

VILNIUS UNIVERSITY

JUSTAS BUJOKAS

THE EPISTEMOLOGICAL SKEPTICISM OF CONSTRUCTIVE EMPIRICISM

Summary of Doctoral Dissertation
Humanities, Philosophy (01 H)

Vilnius, 2018

The dissertation was prepared at Vilnius University during years 2011–2018.

Research supervisor:

Prof. Dr. Marius Povilas Šaulauskas (Vilnius University, Humanities, Philosophy – 01 H) from 2013.04.04 to 2017.04.02;

Prof. Dr. Evaldas Nekrašas (Vilnius University, Humanities, Philosophy – 01 H) from 2011.10.01 to 2013.04.03.

Research consultant:

Prof. Dr. Albinas Plėšnys (Vilnius University, Humanities, Philosophy – 01 H).

Dissertation is going to be defended at a public session of the dissertation assessment council:

Chairman:

Prof. Dr. Skirmantas Jankauskas (Vilnius University, Humanities, Philosophy – 01 H).

Members:

Assoc. Prof. Dr. Jonas Dagys (Vilnius University, Humanities, Philosophy – 01 H);

Prof. Dr. Aldis Gedutis (Klaipėda University, Humanities, Philosophy – 01 H);

Prof. Dr. Algis Mickūnas (Ohio University, Humanities, Philosophy – 01 H);

Prof. Dr. Vytis Valatka (Vilnius Gediminas Technical University, Humanities, Philosophy – 01 H).

The official defense of the dissertation will be held at noon on the 21st of June, 2018, at the Department of Philosophy, Vilnius University, room 201.

Address: Universiteto St 9/1, LT-01513 Vilnius, Lithuania.

The summary of doctoral dissertation was circulated on the 21st of May, 2018.

The dissertation is available at Vilnius University Library and on Vilnius University web page: <https://www.vu.lt/naujienos/ivykiu-kalendorius>.

VILNIAUS UNIVERSITETAS

JUSTAS BUJOKAS

EPISTEMOLOGINIS KONSTRUKTYVIOJO EMPIRIZMO SKEPTICIZMAS

Daktaro disertacijos santrauka
Humanitariniai mokslai, filosofija (01 H)

Vilnius, 2018 metai

Disertacija rengta 2011–2018 metais Vilniaus universitete.

Mokslinis vadovas:

prof. dr. Marius Povilas Šaulauskas (Vilniaus universitetas, humanitariniai mokslai, filosofija – 01 H) nuo 2013–04–04 iki 2017–04–02;

prof. dr. Evaldas Nekrašas (Vilniaus universitetas, humanitariniai mokslai, filosofija – 01 H) nuo 2011–10–01 iki 2013–04–03.

Mokslinis konsultantas:

prof. dr. Albinas Plėšnys (Vilniaus universitetas, humanitariniai mokslai, filosofija – 01 H).

Disertacija bus ginama viešame disertacijos gynimo tarybos posėdyje:

Pirmininkas:

prof. dr. Skirmantas Jankauskas (Vilniaus universitetas, humanitariniai mokslai, filosofija – 01 H).

Nariai:

doc. dr. Jonas Dagys (Vilniaus universitetas, humanitariniai mokslai, filosofija – 01 H);

prof. dr. Aldis Gedutis (Klaipėdos universitetas, humanitariniai mokslai, filosofija – 01 H);

prof. dr. Algis Mickūnas (Ohio University, humanitariniai mokslai, filosofija – 01 H);

prof. dr. Vytis Valatka (Vilniaus Gedimino technikos universitetas, humanitariniai mokslai, filosofija – 01 H).

Disertacija bus ginama viešame disertacijos gynimo tarybos posėdyje 2018 m. birželio mėn. 21 d. 12 val. Filosofijos fakulteto 201 auditorijoje.

Adresas: Universiteto g. 9/1, LT-01513 Vilnius, Lietuva.

Disertacijos santrauka išsiuntinėta 2018 m. gegužės mėn. 21 d.

Disertaciją galima peržiūrėti Vilniaus universiteto bibliotekoje ir VU interneto svetainėje adresu: <https://www.vu.lt/naujienos/ivykiu-kalendorius>.

This dissertation contributes to the solution of the general philosophical problem of the epistemic status of modern science. For at least the last couple of decades the questions of ontology and epistemology of science, also questions about the semantics of scientific language and the methodology of science have been prominent in the scientific realism-antirealism debate. Scientific realists claim that the reason for success of science is the fact that scientific theories are true or approximately true descriptions of nature, including the unobservable part of the world. Antirealists, however, think that the success of science can be explained more modestly. Antirealists claim that the reason for success of science is, for example, its instrumental value or the fact that scientific theories are true descriptions merely of the observables.

Probably the most debated antirealist conception in the contemporary philosophy of science is constructive empiricism (CE) proposed by Bas van Fraassen (1980a). CE is sometimes considered to be the main empiricist alternative to the philosophy of scientific realism (Kukla 1998). The main idea of CE is that in order to accept a scientific theory one does not have to believe that it is true, but rather it is only enough to believe that a theory adequately describes what is observable. This means that, based on CE, scientific practice can be treated as if scientists were agnostic with respect to the unobservable entities described by their theories.

The disagreement between CE and scientific realism has grown to become a multifaceted controversy, which concerns multiple questions from multiple areas of general philosophy of science.

The aim and the objectives of the dissertation. The aim of this dissertation is to investigate, if contemporary natural science can be correctly understood as merely seeking empirically adequate and not necessarily true theories. This aim is pursued by accomplishing the following objectives.

1. The dissertation aims to describe CE conception of science from the polemical point of view: the main concepts used in the CE are analyzed, possible metaphilosophical interpretations of CE are considered, the place of CE among other contemporary philosophies of science (ex. scientific realism (Kukla 1998: 8), logical empiricism and instrumentalism) is defined.

2. The dissertation aims to investigate, if the scientific activity can be correctly interpreted based on the distinction between observable and unobservable entities (DOU). CE considers the category of *empirical adequacy* (and the key distinction this category presupposes, DOU) to be *intra-scientific*. Based on this construal of DOU, critics maintain, science as it is described by CE is irrational or CE conception of science is not ontologically more modest than realist conceptions (thus, CE does not have the key merit empiricism claims to have against its rival). The dissertation aims to defend CE against such criticism.

3. The dissertation seeks to investigate, how well CE explains the phenomena of *scientific activity*. Dissertation analyses, to what extent the comparison between the conception of science and the scientific activity is possible. Also, dissertation explores, if the actual and hypothetical cases of scientific practice are compatible with the CE view on science.

The claims of the dissertation. The dissertation claims, that CE correctly interprets science as seeking merely empirically adequate theories: the critical arguments against CE implicitly attributes to the CE interpretation of science commitments that are not part of CE, because CE implicitly and coherently maintains the position of epistemological skepticism.

1. Science can be understood, mutually, as accepting empirically adequate theories and being objective, even if its agent is ‘epistemic community’; distinction between the ‘acceptance’ of a theory and ‘belief’ in truth of the theory is meaningful.

2. DOU, when this distinction is treated as an intra-scientific notion, is correctly used to define science. The distinction does not make an empiricist conception of science internally incoherent (does not reconstruct science as irrational) and still allows CE to avoid commitments to modal realism, thus, allowing CE to remain ontologically more modest than scientific realism.

3. Scientists seek empirically adequate theories in the actual science, in possible scientific practices in the possible worlds nomologically identical to the actual world, and in possible scientific practices in the possible worlds nomologically different from the actual world.

Method. The general claim of the dissertation is defended to a large extent based

on the CE conception formulated in the seminal work by Bas van Fraassen *The Scientific Image* (van Fraassen 1980a) and emphasizing the ideas of epistemological skepticism implicit in this work.

The first claim is defended based on the explication of the main concepts of CE by Bas van Fraassen, also based on the works of CE proponents André Kukla and Fred Muller. The argument by Paul Horwich, according to which CE distinction between the *acceptance* of the theory and *belief* that theory is true is ‘distinction without a difference’, also the arguments by William Seager and Simone Bahrenberg et al., according to which CE cannot legitimately base their conception on the concept of *epistemic community*, are refuted.

The second claim is defended by refuting arguments against CE DOU. So-called ‘electron-microscope eye’ arguments, as formulated by Grover Maxwell and Paul Churchland, are rejected; also Alan Musgrave’s critical claim, supported by Paul Dicken and Peter Lipton, according to which CE due to its key DOU is viciously circular, is argued against. Furthermore, the methodological argument by James Ladyman, according to which CE due to its DOU has too strong ontological commitments, is refuted. When arguing against CE opponents, the works of CE proponents, such as van Fraassen, Bradley Monton, Fred A. Muller, Joseph F. Hanna, are critically evaluated as well. For example, van Fraassen’s suggestion to solve Musgrave’s problem by necessarily employing the semantic view on scientific language is rejected.

The third claim of the dissertation is defended by analyzing actual and possible examples of scientific practice. CE is defended based on the ideas of philosophers, according to whom CE interprets the aforementioned examples validly. For example, when discussing the dispute between van Fraassen and Stahis Psillos over the theory conjunction practice, this dissertation defends van Fraassen’s views. When analyzing Gideon Rosen and Ladyman dispute vs. Monton and van Fraassenu (over possible scientific practice in the possible world, nomologically different from the actual world) the ideas of Monton and van Fraassen are argued for. Here, the method of thought experimentation is employed to a great extent.

The novelty of the dissertation. The dissertation defends CE from the perspec-

tive of epistemological skepticism. In contrast to the previous attempts to vindicate the CE view on science, this dissertation analysis the problematic auxiliary presuppositions attributed to CE by its critics in detail, and explicitly investigates to what extent those presuppositions are inextricable from CE as a form of empiricism.

Concerning the particular claims.

1. The question of the relationship between pragmatic and epistemic aspects of science or simply about the distinction between the acceptance of a theory and belief that the theory is true was being solved in the dispute among van Fraassen (1980a) and Kukla (1998) vs. Horwich (1991). The dissertation emphasizes that epistemologically skeptical CE can unproblematically claim the concept of *epistemic belief* in truth of a theory being capable of representing different states of affairs in science than the concept of merely *pragmatic acceptance* of a theory.

The question to what extent CE can base its philosophy on the concept of *epistemic community* was being solved in the dispute of Seager (1988) and Bahrenberg et al. (2006) vs. van Fraassen (1980a, 2006a). However, van Fraassen does not define CE position with respect to the concept of *epistemic community* satisfactorily and comprehensively enough.

This dissertation claims that CE can treat science as objective without offering any strict conception of *epistemic community*. It is enough for CE to treat *objectivity* as a basic and intuitively intelligible concept, which expresses the fundamental presupposition of the existence of the external world (presupposition which is inherent to the whole realism-antirealism debate).

This dissertation, after expanding on the main concepts of CE, also contributes to the dispute between van Fraassen and Rosen (Hanna 2004; Rosen 1994; van Fraassen 1994) over metaphilosophical interpretations of CE. In contrast to the previous research, dissertation notes that the distinction between ‘normative’ and ‘descriptive’ philosophies of science is purely methodological-historical. Thus, CE in its answer to the question ‘what is science?’ is not committed to following the strict demarcation line this distinction supposedly draws (Bujokas and Šaulauskas 2014). CE thereby is ‘epistemological’ in a restrictive sense emphasizing its skepticism.

The dissertation also contributes to the research of the relationships among CE and

other contemporary philosophies of science (Kukla 1998: 3–10; Chakravartty 2007: 10; Niiniluoto 2004: 11; Bujokas 2012), such as logical empiricism, instrumentalism, philosophical naturalism, aim-oriented empiricism, and experimentalism.

The dissertation pays most attention to the relationship between CE and logical empiricism. Van Fraassen admits that his philosophy of science has been strongly influenced by logical empiricism. However, there had been no thorough analysis on the topic yet and this dissertation fills this gap in the CE research.

2. There seems to be a consensus that the so-called ‘electron-microscope eye’ arguments against DOU are not valid (Maxwell 1962; Churchland 1985; Kukla 1998: 133; Dicken 2010: 87). However, the problem of CE internal coherency or Musgrave’s problem (Musgrave 1985) has been of great interest lately. The formalism for the investigation of CE internal coherence has been proposed (Muller 2004, 2005) in the central dispute concerning the Musgrave’s problem (Dicken 2009; Dicken and Lipton 2006; Muller 2004, 2005; Muller and van Fraassen 2008). The problem itself, however, still remains the subject for the discussion.

This dissertation solves Musgrave’s problem without committing to the semantic view on scientific language. The latter was suggested by van Fraassen (Muller and van Fraassen 2008) and soundly argued against by the opponents of CE (Dicken 2009). The dissertation shows that the critics of CE, by claiming DOU to be viciously circular, wrongly treats CE as a conception of the *foundations* of knowledge. Epistemologically skeptical CE has no such pretension.

The question of how strong the CE ontological commitments are also hadn’t been solved decisively yet. This problem has been investigated in the dispute between van Fraassen and James Ladyman (Ladyman 2000, 2004; Monton and van Fraassen 2003) over the modal statements in science. In this dissertation, the problem of CE ontological commitments is solved to a large extent supporting CE. This dissertation, however, also questions, whether a weak version of axiological scientific realism formulated by van Fraassen himself and opposing CE (van Fraassen 1980a: 8) is actually ontologically as economical as CE. The positive answer to the latter would be unfavorable to CE.

3. A significant part of van Fraassen’s work is dedicated to the question of how well

empiricism corresponds to the scientific practice (to the *phenomena of scientific activity*).

However, CE lacks explanation, what the fundamental principles of comparing the philosophical conception and the scientific practice are. Separate aspects of scientific practice has been analyzed sporadically in the CE-related controversies (van Fraassen 1975; 1980a: 83–87; Psillos 2005; Rosen 1994: 177; Ladyman 2000: 853; Monton and van Fraassen 2003: 408).

In contrast to the previous research, this dissertation not only analyzes separate cases of phenomena of scientific activity, but also offers the classification of possible modes of comparing the claims of philosophy of science vs. the scientific practice. The basis for this classification – the way in which the object of analysis (ex. the element of scientific practice, episode of the history of science) should be treated with respect to possible worlds: whether the element of the scientific practice exists in the actual world (is a part of our history of science), whether it is possible in the world which is nomologically identical to the actual world, or whether it is possible in the world nomologically different from the actual world.

The structure and the content of the dissertation.

1. *What does CE claim about science?* The first part of the dissertation analysis the main claim of CE, namely, that science seeks theories that are empirically adequate or, in other words, that theories are accepted, when scientists believe they are empirically adequate (van Fraassen 1980a: 12).

1.1. To explicate its conception of science, CE needs to explain what the agent of scientific practice is (what is the significance of the concept of *scientists* as a community to CE), what the distinction between the *acceptance* of the theory and the *belief* in truth (or in empirical adequacy) of theory amounts to, and, finally, what linguistic objects does CE call *theories* and, especially, *empirically adequate* theories. The debates about the concept of empirical adequacy are analyzed in detail in the second part of this dissertation. In this part, the concept of empirical adequacy and its key distinction (DOU) are defined and mentioned just for the purpose of less prominent CE debates. The latter are still extremely important trying to understand CE.

1.1.1. On the face of it, CE describes the attitudes of agents of science (the *epistemic community*) towards their accepted theories. Does it mean that if our epistemic community would be different (from our present human community), science would have to be defined in terms of some other conception and not in terms of CE? No. CE presupposes that science of every epistemic community should be definable in terms of very general CE empiricist conception, though science could *look* different in other epistemic communities.

The more pressing question in the debates of CE is to what extent CE needs to precisely define the concept of epistemic community? Van Fraassen himself refuses to give a precise definition of what the epistemic community is, but claims that to some extent it depends on ideological and moral criteria (van Fraassen 1980a: 18). Simone Bahrenberg et al. maintained that if the latter is the case, the CE DOU is not objective as CE would like it to be, because ideological and moral decisions are not ‘objective’ (Bahrenberg et al. 2006: 40–41).

Van Fraassen bases his answer to this critique on the distinction between the *sense* of the term and the *meaning* of the term (van Fraassen 2006a: 130), but this answer is still susceptible to the above argument by Bahrenberg et al.

To refute Bahrenberg et al. argument, this dissertation invokes the presupposition common to the whole realism–antirealism debate, which is a presupposition of the existence of the external world (Devitt 2007: 768). For CE the objectivity is an intra-scientific concept (van Fraassen 1980a: 82). In science, a fact of the matter is called objective if it is deemed to be independent of our consciousness. In this sense the interactions between observable things and every member of scientific community are objective. Thus, those interactions are objective (ideology-independent) for any number of members of scientific community.

William Seager argued that if epistemic community is really *epistemic*, then every member of this community, ideally, has to treat the stated beliefs of other members of this community as the evidence for their beliefs (Seager 1988: 183). Thus, according to Seager, the extension of what is observable, as construed by CE, covers all the things observable to all the possible members of epistemic community. Those possible mem-

bers of epistemic community include, for example, sentient robots. Thus DOU cannot be maintained – there are no unobservable (in principle) things.

Seager’s attempt to construct a precise rule of how members of epistemic community should base their epistemic beliefs on the testimony of other members, however, is too strong for epistemologically skeptical CE. The question of how the community of scientists is formed seems to be purely sociological or anthropological, but not epistemological. The community is not an essential part of science as empirical activity (Bujokas 2017).

1.1.2. Bahrenberg et al. presents another argument against CE, according to which science (if CE was correct) could not exist as a common enterprise due to the differences in the perceptive abilities of different members of the community (Bahrenberg et al. 2006: 38). CE, however, correctly claims that this argument is flawed. When scientists act as a community, they commit themselves to agreeing on which theories to accept and, thus, agreeing to use the same dictionary due to pragmatic reasons (van Fraassen 1980a: 12).

Here the distinction between the acceptance of the theory and the belief that theory is true comes into question. Paul Horwich claims that the CE description of the behavior of working scientists, when they accept scientific theory, amounts to nothing more nor less than to the description of scientists’ belief in truth of the theory (Horwich 1991: 3; Musgrave 1985: 207). Thus, according to Horwich, the distinction between the belief in truth of the theory and the acceptance of that theory cannot be maintained: CE cannot claim that theory is accepted when scientists believe it to be merely empirically adequate.

Van Fraassen, refuting the above argument, claimed that some reasons for the acceptance are not the reasons for the belief (van Fraassen 1985: 281). Actually, any simple hypothesis about what *epistemic belief* amounts to as different from the pragmatic *acceptance* of a theory, saves the skeptical conception of CE (Kukla 1998: 107–108).

Horwich also attempted to show that there are rather pragmatic and epistemic norms of evaluation for the same state of belief in the whole theory (but not that belief implies acceptance, *contra* CE) (Horwich 1991: 7). However, skeptical CE cannot be a conception of the inner states of minds of scientists. CE is a conception of the relationship between i) the epistemic concept, using which we try to interpret science (namely, the concept of *belief* in theory / empirical adequacy), and ii) the concept using which we describe

successful theories, including their pragmatic success (namely, *acceptance*).

1.1.3. How does CE construe the objects of belief and / or acceptance, namely, theories? Van Fraassen himself endorses the so-called *semantic view* towards scientific theories and opposes *syntactic view*.

Syntactic view (or *received view*) endorsed by logical positivists equates theories with sets of syntactically correct statements that, if not interpreted empirically, do not have independent meaning (ex. Putnam 1960: 20; Suppes 2002: 2–3). According to van Fraassen, this view is disadvantageous for the empiricist philosophy, because, for example, it cannot naturally explain how to interpret the expressions of possible states of affairs (modal statements) in scientific language (van Fraassen 2003: 213).

Semantic view treats scientific theories as abstract classes of mathematical models that satisfy axioms of the theory. Axiom systems, that are quite different at the first sight can, in principle, represent the same class of models, and thus the same theory (Suppes 2002: 25–26). Some CE concepts, however, do not seem to be readily applicable for the description of scientific practice, if the semantic view is invoked. For example, how should one *believe* in a class of abstract mathematical models?

This dissertation maintains the position, that any kind of formal method of conceptualizing scientific language has its flaws, which, however, is not of great importance for CE, as an attempt at the epistemology (and not semantics) of science (Dicken 2009: 38; Halvorson 2015: 15; Lutz 2015). CE is not a conception of scientific language, it is the conception of aims of science.

This dissertation also provides a short analysis on what conception of truth would be suitable for CE as the participant of the realism-antirealism controversy. The result: epistemologically skeptical CE seems to be compatible with multiple conceptions of truth. For example, correspondence (in a weak sense) theory of truth (Tarski 1956) or deflationary conception of truth (Asay 2009) would allow CE to hold its ground in the realism-antirealism controversy.

1.2. How one would classify CE with respect to the usual methodological distinctions in the philosophy of science (how one would define CE *metaphilosophically*)? Is CE full-fledged normative epistemology or is it just a description of the aims of science (axiology

of science). Here the key dispute is between Rosen (1994) and van Fraassen (1994).

1.2.1. According to Rosen, there are three ways to interpret CE.

First of all, CE could be deemed to be purely *descriptive*, which would mean, that most scientists believe their successful theories to be not true but just empirically adequate. Rosen thinks this interpretation of CE is unacceptable, because most of the scientists probably believe their successful theories to be true. However, *contra* Rosen, there are obvious examples of activities, the aims of which are different from what their participants think they are doing (van Fraassen 1994: 186–188).

Second of all, CE can be treated as *normative*. According to this interpretation, the CE would be a conception of what scientists are supposed to do (Rosen 1994). Rosen refuses to seriously consider this possible interpretation of CE (Rosen 1994: 148), because, apparently, van Fraassen himself does not take the possibility of normative interpretation seriously (van Fraassen 1994: 190–191; 1998: 213–214).

This dissertation claims that the possibility of normative interpretation of CE cannot be dismissed. As long as the descriptive interpretation of CE holds, CE is in a very natural and, however, weak sense normative, because every description of an object in our natural language implicitly presupposes the recommendation to base one's judgment on that description. If CE claims to correctly describe (*interpret*) science, it also implicitly claims that science is to be pursued in the way CE describes it.

This proposed weakly normative interpretation of CE is correct despite possible counterarguments (Bujokas and Šaulauskas 2014).

The third of the proposed CE interpretations by Rosen is a *fictionalist* account of CE. According to this interpretation, CE does not seek to describe science, nor it does seek to formulate an imperative for the scientists to follow, but rather CE *quasiasserts* something about science. This interpretation, however, is flawed from the methodological point of view. Philosophical statement can be said to be just philosophical (as different from, for example, sociological or anthropological) without invoking the redundant and pejorative concept of *quasiassertion*.

The proposed weakly normative interpretation of CE has the following advantages: from the methodological point of view, it reduces some tensions in the philosophy of

van Fraassen himself; this interpretation does not unnecessarily cripple CE: even a weak normative interpretation of CE allows CE to participate in the methodological arguments of scientists themselves (Smolin 2006), while descriptive (in a restrictive sense) interpretation would not allow that.

1.2.2. CE does not tell whether or to what extent scientists achieve empirical adequacy in their theories, it just tells what scientists are trying to achieve. Marc Alspector-Kelly argued that because of this kind of modesty CE is not interesting conception of science (is not an *epistemological* view) (Alspector-Kelly 2001: 427; Mizrahi 2014: 604–605).

The immediate response to the critics would be that any conception of the *epistemic* activity is *epistemological*. This answer is well suited for weakly normative epistemologically skeptical CE. By endorsing the epistemology in the strong sense, critics, apparently, endorse the epistemologies of scientific realists (ex. Niiniluoto 2004: 10). CE, however, precisely aims at much weaker commitments than scientific realists.

Moti Mizrahi argued that epistemological-axiological flexibility of CE is an *ad hoc* trick allowing CE to avoid engaging its critics in a straightforward manner (Mizrahi 2014: 604). According to Mizrahi, CE cannot, descriptively, define DOU, because this distinction just does not play a relevant role in the actual scientific practice. When replying to its critics, according to Mizrahi, CE uses untenable normative definitions of this crucial distinction (Mizrahi 2014: 609). It has been already shown, however, that CE, *contra* Mizrahi, is not strictly descriptive, nor prescriptive, but rather straddles both sides of this philosophical-historical distinction.

Also Mizrahi claimed that neither descriptive nor prescriptive interpretation of CE is suitable to defend the supposed views of CE on the concept of *explanation* in science. According to Mizrahi, as a descriptive view, CE would be outright false in maintaining that explanations in science do not play an epistemic role; moreover, as a normative philosophy CE could not defend the empirical adequacy conduciveness of the *inference to the best explanation* (Mizrahi 2014: 611–612).

As a specifically philosophical interpretation of science, however, CE can construe scientific explanation as not an essential part of science even if all scientists were to express opinion to the contrary. Furthermore, inference to the empirical adequacy from the best

explanation was never a part of epistemologically skeptical CE.

1.3. What is the place of CE among other contemporary conceptions of science?

1.3.1. To better define CE place in today's controversies, this dissertation employs the taxonomy often used in the realism-antirealism debate between *semantic*, *epistemological*, and *metaphysical* (or *ontological*) conceptions of science (realist-antirealist theses).

The relationship between CE and its main rival scientific realism is not as trivial as van Fraassen's proposed version of scientific realism might suggest (van Fraassen 1980a: 8; Devitt 2007: 769). CE is not a strict negation of any of three possible realist thesis (semantic, epistemological or metaphysical realism). Moreover, it does not strictly counter some of the more nuanced realist conceptions of science (Putnam 1982: 198–200; Kukla 1998: 11; Niiniluoto 2004: 10), including *axiological* scientific realism (Lyons 2005: 168). This has lead to the claims that scientific realism and CE are, after all, incommensurable or just entirely different conceptions of science, incapable of seriously engaging each other (Kukla 1998: 11; Chakravartty 2007: xiv).

This dissertation, however, makes an attempt to point out a couple of very general differences of CE and scientific realism. As an offspring of empiricist tradition, CE, in contrast to realism, explicitly tries to avoid excess metaphysical commitments; CE is normative in a very weak sense, which means that it takes its attempt at describing the phenomena of scientific activity more seriously than scientific realism: CE even defends its key concepts (such as *objectivity* or *observability*) as scientific rather than susceptible to the armchair philosophy. Thus, realism and CE, after all, have points of contention.

1.3.2. Analyzing the relationship between CE and other non-realist conceptions of science also helps to better define CE.

What is the relationship between CE and logical empiricism, which, as van Fraassen admits, was an important influence when formulating CE (van Fraassen 1980a: 3). In this dissertation, logical empiricism is construed based on Evaldas Nekrašas work (Nekrašas 2010: 15). CE and logical empiricism are compared based on the criteria usually employed for evaluating the correctness of CE. Those are: criterion of ontological economy; criterion of rationality of science; criterion of correspondence to scientific practice.

The principle of ontological economy is common to CE and logical empiricism.

The dissertation holds that questions about the rationality of science are redundant with respect to the usual philosophical questions about the nature of science, scientific method, etc. Thus, at first sight, the question of scientific rationality makes an obvious difference between CE and logical positivism: logical positivism has paid a lot of attention to the inductive reasoning in science, which is not common for CE. This difference, however, is deceptive. Positivist investigations into the nature of inductive method are not normative, but are rather the investigations into how the language of science functions (Nekrašas 2010: 298). This makes logical empiricism closer to the epistemologically skeptical CE, which also avoids serious inquiries into the nature of scientific method, if such thing exists at all.

Logical empiricism takes the analysis of scientific language in its formal shape far more seriously than CE, rather than concentrating on the ‘phenomena of scientific activity’ as CE does.

This dissertation also offers a more nuanced comparison between CE and logical empiricism with respect to the already-mentioned distinction between semantic, epistemological, and ontological kinds of realism and antirealism (ex. Chakravartty 2007: 10).

The dissertation also compares CE with other contemporary views on science. CE is different from the instrumentalism in that CE does not make a distinction between the purely instrumental part of scientific language (language describing unobservables) and language describing only the observables. CE is not a semantic conception, rather it describes how scientific theory (as a whole) comes to be used as a tool pragmatically, and to what extent a successful theory can be treated as a source of knowledge.

CE is similar to Nicholas Maxwell’s *aims-oriented empiricism* (Maxwell 2004, 2015) because both of these conceptions are empiricist conceptions, both inquire into the aims of science and both perceive science as a self-sustained activity defining its own standards of research. However, CE and aim-oriented empiricism also have considerable differences: aim-oriented empiricism is just too optimistic towards the possibility of precisely and specifically capturing assumptions inherent in science (and also capturing the hierarchy of those assumptions), while CE, by invoking the concept of *empirical adequacy*, works on a higher level of abstraction.

This dissertation finally concludes that CE expresses rather *stance* than a very concrete well-defined view on science. Thus, CE is akin to other philosophies that could be treated more like stances rather than very concrete claims. Examples of such conceptions of science are *experimentalism* (Ackermann 1989), *naturalism* in the philosophy of science (Sellars 1991), *skepticism* of Paul Feyerabend (van Fraassen 1980a: 14).

2. *Can CE base its conception on the observable/unobservable distinction?* The second part of the dissertation deals with the issue of the concept of empirical adequacy in CE.

2.1. The issue of empirical adequacy is the most pressing issue in the CE debates and a very important issue for the empiricism in general. Theory is empirically adequate, according to van Fraassen, if what it says about observable things is true. How one should make a distinction between what is observable and what is unobservable in the principled way?

2.1.1. Part of the objections against the empiricist distinction between what is observable and what is not (DOU) are based on the fact that this distinction has various contextual dependencies. These objections are called ‘electronic-eye arguments’ in this dissertation.

Grover Maxwell argued against empiricists (before CE was formulated) using examples that show what we think is observable depends on a) the stage of the development of science or historical period (Maxwell 1962: 6); b) on the perceptive capabilities of a cognitive agent (Maxwell 1962: 7); c) in general, observability predicates are *vague* (ex., we cannot exactly tell, what size the object has to be to be called ‘observable’).

Such dependencies, however, are not perilous to CE. First of all, flexible skeptical CE avoids generalizations on the ontological or strictly normative-epistemological level. Thus, CE conception of DOU holds, as long as this distinction can be made at least on the methodological basis (Maxwell 1962: 8; van Fraassen 1980a: 16–17). Moreover, according to CE, what is observable, is a scientific question, and as long as science is capable of describing in what sense or to what extent some object is observable, one can conclude that CE invokes DOU correctly.

2.1.2. CE claims that DOU is not a distinction between what was observed or is observed and ‘unobserved’, but rather between what is *observable* and *unobservable in*

principle. Based on the same contextual dependencies critics argue, that in principle everything is observable. For example, Maxwell suggested an example of mutant, capable of perceiving X-rays (Maxwell 1962: 11). Paul Churchland suggested that in principle aliens or cyborgs with electron-microscope eyes are possible (Churchland 1985: 43–44), thus, even the tiniest things are in principle observable.

The answer to the critics follows the reply in the previous subsection. Critics just do not show that the features they assign to DOU are relevant for epistemologically skeptical CE in the negative sense. It is obvious that what is observable is the function of observer (van Fraassen 1980a: 19). This is the point of the whole empiricist enterprise. Also, as observability is a matter of science, it is obvious that the extension of observability predicate will depend on scientific theories used (on the development stage the science is in), etc.

What restrictions, after all, CE places on its DOU? Or is CE just another bold *anything goes* in philosophy of science?

2.2. Van Fraassen in his CE seeks to show that science can be understood as a rational activity without in any way binding science, as an epistemic enterprise, with the knowledge of unobservables. According to critics, DOU does not allow CE to do that.

To refute CE attempt of construing science as a rational activity one could a) try to show that CE uses unacceptable notion of *rationality*, while rationality, if understood correctly, would be incompatible with CE; b) even if CE conception of rationality is acceptable, one could try to show that what CE claims about science is still not compatible with CE's own conception of rationality.

2.2.1. Van Fraassen bases his CE on what is usually called 'minimalistic' conception of rationality (van Fraassen 2003: 180; Dicken 2010: 20), according to which rationality is not defined in terms of 'substantive rules', but rather is limited only by laws of logic (to rephrase van Fraassen, rationality is a matter of permission, not compulsion).

Van Fraassen tackles the question of what it means to have a rational belief in his philosophical-psychological *voluntaristic* conception, designed to defend *probabilistic coherence* of bayesian epistemology (van Fraassen 1984). According to this conception, to have a rational belief X is to have a cognitive commitment to X , to have an interest in

acting on X (van Fraassen 1984: 256).

The voluntarist conception is compatible with CE minimalist conception of rationality (or rather conception of non-irrationality). The only constraint the voluntarist conception puts on the complex of beliefs to be rational is to be possible voluntarily acted upon. Thus, the complex of beliefs has to be logically coherent. This conception of rationality is well suited for skeptical CE as any stronger conception would probably presuppose too much about our capabilities to devise a ‘correct’ way of gaining scientific knowledge.

This dissertation also notes that one more principle of rationality can be assigned to CE. Van Fraassen notes, that both scientists and philosophers should follow principle according to which not everything can be said about anything (van Fraassen 1994: 190), which can be called the principle of weak correspondence between the belief and the object of the belief.

The two CE principles mentioned above are so common to any reasonable dialogue that it makes no sense to argue against the correctness of those principles. One could argue for alternative conceptions of rationality, for example, for some realist conception of rationality. But the ideas argued for would be just surrogates for the claims the opposing school of thought defends. Thus, it is impossible to seriously challenge CE by attacking its conception of rationality.

One could try to show, though, that even according to the minimalist conception of rationality CE reconstructs science as irrational. According to critics, the way CE construes DOU makes CE susceptible to such an attack.

2.2.2. Probably the most discussed issue in CE controversies is the CE incoherence argument raised by Alan Musgrave (1985). According to this argument two of very important statements of the philosophy of CE are incompatible (Musgrave 1985: 207).

Mutually problematic statements are a) the CE statement about science itself (that science seeks empirically adequate theories) and b) that what is observable is a question for science itself, that theories themselves say, what is observable.

Suppose, we have theory T , which describes observable A and unobservable B . According to Musgrave, statement about B 's unobservability cannot be believed by scientists based on CE itself. This means that scientists lack crucial information to accept T and

make the important distinction in the first place (Musgrave 1985: 208).

To show, that Musgrave's argument misses the mark, a simple example is used in this dissertation. Imagine a theory, which claims: i) X is observable; ii) y is unobservable; iii) Z is observable; iv) y is some function of X ; v) Z is some function of y . This theory means that, also, Z is some function of X (both are observables). It is absolutely conceivable that after many experiments on observables Z and X scientists come to believe the empirical adequacy of the whole theory. After all, CE does not claim to what extent the theory has to be tested or which part of it has to be tested for scientists to accept it.

Thus, Musgrave's argument is not valid. In order to acquire belief in T 's empirical adequacy, one does not have to have any stance (acceptance, belief) towards that theory.

Paul Dicken and Peter Lipton noted, that one could think of unobservability statements in science as being accepted, rather than believed in (Dicken and Lipton 2006). This suggestion by Dicken and Lipton is not entirely correct, because the whole theory is the object of acceptance in CE, and the belief in the empirical adequacy of the whole theory is what CE recommends as an epistemic stance in science. But the spirit of this statement by Dicken and Lipton can be maintained by claiming that *post factum*, after T has been accepted, statements about unobservables are just accepted.

Critics of CE correctly claimed that van Fraassen's own solution which relies on *semantic view* on scientific theories (van Fraassen 2008: 199–200) to Musgrave's problem is incorrect (Dicken 2009: 38), because CE is not a theory about the formalization of scientific language. Solution suggested in this dissertation does not rely on any view on scientific language.

The solution suggested here also improves on Fred Muller's attempt to rebuff Musgrave's critique (Muller 2004, 2005). Muller's analysis offers a useful formalism for the investigation of Musgrave's problem and rightly suggests that Musgrave incorrectly claims CE to be logically incoherent. However, Muller's attempt just does not answer Musgrave in enough detail to be decisive.

2.3. According to some CE critics, DOU makes CE ontologically more committed than should be acceptable to the empiricism as an alternative to supposedly over-

optimistic scientific realism.

2.3.1. The central critique against CE about its ontological commitments comes from James Ladyman (2000).

An important part of the philosophy of van Fraassen is dedicated to the analysis of *possible* and *counterfactual* states of affairs as they are seen in science. Van Fraassen (and empiricism in general) should hold that there is no such thing as *real* modality in nature (van Fraassen 1980a: 202–203).

Ladyman challenged this contention claiming that CE presupposes an objective modal DOU; thus, DOU makes CE ontologically committed to the reality of possible worlds (Ladyman 2000: 838).

Ladyman formulates his dilemma in more sophisticated terms. He suggests what kind of views on modal facts could be assigned to CE, based on van Fraassen's works and the requirement of CE to be ontologically modest. None of those candidate views, however, allows construing DOU as objective (Ladyman 2000: 849). Thus, CE should be committed to modal objectivism or outright modal *realism* (as Ladyman understands *objectivity*).

This dissertation proposes three possible ways out of Ladyman's dilemma: 1) one could claim Ladyman's conception of objectivity is too strong; 2) one could show, how modal statements in science can be translated into statements without modal concepts; 3) one could claim that even embracing modal realism CE would still be ontologically more modest than scientific realism.

2.3.2. What does CE mean by 'objectivity'? While CE critics talk about objective language of science, in the context of CE one should rather talk about objective *matters of fact* (van Fraassen 2006a: 128). Moreover, *objectivity*, similarly to DOU, is an intra-scientific concept (van Fraassen 1980a: 82) in CE.

The dissertation suggests the following interpretation of two above aspects of 'objectivity' in CE. 'Objectivity', according to CE, is a fundamental, indefinable (in strict manner) concept, using which scientists express the presuppositions about the world 'outside' our consciousness. Similar presupposition is common to the realism-antirealism debate (Devitt 2007: 768). Any attempt to provide a more precise definition, what would make a matter of fact or a linguistic expression, describing a matter of fact, objective, should be

unacceptable for antimetaphysical and skeptical CE.

Buekens and Muller argued, that concept of ‘observability’ is *intentional* and cannot be *physicalist*, thus, cannot be treated as expressing something objective (Buekens and Muller 2012: 92–93). The most characteristic way of CE to refute the objection by Buekens and Muller would be to challenge the *antireductivist* premise (Buekens and Muller 2012: 93) and to claim that in science the content of *intentional* concepts is disclosed to the full extent such disclosure is at all possible. This answer takes into account two possible CE counterarguments, proposed by Buekens and Muller themselves (Buekens and Muller 2012: 98–100).

2.3.3. Ladyman understands ‘objectivity’ as follows: a) objective is that which is independent of our theoretical or scientific beliefs about the world (Ladyman 2000: 846); b) implicitly Ladyman bases his critique on the strong distinction between the linguistic expression and the state of affairs linguistic expression refers to (*truth condition* of that statement). The latter means that, according to Ladyman, similarly to non-modal linguistic expressions, that supposedly refers to some states of affairs (has consciousness independent truth conditions), modal expressions also does refer to some state of affairs, thus making CE committed to some ‘esoteric entities’ (Ladyman 2000: 846).

Even the first aspect of Ladyman’s conception of objectivity is unacceptable to CE, because an intra-scientific concept has to be dependent on our scientific beliefs to at least some extent (Muller 2005: 66).

One could still insist, that CE should explain, how to interpret modal observability statements in science, as they are, obviously, different from regular non-modal linguistic expressions. CE has an acceptable modal-nominalistic answer, claiming that modal expressions are just shorthand for various non-modal contextual expressions (Monton and van Fraassen 2003: 410). Ladyman argued, that if this was the case, CE had no criteria for which contextual statements to keep fixed, without presupposing something like the laws of nature (Ladyman 2004: 760). CE, however, can outright refuse to interpret theories of observability realistically, as critics arbitrarily requires it to do (Douven 1996: S290), and keep itself closer to the ground (Muller 2005: 83).

Suppose critics were successful in showing that CE is not separable from something

like modal realism towards the statements about observables. Can CE still claim that it is ontologically superior to scientific realism, because it recommends belief only to the part of modal statements realists recommend to believe (Monton and van Fraassen 2003: 420)?

This dissertation suggests, that the answer to the latter is not at all clear and would require further investigation, when comparing CE with van Fraassen's own version of scientific realism (van Fraassen 1980a: 8). CE replaces the dispositions of unobservables and observables to act some way with dispositions of observables to act some way. And from mathematical point of view this move of CE is not necessarily ontologically advantageous.

3. *Does CE do justice to the phenomena of scientific activity?* The third part of the dissertation investigates, how well CE reflects on the actual and possible scientific practice.

3.1. To what extent the empirical science can be an object of historical-philosophical investigation?

3.1.1. The question of the relationship between the history of science and philosophy of science is a controversial one (Burian 1977; Laudan 1992; Musgrave 1974; Pinnick and Gale 2000; Staley 1996). As CE aims to correctly interpret scientific practice, this question is of importance to CE as well.

The flexible descriptive-normative nature of CE allows it to successfully participate in realism-antirealism controversies. However, it does not allow CE to facilitate detailed investigations into the history of science in a very direct fashion. In this sense CE is not that similar to historical-philosophical conceptions of ex. Thomas Kuhn or Imre Lakatos. Thus, in the debate mentioned above about the relationship between philosophy and history of science, CE would implicitly support, for example, Rachel Laudan (1992), who argues that philosophy of science and history of science are quite independent from each other. Dissertation illustrates this idea by analyzing some historical-philosophical works (Chang 2004; Franklin 2004; Galison 2008; Pashby 2012).

How the philosophical interpretation of scientific practice can be proceeded with in CE? Bradley Monton and Chad Mohler (2012) claim that there are at least three aspects of science that can be interpreted by CE so well they make for positive arguments sup-

porting CE (Monton and van Fraassen 2003: §2.3–§2.5). Those aspects are: the way experimental practice works in science; the relevance of pragmatic decisions in science; also, according Monton and Mohler, CE correctly construes the role of the *explanations* in science.

This dissertation does not share the views of Monton and Mohler and suggests that the three aspects mentioned above can be satisfactorily interpreted both in the framework of scientific realism and CE. This supports another view on van Fraassen's work upheld in this dissertation. Namely, van Fraassen proposes his conception of science not so much as better alternative to scientific realism, but rather as just an alternative view, using which the phenomena of scientific activity can be successfully encountered (Kukla 1998: 34–38) at least as well as using realist conceptions of science.

3.1.2. Ian Hacking argued that the practice of *experimental corroboration* shows CE to be false, as it makes no sense to claim that scientists do not believe in unobservables, when they obviously try to get a grasp of those unobservables using different kinds of experiments and utilizing different physical mechanisms (Hacking 1985: 144–145). CE, however, can refute this argument claiming that Hacking presupposes what he tries to prove. CE can claim that the success of the corroboration of theory, using different kinds of experiments, can be attributed to the similarity of *observable* structure under investigation, not on *unobservable* structure (van Fraassen 1985: 298).

Another point of contention in CE debates is so-called theory conjunction practice in science (which can be called a practice of corroborating one theory with another). CE critics argued, that it is usual in science to combine accepted theories into one (make a conjunction of two accepted theories) and believe in its truth when designing experiments (Friedman 1983; Psillos 2000, 2005; Putnam 1973). According to critics, this practice would make no sense if scientists would accept theories based on the supposed empirical adequacy of theories, because the conjunction of two empirically adequate theories does not have to be empirically adequate.

Van Fraassen argued, that there is no such thing as conjunction practice in science (van Fraassen 1980a: 87). His answer again is based on semantic view of theories.

This dissertation argues, that even if conjunction practice existed in science it would

rather cause trouble to scientific realism than to CE. For example, one could challenge scientific realists by asking, why would scientists care about the joint theory as if they doubted rules of logic? Realists can retort that by using joint theory scientists can better confirm the theories being joined (Psillos 2000: 69; Friedman 1983: 243). However, this answer is flawed: it just does not seem right to claim that the purpose of the whole enterprise of scientific unification (including plain conjunction) is just confirmation of the most primitive theories.

CE, on the contrary, makes better sense of theory conjunction (and unification). The theory unification is common in science due to pragmatic reasons. And, contrary to scientific realism claims, scientists do not readily accept the unified theory (thus neither believe it is true, nor empirically adequate). Rather, the new theory is thoroughly tested, because, as CE might interpret, the primitive theories were treated as merely empirically adequate.

3.1.3. CE emphasizes the importance of DOU in scientific practice. However, one would struggle to find examples of scientific activities that would be explicitly based on this distinction.

Moreover, CE controversies show, that the question, what is observable, is not as trivial as it may seem.

Muller tested his *observability* definition (Muller 2005: 83) using a couple of different sample objects and deemed black holes to be unobservable (Muller 2005: 83–84). Muller reached this incorrect verdict utilizing, in his definition, the wave theory of light. However, even according to the wave theory of light, black hole would be observable in the bright background. Also, in the latter case of observation, what is actually observed would depend on the gravitational curvature of space, which is analyzed not in the wave theory of light but rather in the general relativity. The decision on whether black hole is observable also depends on the astrophysical distinction between the singularity and the event horizon.

Why do these complications seem not to impede the progress of science if DOU is of such importance as CE claims? Possible answer for CE: when trying to acquire the belief in the empirical adequacy of the theory scientists always have to find out what is possible

to observe and what is not according to the theory itself and other theories. Moreover, as the concept of ‘observability’ is intra-scientific, it can depend on various scientific contextual factors, thus DOU is not explicit, but rather integral part of scientific practice to the very core of the latter.

Similarly, CE can be challenged in terms of scientific practice by noticing, that sometimes scientists talk about ‘direct’ observation of unobservable entities. For example, *dark matter* in astrophysics is said to be detected indirectly when its macroscopic gravitational effects are observed. However, scientists seek to observe it ‘directly’ in the particle accelerators. CE has a way out here as well. The distinction between ‘direct’ and ‘indirect’ observation in science is made purely due to pragmatic reasons in order to separate different fields of research. As long as dark matter is expected to be particulate its potential detection in particle accelerator is said to be ‘direct’. However, the possibility that dark matter is actually composed of macroscopic invisible objects (according to soon-to-be-accepted scientific theory) or of other as yet unconceived entities is always open.

3.2. This section analysis how well CE is capable of encountering hypothetical examples of what we would consider to be scientific practice. Two types of hypothetical cases (or *thought experiments*) are distinguished here: those that envision hypothetical scientific communities or hypothetical scientific practices in the world nomologically identical to the actual world (Maxwell 1962: 4; Churchland 1985: 43–44) and those that depicts science in the world which is (probably) nomologically different from our actual world (Rosen 1994: 77; van Fraassen 1975; Psillos 2005: 184–186).

Despite controversise surrounding method of thought experimentation in philosophy (Brown 2004; Sorensen 1998), this dissertation treats thought experiments as a natural part of philosophy, using which philosophers can investigate, how our language about the subject under consideration (in this case, science) works.

3.2.1. First of all, as an example of the first kind of hypothetical cases analysed here, this dissertation revisits electron-microscope eye arguments and arguments showing that CE can do without strong conception of *epistemic community*. These arguments were presented using hypothetical cases both in previous works and in this dissertation.

Second of all, this dissertation presents a thought experiment, which hadn’t been pro-

posed before. This hypothetical case was designed trying to push the limits of hypothetical reasoning in CE debates.

Imagine visiting an alien planet which inhabits sentient aliens. Imagine, furthermore, that the civilization of those aliens possesses all the usual features we associate with technologically and scientifically advanced community. However, and this is apparently a logical possibility, these aliens communicate among themselves using telepathy. They just have no language at all. If CE tried to avoid claiming *ad hoc* that, in spite of all the technological achievements of this alien civilization, these aliens are not scientists, could CE, based on its weakly epistemological policy, still interpret this kind of scientific activity as scientific?

Probably no, as aliens in the ‘new world’ do not possess theories to accept or to believe in. Note that CE is, in the face of this example, still stronger than its opponent scientific realism, because, whatever the aliens have been doing to achieve their high technological (or scientific) development stage, it must have been *empirical*.

This example also shows, however, that there are limits to how far we can push our philosophical dialogue about science. At the moment this dialogue presupposes that the object of discussion is scientific *theories*, their relationship with the world and, as is the case for CE, the criteria implicit in science for the success of those theories.

3.2.2. As an example of thought experiment, in which world nomologically different from the actual world is envisioned, this dissertation revisits the dispute between van Fraassen and Stathis Psillos about conjunction practice in science (Psillos 2000, 2005; van Fraassen 1975). Dissertation concludes that in this case the role of hypothetical case is purely heuristic.

However, using the latter kind of thought experimentation, CE can be both attacked and defended directly.

The dissertation analyzes the dispute among Rosen, Ladyman, Monton and van Fraassen (Ladyman 2000; Monton and van Fraassen 2003; Rosen 1994). A hypothetical case employed as a point of contention in this dispute is reconstructed in detail.

In this thought experiment the laws of physics are such that there exists a phenomenon of nature, which takes place only once during the lifespan of the universe. This phe-

nomenon occurs under some very specific conditions (or at a specific point in space). Suppose, the already accepted theory of some scientist predicts that phenomenon occurring. Also, imagine that the scientist is capable of checking whether her prediction is correct.

Ladyman and Rosen argued that in this case the scientist would be motivated not to implement the relevant observation or experiment, because her theory, which up to the point has served well, might appear to be empirically inadequate. While in case the observation was successful, theory would yield no more useful predictions.

This critique of CE is incorrect, because CE does not claim that scientists try to save their theories at the cost of relevant experimentation. Implementing the relevant experiment in the hypothetical case analyzed would not mean acting against CE policy.

Next, to support CE, we propose a hypothetical case of two parallel worlds, existing in the same universe. The particles any of those worlds is composed of do not interact with any of the particles from other world. Thus, scientists in neither of those two worlds can in any way observe or investigate another world. Now suppose that in one of those worlds a scientist correctly guesses that the parallel world exists. This scientist starts having dreams (that by accident are correct) about the life and laws of the parallel world. Would we consider the activity of this scientist to be real science? CE would be correct in claiming that this is not the case. Axiological scientific realists, however, by using realist framework, in which the claim that science aims for the truth of theory is weaker than the claim that science achieves truth of a theory (Kukla 1998: 8–11), might have to incorrectly admit that the hypothetical scientist, in acquiring the truth about the world, has been doing real science all along.

Conclusions.

1. The axiological claim of CE that science seeks empirically adequate theories is non-commensurable alternative to the traditional philosophies of science participating in the realism-antirealism controversy: CE is based on the epistemologically skeptical view towards the attempts to reveal the fundamentals of scientific knowledge using philosophical methods in normative manner.

1.1. From the comparative point of view, CE departs from a well-established distinction in the realism–antirealism controversy among semantic, epistemological and ontological philosophical commitments: in contrast to logical empiricism and traditional instrumentalism, CE is not language analysis–oriented philosophy; KE also is not strictly epistemological position, because explicitly it only reconstructs the aims of science, but does not claim whether or to what extent those aims are attained; CE clearly avoids ontological commitments.

1.2. CE is normative philosophy of science only in a weak sense: CE interpretation of science is formulated as a description, but implicitly anticipates that the judgements about science, including judgements on how to proceed with science, will be based on this interpretation. Contradicting Rosen, CE is not a quasiconception: CE is just based on the epistemologically skeptical attitude that although scientific knowledge cannot be grounded absolutely, one can still participate in the philosophical dialogue about such knowledge.

2. It is correct to base a description of contemporary natural science on the distinction between pragmatic acceptance of the theory and epistemic belief that theory is true, because part of the reasons scientists accept theories (the pragmatic values, such as elegance, simplicity, unity, etc.) are not the reasons to believe theories without invoking strong metaphysical presuppositions. Thus, even if one maintains the skeptical point of view towards the attempts to legitimize scientists' epistemic beliefs in decisive manner using philosophical methods, the phenomena of scientific activity can be in relevant way conceptualized using the distinction between acceptance and belief.

3. The agent of the empirically adequate theories seeking science is correctly said to be *epistemic community* only if the concept of 'epistemic community' is invoked in agreement with epistemological skepticism, i.e. expressing that at present our science is organized as a community enterprise; but not presupposing that there are some strong principles, according to which sentient beings should necessarily base their beliefs on the testimony of other members of the community, *contra* Seager. Treating the concept of epistemic community in such manner, science is still correctly interpreted as being objective (*contra* Bahrenberg et al.), because physical interactions between things in this

world and a particular cognitive agent as well as several such agents are as objective as all the other physical interactions among things in the world.

4. When the aims of science are expressed using the distinction between observable and unobservable (DOU), one can still maintain that science is rational activity. Critical arguments against DOU raises the requirements on DOU that skeptical CE, invoking its own minimal standard of non-irrationality, has no intentions to raise.

4.1. The so-called ‘electron-microscope eye’ arguments that claim DOU to be inadmissible for describing science, because DOU is vague and dependent on various contextual factors, are unfounded, because the aforementioned dependencies are correctly assigned to the ‘observability’ predicate when describing the epistemic activity of science. DOU is not definable using the philosophical ‘first principles’ and is not significant from the ontological point of view, however, it is significant from the point of view of skeptical epistemology of CE.

4.2. Alan Musgrave’s critical incoherence argument against DOU is invalid. The CE statement that the reason for the success of scientific theory is that theory is believed to be empirically adequate, does not mean that scientists must base their decision to accept the theory on the DOU, formulated using the already accepted (and the same) theory. Epistemologically skeptical CE is not committed to defending any particular way the theory should be accepted (thus no particular way of gaining beliefs). CE *in abstracta* states what kind of beliefs of scientists towards a theory presupposes the success of that theory. CE allows scientists to seek beliefs in empirical adequacy of the theory without first accepting that theory, thus, without first having the corresponding theory-related beliefs.

5. The claim, that science seeks empirically adequate theories, is epistemologically more modest than realistic interpretations of the phenomena of scientific activity, despite observability statements being modal (*contra* James Ladyman). Skeptical CE, which treats DOU as an intra-scientific distinction, is committed, neither ontologically nor epistemologically, to reify statements of possible observability situations, statements that should be interpreted as linguistic artifacts created by scientists themselves.

6. Interpreting actual scientific practice, possible scientific practices in the world

nomologically identical to the actual world, and possible scientific practices in the possible worlds nomologically different from the actual world, science seeks empirically adequate theories. CE flexible skeptical philosophical interpretation of science correctly represents the phenomena of scientific—essentially empirical—activity.

Publications on the topic of dissertation

Bujokas, J. (2017). Constructive Empiricism Without the Epistemic Community. *Problemos* 91: 17–29.

Bujokas, J. and Šaulauskas, M. P. (2014). The Revisionary Normativity of Constructive Empiricism („Revizionistinis konstruktyviojo empirizmo normatyvumas“). *Problemos*. Supplement: 48–61.

Bujokas, J. (2012). Reductive Empiricism: Methodology or Epistemology („Redukcinis Empirizmas – metodologija ar epistemologija“). *Problemos*. Supplement: 78–88.

Conference presentations

‘Constructive Empiricism Without the Epistemic Community’ at the conference *Philosophy of Science in the Forest 2016*, organized by Dutch Society for the Philosophy of Science, Utrecht (2016.05.19–21).

‘Observability in Constructive Empiricism: Defining the Indefinable’ at the joint doctoral seminar of Zurich and Vilnius University *Concepts and Conceptual Analysis*, Vilnius (2014.10.16–17).

‘What is Science? Contemporary Realism–Antirealism debates’ („Kas yra mokslas? Šiuolaikiniai realizmo ir empirizmo ginčai“) at the conference dedicated to Prof. Rolandas Pavilionis, Vilnius (2014.05.16).

Education

2007–2011 m. M.A. in Philosophy (*cum laude*) at Vilnius University.

2009–2011 m. M.S. in Theoretical Physics and Astronomy (*cum laude*) at Vilnius University.

2008–2009 m. 1 year ERASMUS studies at Lund University. Work under Project in Chemical Physics (in the Department of Chemical Physics).

2003–2007 m. B.S. in Physics at Vilnius University.

Other

2012–2015 m. Part-time teacher in the Department of Philosophy (Vilnius University): Introduction to Philosophy seminars, D. Hume seminars, Philosophy of Positivism seminars.

2015 m. Presentaton in the popular science event *Philosophy Crumbs* („Filosofijos trupiniai“).

2014 m. Organizer of popular science event *Labyrinth of Philosophers* („Filosofų labirintas“).

2013 m. Presentation in the popular science event *Researchers' Night* („Tyrėjų naktis“).

2011–2012 m. Freelance expert with Lithuanian Centre for Quality Assessment in Higher Education (students' representative).

Šioje disertacijoje nagrinėjama šiuolaikinio gamtos mokslo episteminio statuso problema, kuri filosofams aktuali nuo pat moderniosios gamtotyros formavimosi pradžios XVII a. Pastarųjų kelių dešimtmečių filosofijoje mokslo ontologijos, epistemologijos, mokslo kalbos semantikos, taip pat mokslo metodologijos klausimai itin aštriai svarstomi mokslinio realizmo ir antirealizmo kontroversijoje. Mokslo realistai optimistiškai mano, kad šiuolaikinės gamtotyros episteminę reikšmę lemia tai, jog mokslo teorijos teisingai ar apytiksliai teisingai aprašo pasaulį, įskaitant nestebimuosius jame esančius dalykus. Tuo tarpu mokslo antirealistai šiai idėjai oponuoja ir mano, kad mokslo sėkmę galima paaiškinti nuosaikiau, pavyzdžiui, teigiant, kad mokslo sėkmę lemia jo instrumentinė vertė arba tai, kad teorijos teisingai aprašo tik stebimųjų dalykų pasaulį.

Viena iš reikšmingiausių šiuolaikinių antirealistinių mokslo filosofijos krypčių – Baso van Fraasseno konstruktyvusis empirizmas (KE). Ši filosofija kartais laikoma pagrindine empiristine mokslinio realizmo alternatyva, jeigu ne pakeičiančia kitas galimas antirealizmo formas, tokias kaip instrumentalizmą ar tariamai žlugusį loginį empirizmą, tai bent jau sėkmingai pasinaudojančia pastarųjų pranašumais. Pagrindinė KE idėja – priimant gamtos mokslų teoriją nėra būtina manyti, kad teorija sako tiesą apie joje numatomus nestebimuosius esinius, bet pakanka manyti tik tiek, kad teorija yra adekvati empiriniu požiūriu.

KE ir mokslinio realizmo nesutarimas šiuo metu yra peraugęs į daug frontų apimančią disputą, kuriame nagrinėjami įvairių sričių mokslo filosofijos klausimai, pradedant, pavyzdžiui, klausimu, koks mokslo kalbos loginės analizės formalizmas tinkamiausias mokslo teorijoms nagrinėti, ir baigiant plačiu klausimu, ko apskritai turėtų siekti mokslo filosofija?

Tikslas ir uždaviniai. Disertacijos pagrindinis tikslas – ištirti, ar korektiška šiuolaikinį gamtos mokslą suprasti tik kaip siekiantį empiriškai adekvačių, o ne vis teisingesnių teorijų. Disertacijos tikslo siekiama vykdant tris toliau nurodytus uždavinius.

1. Siekiama probleminiu požiūriu apibūdinti KE poziciją, eksplikuojant pagrindines KE vartojamas sąvokas, bei aptariant galimas KE metafilosofines interpretacijas. Išsprendus pastarąsias užduotis siekiama tiksliau apibrėžti KE vietą šiuolaikinėje mokslo filosofijoje – aptarti KE santykį su moksliniu realizmu ir ne-realistinėmis mokslo filosofijos

kryptimis, pavyzdžiui, loginiu empirizmu ir instrumentalizmu.

2. Siekiama iširti, ar mokslo veiklą galima korektiškai interpretuoti remiantis skirtimi tarp stebimųjų ir nestebimųjų esinių (SNS). KE laiko empirinio adekvatumo kategoriją ir jai esminę skirtį tarp stebimųjų ir nestebimųjų esinių endeminėmis mokslo kategorijomis. Dėl to, anot kritikų, mokslas, kaip jį vaizduoja KE, yra neracionalus arba tiesiog KE mokslo koncepcija nėra ontologiniu požiūriu taupesnė (tad nėra niekuo geresnė) už mokslinį realizmą.

3. Siekiama išsiaiškinti, kiek gerai KE paaiškina mokslo veiklos fenomenus. Siekiama iširti, kiek toks filosofinės koncepcijos palyginimas su mokslo veikla (mokslo praktika) apskritai įmanomas ir kiek su KE suderinami faktiniai mokslo praktikos elementai bei hipotetiniai mokslo praktikos pavyzdžiai.

Ginami teiginiai. Disertacijoje teigiama, kad KE korektiškai interpretuoja mokslą kaip siekiantį vien tik empiriškai adekvačių teorijų – prieš tokią poziciją nukreipti argumentai empiristinei mokslo interpretacijai *implicite* priskiria nuostatas, kurios konstruktyviajam empirizmui nepriskirtinos dėl to, kad KE implicitiškai nuosekliai laikosi epistemologinio skepticizmo nuostatos.

1. Empiriškai adekvačias teorijas priimančią mokslą galima suprasti kaip objektyvų, net kai jo subjektu laikoma „episteminė bendruomenė“; skirtis tarp teorijos „priėmimo“ ir „įsitikinimo“ teorijos teisingumu yra turininga.

2. Apibūdinant šiuolaikinį gamtos mokslą korektiška remtis SNS, traktuojant ją kaip mokslui endeminę skirtį. Dėl to empiristinė mokslo koncepcija nėra viduje prieštaringa (nevaizduoja mokslo kaip iracionalaus) ir išlieka ontologiškai taupesne už mokslinį realizmą (neįsipareigoja modaliniam realizmui – galimų stebėjimo situacijų sudaiktinimui).

3. Interpretuojant faktinę mokslo praktiką, galimas mokslo praktikas šiame iš nomologiškai galimų pasaulių, ir galimą mokslo praktiką galimuose nuo mūsų pasaulio nomologiniu požiūriu besiskiriančiuose pasauliuose, mokslas siekia empiriškai adekvačių teorijų.

Metodas. Bendroji tezė ginama iš esmės palaikant Baso van Fraasseno darbe „Mokslinis vaizdas“ suformuluotą KE koncepciją ir pabrėžiant joje slypinčią epistemologinio skepticizmo nuostatą.

Pirmasis teiginys ginamas remiantis Baso van Fraasseno siūloma pagrindinių KE sąvokų eksplikacija, taip pat remiantis KE palaikančių André Kukla'os ir Fredo Mullerio darbais. Čia atmetamas Paulo Horwicho argumentas esą KE skirtis tarp teorijos priėmimo ir įsitikinimo jos teisingumu yra neturininga („skirtis be skirtumo“), taip pat Williamo Seagerio bei Simone Bahrenberg et al. argumentai esą KE negali pagrįstai remtis „episteminės bendruomenės“ sąvoka.

Antrasis teiginys ginamas atremiant prieš KE siūlomą SNS nukreiptus argumentus: oponuojama Groverio Maxwello ir Paulo Churchlando „elektroninės akies“ argumentams, taip pat Alano Musgrave'o ir Paulo Dickeno bei Peterio Liptono palaikomam argumentui, esą KE remdamasis skirtimi tarp stebimųjų ir nestebimųjų esinių patenka į ydingą ratą. Taip pat oponuojama Jameso Ladymano metodologiniam argumentui, anot kurio, KE remdamasis skirtimi tarp stebimųjų ir nestebimųjų esinių prisiima empirizmui per stiprių ontologinių įsipareigojimų. Atsakant į kritikų argumentus dėl skirties tarp stebimųjų ir nestebimųjų esinių kritiškai įvertinami ir KE šalininkų van Fraasseno, Bradley Montono, Fredo A. Mullerio, Josepho F. Hanna'os darbai (pavyzdžiui, atmetamas van Fraasseno siūlomas Musgrave'o problemos sprendimas, anot kurio, KE būtinai turi remtis semantine mokslo kalbos koncepcija).

Trečiasis teiginys ginamas nagrinėjant faktinius ir galimus mokslo praktikos pavyzdžius ir remiantis filosofais, anot kurių KE tokius pavyzdžius interpretuoja tinkamai. Pavyzdžiui, van Fraasseno ir Stathis Psilloso ginče dėl konjunkcinės mokslo praktikos palaikomas van Fraassenas. Gideonu Roseno ir Ladymano ginče su Bradley Montonu ir van Fraassenu (dėl galimos mokslo praktikos nuo faktinio pasaulio besiskiriančiame nomologiškai galimame pasaulyje) palaikomi Montonas ir van Fraassenas. Ginant šį teiginį plačiai remiamasi mintinių eksperimentų metodu.

Disertacijos naujumas. Disertacijoje ginamas konstruktyvusis empirizmas, nuosekliai grindžiamas epistemologiniu skepticizmu. Kitaip nei ligšioliniuose bandymuose pateisinti KE siūlomą mokslo vaizdą, šiame darbe išsamiai nagrinėjamos papildomos KE kontroversijose implicitiškai glūdinčios, kritikų KE priskiriamos problemiškos filosofinės nuostatos ir *explicite* aiškinamasi, kiek tokios nuostatos reikalingos KE, kaip empirizmo formai.

Ginčas dėl pragmatinių ir episteminių mokslo aspektų santykio arba tiesiog dėl skirties tarp teorijų priėmimo ir įsitikinimo jų teisingumu spręstas dispute tarp van Fraasseno (1980a), André Kukla'os (1998) prieš Paulą Horwichą (1991). Disertacijoje pabrėžiama, kad epistemologiniu požiūriu skeptiškas KE turi išteklių neproblemiškai konstatuoti, jog filosofiniame dialoge „episteminio įsitikinimo“ sąvoka (kaip aprašanti kitokias dalykų padėtis moksle nei kad „pragmatinio priėmimo“ koncepcija) priimtina ir be pretenzijų iš esmės, giliai eksplikuoti jos turinį.

Klausimas, kiek KE gali remtis „episteminės bendruomenės“ sąvoka, bandytas išspręsti Williamo Seagerio (1988) ir Simone Bahrenberg et al. (2006) ginče prieš van Fraassoną (1980a, 2006a), tačiau van Fraasseno atsakymas neatrodo pakankamas ir gerai apibrėžiantis KE poziciją „episteminės bendruomenės“ klausimu.

Disertacijoje teigiama, kad KE gali, nuosekliai abejodamas epistemologijos galiomis, mokslą kaip objektyvų suprasti ir nesiūlydamas griežtos „episteminės bendruomenės“ koncepcijos. KE pakanka „objektyvumą“ laikyti pamatine intuityviai suprantama, mums išorinio pasaulio egzistavimo prielaida (kuri būdinga visai mokslinio realizmo bei antirealizmo kontroversijai) paremta, bet išsamesnei filosofinei refleksijai neprieinama sąvoka.

KE metafilosofinių interpretacijų klausimas tirtas van Fraasseno ir Roseno dispute (Hanna 2004; Rosen 1994; van Fraassen 1994), tačiau aiškaus atsakymo, ar KE, pavyzdžiui, yra normatyvinė, ar deskriptyvinė filosofija, šiuose tyrimuose taip ir nepateikta. Kitaip nei ligšioliniuose tyrimuose, disertacijoje pastebima, kad skirtis tarp „normatyvinių“ ir „deskriptyvinių“ mokslo filosofijų yra tik metodologinė-istorinė. Tad KE, atsakydamas į klausimą „kas yra mokslas?“, nėra įpareigotas laikytis griežtų tokios skirties brėžiamų linijų. KE gali pateikti tarpinę silpną prasme normatyvinę savo teiginio, jog mokslas siekia empiriškai adekvačių teorijų, interpretaciją. Tad ir čia KE rodo savo skepticizmą – yra „epistemologinis“ tik ribotai.

Šioje disertacijoje taip pat prisidedama prie KE ir kitų šiuolaikinių mokslo koncepcijų santykio tyrimų (Kukla 1998: 3–10; Chakravartty 2007: 10; Niiniluoto 2004: 11; Bujokas 2012) – apibrėžiamas KE santykis su loginiu pozityvizmu, instrumentalizmu, filosofiniu natūralizmu, į tikslus orientuotu empirizmu, eksperimentalizmu.

Daugiausia dėmesio šiame darbe skiriama KE ir loginio empirizmo santykio klausimui.

mui. Nors van Fraassenas gana akivaizdžiai pripažįsta loginių empiristų įtaką savo mokslo filosofijai, išsamesnės analizės, koks KE ir loginio empirizmo santykis, dar nėra buvę.

Tiriant KE SNS problemą beveik pasiektas konsensusas, kad prieš šią skirtį nukreipti vadinamieji „elektroninės akies“ argumentai nepagrįsti. Taip pat plačiai tirta vadinamoji KE vidinio nuoseklumo arba Alano Musgrave'o problema (Musgrave 1985). Centriniam ginče dėl Musgrave'o problemos sukurtas formalizmas KE vidiniam nuoseklumui tirti. Pats van Fraassenas šią problemą siūlo spręsti įsipareigojant semantinei mokslo kalbos koncepcijai (Muller 2008), bet toks sprendimas oponentų pagrįstai kritikuojamas (Dicken 2009).

Disertacijoje Musgrave'o problema išsprendžiama išvengiant įsipareigojimo semantinei mokslo kalbos koncepcijai. Parodoma, kad kritikai, teigiantys, esą KE remdamasis SNS patenka į ydingą ratą, nepagrįstai KE traktuoja kaip pažinimo pagrindų klausimus nagrinėjančią koncepciją. Tokių pretenzijų epistemologiškai skeptiškas KE neturi.

Taip pat neišspręstas klausimas, kiek dideli KE ontologiniai įsipareigojimai. Šis klausimas aiškiausiai tirtas van Fraasseno ir Jameso Ladymano dispute (Ladyman 2000, 2004; Monton ir van Fraassen 2003). KE ontologinių įsipareigojimų problema disertacijoje sprendžiama KE naudai tik iš dalies. Į Ladymano problemą KE šalininkai paprastai atsako mėgindami parodyti, kad kontrafaktinės KE ginti reikalingos išraiškos yra kalbiniai artefaktai.

Disertacijoje iškeliamas klausimas, ar nebūtų galima parodyti, jog paties van Fraasseno suformuluota KE oponuojanti silpna mokslinio realizmo versija (van Fraassen 1980a: 8), kalbant apie modalinius teiginius moksle, yra tiek pat ontologiškai taupi, kiek ir KE.

Didelė dalis iš van Fraasseno darbų skirti tirti, kiek empirizmas atitinka mokslo praktiką (mokslo veiklos fenomenus).

Vis dėlto, KE filosofijoje trūksta paaiškinimo, kokie tokio filosofinės koncepcijos lyginimo su mokslo praktika pagrindai. Kitaip nei ankstesniuose KE tyrimuose, užuot tik nagrinėjus atskirus sporadiškai KE kontroversijose aptariamus mokslo epizodus ar mokslo praktikos elementus, šioje disertacijoje pasiūloma mokslo filosofijos atitikties mokslo praktikai analizės būdų klasifikacija. Tokios klasifikacijos pagrindas – analizuojamo dalyko (mokslo praktikos elemento, epizodo) traktuotė galimų pasaulių atžvilgiu: ar mokslo

praktikos elementas egzistuoja faktiniame iš galimų pasaulių (priklauso mūsų mokslo istorijai), ar yra galimas su faktiniu pasauliu nomologiniu požiūriu sutampančiame pasaulyje, ar yra galimas nomologiškai nuo faktinio pasaulio galbūt besiskiriančiame pasaulyje.

Disertacijos struktūra.

Disertacijoje iš eilės ginami pagrindiniai jos teiginiai. Pirmąją dalį galima laikyti disertacijos probleminiu įvadu. Šioje dalyje išsamiai supažindinama su KE filosofija, apibrėžiama KE vieta mokslo filosofijoje įprastos skirties tarp normatyvinių ir deskriptyvinių mokslo koncepcijų atžvilgiu, taip pat analizuojamas KE ir kitų šiuolaikinių mokslo filosofijos krypčių santykis.

Pirmajame šios dalies skyriuje aptariamas pagrindinis KE teiginys apie mokslą (van Fraassen 1980a: 12), anot kurio mokslas siekia empiriškai adekvačių teorijų. Analizuojamos šiam teiginiui suformuluoti pasitelkiamos sąvokos, ypač *įsitikinimo* teorijos teisingumu arba empiriniu adekvatumu, teorijos *priėmimo*, *episteminės bendruomenės* sąvokos. Taip pat analizuojama, kaip KE būtų linkęs konceptualizuoti episteminių ir pragmatinių laikysenų objektus moksle, būtent mokslo *teorijas*. Šiame skyriuje KE ginamas nuo Bahrenberg et al. (2006), Seagerio (1988), Horwicho (1991) kritinių argumentų.

Antrajame pirmosios dalies skyriuje, remiantis Roseno ir van Fraasseno ginču (Rosen 1994; van Fraassen 1994), parodoma, kad KE galima suprasti kaip tarp deskriptyvumo ir normatyvumo bei tarp griežto epistemologinio normatyvizmo ir mokslo aksiologijos balasuojančią filosofinę koncepciją. Šiame skyriuje taip pat atmetamas Roseno pasiūlymas traktuoti KE kaip kvazikonceptiją (*quasiassertion*).

Trečiajame skyriuje, remiantis pirmojo ir antrojo skyriaus rezultatais, aiškinamasi, koks KE santykis su kitomis realizmo–antirealizmo kontroversijai svarbiomis mokslo filosofijos kryptimis. Remiantis realizmo–antirealizmo kontroversijai įprasta skirtimi tarp semantinių, epistemologinių ir ontologinių mokslo koncepcijų, aptariamas KE ir mokslinio realizmo santykis. Taip pat, remiantis Evaldo Nekrašo darbu (Nekrašas 2010), išsamiai aptariami KE ir loginio empirizmo panašumai bei skirtumai. Šiame skyriuje taip pat aptariamas KE ir kitų ne-realistinių mokslo filosofijos krypčių, tokių kaip instrumentalizmas, į tikslus orientuotas empirizmas (Maxwell 2005), eksperimentalizmas, natūralizmas

mokslo filosofijoje, santykis.

Antrojoje disertacijos dalyje ginama KE skirtis tarp stebimųjų ir nestebimųjų esinių (SNS).

Pirmajame antrosios dalies skyriuje atsakoma į vadinamuosius „elektroninės akies argumentus“ (Churchland 1985; Maxwell 1962), anot kurių KE SNS būdingos kontekstinės priklausomybės neleidžia KE šia skirtimi remtis korektiškai. Teigiama, kad epistemologinis KE skepticizmas SNS leidžia priklausyti nuo episteminės bendruomenės percepcinių gebėjimų, nuo teorijų, kuriomis remiantis ši skirtis formuluojama, ir kt. Taip pat SNS korektiškai gali būti traktuojama kaip miglota (*vague*).

Antrajame antrosios dalies skyriuje sprendžiama Alano Musgrave'o (1985) suformuluota KE vidinio nuoseklumo problema. Šiame skyriuje parodoma, kad epistemologiškai skeptiškas KE, remiantis paties KE minimalistine ne-iracionalumo koncepcija, nevaizduoja mokslo, kaip pažeidžiančio savo paties nusistatytą teorijos priėmimo standartą.

Trečiajame antrosios dalies skyriuje KE ginamas nuo Jameso Ladymano argumento, esą KE numato įsipareigojimus modaliniam realizmui (objektyvizmui) (Ladyman 2000). Šiame skyriuje teigiama, kad Ladymano argumentas paremtas per stipria skeptiniam KE nebūdinga objektyvumo koncepcija. Be to, pastebima, kad KE gali tiesiog atsisakyti reifikuoti modales kalbines išraiškas moksle. Vis dėlto, čia taip pat keliamas klausimas, kurio sprendimas išeina už šios disertacijos ribų, ar KE išties ontologiškai taupesnis už paties van Fraasseno pasiūlytą aksiologinę minimalią realizmo versiją (van Fraassen 1980a: 8).

Trečiojoje disertacijos dalyje skiriami trys lygmenys, kuriais KE galima lyginti su mokslo praktika.

Pirmajame trečiosios dalies skyriuje aptariama galimybė KE lyginti su *faktinio pasaulio* faktine mokslo praktika. Šiam tikslui pirmiausia aptariama, kiek KE galima laikyti istorine mokslo koncepcija. Daroma išvada, kad KE normatyvinis aspektas neleidžia tiesiogiai taikyti mokslo istorijos tyrimų KE pagrįsti. Šiame skyriuje taip pat nagrinėjama, kaip KE ir kaip jo pagrindinis oponentas mokslinis realizmas galėtų traktuoti eksperimentinę mokslo praktiką, pragmatinius sprendimus moksle, *paiškinimo* kategoriją moksle (Monton ir Mohler 2012). Šiame skyriuje KE taip pat ginamas nuo kritinių mokslo koroboracijos

argumentų (Friedman 1983; Hacking 1985; Psillos 2000).

Antrajame trečiosios dalies skyriuje nagrinėjama, kiek KE įmanoma palyginti su galima *faktinių mokslo dėsnių pasaulio* mokslo praktika ir galima mokslo praktika *galimame pasaulyje*, nomologiškai galbūt besiskiriančiame nuo faktinio. Čia pasiūlomas hipotetinės mokslo praktikos mintinis eksperimentas, kuriuo atskleidžiamos hipotetinių samprotavimų (kurie ypač būdingi ir su KE susijusioms kontroversijoms) mokslo filosofijoje ribos. Taip pat šiame skyriuje rekonstruojamas van Fraasseno, Roseno ir Ladymano ginče nagrinėtas mintinis eksperimentas (Ladyman 2000; Monton ir van Fraassen 2003; Rosen 1994), kuriuo KE mėginta kritikuoti. Be to, pasiūlomas mintinis eksperimentas, kuriuo KE galima mėginti grįsti, kaip stipresnę už mokslinį realizmą koncepciją.

Išvados.

1. Konstruktyviojo empirizmo (KE) aksiologinis, tai yra mokslo tikslus atspindintis teiginys, kad mokslas siekia empiriškai adekvačių teorijų, – tai tradicinių realizmo-antirealizmo kontroversijose dalyvaujančių mokslo filosofijos krypčių nebendramatė alternatyva, besiremianti epistemologiškai skeptišku požiūriu į mėginimus normatyviai filosofiniais metodais atskleisti mokslo, kaip episteminės veiklos, pagrindus.

1.1. Lyginamuoju požiūriu KE išeina už realizmo-antirealizmo ginčiuose plačiai priimtą skirties tarp semantinių, epistemologinių ir ontologinių filosofinių įsipareigojimų ribų: kitaip nei loginis empirizmas ir tradicinis instrumentalizmas, KE nėra į mokslo kalbos analizę orientuota filosofija; KE taip pat nėra griežtai epistemologinė pozicija, nes eksplicitiškai įsipareigoja tik nustatyti mokslo siekinius, bet ne pasakyti, ar tie siekiniai įgyvendinami; KE aiškiai vengia ir ontologinių įsipareigojimų.

1.2. KE yra normatyvinė mokslo filosofija tik silpna prasme – tiek, kiek empiristinė mokslo interpretacija, kuri formuluojama kaip deskripcija, implicitiškai numato rekomendaciją ta interpretacija remtis. Prieštaraujant Rosenui, KE nėra kvazikonceptcija – KE tiesiog remiasi epistemologinio skepticizmo nuostata, kad nors paties mokslinio pažinimo neįmanoma absoliučiai pagrįsti, bet dalyvauti filosofiniame dialoge apie tokį pažinimą įmanoma.

2. Aprašant šiuolaikinį gamtos mokslą pagrįsta remtis skirtimi tarp pragmatinio teo-

rijos priėmimo ir episteminio įsitikinimo teorijos teisingumu, nes dalis priežasčių, dėl kurių mokslininkai priima teorijas (pragmatinės teorijų vertybės – elegancija, paprastumas, bendrumas), nėra priežastys tomis teorijomis tikėti be stiprių metafizinių prielaidų. Tad mokslo filosofijos dialoge, net ir laikantis skeptinės pažiūros į bandymus mokslininkų episteminius įsitikinimus iš esmės pateisinti filosofijos metodais, mokslo veiklos fenomenai gali būti reikšmingai konceptualizuojami per skirtį tarp priėmimo ir įsitikinimo.

3. Empiriškai adekvačių teorijų siekiančio mokslo subjektu „episteminė bendruomenė“ laikytina tik „episteminės bendruomenės“ sąvoką vartojant nuosekliai epistemologiniam skepticizmui, – tai yra siekiant konstatuoti, kad esamu momentu mūsų mokslas kuriamas bendruomeniškai, – bet ne absoliučiai – siekiant nurodyti pirmuosius principus, pagal kuriuos vienos protingos būtybės privalo remtis kitų liudijimais, *contra* William Seager. Episteminę bendruomenę traktuojant tokiu būdu, mokslas vis tiek suprantamas kaip objektyvus (*contra* Bahrenberg et al.), nes pasaulyje esančių dalykų fizikinės sąveikos ir su atskiru pažįstančiuoju subjektu, ir su keliais tokiais subjektais yra tiek pat objektyvios, kiek ir bet kokios kitos fizikinės sąveikos tarp pasaulyje esančių daiktų.

4. Mokslas rekonstruojamas kaip racionali veikla, jo tikslus išreiškiant per skirtį tarp stebimųjų ir nestebimųjų esinių (SNS). Kritiniai prieš SNS nukreipti argumentai kelia SNS tokius reikalavimus, kokių skeptiškas, savo nusistatyto minimalaus ne-iracionalumo standarto besilaikantis KE jai netaiko.

4.1. Vadinamieji elektroninės akies argumentai, anot kurių, mokslas negali būti aprašomas remiantis SNS, nes SNS yra miglota ir priklausoma nuo įvairių kontekstinių veiksmių, nepagrįsti, nes tokios priklausomybės „stebimumo“ predikatui, norint aprašyti pažintinę mokslo veiklą, priskiriamos korektiškai. SNS nėra apibrėžiama arba pagrįdžiama iš pirmųjų filosofinių principų bei nėra ontologiškai reikšminga, bet ji laikytina reikšminga skeptiškos KE epistemologijos požiūriu.

4.2. Alano Musgrave'o prieš SNS nukreiptas KE nuoseklumo kritinis argumentas nepagrįstas: tai, kad mokslo teorijos sėkmę lemia manymas, kad ji empiriškai adekvati, nereiškia, kad mokslininkai, priimdami mokslo teoriją, turi remtis pagal jau priimtą (ir tą pačią) teoriją formuluojama SNS. Epistemologiškai skeptiškas KE neįsipareigoja ginti jokio konkretaus teorijos priėmimo, taigi ir įsitikinimų įgijimo būdo, bet abstrakčiai

konstatuoja, kokie mokslininkų įsitikinimai teorijos atžvilgiu lemia teorijos sėkmę. KE leidžia mokslininkams siekti įsitikinimo teorijos empiriniu adekvatumu dar nepriėmus tos teorijos, taigi neturint atitinkamų su ja susijusių įsitikinimų.

5. Teiginys, kad mokslas siekia empiriškai adekvačių teorijų, epistemologiniu požiūriu nuosaikesnis už realistines mokslo veiklos fenomenų interpretacijas, neatsižvelgiant į tai, kad stebimumą aprašantys teiginiai moksle yra modaliniai (*contra* James Ladyman). Skeptinis KE, SNS traktuodamas kaip mokslui endeminę skirtį, neįsipareigoja nei ontologine, nei epistemologine prasme reifikuoti galimų stebėjimo situacijų, kurios traktuotinos kaip pačių mokslininkų kuriami lingvistiniai artefaktai.

6. Interpretuojant faktinę mokslo praktiką, galimas mokslo praktikas šiame iš nomologiškai galimų pasaulių, ir galimą mokslo praktiką galimuose nuo mūsų pasaulio nomologiniu požiūriu besiskiriančiuose pasauliuose, mokslas siekia empiriškai adekvačių teorijų. Visais šiais lygmenimis, šioje disertacijoje pasirinktos tokių esamų ir galimų mokslo veiklos fenomenų imties ribose, KE lanksti skeptinė filosofinė mokslo interpretacija pagrįstai atsižvelgia į mokslo – iš esmės empirinės veiklos – fenomenus.

Mokslo darbai disertacijos tema

Bujokas, J. (2017). Constructive Empiricism Without the Epistemic Community. *Problemos* 91: 17–29.

Bujokas, J. ir Šaulauskas, M. P. (2014). Revizionistinis konstruktyviojo empirizmo normatyvumas. *Problemos*. Priedas: 48–61.

Bujokas, J. (2012). Redukcinis empirizmas: metodologija ar epistemologija. *Problemos*. Priedas: 78–88.

Pranešimai konferencijose

„Constructive Empiricism Without the Epistemic Community“ Nyderlandų mokslo filosofijos asociacijos organizuotoje konferencijoje *Philosophy of Science in the Forest 2016*, Utrechtas (2016.05.19–21).

„Observability in Constructive Empiricism: Defining the Indefinable“ jungtiniame VU ir UZH (Ciuricho universiteto) filosofijos doktorantų seminare *Concepts and Conceptual Analysis*, Vilnius (2014.10.16–17).

„Kas yra mokslas? Šiuolaikiniai realizmo ir empirizmo ginčai“ prof. R. Paviloniui atminti skirtoje konferencijoje, Vilnius (2014.05.16).

Išsilavinimas

2007–2011 m. Įgytas Filosofijos magistro laipsnis (*cum laude*) Vilniaus universitete.

2009–2011 m. Įgytas Teorinės fizikos ir astronomijos magistro laipsnis (*cum laude*) Vilniaus universitete.

2008–2009 m. 1-erių metų ERASMUS studijos Lundo universitete. Vykdytas Cheminės fizikos projektas (Cheminės fizikos departamente).

2003–2007 m. Įgytas Fizikos bakalauro laipsnis Vilniaus universitete.

Kita veikla

2012–2015 m. Dėstytojas valandininkas Filosofijos katedroje (Vilniaus universitetas).

Vesti Filosofijos įvado, D. Hume'o, Pozityvizmo filosofijos seminarai.

2015 m. Pranešimas mokslo populiarinimo renginyje „Filosofijos trupiniai“.

2014 m. Mokslo populiarinimo renginio „Filosofų labirintas“ organizavimas.

2013 m. Pranešimas mokslo populiarinimo renginyje „Tyrėjų naktis“.

2011–2012 m. Laisvai samdomas Studijų kokybės vertinimo centro ekspertas (studentų atstovas).