

23 NEW PROBLEMS FOR THE ARGUMENT VIEW OF THOUGHT EXPERIMENTS¹

NOVOS PROBLEMAS PARA A TESE DO ARGUMENTO SOBRE EXPERIMENTOS MENTAIS

Roberto S. Nitsche
Tiegue V. Rodrigues

Abstract: It is assumed that thought experiments are devices of imagination that can yield us beliefs constituting knowledge. Nevertheless, how thought experiments work to provide positive epistemic status is a controversial matter. One of the main approaches available in the literature to account for thought experiments is the so-called Argument View. Advocates of this view argue that thought experiments have no epistemic significance. They claim that there is not anything distinctive about thought experiments because they work just like arguments. In this paper, we challenge the argument view by presenting several objections that expose its implausibility. Explicitly, we examine fundamental aspects of the view – which involve the notions of “argument” and “inference” – to demonstrate that a thinker who comes to know something through the execution of a thought

¹ revisado por xxxx

experiment will hardly be considered as effectively having executed an argument or a process of inferential reasoning.

Keywords: Norton; thought experiments; knowledge, justification; arguments; inference.

Resumo: É assumido que experimentos mentais são dispositivos da imaginação que podem produzir-nos crenças que constituam conhecimento. Não obstante, é uma questão controversa como os experimentos mentais funcionam de modo a fornecer *status* epistêmico positivo. Uma das principais abordagens disponíveis na literatura para explicar experimentos mentais é a assim chamada Tese do Argumento. Os defensores dessa tese argumentam que experimentos mentais não têm importância epistêmica. Eles alegam que não há nenhuma coisa distinta nos experimentos mentais, porque funcionam exatamente como argumentos. Neste artigo, desafiamos a Tese do Argumento, apresentando várias objeções que expõem a sua implausibilidade. Explicitamente, examinamos aspectos fundamentais da tese – que envolvem as noções de “argumento” e “inferência” – para demonstrar que um pensador que passa a saber algo pela execução de um experimento mental dificilmente será considerado como tendo efetivamente executado um argumento ou um processo de raciocínio inferencial.

Palavras-chave: Norton; experimentos mentais; conhecimento; justificação; argumentos; inferência.

1 INTRODUCTION

It is uncontroversial that, throughout history, thought experiments have been seen as valuable tools that are capable of providing new knowledge about the world. They are abundant in literature, and they can be found in different areas of inquiry such as ethics,

philosophy of mind, epistemology, and in natural sciences. Despite its central role within philosophy, it was in science that the debate regarding the nature and application of thought experiments has mostly flourished. Even though we believe that a unified account of thought experiments is preferable and worth having, we won't be able to pursue it here. Rather, we focus on the current debate about how knowledge is generated via thought experiments. We discuss a prominent view that was introduced precisely to account for the application of thought experiments within the scope of science.²

Some authors (LAYMON, 1991; RESCHER, 1991; IRVINE, 1991; FORGE, 1991; BUNZL, 1996; NORTON, 1991, 1996, 2004a, 2004b; HÄGGQVIST, 1996; WILLIANSOM, 2007)³ have advocated for an intuitive and influential way to explain how scientific thought experiments can yield knowledge about the world. Despite minor differences, these authors share a common basic view, which we shall refer to as the *Argument View*. According to this view, thought experiments work just like (or in connection to) arguments. To put it differently, they hold that to conduct a thought experiment is equivalent to execute an argument. A significant outcome of this view is that it renders scientific thought experiments superfluous, i.e., their elimination does not amount to any relevant epistemic loss.

Despite the recognition that the argument view has received, due mainly to John Norton's defense of it, it is safe to say that within philosophical literature most of the authors reject it. Not because they think it is simply false but because they disagree about its scope, i.e., they disagree that all thought experiments could only work

² However, the problems we will rise here for such account are not limited to thought experiments in science, they can be generalized by any account of thought experiment, philosophy included.

³ Häggqvist (1996) proposed an account according to which thought experiments are not themselves arguments but "work through their connection with arguments." But when all the details are spelled out and its implications are recognizable, his view seems to collapse into the claim that thought experiments are just arguments after all (see SIDELLE, 1998).

as arguments. Some authors have argued that the achievement of scientific thought experiments is revealed once we allow for the possibility of a direct rational grasp or intuition of relations between universals (BROWN, 1986, 1991, 1992, 2004). Others conceived thought experiments as mental models, fictions, exemplifications, or as requirements for the possibility of empirical experiments (see, e.g., BISHOP, 1999; DAVIES, 2007; GENDLER, 2004; GOODING, 1992, 1994; MIŠČEVIĆ, 2007; NERSESIAN, 1992, 1993, 2007; BRENDÉL, 2004; ELGIN, 2014; SORENSEN, 1992; BOKULICH, 2001; BUZZONI, 2008).

In this paper, we follow some of the authors mentioned above in the sense that we reject the argument view. However, we move away from them to the extent that our objection questions the very basis of this view, showing its implausibility. We argue that the argument view fails because it cannot correctly explain the epistemic significance of thought experiments. We examine crucial features of this approach, which require the notions of “argument” and “inference,” to show that a thinker who comes to know something through the execution of a thought experiment will hardly be recognized as effectively having executed an argument or a process of inferential reasoning.

Here is our plan for the paper. In the next section, we lay out the argument view. Subsequently, in section 3, we clarify two notions that are central to a proper assessment of the argument view and for which its supporters fail to give a precise specification. In section 4, we present several objections to the argument view. Finally, in section 5, we conclude that the argument view does not successfully account for the epistemic significance of thought experiments.

2 THE ARGUMENT VIEW OF THOUGHT EXPERIMENTS

Although different authors have, implicitly or explicitly, argued for the *argument view* (from now on just AV), they all share the general idea that thought experiments are (or work) just as arguments.

Irvine argues that thought experiments “are simply arguments concerning particular events or states of affairs of a hypothetical (and often counterfactual) nature which lead to conclusions” (1991, p. 150) regarding the nature of the world. Rescher states that a thought experiment is just “an attempt to draw instruction from a process of hypothetical reasoning that proceeds by eliciting the consequence of a hypothesis” (1991, p. 31). Bunzl says that thought experiments are “simply inferential in nature” (1995, p. 391) and that “the force of the [thought experiment] relies on much more mundane matters of deductive logic” (BUNZL, 1996, p. 232). Williamson holds that thought experiments must embody “a straightforward valid modal argument for a modal conclusion” (2007, p. 187). Norton (1991, 1996, 2004a, 2004b) claims that thought experiments are

arguments which: (i) posit hypothetical or counterfactual states of affairs, and (ii) invoke particulars irrelevant to the generality of the conclusion [...] Thought experiments in physics provide or purport to provide us with information about the physical world. Since they are *thought* experiments rather than *physical* experiments, this information does not come from the reporting of new empirical data. Thus, there is only one non-controversial source from which this information can come: it is elicited from information we already have by an identifiable argument, although that argument might not be laid out in detail in the statement of the thought experiment. The alternative to this view is to suppose that thought experiments provide some new and even mysterious route to knowledge of the physical world. (NORTON, 1991, p. 129)

Proponents of AV are generally empiricists who accept the general view according to which the ultimate grounds for knowledge (and justification) rests on sense experience. They assume that “pure

thought cannot conjure up knowledge” (NORTON, 2004b, p. 50)⁴; it can only transform the pre-existing one. And this is precisely what they hold that thought experiments can do. However, given that thought experiments can (without acquiring new information) provide knowledge about the world without empirical manipulation, they must operate by performing another kind of manipulation on the existing knowledge, namely, logical manipulation. The AV holds that the only way for this transformation to happen – and consequently for rejecting any appeal to “epistemic magic” (NORTON, 2004b, p. 45) – is to acknowledge that “the only other source of obtaining such new information must result from the reconsideration of previous data by way of argument” (IRVINE, 1991, p. 150); for the conclusion of an argument can make explicit information that was implicit in the argument’s premises. Thus, all results achieved via thought experiments must be grounded and demonstrable by reconstructed arguments.

The recognition of the central role that the notion of “argument” plays in the defense of AV seems to require from its supporters a precise stipulation of what they mean by it. Although they do suggest some indication of it, they fail to provide a precise description. Since identifying the arguments underlying thought experiments is usually a challenging task, we must be able to reproduce them as arguments to fully appreciate the before-mentioned arguments. Their overall strategy to show that thought experiments are arguments is usually to reduce them into a set of propositions and assumptions, conducing to a conclusion via deductive and non-deductive inferences. They typically recognize any inference that is allowed by a deductive, inductive or even informal logic as an argument (NORTON, 2004b, p. 64), and they also go further admitting diagrams to be proper steps

⁴ It is reasonable to say that Norton’s account is a direct response to the Platonic account proposed by James Brown (1986, 1991, 1992, 2004). Brown’s account has a rationalist flavor. According to him, the best way to account for scientific thought experiments and its success requires us to allow for the possibility of a direct rational grasp of relations between universals.

in arguments (NORTON, 2004b, p. 58). They tend to assume that “a generalized logic is what governs any exposition that uses templates with variable content” (NORTON, 2004a, p. 1143). This claim invites the interpretation that the proponents of AV take the notion of “argument” broadly and conventionally, consisting of premises and a conclusion. Moreover, such a claim also implies that the standards to judge the outcomes achieved through thought experimentation supervene on the evaluation of the recognized arguments they exhibit. As Norton suggests, “a good thought experiment is a good argument; a bad thought experiment is a bad argument” (NORTON, 1991, p. 131), and “if they fail, they do so for an identifiable reason” (NORTON, 2004b: p. 51-52).

Taking a step back and considering Norton’s quotation mentioned at the beginning of this section we can have a clear example of the requirements imposed to thought experiments by AV advocates. One of the requirements, as put by Norton, is that a thought experiment must represent a hypothetical or counterfactual state of affairs. This condition is responsible for the *mental* feature of the thought experiment. For without the hypothetical or counterfactual condition, a thought experiment would just be the equivalent of a physical experiment’s description or states of affairs that need not involve thought experimentation.⁵ The other requirement he suggests can be described as the details that are irrelevant to the generality of the conclusion and are responsible for the *experimental* characterization of the thought experiment. In Einstein’s elevator thought experiment, we are asked to imagine a physicist who was drugged and unconsciously taken to a box; and all of these details are irrelevant according to Norton. We could imagine that instead of a physicist, we had a layperson in physics; we could also imagine

⁵ For a discussion of whether a counterfactual condition is a necessary condition to a proper definition of thought experiments see Irvine (1991). Despite having a view similar to Norton, he argues that such a condition is not required.

that the person was knocked out, rather than drugged. By removing the irrelevant details, we are left only with the arguments.

According to AV advocates, the successful thought experiments will be those who have in common “some sort of mark of truth” (NORTON, 2004a, p. 1143). This “mark” that tells us whether a thought experiment (or the argument it exhibits) is justified is something completely internal. This mark cannot be something that depends on factors that are external to the thought experiment itself such as the subject who performs it or because it is found in a definite list of valid thought experiments; what would be quite arbitrary. It is the structural feature of the thought experiments that can be shared by other similarly successful inferences, and we should be able to find this mark only by “reading its text” (NORTON, 2004a, p. 1143) or hearing the description of the scenario comprising the thought experiment. “The mark is just that the thought experiment either uses an argument form licensed by logic or can be reconstructed as one” (NORTON, 2004b, p. 54). Consequently, this “mark” also cannot give an accurate description of all the information contained in the scenario; it only represents a template from which we can modify information, and it is this “mark” that enables the evaluation of future examples of thought experiments.

Proponents of the AV also tend to support the principle, as introduced by Norton, called the *elimination thesis (ET)*: any conclusion reached by a (successful) scientific thought experiment will also be demonstrable by a non-thought-experimental-argument.⁶ The acceptance of (ET) inevitably leads to the recognition that thought experiments are simply trivial and dispensable since any conclusion reached by their execution can also be demonstrable and reconstructed as arguments without any significant epistemic loss. And, as a consequence, thought experiments are destitute of any epistemic significance.

⁶ See Norton (1991, p. 131) and Norton (1996, p. 336).

The argument view is engaging and quite convincing. After all, one natural way thought experiments are presented to us is by manipulating sentences – some of which can be seen as premises attempting to convince us of a conclusion – just like arguments. However, there are some reasons for us to worry about this view. In the remaining of this paper, we present several objections to the argument view. Nevertheless, before presenting our objections, we elucidate essential features concerning the nature of arguments and inferences.

3 ARGUMENTS AND INFERENTIAL REASONING

As we have seen in the previous section, the argument view states that thought experiments work just as arguments. The strategy employed by its advocates is to decode thought experiments into lists of propositions or premises leading to a conclusion via inferences of an acknowledged sort (deductive and non-deductive). However, its advocates don't specify precisely what they mean by "argument," and also by "inference." In this section, we distinguish and elucidate these notions, which permit us to evaluate the implications that underlie such a view, as well as our objections to it.

First, let us focus on the notion of "argument." Arguments are generally conceived to be of two sorts: deductive and inductive (COPI; COHEN, 2005; SINNOTT-ARMSTRONG; FOGELIN, 2010). Deductive arguments are defined by the logical structure or form they manifest. An argument is considered deductive in the case the conclusion logically follows from the premises. Such a thing does not happen with inductive arguments, in which the truth of the premises only makes the truth of the conclusion probable, it does not guarantee it. It is noteworthy that it is not any group of propositions that will qualify as an argument. Philosophers tend to consider that an argument is something well structured, more akin to a notion that logicians use

to call derivation: a series of statements with intermediate steps providing the (inferential) transition from premises to conclusion.

There are two main approaches regarding how a set of premises can make an argument. On the one hand, there is the structural approach. Advocates of it hold the thesis that the premises of an argument are reasons offered in support of its conclusion (See, for example, COPI; COHEN, 2005; BASSHAM; IRWIN; NARDONE; WALLACE, 2005; GOVIER, 2010; and see, for discussion, JOHNSON, 2000). Hence, an indefinite group of propositions lacks the structure of an argument unless there is a thinker who is responsible for putting forward some of them (premises) as reasons in support of one of them (conclusion). The structure exhibited by an argument cannot be properly described just as a function of the syntactic and semantic features of the propositions that constitute such an argument. Rather, the structure of an argument is fundamentally explained by the intentions of the thinker who presents the argument in a specific way.⁷ For present purposes, it is enough to consider such “intentions” as the subject’s judgment that the propositions he counts as premises do provide the fundamental support for the proposition he counts as the conclusion.

According to this approach, it is not adequate to think the occurrence of two distinct kinds of arguments. Alternatively, what we have is that in some cases of inferential reasoning the premises logically entail the conclusion while, in others, they merely make the conclusion more probable. But that only means we have two different sets of standards governing the evaluation of inference, not that we have two different kinds of inference (Boghossian 2014). It is the *intention* of the thinker that we seem able to distinguish: intuitively, we appear to be able to discriminate between a thinker who intends to be making a

⁷ Different accounts of the nature of the intended support offered by the premises for the conclusion in an argument generate different structural characterizations of arguments. For discussion, see Hitchcock (2007).

deductively valid inference versus someone who intends to be making an inductive one. But this implies that the thinker can “see” that her premises do provide sufficient justification for her conclusion.

On the other hand, there is the pragmatic approach. According to this approach, the nature of arguments is not simply captured by its structure. In contrast to structural definitions of arguments, pragmatic definitions consider the *function* of arguments. Distinct approaches can be taken to explain the several purposes that arguments might serve to generate distinct pragmatic definitions of arguments.⁸ Consider the following pragmatic definition: a group of propositions is an argument if and only if there is a thinker who puts forward some of them (the premises) as reasons in support of one of them (the conclusion) in order to rationally convince a given audience of the truth of the conclusion. Such a definition calls for the use of arguments as instruments of rational persuasion.⁹ It’s noteworthy that by appealing to the aims of arguments, pragmatic definitions emphasize the acts of proposing an argument in addition to the arguments themselves.¹⁰ Pragmatic definitions still need the structure of propositions in order to portray arguments; it only opens up the scope to capture the (allegedly) variety of purposes arguments may serve.

Another important elucidation concerns the term “reasoning.” Although it is closely related to “argument,” they are conceptually

⁸ Some authors have urged that the acts of explaining and arguing have totally different aims. Whereas the act of explaining is intended to extend the audience’s comprehension, the act of contestation is geared toward enhancing the acceptableness of a posture. This distinction in aim is sensible of the actual fact that in presenting an argument the thinker believes that her posture isn’t nonetheless acceptable to her audience, however in presenting evidence the thinker is aware of or believes that her audience already accepts the explicandum. For more discussion on this, see Snoeck Henkemans (2001, p. 232), and Van Eemeren and Grootendorst (1992, p. 29).

⁹ For definitions of argument that make such an appeal, see Walton (1996, p. 18), Johnson (2000, p. 168), Hitchcock (2007, p. 105), and Mercier and Sperber (2011).

¹⁰ The field of argumentation, an interdisciplinary field that includes rhetoric, informal logic, psychology, and cognitive science, highlights acts of presenting arguments and their contexts as topics for investigation that inform our understanding of arguments. See Houtlosser (2001) for discussion of the different perspectives of argument offered by different fields.

different. Defenders of the argument view are also silent about what they mean by “reasoning.” It is a hard task to give a full account of the nature of reasoning, and it is not our purpose to propose an interpretation for it here. Rather, we aim to clarify and call attention to some distinctive features that clear cases of reasoning seem to display and contrast them with the argument view. We take reasoning to be inferential reasoning (and from now on we are going to use “reasoning” and “inference” interchangeably). John Broome (2001) suggested that every case of reasoning is a sequence of mental states that have propositions as their contents.¹¹ One feature displayed in clear cases of reasoning is what Boghossian (2003) has called *content gaps*. A content gap is a gap between the content of the first mental state in the sequence of mental states the thinker considers as her premises and the content of the final mental state that is her conclusion. Let’s consider two examples. First, suppose that a thinker notices that there are no coins left in her pocket when trying to pay the parking meter, and infers the conclusion that she has given all of her coins to a beggar on the street. The subject’s two beliefs, in this case, have two very different contents: *there are no coins left in her pocket when trying to pay the parking meter* at one hand, and *that she has given all of her coins to a beggar on the street* on the other. It is easy to imagine different ways the subject might *fill* that gap in an epistemically suitable way: by remembering that she emptied her pockets in front of the beggar who was not satisfied with her alms, for example, or by reflecting that she needs to stop giving alms to beggars on the street. Now, consider another situation in which one visually perceives a blue door, and by endorsing her perception forms the corresponding belief that there is a blue door. The first case is a paradigmatic case of reasoning, while the latter is not. Whereas in the former case, the content gap is clear

¹¹ It is important to note that he does not intend this to be a sufficient condition for reasoning, only a necessary one.

between the premises and the conclusion, in the latter, it does not seem to hold any gap at all.¹² As suggested by Boghossian (2003, p. 235-237), content gaps are indicative of cases of inferential justification.

But the content gap is not a sufficient condition for inferences, not every group of mental states that displays a content gap can be recognized as a case of reasoning: think of a subject drifting from thought to thought in an episode of daydreaming, or someone who is suffering from ADHD whose mental activity is overloaded in the sense that there is an overflow of thoughts without any particular engagement. Another feature that distinguishes paradigmatic instances of reasoning is that it is intuitively fitting to govern the changes among the steps of the thinker's reasoning, and the thinker himself, to certain sorts of epistemic normative evaluation. When the subject reasons, "I always keep my coins either in my pocket or in my piggy bank; they're not in my pocket; so I must have left them on my piggy bank," we judge the steps to be ones that the subject ought to take, or that it is good to take, from an epistemological point of view. They conform to certain rules, and we might praise her, or say that she has conducted herself as she should, epistemologically speaking, in so reasoning that way. These sorts of appraisals are appropriate for us to make in this case.¹³ This clearly contrasts with the daydreamer or the subject suffering from ADHD, for both of them such normative evaluation seems to be out of place.

As exemplified above, lots of thoughts or mental states can succeed one another without being causally *proper related* by inference. One's inferring (conclusion 3) cannot consist just in her judging

¹² Most would not be willing to count the belief that there is a blue door as inferentially justified in this case. One that denies it might, at best see it as a degenerate case of reasoning. However, that is very implausible.

¹³ Likewise, had she taken some other steps—they're not in my pocket, so they're probably not on my piggy bank either—it would be appropriate for us to judge them to be epistemically bad or impermissible, and to say that she has not conducted herself as she should.

(premise 1) and (premise 2), and in this fact *causing* her to judge (conclusion 3). We follow Boghossian (2014), for present purposes, in assuming that a proper inferential relation is a transition from some beliefs to a conclusion in which the subject *takes* her conclusion to be supported by the presumed truth of those other beliefs. The way we see things, a proper or adequate instance of inferential reasoning requires something along the lines of what Boghossian has called the *taking condition*: “inferring necessarily involves the thinker taking his premises to support his conclusion and drawing his conclusion because of that fact” (Boghossian 2014, p. 5).¹⁴ The idea that appears to be behind the taking condition is that no causation process will count as someone’s process of inference unless it consists in an attempt to arrive at a belief by deciding what, in some broad sense, is supported by further things one already believes. We also assume that reasoning is to be seen as person-level, as a mental action that a subject performs, in which she is either aware or can become aware of why she is moving from some beliefs to others (from certain premises to a certain conclusion).

4 PROBLEMS FOR THE ARGUMENT VIEW

Now we can proceed to present our objections to the argument view. An *experiment* – physical or mental – is a type of procedure carried out to support (refute or validate) a hypothesis.¹⁵ From an epistemological point of view, this means that thought experiments can provide evidence or justification (positive or negative) for a given proposition about how

¹⁴ For discussions of this view see Rosa (2019), McHugh and Jonathan (2016), and Valaris (2016).

¹⁵ We have reasons to think that this will not be entirely correct if a unified account of thought experiments in philosophy and science is pursued. There are several cases of thought experiments in philosophy that do not seem to be supporting any specific conclusion such as the “trolley case.” However, within the scope of this paper such claim seems to be unproblematic.

the world is like. However, we wonder how exactly an experiment – a thought experiment – can yield knowledge or justification?

Generally speaking, knowledge and justification can be subdivided according to the sources from which it arises. A source of knowledge (and justification) “is roughly something in the life of the knower – such as perception or reflection – that yields beliefs constituting knowledge” (AUDI, 2005, p. 71). Among the classical basic sources of knowledge and justification are perception, testimony, reasoning, introspection and rational insight (or rational intuition).¹⁶ As an answer to the previous question, it seems reasonable to think that if we gain knowledge or justification from thought experiments, then some (if not all) of the sources mentioned above must be responsible for it.

Acknowledging for the fact that there are several sources of knowledge and that we can come to know things in different ways through them might suggest that it is rather unlikely that the only way we could obtain knowledge from thought experiments is by inferential reasoning, as suggested by the proponents of AV. Of course, this is far from posing a final threat to the view but it can be a good start.

At first glance, AV seems to indicate that *reasoning* is the epistemic source responsible for grounding the knowledge obtained via thought experiments because it assumes that thought experiments are nothing but arguments, which are governed by logical rules. As Norton and Irvine suggest, “a good thought experiment is a good argument; a bad thought experiment is a bad argument” (NORTON, 1991, p. 131) and the only “source of obtaining such new information must result from the reconsideration of previous data by way of argument” (IRVINE, 1991, p. 150). But that does not seem quite right, for the proponents of AV are also committed to some basic empiricist assumptions regarding the origin of our knowledge

¹⁶ This list of sources of knowledge is not to be exhaustive. It simply includes what philosophers traditionally tend to consider as sources. See Audi (2005) for discussion.

acquired through thought experiments. Norton also asserts that “pure thought cannot conjure up knowledge” (NORTON, 2004b, p. 50). He also claims that “deductive inferences merely restate what we have already presumed or learned. [...] We are just restating what we already have in the premises.” (NORTON, forthcoming, Chapter 2, p. 7). These assumptions seem to indicate that the only source responsible for grounding the knowledge that is obtained via thought experiments is not reasoning but perception because our informational content is derived from sense experience. And this creates tension within AV: on the one hand, the knowledge acquired via thought experiments seems to be based on reasoning; on the other hand, it seems to be based on perception.¹⁷

Once AV advocates assume empiricism there is no alternative except to embrace fallibilism. The acceptance of fallibilism in contemporary epistemology is practically universal, and it stems from the widely supported view that what we seek in developing a general theory of knowledge is an account that squares with our strong intuition that we do know numerous things about the world. Any knowledge account that endorses the principle that “S knows q based on reason r only if r entails q” (COHEN, 1988, p. 91) is doomed to a skeptical conclusion. Rejecting this entailment principle constitutes a necessary way (although not sufficient) for evading this immediate skeptical result, leading us to embrace a fallibilist principle that “allows that S can know q on the basis of r where r only makes q sufficiently probable” (COHEN, 1988, p. 92).

¹⁷ One might want to argue something weaker, that both reasoning and perception could be playing an important role in generating the support for the knowledge from thought experiments. However, the problem is not solved because both Norton and other AV proponents are just silent about it. An anonymous referee suggested that “it’s not clear that this is a serious problem for AV. The thesis that both perception and reasoning play a role in thought experiments could be easily accommodated within AV, requiring, at least to me, only minor changes.” We are not sure that only minor changes could be enough to solve this problem because since AV advocates claim that reasoning is responsible for all the epistemization in play, they certainly would have to weaken his view in order to say that perception has also a part to play in it.

This shows that in the end, even deductive arguments are fallible when their premises have empirical content. Hence deductive arguments are not much different from inductive arguments after all, at least not from an epistemological point of view. The notion of “derivation” and “proof” that seems to be acting as AV’s background assumptions of logic has some of its powers undermined when dealing with empirical (fallible) content. Empirical premises are not like accepted axioms from mathematics; they are only probable given the evidence available in their favor. Logic itself cannot make something (a conclusion) truth out of something (premises) false (letting contradictions aside), nor it can preserve something that is not present (such as truth or other epistemic property). So, AV seems to suggest that thought experiments not only require arguments to be licensed by logic but also require sound ones, that is, their premises must also be true.¹⁸ And this creates an extra difficulty for AV to properly evaluate thought experiments.

These considerations suggest that AV faces a dilemma. On the one hand, given his endorsement of licensed logical structures as the only way to evaluate the success of thought experiments, reasoning appears as the source responsible for the knowledge obtained via thought experiments. Subsequently, bad cases of thought experiments will be those cases that exhibit some sort of fallacy. But this is a mistake, we don’t evaluate arguments only by its formal structure. We also evaluate them according to their epistemic properties (such as having a false premise or not being truth-conducive), and AV is unable to account for this fact. Following AV in this way, we end up with the very implausible and unwelcome result that the identification of false premises is not enough to reject the result (conclusion) delivered by thought experiments when they still exhibit a structure that is licensed by logic. On the other hand, given that AV embraces empiricism, it is committed

¹⁸ Stuart (2016) makes a similar point.

to the view that perception is the ultimate source of knowledge, and that the knowledge we gain from thought experiments is grounded exclusively on perception. We don't see how AV advocates can answer this dilemma without giving up one of its horns.¹⁹

The AV is also problematic once we consider inductive arguments more closely. Its reliance on the logical structure of arguments to demonstrate the validity of thought experiments as a justified way to yield knowledge also has a very implausible result when we consider inductive arguments. In contrast to deductive arguments, inductive arguments are by definition invalid ones; and for this reason, the logical rules used to evaluate deductive arguments cannot be applied to them because they cannot be accessed by forms licensed by logic.²⁰ Therefore, AV is unable to account for thought experiments that employ inductive arguments. This is a serious problem given that AV holds that all thought experiments do is to organize and generalize the knowledge we already have.

Another important challenge AV faces is also related to the claim that “deductive inferences merely restate what we have already presumed or learned, [...] we are just restating what we already have in the premises” (NORTON, forthcoming, Chapter 2, p. 7). If inferences only restate what we already know, then thought experiments (understood as arguments) couldn't produce new knowledge about the world as it is claimed. And this is just false. Consider a subject who comes to believe that Socrates is mortal by inferring it from her beliefs that all men are mortals and that Socrates is a man. Of course, from a conceptual or informational point of view, there is indeed nothing new in the conclusion. However, there is something about the conclusion that

¹⁹ One way for him to go would be to keep empiricism and to say that reasoning (logical structure) is a non-basic source that works conditioned on perception. Doing so would substantially change his position.

²⁰ Inductive logic and theory of probabilities are supposed to account for this. However, the way Norton develops his account always favors deductive logical rules.

is clearly new to the subject and that she didn't have or knew before performing such inference, namely, the belief that Socrates is mortal. But the mental state of belief is not the only new thing that she has; the individual representation of a particular state of affairs (the fact that Socrates is mortal) is what is new to her. Imagine that, before her execution of such inference, we examined her "belief box" searching for her knowledge that Socrates is mortal. We would only be able to find her beliefs that all men are mortal and that Socrates is a man. We wouldn't be able to find her belief that Socrates is mortal, and that is because she didn't have this belief before the execution of the inference.²¹ So, it is a mistake to say that her knowledge that Socrates is mortal was already in her possession only by looking at her premises.²²

Still another different objection to AV can be suggested in the following lines. Remember that AV's fundamental allegation is that thought experiments are just dressed-up arguments: "the actual conduct of a thought experiment consists of the execution of an argument" (NORTON, 2004b, p. 50). This assumption is very problematic. First, if thought experiments are just arguments, they are dispensable.²³ Why would someone bother to construct an alternative narrative when she could just present the argument itself? In response to this question, Norton appeals to pragmatic features of thought experiments when he claims: "the actual arguments that replace [the thought experiments] might well be harder to follow"

²¹ One way Norton could answer this challenge is by appealing to a dispositional account of belief, and say that we already knew that Socrates is mortal dispositionally. We don't believe that this move would do any good in here because it would still question the necessity of the subject to undergo the reasoning in the first place.

²² Deductive inference is usually regarded as being "tautological" or "analytical": the information conveyed by the conclusion is contained in the information conveyed by the premises. See Sequoiah-grayson (2008), Hintikka (1973a; 1973b), for further discussion. However, deductive principles have already been proved to fail, especially regarding epistemic properties such as evidence, justification and knowledge. For detailed discussion see Dretske (1970), Nozick (1981), Willianson (2000), Pritchard (2005), De Almeida (2011).

²³ Gendler (1998) presses this point.

(NORTON, 2004b, p. 50). Here Norton indicates that the presentation of an argument through a thought experiment can serve to *facilitate* its comprehension. If this interpretation is correct, then there is something more to a thought experiment than the argument itself that helps us to be justified in believing its conclusion. But the AV advocates do not recognize this fact. Second, to consider thought experiments as a tool for facilitating the subject's comprehension is also very suspicious, not to mention the fact that this claim remains in tension with other of AV allegations: arguments "may not be detailed in the statement of thought experiment" (NORTON, 1991, p. 129). If thought experiments are picturesque arguments and they might not be explicit, then it is hard to see how one could properly execute the expected argument in order to be justified in its conclusion. The situation can be much worse when the argument carried out by the thought experiment is a complex one.

Finally, our last and more pressing objection to AV goes as follows. AV holds that to conduct a thought experiment is equivalent to execute an argument. And, as we have seen in the previous section, to execute an argument is to execute an inferential reasoning process with certain intention (deductive or inductive). Inferring "necessarily involves the thinker *taking* his premises to support his conclusion and drawing his conclusion because of that fact" (BOGHOSSIAN, 2014, p. 5). This strongly suggests that to be considered as an appropriate (justified or warranted) causal process, inferring must inevitably consist in the subject's self-governing effort to arrive at a certain belief (conclusion) by figuring out what is supported by other things she already believes (premises). In this sense, reasoning is not just something that happens to us, but it is something that we do, something we execute at a personal level. And it is something that we execute with a purpose, namely, the purpose of figuring out what follows or is supported by other things one believes. This view about inferential reasoning (which we consider to be correct) presents a serious problem to AV.

An alternative way to access thought experiments is to focus on its *construction* on the one hand or to focus on its *presentation* at the other. The *context of construction* (or the *speaker context*) is that of the speaker who produces the thought experiment in order to support or validate a given conclusion. The *context of presentation* (or the *hearer context*) is that of the subject who receives or executes the thought experiment in order to be convinced of a given conclusion. When we think about the context of construction – without losing sight of AV's approach – it immediately comes to mind that the speaker who conducts the thought experiment must be aware of the argument that is being employed by her thought experiment. Given that to argue is, among other things, intended to convince one's audience to accept a given conclusion, and that thought experiments are just arguments, the speaker who introduces a thought experiment also aims to convince her audience of a certain conclusion. This appears to require that the speaker must be aware of the argument that underlies the thought experiment she produced. Most importantly, the speaker herself is expected to have successfully executed the argument. Norton appears to support this claim when he indicates that thought experiments are dispensable. Furthermore, it implies that the thinkers who have presented important thought experiments could just have presented them in the form of arguments. This is not completely false, but it is very implausible. It's a mistake to assume that a thinker who proposes a given thought experiment could have effectively stated it as an argument. This is because it is far from obvious that the thinker has performed the alleged underlying argument through a genuine instance of an inferential reasoning process, or even that she was aware of the existence of such an argument. If this is true, AV fails and inferential reasoning simply cannot be accounted to explain our knowledge obtained through most of thought experiments.

Things don't seem to be any different regarding the context of presentation. In such a context, the hearer is expected to believe a certain conclusion by hearing or reading a given thought experiment. Whether the hearer is or isn't justified in believing the conclusion obtained via thought experiments supervenes on the evaluation of the recognized arguments they exhibit. Given that thought experiments are picturesque arguments, not explicit, and the arguments they convey are for the most part complex, it is very unlikely that someone (the hearer) who executes a thought experiment is actually executing an argument. This is so because, in thought experiments whose arguments are complex, it seems very unlikely that the thinker executing them is effectively taking the premises (as intended by the speaker) to support the conclusion and drawing the conclusion because of such fact. Additionally, in order to do this, the thinker would also have to believe the premises comprising the argument. And again, it is highly unlikely that the thinker actually holds such beliefs. If we look at her "belief box" we probably wouldn't be able to find such beliefs there. Consequently, the thinker wouldn't be able to perform such inferences. And this indicates that if the subject acquired knowledge by conducting the thought experiment, it wasn't by means of executing an inferential reasoning. So, the argument view account is false.

5 CONCLUSION

In this paper, we have advanced several reasons for thinking that the argument view about thought experiments is false. Advocates of this view have argued that scientific thought experiments are arguments or can be reconstructed as arguments without any relevant epistemic loss. They vindicate that thought experiments are just arguments in disguise, and as such, they must be evaluated by the same standards used to evaluate arguments, namely, by appealing to the licensed logical forms they manifest.

After presenting, in section 2, the argument view of thought experiments we moved on to section 3; where two notions central to the view have been clarified, notions for which no precise specification is given, namely, “argument” and “inference.” In section 4, we have advanced original objections to the argument view. We have successfully displayed that given some basic assumptions regarding arguments and inferential reasoning the argument view turns out to be inadequate to explain the epistemic significance of thought experiments.

We also have shown that to reconstruct thought experiments, as arguments, do not entail that a subject who comes to know a conclusion based on her conduction of a thought experiment is necessarily inferring it. Likewise, the fact that a subject formulates a thought experiment does not entail that she is aware of any argument that might be underlying such a thought experiment, or the subject who is presented with the thought experiment and execute it seems to be aware that she has executed an argument.

REFERENCES

- AUDI, R. Sources of Knowledge. In: MOSER, P. K. (ed.). *The Oxford Handbook of Epistemology*. Oxford: Oxford University Press, 2005, p. 71-94.
- BASSHAM, G.; IRWIN, W.; NARDONE, H.; WALLACE, J. *Critical Thinking: A Student's Introduction*. 2. ed.. New York: McGraw-Hill, 2005.
- BISHOP, M. Why thought experiments are not arguments? *Philosophy of Science*, v. 66, n. 1, p. 534-541, 1999.
- BOGHOSSIAN, P. Blind Reasoning. *Aristotelian Society*, v. 77, n. 1, p. 225-248, 2003.
- BOGHOSSIAN, P. What is Inference? *Philosophical Studies*, v. 169, n. 1, p. 1-18, 2014.
- BOKULICH, A. Rethinking thought experiments. *Perspectives in Sciences*, v. 9, n. 1, p. 285-307, 2001.
- BRENDEL, E. Intuition pumps and the proper use of thought experiments. *Dialectica*, v. 58, n. 1, p. 89-108, 2004.

BROOME, J. Normative Practical Reasoning. *Aristotelian Society*, v. 75, n. 1, p. 175-193, 2001.

BROWN, J. Thought experiments since the scientific revolution. *International Studies in the Philosophy of Science*, v. 1, n. 1, p. 1-15, 1986.

BROWN, J. *The laboratory of the mind: thought experiments in the natural sciences*. London: Routledge, 1991.

BROWN, J. Why empiricism won't work. *Proceedings Philosophy of Science Association*, v. 2, n. 1, p. 271-279, 1992.

BROWN, J. Why thought experiments do transcend empiricism. In: HITCHCOCK, C. (ed.). *Contemporary debates in the philosophy of science*. Blackwell: Malden, 2004, p. 23-43.

BUNZL, M. Bunzl on Sorensen's Thought Experiment. *Informal logic*, v. 17, n. 3, p. 389-393, 1995.

BUNZL, M. The Logic of Thought Experiments. *Synthese*, v. 106, n. 1, p. 227-240, 1996.

BUZZONI, M. *Thought experiment in the natural sciences*. Würzburg: Königshausen & Neumann, 2008.

COHEN, S. How to Be a Fallibilist? *Philosophical Perspectives*, v. 2, n. 1, p. 91-123, 1988.

COPI, I.; COHEN, C. *Introduction to Logic*. Upper Saddle River, NJ: Prentice Hall, 2005.

D'AGOSTINO, M.; FLORIDI, L. The enduring scandal of deduction: Is propositional logic really uninformative? *Synthese*, v. 167, n. 1, 271-315, 2009.

DAVIES, D. Thought experiments and fictional narratives. *Croatian Journal of Philosophy*, v. 7, n. 1, p. 29-45, 2007.

DE ALMEIDA, C. Epistemic closure, skepticism and defeasibility. *Synthese* (Dordrecht. Online), v. 188, n. 1, p. 197-215, 2011.

DRETSKE, F. Epistemic operators. *Journal of Philosophy*, v. 67, n. 24, p. 1007-1023, 1970.

EEMEREN, F. H. van; GROOTENDORST, R.; HENKENMANS, A. F. S. *Argumentation: Analysis, Evaluation, Presentation*. Mahwah, NJ: Lawrence Erlbaum Associates, 2002.

EEMEREN, F. H. van; GROOTENDORST, R. *Argumentation, Communication, and Fallacies: A Pragma-Dialectical Perspective*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1992.

ELGIN, C. Fiction as thought experiment. *Perspectives in Science*, v. 22, n. 1, p. 221-241, 2014.

FORGE, J. Thought Experiments in The Philosophy of Physical Science. In: HOROWITZ, T.; MASSEY, G. (eds.). *Thought Experiments in Science and Philosophy*. Savage, MD: Rowman and Littlefield Publishers, p. 209-222, 1991.

GENDLER, T. Galileo and the indispensability of scientific thought experiment. *The British Journal for the Philosophy of Science*, v. 49, n. 1, p. 397-424, 1998.

GENDLER, T. Thought experiments rethought and re-perceived. *Philosophy of Science*, v. 71, n. 1, p. 1152-1163, 2004.

GOVIER, T. *A Practical Study of Argument*. Belmont, CA: Wadsworth, 2010.

GOODING, D. What is experimental about thought experiments? *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, v. 2, n. 1 p. 280-290, 1992.

GOODING, D. Imaginary science. *The British Journal for the Philosophy of Science*, v. 45, n. 1, p. 1029-1045, 1994.

HÄGGQVIST, S. *Thought Experiments in Philosophy*. Stockholm: Almqvist & Wiksell International, 1996.

HINTIKKA, J. *Logic, Language-Games and Information*. Clarendon: Oxford, 1973a.

HINTIKKA, J. G. H. Von Wright on Logical Truth and Distributive Normal Forms. In: SCHILPP, P. A.; HAHN, L. (eds.). *The Philosophy of Georg Henrik von Wright*. La Salle, Ill.: Open Court, 1973b, The Library of Living Philosophers, v. 19, p. 517-537.

HITCHCOCK, D. Informal Logic and The Concept of Argument. In: JACQUETTE, D. (ed.). *Philosophy of Logic*. Amsterdam: Elsevier, 2007, p. 5-101.

HOUTLOSSER, P. Points of View. In: VAN EEMEREN, F. H. (ed.) *Critical Concepts in Argumentation Theory*. Amsterdam: Amsterdam University Press, 2001, p. 27-48.

IRVINE, A. D. On the Nature of Thought Experiments in Scientific Reasoning. In: HOROWITZ, T.; MASSEY, G. (eds.). *Thought Experiments in Science and Philosophy*. Savage, MD: Rowman and Littlefield Publishers, 1991, p. 149-165.

JOHNSON, R. *Manifest Rationality*. Mahwah, NJ: Lawrence Erlbaum Associates, 2000.

LAYMON, R. Idealization, explanation, and confirmation. In: HOROWITZ, T.; MASSEY, G. (eds.). *Thought Experiments in Science and Philosophy*. Savage, MD: Rowman and Littlefield Publishers, 1991, p. 167-191.

MCHUGH, C.; WAY, J.. Against the taking condition. *Philosophical Issues*, v. 26, n. 1, p. 314-331, 2016.

MERCIER, D.; SPERBER, D. Why do humans reason? Arguments for an argumentative theory. *Behavioral and Brain Sciences*, v. 34, p. 57-111, 2011.

MIŠČEVIĆ, N. Mental models and thought experiments. *International Studies in the Philosophy of Science*, v. 6, n. 1, 1992, p. 215-226.

MIŠČEVIĆ, N. Modelling intuitions and thought experiments. *Croatian Journal of Philosophy*, v. 7, n. 1, 2007, p. 181-214.

NERSESSIAN, N. How do scientists think? Capturing the dynamics of conceptual change in science. In: GIÉRE, R.; FEIGL, H. (eds.). *Cognitive models of science*. Minneapolis: University of Minnesota Press, 1992, p. 3-45.

NERSESSIAN, N. In the Theoretician's Laboratory: Thought Experimenting as Mental Modeling. *Proceedings of Philosophy of Science Association*, v. 2, n. 1, p. 291-301, 1993.

NERSESSIAN, N. Thought Experimenting as Mental Modeling. *Croatian Journal of Philosophy*, v. 7, n. 2, p. 125-161, 2007.

NORTON, J. Thought experiments in Einstein's work. In: HOROWITZ, T.; MASSEY, G. (eds.). *Thought experiments in science and philosophy*. Lanham: Rowman & Littlefield, 1991, p. 129-148.

NORTON, J. Are thought experiments just what you thought? *Canadian Journal of Philosophy*, v. 26, n. 1, p. 333-366, 1996.

NORTON, J. A material theory of induction. *Philosophy of Science*, v. 70, n. 1, p. 647-670, 2003.

NORTON, J. On thought experiments: is there more to the argument? *Philosophy of Science*, v. 71, n. 1, p. e1139-1151, 2004a.

NORTON, J. Why thought experiments do not transcend empiricism. In: HITCHCOCK, C. (ed.). *Contemporary debates in the philosophy of science*. Somerset: Wiley-Blackwell, 2004b, p. 44-66.

NORTON, J. A little survey of induction. In: ACHINSTEIN, P. (ed.) *Scientific evidence: philosophical theories and applications*. Baltimore: Johns Hopkins University Press, 2005, p. 9-34.

NORTON, J. There are no universal rules for induction. *Philosophy of Science*, v. 77, n. 1, p. 765-777, 2010.

NORTON, J. History of science and the material theory of induction: Einstein's Quanta, Mercury's Perihelion. *European Journal of Philosophy of Science*, v. 1, n. 1, p. 3-27, 2011.

NORTON, J. A material dissolution of the problem of induction. *Synthese*, v. 191, n. 1, p. 671-690, 2014.

NORTON, J. *The material theory of induction*. (Forthcoming) Available from: https://www.pitt.edu/~jdnorton/papers/material_theory/material.html

NOZICK, R. *Philosophical Explanations*. Oxford: Oxford University Press, 1981.

PRITCHARD, D. *Epistemic Luck*. N. York: Oxford University Press, 2005.

RESCHER, N. Thought Experimentation in Presocratic Philosophy. In: HOROWITZ, T.; MASSEY, G. (eds.). *Thought Experiments in Science and Philosophy*. Savage, MD: Rowman and Littlefield Publishers, 1991, p. 31-41.

ROSA, Luis. Reasoning without regress. *Synthese*, v. 196, n. 6, p. 2263-2278, 2019.

SEQUOIAH-GRAYSON, S. The Scandal of Deduction: Hintikka on the Information Yield of Deductive Inferences. *Journal of Philosophical Logic*, v. 37, n. 1, p. 67-94, 2008.

SIDELLE, A. Review of Häggqvist's Thought Experiments in Philosophy. *Philosophical Review*, v. 107, n. 1, p. 480-483, 1998.

SINNOTT-ARMSTRONG, W.; FOGELIN, R. *Understanding Arguments: An Introduction to Informal Logic*. 8 ed. Belmont, CA: Wadsworth, 2010.

SNOECK HENKEMANS, A. F. S. Argumentation, explanation, and causality. In: SANDERS, T.; SCHILPEROORD, J.; SPOOREN, W. (eds.). *Text Representation: Linguistic and Psycholinguistic Aspects*. Amsterdam: John Benjamins Publishing, 2001, p. 231-246.

SORENSEN, R. *Thought Experiments*. Oxford: Oxford University Press, 1992.

STUART, M. Norton and the Logic of Thought Experiments. *Axiomathes*, v. 26, n. 1, p. 451-466, 2016.

VALARIS, M. What reasoning might be. *Synthese*, v. 194, n. 6, p. 2007-2024, 2016.

WILLIAMSON, T. *Knowledge and Its Limits*. Oxford: Oxford University Press, 2000.

WILLIAMSON, T. *The philosophy of philosophy*. Malden: Blackwell Publishing, 2007.

WALTON, D. *Argument Structure: A Pragmatic Theory*. Toronto: University of Toronto Press, 1996.

PROVA DO AUTOR
EDUARDO ALVES
J.R. FETT
KÁTIA M. ETCHEVERRY