

## EXPERIMENTS WITHOUT CONCRETE. THE CASE OF ECONOMICS

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The article examines the question whether the economic discipline can be regarded as a kind of natural science it strives to be, taking into consideration the interpretation of an economic model as a kind of a thought experiment and closer connection between thought experiment and experimentation. The authors turn to epistemological analysis of thought experiments both in natural sciences and in economics and consider the historical background of this research tool and its relations with the experimentation practice. The study shows that the use of thought experiments in the economic theory and in natural sciences are fundamentally different. In natural science the thought experiment has never been detached from the material experimentation. On contrary, in economics it is used as an isolated procedure. However, isolated thought experiment is not a full-fledged research tool for studying the reality, as in that case it will affect some troubles with realism and practical efficiency of the research results. Rather, it constitutes the instrument for structuring or «mapping» the field of inquiry and can give results with social-constructive capacities.

**Keywords:** experiment, thought experiment, reality, economic model, economic theory, natural science, economics



## ЭКСПЕРИМЕНТЫ БЕЗ МАТЕРИИ: МОДЕЛИ В ТЕОРЕТИЧЕСКОЙ ЭКОНОМИКЕ

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В статье обсуждается вопрос о том, может ли экономическая теория как научная дисциплина претендовать на статус естественной науки, которой она стремится стать в эпистемологическом смысле. В частности, рассматривается интерпретация экономических моделей – основного исследовательского метода и результата экономической теории – как разновидности мысленного эксперимента с последующим отождествлением мысленного эксперимента и естественнонаучного эксперимента. Авторы подробно анализируют мысленный эксперимент как научный метод в естествознании и в экономической теории, уделяя особое внимание историческому контексту его появления в экспериментальной практике естествознания. Результаты



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этого анализа показывают, что использование мысленного эксперимента в экономической теории и в естествознании имеет фундаментальные различия. В естествознании мысленный эксперимент никогда не отрывался от материальной экспериментальной практики. Напротив, в экономической теории он используется как самодостаточный изолированный исследовательский метод. Однако изолированный от экспериментальной практики мысленный эксперимент не может быть надежным, полноценным инструментом исследования реальности. В этом случае неизбежно появляются проблемы с реалистичностью полученных результатов и возможностью их применения на практике. Мысленный эксперимент в экономике это лишь средство картографирования предметной области и исследовательский инструмент со значительными социально-конструктивными возможностями.

**Ключевые слова:** эксперимент, мысленный эксперимент, реальность, экономическая модель, экономическая теория, естествознание, экономика

Our experiments not only proved the *existence* of a nervous apparatus in the above-mentioned glands, but also *disclosed some facts* clearly showing the participation of these nerves in normal activity.

*Ivan Pavlov*<sup>1</sup>

We are *storytellers*, operating much of the time in *worlds of make believe*. We do not find that the *realm of imagination* and ideas is an alternative to, or retreat from, practical reality. On the contrary, it is *the only way* we have found to think seriously about reality.

*Robert Lucas*<sup>2</sup>

Modern philosophy of economics has been extensively discussing the state of mainstream economics of today and notably the status of economics theorists' production that is models. The focus of these discussions is the relationship between models and reality, and how does one bridge the gulf between model and reality (as a supposed target system). The solution of this problem has an effect on the assessment of the economics as a useful science, feasibility of its theories and the applicability of models' results to the policy-making.

The problems we are going to discuss here look to be not internal narrowly disciplinarian economics' question, but big epistemological problems. The first one raises the question of experimental basis of social sciences – whether they represent reality or, like it is supposed by constructivists, just preparing the prospect of changes and legitimating for one or

<sup>1</sup> [Pavlov, 1904]. Words in bold marked out by authors of the paper.

<sup>2</sup> [Lucas, 1988]. Words in bold marked out by authors of the paper.



another type of political order. And the other one takes a look at the thought experiment as a scientific method and at the relations between theoretical and experimental methods and means. One of the most discussing methods in this context is modeling due to models' ability to be both material and ideal and because they seem to be mediators, a bridge between knowledge (ideal models) and reality (material models).

As it is now generally recognized that modern economic science based on conventional economic and mathematical models failed to foresee the current financial and economic crisis (that is the real event) that has made the ground especially fertile to rethink the problem of relationship between models and reality and the discipline foundation. Thus, according to R. Solow modern macroeconomics has not only failed at solving present economic and financial problems, but is bound to fail being built on too simplistic equally *unrealistic* assumptions: one "faced with the thought that economic policy was being pursued on this basis, might reasonably wonder *what planet* he or she is on" [Solow, 2010, p. 2]. Assessing economics' realism another Nobel laureate P. Krugman noted: "there *was nothing* in the prevailing models suggesting the possibility of the kind of collapse that happened last year" [Krugman, 2009, p. 1]. Heterodox economists L.P. Syll declared a more radical, but methodologically pure position: "the recent economic crisis and the fact that orthodox economic theory has had *next to nothing* to contribute in understanding it, shows that neoclassical economics – in Lakatosian terms – is a degenerative research program in dire need of replacement" [Syll, 2010, p. 1].

Thus, one of the key theses in discussions on the status of the theoretical results in economics is to blame models' formalism as it prevails over substance and this might lead towards inadequate reflection of the real world or even ignoring it [Lawson, 1997; Koshovets and Frolov, 2013; Ananyin, 2005]. There are three main lines of defence of modelling and its realisticness against this criticism:

1) Problem is disowned or somehow denied. The models' realisticness is considered as a part of more general problem of modelling and scientific representation. An economist theoretician faces the nemesis of common sense picture of reality to be replaced with a scientific picture. Thus, in economic theorizing and modelling, economic reality and its constituents are inevitably theoretically modified (selected, isolated, idealized, abstracted, simplified, aggregated etc.) [Mäki, 2009]. Economists prescribe or imagine *a world in the model* and not make *a model to represent the world we live in* [Morgan, 2012]. In fact, such positions mean that procedure of modelling is seen as quite natural, not problematic. The representatives sufficiently resemble (or do not sufficiently resemble) what they represent, thus, the gap between the two could be ignored, for example, by treating the substitute systems as if they were real systems. In other words, the ontological difficulties are **disregarded as the issue of model correspon-**



dence to reality is taken simply as a problem of effective representation and limited by reasoning about its explanatory, instrumental and descriptive advantages for economists.

2) Instrumentalist approach notably advanced by M. Friedman, who claimed that **a useful economic theory should be judged only by its simplicity and fruitfulness** as an engine of predictions, no matter whether its presuppositions are realistic or not. M. Friedman rejects testing a theory by the realism of its assumption: “**truly important and significant hypotheses** will be found to have “assumptions” that are wildly inaccurate descriptive representations of reality, and, in general, the more significant the theory, the more unrealistic the assumptions in this sense” [Friedman, 1953, p. 14].

3) Consideration of models in the context of experimental practices, that means to interpret or even recognize a model as a kind of an experiment at least as thought experiment or counterfactual judgment [Lucas, 1980; Mäki, 1992; Mäki, 2005, Morgan, 2002; Morgan, 2005; Sugden, 2002].

Currently, the last line is the mostly demanded to defend modelling. Below we mostly consider latter two approaches – instrumentalism and “models are experiments” – with focus on the third one as the first and the second approaches generally ignore or avoid the problem of models’ realism, while the third one is trying to justify not only the actual theoretical practice of economics, but also the discipline ambitions to be a natural science, a kind of “real science”<sup>3</sup>.

We will focus primarily on the analysis of this problematic relationship of thought and real experiments and try to make clear the conditions in the presence of which the thought experiment is a full-fledged experimental practice and why it has *quite different epistemological status* in economic theory from that of the natural sciences. Firstly, we have to trace thought experiments background, how it appeared in the scientific practice and why we trust them despite of their non-experimental (non-empirical) nature.

## The roots of thought experiment as scientific method

Although the emergence of the notion “thought experiment”, apparently, refers to the beginning of the XIX century and is related to the works of the famous Danish physicist H. Oersted, we owe credit for the development of this concept within the context of scientific methodology to another renowned scientist E. Mach<sup>4</sup>. He was the first to describe thought experimentation as a full scientific method [Mach, 2003, p. 192–207].

<sup>3</sup> On roots and reason for such claim and ambitions see [Koshovets, 2010].

<sup>4</sup> About origins of the notion “thought experiment” and evolution of its conceptual content, see [Roux, 2011, p. 1–19].



E. Mach introduces the concept of the “thought experiment” in the course of reconstruction of Galileo’s method, which is a cornerstone of experimental natural sciences [Mach, 2000:105 et seq.; Lipkin, 2001, p. 17–31]. According to E. Mach, “aside from the physical experiment, there is another experiment making wide use at a *higher level of mental development* – a thought experiment or an experiment within the mind” [Mach, 2003, p. 195]. It is *based on previous experience*, – relies on accumulated data, including data that is not realized directly (the “experience” of the researcher) or is missed at the moment of an observation (the “memory” of the researcher). Working within the dimension of a thought, the researcher has the possibility of sparing efforts, because we always have our “notions” at our fingertips and the development of a mental model requires significantly less resources. Here, one may *arbitrarily* vary conditions of the experiment and analyze *possible* consequences and *inevitable* restrictions, achieving clear results (“guesses”).

Trapped in the advantages of a thought experiment, E. Mach from time to time gives a reason to believe this method is quite self-sufficient: “because it is not at all important whether the experiment is held in reality or not if its result is beyond doubt” [Mach, 2000, p. 33].

However, E. Mach (and natural sciences practice) means something vastly different. The thought experiment always rests on experience and, in this regard it is *not always quite “mental”*, occurring in the mind. For example, E. Mach excludes counterfactual judgments from the number of thought experiments on principle, because they always contain an *unrealistic premise*. Thus, the notion modeled by them importantly goes beyond *actual experience* and for this reason they are “useless for physics”. E. Mach repeatedly emphasizes a fundamental interdependence of a thought and physical (material) experiment. “A thought experiment is a necessary primary condition of a physical experiment” and it “encourages the physical experiment as its *natural continuation*, which must have *complementary, definitive meaning*” [Mach, 2003, p. 195–197].

In addition, E. Mach lines up with P. Duhem and asserts that the latter is right, “when he warns against the description of thought experiments as if they were physical experiments, i.e. *against postulates being passed off as facts*” [Mach, 2003, see comment 5].

Thus, as a matter of fact, a thought experiment is not regarded as an isolated, detached procedure in natural sciences: what is at issue is the synthetic method, within which the thought experiment as an independent type of work is *inseparably linked* to a material experiment and epistemologically depends on available experience (“facts”); the possibility of separation from it (i.e. use of unrealistic premises) *is not even considered*. The material experiment precedes the thought experiment, outlining the subject matter and tasks of research. The thought experiment synthesizes and generalizes available experience, forming a model, which is then checked by the material experiment, retaining a “definitive” value.



Thus, the thought experiment receives not only the name, but also the credibility to its own results thanks to inseparable connection with the material experiment, which is considered in the methodology of classical natural sciences as a non-removable component of research practice. This position was adhered to by founders of classical natural sciences, as well as by H. Oersted and E. Mach who were direct predecessors of modern stage of physics development and due to whom the notion regarding thought experiment theoretically shaped and entered into a spectrum of problems of the philosophy and methodology of science.

Tight historical and methodological connection of thought experiment with material experimentation turned out to be one of the main reasons of confusion that arose in the course of theoretical development of the concept of thought experiment and the evolution of ideas for its use and capacities. Originally, the idea of the thought experiment was built similarly to “routine”, physical experimentation, in close connection with the latter. However, subsequently, the thought experiment, terminologically separated by E. Mach, was gradually “detached” from natural sciences practice, a sole part of which it was for E. Mach – and “turned” into an independent procedure, claiming the role of a certain *equivalent* of classical (material) experimental practice.

Thus, a separate, though extremely important, *component* of a method turned into an *independent tool for research*, capable of providing an increment of knowledge by itself. At the same time, there is no a sufficient methodological explanation regarding for what reasons (except out of an *assumed* similarity to the natural sciences experimental practice) and how this method can provide an increment of knowledge about reality (which is typical for experimentation as a method of science).

Thus, by and large, we do not have a clear idea of the thought experiment as an independent scientific method (or as a group of methods) because it was, in fact, detached from its experimental “family history”, yet it was not given alternative epistemological rationale and, therefore, it still relies on our intuitive confidence to the word “experiment” and its meaning in natural sciences.

This problem is not completely unnoticed (see, for example, [Gooding, 1992; Bishop, 1999]). However, in a significant number of cases, the discussion on thought experiments is held in the complete absence of clarity of the notion, as if everyone is perfectly informed on what exactly is meant. “We set things up in the imagination, we let it run, we see what happens, and we draw a conclusion”, – this is the way one of the leading experts describes the scheme of thought experiment, emphasizing that everything goes the same way in a “real” experiment, “except that it’s done in the imagination rather than in the real world” [Brown, 2007, p. 155].

Indeed, the similarity is impressive – if one looks from a sufficiently great height, a giraffe and a hippopotamus can most certainly be seen as identical objects. In the same way, an abstract and inattentive glance makes



any distinction between a thought and a “real” (it is remarkable, that J. Brown uses precisely this epithet) experiment “nearly” imperceptible. Accordingly, it should not be surprising, when the only difference of a thought experiment from an arbitrary, logically consistent reasoning – its liaison with *experimental* that is material component, strictly connected it with the “real” world, – is easily falling through to this “near” indiscernibility.

Thus, what actually is the isolated thought experiment (i.e. used outside of connection with a material experiment) and what capacities can it possess as a method of economic science?

## Experiment and model – a cozy analogy

Let us have a look on the position taken by U. Mäki, who states that the theoretical model is a kind of an experiment. He argues: “I have called models based on theoretical isolation ‘thought experiments’ in analogy to ‘material experiments’. **This sounds like justified given the strong structural similarities between material experimentation and theoretical modelling**” [Mäki, 2005, p. 307].

Yet, if the similarity of the modelling and thought experiment, understood as a theoretical process with research goals, is quite obvious, the resemblance of thought and physical experiments is of very problematic nature, despite the presence of the word “experiment” in both terms and possible affinity from historical point of view.

It should be noted that in **methodology of economics** “**thought experiments**” and models as thought experiments can mean very different theoretical operations – counterfactual judgments, constructive hypotheses, game models, and so on. The only thing in common among these interpretations is a very general idea that we deal with some kind of intellectual procedure (usually in a discourse form), which holds on some strict rules and solve some research task<sup>5</sup>. Thus, the meaning of the term “thought experiment” appears to be extremely vague. However, since we are talking about a certain “experiment”, the relevant practice implicitly **rests on the authority of material (physical) experimentation** and is intuitively regarded as an analogue of the key method of natural sciences. It remains only to find a key element of their similarities or identify to any extent a model and experimentation.

For example, defending an analogy of a model (as a thought experiment) and an experimentation U. Mäki believes that in both cases it is about practice aimed at isolation and taking control over the subject of

<sup>5</sup> If we take a look at the current theory of “thought experiment”, we find out that there is serious trouble with basic definition: “Thought experiments are performed in the laboratory of the mind. Beyond that bit of metaphor it’s hard to say just what they are” [Brown, 1991, p. 1]. Compare with [Roux, 2011, p. 19].



inquiry. “The structure of experimentation, involving manipulation and isolation, is the same, while what is different is the way these controls and isolations are affected: by way of thinking and assuming and by way of material or causal manipulation” argues U. Mäki. Furthermore “given this difference, it is not surprising that theoretical models are capable of effecting isolations more stringently than material models” [Mäki, 2005, p. 306].

Similarly, R. Lucas offers theorists to imagine subjecting their models to some kind of “operational experiment” and checking them on “a variety of reactions” [Lucas, 1981, p. 8]. Certainly, since fully-fledged experiments in social sciences as a rule are unmanageable due to many reasons, economists have to substitute experimentation with something else. The best way to understand and explain something in the real economy is to build a model and make things happen in this “analogue-economy model” rather than designing things happening in a real economic system. R. Lucas contends that “one of the functions of theoretical economics is to provide fully articulated, artificial economic systems that can serve as laboratories in which policies... can be tested out...” [ibid., p. 696]. For instance, after having made a simulacrum-depression one hopes to find out what would happen in the model as a result of an economists’ manipulation that “would in fact happen” [Lucas, 1988, p. 4].

Thus, according to R. Lucas, models are the laboratories of economic theories and U. Mäki thinks that with “this statement, most scientists agree”. Developing this thesis, U. Mäki notes that “just as laboratory scientists design and examine the artificial worlds of experimental situations in their laboratories, economic theorists design and examine the artificial worlds of their theoretical models” [Mäki, 2005, p. 307]. As the physical experiment is based on the isolation of fragments of the world for the study of its certain properties by methods of causal control, the modeling introduces certain assumptions, by which the researcher can effectively control “an environment”.

M. Morgan holds a likewise but much more careful and reasonable approach. According to her, “experiments and models have much in common in the way they are used in economics. They share traits which enable both to operate as epistemic mediators: tools of investigation to help find out about either the world or theories” [Morgan, 2005, p. 318]. Yet experiments offer greater epistemic power than models as a means to investigate the economic world. “This outcome rests on the distinction that whereas experiments are versions of the real world captured within an artificial laboratory environment, models are artificial worlds built to represent the real world” [ibid., p. 317].

Such a high level of confidence and widespread approval for thought experiments regarded as nearly the same as experimentation in combination with uncertainty of the term itself, move us to make a detailed examination of this scientific procedure. Further, we shall focus primarily on the



analysis of problematic relationship of both experiments and try to make clear the conditions in the presence of which the thought experiment is a full-fledged experimental practice and why it has *quite different epistemological status* in economic theory from that of the natural sciences.

## **Between the concrete and thinkable – the case of economics**

In natural sciences, theoretical models, eventually, are found upon the experimental data – here, a strict methodological standard<sup>6</sup> is a presence of such liaison as “formalized theoretical construction (mathematical model) – physical model (interpretation) – measuring and preparation procedures system, which provides the model (“theory”) adaptation to the material conditions (“reality”)” [Lipkin, 2001, p. 46–54]. Therefore, within the complex of these sciences a conclusive means to exhibit, demonstrate the research object and to confirm its correlation to the object domain (subject matter) is an experiment that *demonstrates the reality* (existence) of various components of model /conceptions formed in theoretical layer of science (comp. with Pavlov’s epigraph quotation above). Without the experiment the correlation of the theoretical results to the object domain remains indefinite, and one cannot solve an issue of our ideas correspondence to something beyond these ideas. In other words, one cannot decide whether theoretical models are simply logically correct (and even, perhaps, pragmatically efficient) fantasy or something more than that (comp with Lucas’s epigraph quotation above).

In social sciences, including economic theory, a possibility to set up the experiment and to create material experimental models is rather limited and often it is missing at all. As far as the transition “thought experiment” – “material experiment” in social sciences is complicated, a possibility of solitary use of a thought experiment turned out to be extremely actual and alluring. However, if in natural sciences the thought experiment results are always compared to the experimental (material) procedure of the “reality” demonstration in the form of experimental data, in social sciences to make such procedure is extremely problematic.

Therefore, we conclude that economics thought experiments (models) themselves should not be regarded as representations but rather, as projects to be implemented. Indeed, one can rather use the economics model as

<sup>6</sup> This standard of classical natural science was significantly deformed in XX-XXI centuries through problematization of observer status and measuring procedures (starting from the Theory of relativity and quantum physics). However, in general, it keeps the meaning of methodological reference point, because to deny the requirement of obligatory presence of experimental layer (in K. Popper’s terms – potential falsifiers) means loss of connection with the object and, thereby, transformation of “natural” science into a “supernatural” one.



a normative construction for further politico-social transformation of the reality (this is an implicit message of R. Lucas), but it is hardly possible to rely on the demonstration of model's reality before its realization as politico-social regulation. Moreover, as a science about real world, economics cannot be reduced to achieving normative objectives as to get or even to prescribe "what ought to be", we should already have an idea of "what is".

Now let us compare the key features of material and thought experiments, which are presented in the following table [Koshovets, Varkhotov, 2014]:

Material experiment	Thought experiment
<p><b>Means of object demonstration (exhibiting)</b> through the standardized rated experience (i.e. strictly controlled and reproduced extraction from the reality the measurable invariants).</p>	<p><b>Means of object demonstration through an abstract-logical limitation</b> of the object domain; the experience is replaced by a <i>theoretically feasible</i> experience.</p>
<p><b>Always mediated by devices</b> which are delegated for retrieval and filtration of the data. Data are provided by a device in the form of simple and definite (usually numerical) representations.</p>	<p><b>Technological and practical component is missing</b>, empirical component is input as a logically feasible experience (everything goes if it is not logically prohibited); one accepts no matter how absurd, from practical point of view, messages; only those impossible that are prohibited in mind (usually, – the contradictory propositions). Through such freedom to the experience one gets a possibility for creative construction of theoretical models. The latter singles out the invariants that is unobserved directly, missing in the experience.</p>
<p><b>The observer is neutralized</b> as much as possible: ideally, the observer substitution should not influence on the result; this is achieved through an expansion of the functions delegated to the technical system (devices).</p>	<p><b>The construction one traces is unobserved, but logical, i.e. inherently intersubjective</b>; there is no experience here, therefore no problems which could arise from the difference of experience.</p>
<p>The experiment <b>provides stable and reproducible material results</b>, which can always be demonstrated in the external (regarding the observer) way (they are the objects of sense experience).</p>	<p>Thought experiment also <b>provides stable and reproducible results, yet the result presented is logically possible</b>, but not empirically actual or practically real.</p>



As can be seen from the table, a thought experiment, isolated from the material one, loses the key trait for the experimental research – it is unable **to demonstrate** the research object as a real one existing before and apart from the researcher’s mind (again comp. Pavlov’s and Lucas’ epigraph quotation). The object can be diversely elaborated from the viewpoint of how it is built in theory, but the issue of its *reality* within the frames of thought experiment (model) is **fundamentally insolvable** due to ontological *difference of “substances”* from which the material and the thought experiments (models) are “composed” (comp. with M. Morgan’s table in [Morgan, 2005, p. 321]). Besides, in the material experiments the model and the modeled objects are *substantially* linked while in economics a model and modeled objects are substantially different. So we can conclude similarly to M. Morgan’s statement that experiments are versions of the real world, thought experiments are artificial worlds built to represent the fragment of the real world or even imagine a world.

By thought experiment the researcher fixes the limits of capacities for the set premises – “What if?”, “What would happen assuming that...” However, the relevance of these assumptions to the reality cannot be assessed with the help of the thought experiment itself; it is necessary to set it by other procedures enabling to reveal the correlation to the object domain (subject matter) and descriptive validity of the model. Therefore, a thought experiment itself *cannot be an instrument to research the reality* – in the sciences about reality (including physics and economics) it must always be appositional to *epistemological procedures referencing* to the object domain that is to some technical, material practices [Koshovets, Varkhotov, 2015].

In the absence of such procedures, the freedom of a “thought experiment” author, in fact, is not limited by anything, except for the adopted logical postulations (rules of reasoning). The only thing one can expect in this situation is to obtain a locally effective knowledge of unknown degree of universality with lasting doubt of its representativeness and practical applicability.

Relying on our analysis, we consider the thought experiment as a *means of mapping an object domain (subject matter)*. No strong conclusions except for the organizational ones should be drawn from it: the map fixes a certain system of differences which is *supposedly* considerable for presentation of a place. Yet the map is not a sufficient basis to consider the place as existing, and the mapping method chosen as relevant. “The one who spent a long time looking at the map can mistake the map for a place”, – N. Taleb noted [2007]. This is what will happen if one is sequentially driven by the idea of economic reality research with the base on thought experiments (models) as independent procedures of knowledge increment.



## Conclusion

We have seen that thought experiments in the economic theory and in natural sciences are fundamentally different. Although the practice of a thought experiment, indeed, ascends to physics, in natural sciences thought experiments have never been detached from material experimentation and are not considered as a separate self-contained research procedure. It would appear that this close dependence of two type of experiments is significant and of considerable epistemological matter. *Experimentation ensures the correlation of the results of theoretical work to the object domain (subject matter) and therefore to reality.* Without this one cannot decide whether a theoretical model or a thought experiment is just a logically correct and perhaps even pragmatically effective fantasy or something different. Practically the question of any theoretical construction's realisticness can never be solvable within the scope of a thought experiment.

However, advocates of models conceived as a kind of thought experiment in economics ignore this close epistemological interrelation of a material experimentation and a thought experiment in natural sciences and put forward the hypothesis that there is no big difference between these two types of experiments. Both of them are based on isolation. The major difference between the two is that the controls effecting the required isolation are based on material manipulations in one case, and on assumptions in the other.

Yet, most theoretical assumptions including those of thought experiments and models are intuitive and therefore should be evaluated by some epistemological procedures which can identify their descriptive validity and correlation to the object domain. We argue that the *isolated* use of a thought experiment sets the capacities' limits for the given assumptions, and their trustworthiness or credibility cannot be assessed by means of a thought experiment.

Sciences about reality imply the availability of a method to demonstrate what they are about, and material experimentation plays a key role in this respect. By itself, a thought experiment (and a model) neither proves nor disproves anything as being or real; it only enables to structure the discipline object domain (field of inquiry) without drawing a distinction between the real and the fictional.

That is why theoretical models may be considered as experiment analogues only when realisticness of thought experiments producing these models is established by another, non-theoretical way. In all other cases, one has to consider thought experiment only as a mapping tool. The resulting map can be useful in various respects, but like any other map itself cannot be a reliable evidence for the existence of the terrain shown on it.

To conclude and for further consideration, we claim that economic models are artificial imaginable worlds with some particular capacities, which make them quite similar to maps. Thus, economic *models are*



“maps”. Indeed, a map combines elements of the normative and descriptive. Any map always includes schematization, abstraction, and ranking or ordering system of significant/insignificant (main/ minor features etc.) that is a system of requirements for the *interpretation* of a terrain. Maps, by definition, always purport to be a *representation* of a terrain real or fictional. However, more important that maps solve a task of an entirely different nature, which is not reducible to representation or system of prescription. Rather, *they describe the strategy of a person*, and that means they reflect not so much a world itself but *a way for its use by an agent*.

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