead & Russell, 1910-1913), but never returned to the topic after working on process metaphysics. In short, it has been suggested that "[m]athematics has none of the characteristics process philosophers desire… Process philosophers should either admit that mathematics is incompatible with process philosophy, and that it therefore marks the limits of doctrine, or find a way to fit mathematics within a processual framework" (Decock, 2004, p. 102).

We may agree or disagree with Decock's statement, but it highlights that metaphysics are relied on when describing and understanding what sciences are about, their domain. Studies in metaphysics are compartmentalized in regions. Though it may be the ultimate goal and such universal claims have been made, rarely do structuralists or process metaphysicists make universal claims a la "at bottom, everything really is processes". Metaphysicists fight their war for supremacy battle by battle. French (2014) mainly treats physics as a matter of structures rather than objects. He concludes with a study of structuralism metaphysics in biology and invites further attempts at understanding other sciences as being fundamentally involved in describing structures. Rescher and other process metaphysicians claim strengths in other areas of reality: after exploring the writings of Sartre and wider existential themes, Rescher suggests that understanding persons is far better captured by process metaphysics. He suggests: "People instinctively dislike being described in thing-classificatory terms… [O]bject-property attributions indicate a fixed nature that we naturally see as repugnant to ourselves" (Rescher, 2000, p. 14). Persons and value are but some of the elements of reality where process metaphysics claim comparative strengths in describing and understanding reality (cf. Seibt, 2015).

We cannot here assess this claim on behalf of process metaphysics. Generally, we have no way of comparing language and reality directly and saying which kind of language best mirrors the metaphysics in question. Yet, in different areas of learning – say, learning about grief through literature and transferring it to the practice of palliative care or understanding education in music - educational scientists have rich resources in the different kinds of metaphysics that have informed

accounts of the fundamental character of what these areas are about, such as music (Christensen 2004), biology, chemistry and psychology.

5. Choosing and revising metaphysics using new and old words: transfer and transformation

I have suggested two cases of the relevance of metaphysics – structuralism and process theory – for discussion of transfer. So far, I have suggested that metaphysics is something one can choose in theory construction. In this section we ask: what are we to make of the apparent commitment to a general metaphysical outlook that seems inherent in the language with which we theorize – one we inherit from other theorists and comes imbued with the meaning that it does?

To bring this first question into focus, consider that our language immediately seems to commit us to the existence of an enormous amount of things. A cursory reading of the present chapter would seem to populate the universe with such objects as *starting points*, *theories, concerns* and *concepts* (Moltmann, 2018). How are we to even begin thinking about metaphysics as suggested, without immediately facing a charge of being incoherent – of continuing to talk in terms of what we want to do away with in our metaphysics? The challenge is frequently registered by process philosophers and structuralists alike (cf Rescher, 1996; French, 2014; Seibt, 2015). As indicated above, they are inclined to speak of a theoretical bias that is more prevalent in Indo-European languages and which is strengthened by the standard interpretation of predicate logic in terms of static individuals, exemplified timelessly. Yet, there are more ways of interpreting the existential commitment of apparent thing-locutions: "there is something funny going on over there" or "what is this thing called love?" will typically not concern a thing, but a series of events and dispositions.

The educational scientist thinking about learning might well aim to achieve more than to avoid inconsistency between, say, a process-informed view of learning and talk of transferring given items of knowledge. Discussions of transfer do not show any sign of slowing down, and some educational scientists believe transfer discussions ought to be dismissed. In the case of transfer discussion, the use of language and the ideas readily associated with transfer - carrying something around - is considered to be fundamentally at odds with gaining a correct understanding of learning. The situation is in relevant ways similar to the one perceived by a young Heidegger, concerning philosophy: "For the most part, the philosophy of today's situation moves inauthentically within the Greek conceptuality, and indeed within a conceptuality which has been pervaded by a chain of diverse interpretations." (Heidegger, 1922, cited in Schwartz, 2003). It was his constant struggle with his inherited language and its sway over his thinking that led Heidegger to his famed, process-oriented approach to understanding human beings and metaphysics. This was achieved through widespread use of neologisms, his most well-known being that of *Dasein* – being there. With this, Heidegger offered a version of process philosophy center stage, as he interpreted what the tradition had conceived as things - world, self, others, time - as modes and ways in which *Dasein* occurs, while *Dasein* is the interactivity of what he called "disclosure" (cf. Heidegger, 1927).

The point I wish to emphasize presently was that revision of what was considered theoretically unviable metaphysics was achieved through careful attention to the language with which was theorized. Heidegger is famed for his neologisms. Of themselves, they are neither necessary nor sufficient for achieving a genuine change in the way that inherited metaphysical schemes in our language influence our theories. Close attention to the way words have a history and shape our metaphysical thinking is called for. If introducing new words (or old words in new scientific contexts) it should be clear that new concepts should be able to address the standing questions in a given science adequately. While not inventing new words, abandoning some words and favouring others is a strategy that could be clearly observed in the writings of Lave and indeed, in the present volume. Having criticized accounts of learning based on transfer in terms of "forms of knowledge [that are] universally insertable into any situation" (Lave, 1988, p. 122) Lave widely replaced "transfer" with "transformation", speaking instead of "a process of transformation" (Lave, 1988, p. 59). A Google Books Ngram search confirms the widespread uptake of "transformation" in connection with learning in the years following the publication of Lave's work.

When anyone wants to do away with a notion of "transfer" or supplement it with "transformation" as this volume seeks to do, a challenge remains of making clear the kind of metaphysics – the kinds of processes and changes – that this word suggests and carries with it. After all, it comes with a rich history of diverse usage in zoology, theatre, physics, linguistics and other practices and sciences. We cannot here survey the extremely varied meanings of "transformation". Jean Lave made none of her usages explicit, and "transformation" can become an extremely vague and unspecific placeholder for more or less "drastic change". In the present anthology, we recognize the fact that the word "transformation" comes with a range of meanings, and that transformation concerns the change in knowledge that at times are required for transfer. Chapter 3 mentioned "metamorphosis" as one zoology-inspired way of modelling the transformation that a resituation of knowledge results in. As chapter 7 demonstrates, a less dramatic usage of "transformation" is found in mathematics, where the meaning of the word is much more fixed and clear. In other cases, the process of change that takes place in transformation of knowledge will have to be explicated and described in detail, perhaps with no suitable concept being available to take the place of a description of the transformation in terms of context levels (chapter 4) and forms of knowledge (chapter 2). Other usages of "transformation" are found in relation to energy and in linguistics. Each of these usages come with one or more models of change, and new ones may be associated with the word. Again, this underscores how the area of metaphysics that systematically explores change in the form of processes can be of assistance in developing accounts of changes – transformation – in both learners and their knowledge of domains.

6. Concluding remarks

This chapter has set out to survey existing reliance on metaphysics in educational science and discussion of transfer and transformation. Taking seriously relatively brief remarks in influential discussion of transfer and transformation that form part of the history of the present volume, I have sought to indicate ways that metaphysics can become more than a field that is briefly referred to in exposition of ideas and theories. There is after all a history of very fruitful interaction between

science and metaphysics (Jammer, 1997). The relation between the science and metaphysics can take different forms – from plundering to conversation – and this chapter has offered reasons and motivation for educational science and metaphysics being conversation partners with a view to understanding transfer and transformation.

References

Brown, J. S., & Duguid, P. (2000). *The social life of information*. Boston: Harvard Business School Press.

Chi, M. T. H., Slotta, J. D., & De Leeuw, N. (1994). From things to processes: A theory of conceptual change for learning science concepts. *Learning and Instruction*, *4*(1), 27–43.

Christensen, E. (2004). Overt and Hidden Processes in 20th Century Music. In J. Seibt (Ed.), *Process Theories: Crossdisciplinary Studies in Dynamic Categories* (pp. 97–117). Dordrecht and London: Kluwer Academic Publishers.

Dall'Alba, G., & Barnacle, R. (2007). An ontological turn for higher education. *Studies in Higher Education*, *32*(6), 679–691.

Decock, L. (2004). The taming of change. In *After Whitehead: Rescher on process metaphysics* (pp. 95–112). Frankfurt: Ontos Verlag.

Dubé, L., Bourhis, A., & Jacob, R. (2006). Towards a typology of virtual communities of practice. *Interdisciplinary Journal of Information, Knowledge, and Management*, *1*, 69–92.

Dummett, M. A. E. (2012). The place of philosophy in European culture. *European Journal of Analytic Philosophy*, *8*(1), 14–23.

French, S. (2014). *The structure of the world: Metaphysics and representation*. Oxford: Oxford University Press.

Frigg, R., & Votsis, I. (2011). Everything you always wanted to know about structural realism but were afraid to ask. *European Journal for Philosophy of Science*, *1*(2), 227–276.

George, D. J., & Velleman, A. (2002). *Philosophies of mathematics*. Oxford: Blackwell.

Greeno, J. G. (1997). On claims that answer the wrong questions. *Educational Researcher*, *26*(1), 5–17.

Hawley, C. (2016). Applied metaphysics. In K. Brownlee, D. Coady, & K. Lippert-Rasmussen (Eds.), *A companion to applied philosophy* (pp. 165–179). Wiley-Blackwell.

Jammer, M. (1997). *Concepts of mass in classical and modern physics*. Cambridge, MA.: Harvard University Press.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge: Cambridge University Press

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lobato, J. (2008). When students don't apply the knowledge you think they have, rethink your assumptions about transfer. In M. Carlson & C. Rasmussen (Eds.), *Making the connection: Research and teaching in undergraduate mathematics education* (pp. 287–304). Washington, DC: Mathematical Association of America

Moltmann, F. (2018). Natural language and its ontology. In *Metaphysics and cognitive science*. Oxford: Oxford University Press.

Mourelatos, A. P. D. (1978). Events, processes, and states. *Linguistics and Philosophy*, *2*(3), 415–434.

Packer, M. (2001). The problem of transfer, and the sociocultural critique of schooling. *The Journal of the Learning Sciences*, *10*(4), 493–514.

Popper, K. R. (1959). *The logic of scientific discovery*. London: Hutchinson & Co.

Popper, K. R., & Eccles, J. (1981). *The self and its brain*. Springer International.

Quine, W. v. O. (1960). *Word and object*. Boston: MIT Press.

Rescher, N. (1996). *Process metaphysics: An introduction to process philosophy*. New York: SUNY Press.

Rescher, N. (2000). *Process philosophy. A survey of basic issues*. Pittsburgh: University of Pittsburgh Press.

Seibt, J. (2004). Free process theory: Towards a typology of processes. *Axiomathes - An International Journal for Formal Ontology and Cognitive Science*, *14*, 23–57.

Seibt, J. (2015). Process philosophy. *Stanford Encyclopedia of Philosophy*, *Summer*. Retrieved from http://plato.stanford.edu/archives/sum2012/entries/process-philosophy/

Shapiro, S. (2000). Thinking about mathematics. In *The philosophy of mathematics*. https://doi.org/10.2307/2687736

Thompson, M. (2011). Ontological shift or ontological drift? Reality claims, epistemological frameworks, and theory generation in organization studies. *Academy of Management Review*, *36*(4), 754–773.

van Inwagen, P. (1998). Meta-ontology. *Erkenntnis*, *48*, 233–250.

Vendler, Z. (1957). Verbs and times. *The Philosophical Review*, *66*(2), 143.

Wagner, J. F. (2010). A transfer-in-pieces consideration of the perception of structure in the transfer of learning. *Journal of the Learning Sciences*, *19*(4), 443–479.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: University of Cambridge Press.

Whitehead, A. N. (1898). *A treatise on universal algebra*. Cambridge: Cambridge University Press.

Whitehead, A. N., & Russell, B. (1910-1913). *Principia mathematica. Vols I-III*. Cambridge: Cambridge University Press.

Worrall, J. (1989). Structural realism: The best of both worlds? *Dialectica*, *43*(1–2), 99–124.

Wright, C., & Hale, B. (2001). *The reason's proper study: Essays towards a neo-fregean philosophy of mathematics.* Oxford: Oxford University Press.