Croatian Journal of Philosophy
Vol. XXIV, No. 71, 2024
https://doi.org/10.52685/cjp.24.71.2
Received: September 19, 2022
Accepted: June 26, 2024

Thought Experiment as Bridge Between Science and Common Sense

JAMES W. McALLISTER
University of Leiden, Leiden, Netherlands

This reflection on the recent work of Nenad Miščević on thought experiment pursues two themes. One is the congruence between the historical development of the practice of thought experiment in science over the centuries and the development of philosophical accounts of thought experiment. The second is the idea that thought experiment provides a point of contact between common-sense and scientific conceptions of particular phenomena.

Keywords: Common sense; mental modelling; science; thought experiment.

1. *Twin histories*

There is not just a single history of thought experiment, but two. History 1 is the record of the rise and use of thought experiment in natural philosophy and science over the centuries. This history includes, among its high points, the classic thought experiments proposed by Galileo Galilei, Isaac Newton, and Albert Einstein. History 2, by contrast, is the succession of accounts thematising and analysing thought experiment as a distinctive device in scientific practice. This history consists of theories of the philosophy, epistemology, and methodology of thought experiment. It includes landmark contributions by such writers as Alexandre Koyré and Thomas S. Kuhn, as well as the revived debate among philosophers of science since the 1990s (Stuart and Fehige 2021).

The relation between these two histories presents an oddity. We expect the history of philosophy of science to mirror the history of science in various ways, of course: the former is, in part, a reflection on con-

ceptual changes and methodological innovations in the latter. In most cases, however, philosophical accounts of a facet of science do more than merely recapitulate that facet: they account for it at a higher conceptual level. In the case of thought experiment, by contrast, the relation appears more mechanical: history 2 simply reiterates history 1, it seems. Every conception of thought experiment put forward in history 2 is seemingly already present in history 1.

Here are some examples. Roy A. Sorensen (1992) in history 2 proposed a philosophical account of thought experiment as a species of concrete experiment: in history 1, natural scientists of the eighteenth and nineteenth centuries progressively incorporated a mature practice of thought experiment into a broader experimental methodology. John D. Norton (2004) in history 2 analysed thought experiments as arguments with suggestive premises: Aristotelian natural philosophers in history 1 constructed a variety of arguments *secundum imaginationem*, consisting of imaginative and counterfactual reasoning. James R. Brown (2011) in history 2 proposed a Platonist account, according to which some thought experiments allowed us to apprehend laws of nature: in history 1, Galileo used thought experiment to portray the laws of the new mechanics as evident and indubitable. The same holds, lastly, for my own contribution. I have argued that thought experiment acquires evidential significance only on certain metaphysical assumptions: where these assumptions are not accepted, thought experiment is evidentially inert. I have been able to find many examples in history 1 of researchers outside nomothetic domains who declined to lend evidential significance to thought experiment for this reason (McAllister 2018).

Why do accounts of thought experiment in history 2 seem fated to repeat what instances of the use of thought experiment in history 1 already offer? One possible explanation is that philosophers in history 2 have seen their task as clarifying, endorsing, and justifying examples of thought experiment that they found in history 1. That sounds unlikely, however: philosophers usually set themselves more ambitious goals.

A more intriguing hypothesis is that history 2 parallels history 1 on this topic because the two explore the same space of conceptual possibilities. There are only so many possible conceptual structures for thought experiment, and both histories exhaust them. This hypothesis gains plausibility in the light of the special role of thought experiment in theorising in philosophy. Philosophical analysis of other evidential devices in science—laboratory experiment, fieldwork or computer simulation, say—does not itself consist of laboratory experiment, fieldwork or computer simulation. Philosophical analysis of thought experiment, by contrast, consists largely in thought experiment—that is, in imaginative modelling of possible uses of the device in reaching conclusions. If thought experiment were restricted to a limited set of conceptually coherent options, then it would not be surprising if this framework constrained both history 1 and history 2.

This suggests that there are two ways of developing the philosophy of thought experiment, and thereby extending and enriching history 2. One way is to continue the project of creating accounts that explain and justify yet further individual examples of thought experiment found in history 1, clarifying their epistemology and methodology. Many writers have pursued this project, as we have already seen. The second way is to survey and elucidate the overarching space of conceptual possibilities that the device of thought experiment inhabits in both history 1 and 2.

Nenad Miščević in his book, *Thought Experiments*, makes a contribution to both these projects. Miščević's primary aim is to present a specific account of thought experiment, thus occupying a particular place in the conceptual space. In passing, however, he also offers a valuable suggestion about the space as a whole that instances of thought experiment inhabit.

The first project takes off in chapter 3: Miščević critically reviews some previous accounts of thought experiment, including inferentialist, Platonist, and Kantian theories. From chapter 4 onwards, Miščević develops his own alternative proposal in this repertory. This is a mental modelling account of thought experiment. In particular, Miščević argues that the function of thought experiment is to prompt a researcher to activate and draw upon unarticulated (and perhaps inarticulable) cognitive resources. Some of these resources may be innate, whereas others are the accumulation of our experiences of the world.

Miščević's thinking along these lines stretches back over thirty years, and his ideas have stimulated wide debate (Miščević 1992; Borstner and Gartner 2017). The new book adds much detail. For example, Miščević now suggests that the performance of a thought experiment traverses seven stages: these start with retrieving an unarticulated intuition, and conclude with identifying the significance of the thought experiment for our broader understanding of the world. This schema amounts to a practical guide for performing thought experiments (Miščević 2022: 17–22).

I suggested above that every conception of thought experiment that philosophers put forward in history 2 is already found in history 1. This holds for Miščević's conception too. Its counterpart in history 1 is an iconic thought experiment in mechanics, featuring a *clootcrans* or "wreath of balls," which Simon Stevin proposed in 1586. Stevin used this thought experiment to conclude that a chain draped over a frictionless prism would not slide off in either direction, and thence to derive the condition for the balance of forces on inclined planes (Dijksterhuis 1955: 176–179).

Miščević returns to Stevin's thought experiment several times in the course of the book. The example is particularly apposite for Miščević, for two reasons. In general terms, it is an instance of mental modelling: Stevin asks us to picture the dynamics of the chain in our mind. On a more specific level, Stevin's reasoning in the thought experiment

turns on the principle of impossibility of perpetual motion: this appears suddenly as a premise in the course of the argument, as if the thought experiment had prompted the natural philosopher to recall it at the appropriate step. This illustrates what Miščević describes as the tendency of thought experiment to activate implicit cognitive resources. In Miščević's words:

> Stevin's TE and the resulting intuition that the chain will not move, deploys some spatial-geometrical knowledge that might be innate and in this sense a priori, some naïve physics that is partly innate (a priori) and partly derived from and justified by experience (a posteriori), and we can trace each of the lines of justification to its distinctive source. (Miščević 2022: 25–26)

All this fits together well. In fact, however, Miščević has not only a counterpart in history 1, but also a precursor in history 2. Ernst Mach also propounded a mental modelling account of thought experiment. Mach hypothesised that a scientist had a store of intuitive knowledge laid down from previous experience:

> Everything which we observe in nature imprints itself uncomprehended and unanalysed in our percepts and ideas, which, then, in their turn, mimic the processes of nature in their most general and most striking features. In these accumulated experiences we possess a treasure-store which is ever close at hand and of which only the smallest portion is embodied in clear articulate thought. The circumstance that we are easier able to employ these experiences than we are nature itself, and that they are, notwithstanding this, free, in the sense indicated, from all subjectivity, invests them with high value. (Mach [1883] 2013: 28)

Thought experiment allowed the scientist to tap into this store and retrieve items of knowledge that were suited to tackling a particular problem, according to Mach. Furthermore, Mach too took Stevin's chain thought experiment to illustrate this conception, and presented a detailed analysis of it (Mach [1883] 2013: 24–31). Since both Miščević's theory and his understanding of Stevin's thought experiment recall Mach quite closely, it would have been interesting if he had contrasted his views in detail with those of Mach; in fact, he touches on the similarity only briefly (Miščević 2022: 31).

2. *Bridge function*

I see in Miščević's book also a contribution to the second project that I identified above, namely the investigation of the overarching conceptual space in which thought experiment operates. Rather than striving to add to our stock of individual models of thought experiment, this project attempts instead to identify the range of possibilities that accommodates all such models.

Miščević locates this conceptual space between the domains of science and common sense. Since antiquity, philosophers have been intrigued by the existence of two forms of knowledge: everyday, practical conceptions of the world that people share widely and apply in concrete

cases, and specialist, formal or technical conceptions that are the product of systematic investigation and reasoning within disciplinary settings. A particular question has concerned the relation between these two forms of knowledge. Should they be seen as separate domains, or is there some point of contact between them?

Miščević's intriguing proposal is that thought experiment acts as a link between everyday and technical modes of knowing:

> Why is […] a TE indispensable? Because philosophers are vitally interested in connections between our spontaneous understanding of important properties […] and the results of science. In order to answer the question about the relation between, say, scientific determinism and our belief in freedom, we need to confront them, and we cannot do it within science alone. We need the bridge, and TE is a perfect candidate. (Miščević 2022: 28)

The example of free will is well chosen. This concept features prominently in both domains: common sense includes well-entrenched assumptions about human freedom to make decisions and take actions, while physics and the neurosciences advance theories about the degree to which human acts can be explained by—and thus be reduced to—more basic causal factors. If we are to develop a unified view of this domain, then these two discourses must communicate: insights from science may refine and correct common sense, but it is also important that the view put forward by science speak to our everyday experience (Nahmias 2014). Thought experiments about free will are able, as Miščević suggests, to provide a bridge between these two discourses.

If this proposal is to contribute to the second project that I identified above, of systematising the overarching conceptual space of thought experiment, then it must provide a framework that is demonstrably more encompassing than individual models of thought experiment are, and sufficiently flexible to do justice to a wide variety of them. Miščević's proposal is capable of meeting this challenge. To appreciate this, we need only note that there are many different ways of—and purposes for—building a bridge between common sense and science: different examples and models of thought experiment correspond to these different possibilities.

Consider the following instances. We may wish to forge a link between science and common sense by spurring science to take up and resolve puzzles suggested by everyday intuition. This is the function carried out by Einstein's light beam thought experiment. Second, we may wish to test scientific theories against criteria of acceptability rooted in common sense. This is what Galileo's falling body thought experiment does. Third, we may wish to probe the implications of particular scientific theories for everyday conceptions of the world—Erwin Schrödinger's cat thought experiment in quantum theory does this. Many further alternatives can be devised.

Miščević's suggestion, that what is common to all instances and models of thought experiment is a capacity to bridge the gap between science and common sense, is an original and powerful contribution

to elucidating thought experiment in its variety. It is more than that, though. It is also a novel and convincing answer to the debate about the relation between science and common sense that has endured since Arthur S. Eddington's "two tables" parable (Eddington 1928).

Eddington intended his parable to highlight the incommensurability between the dominion of common sense, in which a table was solid, sharply bounded, and coloured, and that of science, in which a table was none of these things. Philosophers over the decades have been divided about the most convincing response to Eddington. Some have embraced eliminativism, holding that only one of the two worlds genuinely exists; others have postulated priority of one over the other. Miščević, by contrast, succeeds in placing the two domains on the same level by the simple and flexible notion of constructing a bridge between them.

Tamar Szabó Gendler (2007) has already gone some way in this direction, albeit for philosophical rather than scientific thought experiments. Gendler pointed out that discussion of a philosophical problem may take very different forms and elicit differing intuitions depending on whether it is based on a description of an abstract and general state of affairs, or on a portrayal of a concrete and particular scenario. An abstract and general description is the typical centrepiece of scientific conceptions of the world, whereas concrete particulars are more often the object of common-sense conceptions. Gendler ascribed to philosophical thought experiments the function of linking and comparing these two conceptions, somewhat similar to that which Miščević attributes to scientific thought experiments.

To my mind, the greatest value of Miščević's book is to be found in his contribution to this second project, even more than in that to the first. His arguments for the mental modelling account of thought experiment will be received with interest by philosophers inclined to a cognitive science approach to scientific methodology. However, I find Miščević's idea about the functions that thought experiments play regardless of the particular epistemology that we attribute to them, creating a link between the domains of science and common sense, to be of greater significance and originality. It will be a pleasure to see to what further insights and developments this intriguing suggestion gives rise in years to come.

Acknowledgements

I presented a previous version at the 47th Annual Philosophy of Science Conference, Inter-University Centre Dubrovnik, April 2022. I remember Nenad Miščević (1950–2024) with affection and gratitude for invariably interesting and friendly discussions of thought experiment and other topics in Dubrovnik over many years.

References

Borstner, B. and Gartner, S. (eds.). 2017. *Thought Experiments between Nature and Society: A Festschrift for Nenad Miščević*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Brown, J. R. 2011. *The Laboratory of the Mind: Thought Experiments in the Natural Sciences*. Second edition. Abingdon: Routledge.

Dijksterhuis, E. J. (ed.). 1955. *The Principal Works of Simon Stevin*. Vol. 1. Amsterdam: C. V. Swets and Zeitlinger.

Eddington, A. S. 1928. *The Nature of the Physical World*. Cambridge: Cambridge University Press.

Gendler, T. S. 2007. "Philosophical Thought Experiments, Intuitions, and Cognitive Equilibrium." *Midwest Studies in Philosophy* 31: 68–89.

Mach, E. [1883] 2013. *The Science of Mechanics*. Translated by T. J. McCormack. Second edition. Cambridge: Cambridge University Press.

McAllister, J. W. 2018. "Historicism and Cross-culture Comparison." In M. T. Stuart, Y. Fehige, and J. R. Brown (eds.). *The Routledge Companion to Thought Experiments*. London: Routledge, 425–438.

Miščević, N. 1992. "Mental Models and Thought Experiments." *International Studies in the Philosophy of Science* 6: 215–226.

Miščević, N. 2022. *Thought Experiments*. Cham: Springer.

Nahmias, E. 2014. "Is Free Will an Illusion? Confronting Challenges from the Modern Mind Sciences." In W. Sinnott-Armstrong (ed.). *Moral Psychology*. Vol. 4, Freedom and Responsibility. Cambridge, Mass.: MIT Press, 1–25.

Norton, J. D. 2004. "On Thought Experiments: Is There More to the Argument?" *Philosophy of Science* 71: 1139–1151.

Sorensen, R. A. 1992. *Thought Experiments*. New York: Oxford University Press.

Stuart, M. T. and Fehige, Y. 2021. "Motivating the History of the Philosophy of Thought Experiments." *HOPOS: The Journal of the International Society for the History of Philosophy of Science* 11: 212–221.