Thought Experiment as an Interdisciplinary Pedagogy

Sharon Kaye

Abstract
The thesis of this paper is that thought experiments provide an especially powerful way to frame a class discussion. They work for students for the same reason that they have worked for great geniuses (such as Einstein) through the ages—namely, because they are interdisciplinary. Competing rationalist and empiricist accounts of how thought experiments work suggest that they will engage both rationally- and empirically-minded students. Examples of student responses to thought experiments confirm that they bring out interestingly diverse ways of thinking. Concern that inter-disciplinary pedagogy makes genuine communication impossible has led some theorists to insist on a methodological pluralism that refuses to privilege any one approach. I argue however, that interdisciplinary instructors must ultimately ask students to incorporate their diverse perspectives into the discourse of the instructor's discipline in order to ensure that their work is judged in accordance with a time-tested criterion of excellence.

Introduction
I began one of my classes this semester with the following thought experiment:

> You came to this room expecting a lecture, but this is a sting. My name is Agent Dana Scully, I am with the FBI, and you are under arrest. Please hand over your wallets, your cell phones, and your belts.… What? You say you are innocent? Well, let me enumerate just a few of the laws you have broken lately: first, traffic violation, which you commit just about every time you drive; second, copyright violation—pirated movies, and music—did you know that Time Warner owns the rights to the Happy Birthday song?; third, substance abuse—need I say more?; fourth, tax fraud, … the list goes on and on…. Still not willing to turn yourself in? Let us take a vote. How many of you feel you are innocent? Why?

Sharon Kaye

The question this thought experiment produces, "Do you really think you have the right to live in a country whose laws you regularly disobey?" is the very question Socrates posed before drinking the hemlock with which his fellow citizens sentenced him to death (Plato, 2002a, 45-57). It launches an exploration of justice, a concept central to many courses in higher education, including philosophy, sociology, religious studies, English literature, to name a few.

Thought experiments are an especially powerful way to frame a class discussion. They work for students for the same reason that they have worked for great geniuses (such as Einstein) through the ages—namely, because they are interdisciplinary.

What is a thought experiment?
A thought experiment is an imaginary scenario explored for the purpose of acquiring knowledge. Since the beginning of Western civilization, thought experiments have been used with great success in almost every field, from science, to ethics, to history (Rescher, pp. 61–72, 2005).

The ancient Roman philosopher Lucretius provides a classic example: Imagine throwing a spear at the edge of the universe. Either it will keep on going or it will hit a boundary. If it keeps on going, then you are not at the edge after all. But if it hits a boundary, then you are not at the edge either because a boundary is a divider with something on the other side. Lucretius believed this thought experiment proved that there is no edge—the universe must be infinitely large (Bailey, 1950, pp. 58–59).

There have been many competing accounts of the nature of thought experiment throughout history (Weber, 2003, pp. 28–38; Perler, 2008, pp. 143–153. Brooks, 1994, pp. 71–83). More recently, Letitia Meynell argues that thought experiments are ultimately props for imagining fictional worlds (Meynell, 2014, pp. 4149–4168.). She identifies six distinctive features that are common among them. These features help us understand what a thought experiment is.

The first is imagery—whether in the form of a diagram or just a mental picture. Imagery serves to stimulate the imagination and to ensure that all parties to the conversation are focused on the same idea. Lucretius does not abstractly posit "a projectile," he posits a spear—a very common object in his day. In my classes, I use my best acting skills—to the point where students complain, "Stop! You're scaring me!" The more concretely one can encapsulate the questions at hand, the more successful the thought experiment.

The second is experiential language. Lucretius does not ask us to imagine someone else throwing a spear. He puts us right there in outer space, poised to find out firsthand what happens to the spear. By casting us as the agent, not just an observer, Lucretius engages the senses as well as the intellect. We feel the spear; we see it fly. Likewise, I want my students to feel the cold metal of the handcuffs on their wrists. Through make-believe, we are fully engaged, the better to illicit authentic intuitions about the situation.

The third is an epistemological analysis, showing how the thought experiment justifies (or fails to justify) its conclusion. Though it is difficult to explain how imaginary scenarios produce knowledge, it is clear that we gain insight by understanding how they relate to our beliefs. Lucretius imagined a universe that must either have an edge or must go on infinitely because he assumed that space is Euclidean or flat. Today, space is no longer regarded as Euclidean, but rather curved in a complex way. Hence the thought experiment no longer regarded as providing insight into the way the world actually is. But this was only discovered by unearthing the beliefs underlying the scenario. Needless to say, there are competing accounts of how the beliefs involved in thought experimenting become knowledge (Clatterbuck, 2013, pp. 309–329).

Fourth is the irreducibly imaginative character of most thought experiments. While it might be possible to restate Lucretius's case in purely propositional form, the same is not true of the FBI thought experiment from my classroom. This scenario is not so much trying to prove that you are not innocent, but rather that your assumption of innocence is problematic. In a similar vein, Lucretius's thought experiment was, and still is, successful in so far as it proves that your assumption that the universe is finite is problematic. By serving up the problem rather than stating a conclusion, a thought experiment opens up conceptual space. This "laboratory of the mind" is characteristic of novels, plays, and other forms of fiction (Elgin, 1993, pp. 13–28; 2007, pp. 43-54; and 2014, 221–241).

Fifth, thought experiments tend to admit of different interpretations and to provoke opposition. For example, Aristotle objected to Lucretius's conclusion on the grounds that the world could not rotate uniformly if it were infinite in size. His geometrical proof of this claim is highly abstract and hence never became as famous as its rival. A more modern objection along the same lines might be: How can the universe be infinite if it is expanding? At any rate, thought experiments are designed to provoke thoughts—to raise more questions than they answer.

Finally, and most significantly, thought experiments are objective even though they are not real. When people discuss a thought experiment, it is

crucial that they agree to the "ground rules" of their make-believe world. If they imagine whatever they please and don't fully reveal to one another what they are imagining, then they make no progress on the question at hand. As though playing a video-game together, they must construct a virtual reality of fictional truths. Disagreements often arise from different rules, and insights are often gained by bringing to light hidden or unspoken rules. Rather than being private and subjective, thought experiments specify distinctive cognitive content. In this way they have "being in their non-being" (Meinong, 1907, 273–283).

How do thought experiments work?

Thought experiments are puzzling because we do not ordinarily think of imagination as a tool for knowledge acquisition. On the contrary, imagination, a fantasy about that which is not real, is commonly considered the opposite of fact, that which is real. How can a fantasy produce reliable information about reality?

Two competing answers to this question have emerged in the last ten years. We should consider them each in turn.

James R. Brown proposes that finely tuned imagination is actually a powerful form of mental perception. We all agree that physical perception—sight, hearing, smelling, touching, and tasting—is a way of gathering data about the physical world. Likewise, mental perception gathers data about truths that transcend the physical world (Brown, 2004).

Brown characterizes his view as "Platonic" with reference to the ancient Greek philosopher Plato. One of Plato's lifelong concerns was to identify a reliable source of truth. Rejecting physical perception as unreliable, he turned to mathematics as an ideal model. When we contemplate the equation $a2+b2=c2$ we "see" the truth with the mind's "eye." This seems to imply that there is another world, beyond the physical world, for us to discover. Plato called it the world of Forms (Plato, 2002b, pp. 91–3). He believed that human beings must have had access to this world before we were born since perceiving it feels like remembering.

For Brown, thought experimenting can provide a highly effective form of mental perception. When Lucretius imagined himself throwing a spear at the edge of the universe, he discovered something true that he could never perceive physically. This suggests that mental perception is not limited to math but can be extended to any area of inquiry (Brown, 2010, pp. 1–15). Brown's account is called "rationalist" because it holds that human beings can acquire knowledge through pure reason, without depending on physical perception.

John D. Norton presents the opposing empiricist account of how thought experiments work. In Norton's view, Plato's world of Forms does not exist. All knowledge comes either directly or indirectly from physical perception. Even mathematical equations such as $a2+b2=c2$ have an empirical source: they are abstracted from our observations of physical objects. Likewise, when Lucretius imagined throwing a spear at the edge of the universe, he extrapolated from his real life experience (Norton, 2004b, pp. 44–66).

Norton maintains that every thought experiment is really an argument in disguise (Norton, 2004a, pp. 1139–1151). Lucretius's thought experiment, for example, may be reconstructed as follows:

1. If the universe is finite, then it is surrounded by a final boundary.
2. But no boundary can be final because there always has to be something on the other side.
3. Therefore, the universe must be infinite.

We can picture Lucretius using his thought experiment to convince his opponents of his conclusion.

Norton contends, against Brown, that there is no reason to suppose Lucretius's thought experiment helped him to discover his conclusion. Surely the discovery came through reflection on ordinary empirical observation of various kinds of physical boundaries. The human mind is able to collect data from repeated experience and then construct abstract representations of things it is unable to experience. For example, we construct the idea of a perfect triangle by abstracting imperfections from the various physical triangles we encounter every day. Like Plato's illustrious student Aristotle, Norton insists that there is no justification for supposing that human beings can remember a transcendent world in which such truths exist. The mind is born a blank slate (Aristotle, 1986, 3.4.430a1).

Brown and Norton occupy opposite ends of the spectrum in explaining how thought experiments work. For Brown, thought experiments focus the mental perception that enables humans to discover transcendent truths. For Norton, they provide convincing illustrations for arguments rooted in empirical observation. I maintain, however, that these rival theories are not mutually exclusive from a pedagogical point of view.

The first clue to the underlying value of thought experiment comes from noticing that they very often don't produce true conclusions at all. Lucretius's spear, for example, doesn't actually prove that the universe is infinite at all.

This thought experiment fails because the thought experimenter has overlooked the fact that it is actually possible for a surface to both be finite and have no edge; the surface of a sphere is an example. The thought experimenter mistakenly saw a contradiction when there is none (Cooper 343).

Newton's thought experiments overturned those of his ancient predecessors; Einstein's overturned Newton's, and recent thought experiments in quantum mechanics overturned Einstein's. Science continues to progress as do all other fields of inquiry. We have not settled upon the final answer.

And yet, each moment of overturning is flash of brilliant insight. If we do not learn the final answers in those moments, exactly what do we learn?

In those moments we learn about how we think. We see the power of a particular line of logic. We see the workings of the human mind at its best. While this thinking about thinking plays out with searing intensity at the professional level, it can be profitably modeled among amateurs in the classroom. As Elke Brendel writes,

the long and sometimes fruitless debate in epistemology between internalist and externalist approaches to knowledge could indicate that there is not just one single concept of knowledge but at least two different concepts, each of which reflects different features of knowledge…. With the help of thought experiments these divergent, but legitimate concepts of knowledge can be clarified (2004, p. 104).

In a similar vein, Jeremy Goodenough documents how a single thought experiment described in two different ways can lead the same people to opposite conclusions. He concludes that their value lies in the shedding light on the ways in which we think and feel (2011, p. 12). Intellectuals benefit from understanding the workings of intellect as much as the mechanic benefits from understanding the workings of the machine.

Since no one knows for sure whether or not a transcendent realm of truths exists, we cannot determine once and for all whether Plato or Aristotle was correct. One thing of which we can be quite certain, however, is that some students are rationalists and others are empiricists. In a classic article, Felder and Silverman synthesize findings from a number of studies to identify contrasting learning styles (Felder, R.M. and L.K. Silverman, 1988, pp. 674–681). They define a student's learning style by the answers to four questions:

- What type of information does the student prefer: sensory (sights, sounds, and physical sensations), or intuitive (memories, ideas, and insights)?
- How is information received: visual (pictures, diagrams, graphs, and demonstrations), or verbal (sounds, written and spoken words, and formulas)?
- How do they process information: actively (through engagement in physical activity or discussion) or reflectively (through introspection)?
- How does the student progress toward understanding: sequentially (in a logical progression of small incremental steps), or globally (in large jumps, absorbing material randomly)? (Wirz, 2004, p. 2)

The dimensions of this model are a matter of degree and a student's preference for the different styles may change with time or from one subject to another. Yet the data clearly suggests that some students learn best "intuitively" from formulas and principles while others learn best "sensorily" from hands-on experiences or concrete examples. These are the rationalist and empiricist, respectively.

Regardless of whether or not Brown is correct to posit a transcendent world, he is certainly correct to suggest that thought experiments focus mental perception in a productive way for those who are rationalistically inclined. Likewise, Norton is correct to suggest that, for those who are empirically inclined, thought experiments can illustrate an argument in a uniquely compelling way. We can set aside the ancient metaphysical debate over transcendent truth while agreeing that rationalist and empiricist approaches to learning are equally important. The fundamental value of thought experimenting is to reveal these divergent approaches at work.

The interdisciplinary nature of thought experiments
Interdisciplinary is the combination of academic disciplines or schools of thought to produce new perspectives and solutions (Augsburg, 2005). In addition to combining philosophy, history, literature, drama, science, and theology at a surface level, at a deeper level, thought experimenting combines rationalist and empiricist schools of thought. In this way it reminds us why all our disciplines are called "arts and sciences" in the first place: the place where intuition and observation meet.

As we've seen, Lucretius provides us with a simple scientific thought experiment. Its interdisciplinarity stems primarily from its invitation to both rationalist and empiricist analysis. Judith Jarvis Thomson provides a famous

example of a much more complicated ethics thought experiment that is interdisciplinary on another level (1971, pp. 47–8).

You wake up in the hospital to find a famous violinist dependent on you for life support. He is attached to you through various tubes and will need you to remain in bed next to him for nine months. Exactly how and why this happened can be elaborated in a number of different ways. For our purposes, suffice it to say that when I present it to the students I tell them that at the end of the class period we are going to take a vote: will you sacrifice a significant portion of your life to save this stranger or will you pull the plug?

The student reactions are interesting. Here is a sampling:

"I'm going to sue the paramedic who did this to me without my permission!"
"But if you pull the plug, you kill him. Killing an innocent person is murder, which violates the sixth commandment."
"Killing isn't the same as letting him die. I have the right to my body; he doesn't have a right to it."

In these three reactions, we see a legalistic thinker, a theological thinker, and a political thinker hashing it out. Thomson used the thought experiment as a model for thinking about abortion. This adds a literary dimension: does the violinist scenario provide an apt comparison to an unwanted pregnancy? Students have a lot to say about that too. Their writing assignment for this week will be to take a position on the question of whether or not abortion is ever morally permissible. The students always express a wide variety of views on this issue because they know, by observing the neutral role I adopt in facilitating the thought experiment, that I will not judge them according to what position they take, but rather according to how well they argue for it.

Back in my lecturing days I always had trouble explaining to my students how the theory of evolution challenges the argument from design, according to which, as Thomas Aquinas famously argues, God must exist because only he could have created such an extraordinarily complex system of nature (1996–1997, Part 1, Article 3, Question 2). Now I get the point across with the help of a thought experiment.

I tell the students that the CDC has learned that they and everyone in their generation is barren. The human race will soon be extinct. However, we have discovered that the apelike species from which we evolved is still alive in Africa. If we put some members of this species into an "evolution accelerator" we can evolve a new race of humans before our race dies out. Again, they are required to vote: should we do it?

A sample of common student reactions:

> "How could humans create other humans from animals? They would lack the divine spark that makes us different from the animals."
> "How could evolution be accomplished in such a short time? It would take millions of years and the random mutations might lead to some creature other than human."
> "How would the new race interact with our old race? Would we intermix or keep them separate and would we tell them that we made them?"

In these reactions, a theological thinker, a scientific thinker and a sociological thinker pushes the limits of their understanding. Their writing assignment for the week will not directly concern this thought experiment. It will ask them to take a position on whether or not evolution defeats the design argument for the existence of God. In my experience, not only do the students have more fun in class, imagining and laughing about strange possibilities, they also produce higher quality papers.

Finally I will mention one of my favorite class thought experiments: what if you alone exist and all of reality is, as René Descartes suggested, an illusion imposed on you by an evil genius? (1993, bk. I) This is a deep, purely philosophical meditation. And yet it is perennially popular. It takes a while to explain to the students why, under these circumstances, they cannot know whether the world exists, or whether they have a body, or whether any of their memories are true. Once they understand the dire nature of their situation, however, they spontaneously recreate Descartes' moment of eureka, each in their own way. At the hands of this evil genius, I ask them, what can you be certain of?

> "That I exist."
> "That I am perceiving something."
> "That I am thinking."

Here we have a barebones confrontation between an ontological thinker, an empiricist, and a rationalist. They are each right within their own systems.

When teaching through thought experiments, the instructor is forced to refrain from imposing a hidden agenda on the discussion. By exploring a problematic scenario and then being required to vote on its resolution, students discover how they think in contrast to how others think; they have to decide for themselves the best way to the truth. Hence this pedagogy is a

propaedeutic to professor proselytizing in the university. As Oskar Gruenwald, editor of the Journal of Interdisciplinary Studies, argues, "the university needs to re-dedicate itself to the search for truth about ourselves and the world without cant and politically correct ideologies" (2011, p. 16). Thought experimenting is a specific proposal for how to accomplish this in the classroom.

The challenge of interdisciplinary pedagogy
So far I have argued that thought experiments promote interdisciplinary classroom discussions and that these are valuable in university education because they fostering each student's individual approach to the search for truth.

Nevertheless, interdisciplinary pedagogy is challenging due to its complexity. As Harvard education researcher Zachary Stein et al. argue,

> Interdisciplinary syntheses are among the most epistemologically complex endeavours that humans can attempt. This complexity arises primarily from the deep differences of perspective that must be bridged in order to carry out interdisciplinary projects. That is, different methods and disciplines frame different perspectives and thus generate different kinds of knowledge (2008, p. 402).

Stein et al. report the results of an experiment aimed at gaging the value of interdisciplinary discussions among professionals. In one such experiment, an accomplished mathematician and an accomplished neuroscientist were asked to discuss problems at the intersection of their fields. Analysing the transcriptions, Stein et al. write,

> These conversations were attempts to advance knowledge by bringing together and synthesising diverse and sophisticated perspectives on issues of great importance (from mathematics to morality and from physics to politics). But instead of reading like constructive dialogues, these conversations often read like a set of juxtaposed monologues. In both cases the two experts find it difficult to avoid privileging the methodological perspectives they hold dear. And all too often the result is disciplinary ships passing in the epistemological night. (2008, p. 405)

Stein et al. conclude that the experiments demonstrate that interdisciplinary studies are prone to two problems that stem from differences between levels

of analysis and differences between basic viewpoints. Let us look at each in turn in connection with a course in the bioethics of learning disabilities.

The levels of analysis problem arises when discussants are using different explanatory frameworks. One discussant may be interested in understanding how various pathologies are diagnosed and treated, while another is interested in understanding how they are accommodated within the school system. Although each discussant uses the term "ADHD" accurately, one has a biological understanding of it; the other, institutional.

The basic viewpoints problem arises when discussants start with incompatible assumptions about the world. One discussant may believe that the term "ADHD" names a genuinely debilitating physiological disorder while another believes it to be a largely imagined psychosomatic condition. Although the discussants may agree that school systems need to offer accommodations for students with ADHD, they may strongly disagree about their extent.

Stein et al. call for a commitment to methodological pluralism as a means of addressing both of these problems. By methodological pluralism they seem to imply that instructors of interdisciplinary courses should avoid privileging any one methodology over another. They should explicitly respect and call attention to the different levels of analysis and different basic viewpoints without attempting to reduce them to a single approach.

In my view, the problem with this proposal is that a professor trained in one field is really in no position to instruct students in areas outside of that area of specialization. How is a historian to evaluate the kind of knowledge generated by a budding psychologist? Will she be able to distinguish good psychological methodology from bad? If not, then methodological pluralism just opens the door to anything goes—a "free-for-all" gab session with no educational value whatsoever.

While I fully endorse Stein et al.'s insistence on respecting and calling attention to differences, I think there is a sense in which different approaches must be reduced or at least subordinated to a single approach within a course. Although my class discussions are interdisciplinary, my class is still a philosophy class. This means that the papers the students write for their final grades are philosophy papers. I am trained in philosophy. I am not competent to judge a literature paper or a psychology paper. Hence the literary and psychological thinkers in my class will have to learn how to incorporate their insights into philosophical discourse. I would expect the same subordination to occur in any interdisciplinary course. The very term "interdisciplinary," after all, presupposes the underlying presence of the disciplines. The disciplines demarcate powerful methodologies that establish criteria of

excellence. Although these methodologies change and grow slowly over time, it is still up to instructors who have mastered these methodologies to pass them on to the next generation.

Hence it seems that, as Jennifer Jesse, co-editor of the American Journal of Theology and Philosophy, argues, one cannot be interdisciplinary without being self-consciously so (2011, p. 72). In fact, being interdisciplinary largely amounts to introducing a metanarrative into class discussions that constantly highlights the plurality of our thinking with the aim of ultimately unifying us in the age-old quest for truth.

Conclusion

We may agree that lecturing creates a perniciously passive classroom, but how to create a lively and meaningful discussion? Playing the usual "I ask and you answer" game creates a predictable and inauthentic exchange. Thought experiment, in contrast, is spontaneous, mutually insightful for teacher and student, and fun. Thought experiment is the sine qua non of philosophy; catalogues of famous and not so famous ones can readily be found (Schick, 2013; Tittle, 2004). But remember: philosophy is the mother of all the disciplines. To this extent philosophy is a welcome complement to any university course, from history (De Mey, 2003), to economics (Stringham, 2008), to math (Clegg, 2003, pp. 239–242).

University education should aim to produce philosophical historians, philosophical economists, and philosophical mathematicians. What is the distinguishing mark of the philosopher? According to Edouard Machery, Sorbonne educated Resident Fellow of the Center for Philosophy of Science at the University of Pittsburgh,

> philosophers are less likely to blindly accept their intuitions and more likely to submit those intuitions to scrutiny. Philosophers ponder; they question what spontaneously seems to be the case; they readily take a skeptical eye toward how things seem to them (2011, p. 211).

By thought experimenting about what is possible, philosophers learn to question what is allegedly actual. By reflecting on their own and others' thought processes, they learn to trust the process of inquiry rather than authority.

How can we ensure that the university will continue to be a source of knowledge and inspiration for the next generation and into the future? Oskar Gruenwald argues, "Philosophy can help here in suggesting not only the obvious distinctions concerning appropriate methodologies in the natural

sciences, social sciences, and humanities, but also concerning the need for more global, interdisciplinary approaches for greater understanding" (1999, p. 163). As the number of disciplines continues to multiply and the interconnections among them become increasingly complicated, the university must stay rooted in its philosophical past and thought experiment is a promising way to accomplish this.

References

Aristotle, De Anima (On the Soul). (1986). Hugh Lawson-Tancred, (tr.), New York, NY: Penguin Classics.

Augsburg, T. (2005). Becoming interdisciplinary: An introduction to interdisciplinary studies. Dubuque, IA: Kendall/Hunt.

Bailey, Cyril. (1950). Lucretius on the Nature of Things, (translation of De Rerum Naturae), ninth reprint, Oxford, UK: Clarendon Press.

Brendel, Elke. (2004). Intuition Pumps and the Proper Use of Thought Experiments. Dialectica 58(1), 89–108.

Brooks, David H. M. (1994). The Method of Thought Experiment. Metaphilosophy, 25: 71–83.

Brown, James R. (2004). Why Thought Experiments Do Transcend Empiricism. in C. Hitchcock (ed.), Contemporary Debates in the Philosophy of Science, Malden, MA: Blackwell, 23–43.

—–, 2010, Laboratory of the Mind: Thought Experiments in the Natural Sciences, [2nd edition], London, UK: Routledge Second Edition.

Clatterbuck, Hayley. (2013). The epistemology of thought experiments: A non-eliminativist, non-platonic account. European Journal for Philosophy of Science, 3: 309–329.

Clegg, Brian. (2003). Infinity: The Quest to Think the Unthinkable, London, U.K.:Constable & Robinson Ltd.

Cooper, Rachel. (2005). Thought Experiments. Metaphilosophy, 36(3), 328–347.

De Mey, Tim and Erik Weber. (2003). Explanations and Thought Experiment in History. History and Theory 42(1), 28–38.

Descartes, René. (1993). Meditations on First Philosophy, Stanley Tweyman (ed.), London, U.K.: Routledge.

Elgin, Catherine Z. (1993). Understanding: Art and Science. Synthese, 95: 13–28.

—– (2007). The Laboratory of the Mind. in J. Gibson (ed.), A Sense of the World: Essays on Fiction, Narrative and Knowledge, Oxon: Routledge-Taylor Francis, 43–54.

––– (2014). Fiction as Thought Experiment. Perspectives on Science, 22: 221–241.

––– (2007). Philosophical Thought Experiments, Intuitions, and Cognitive Equilibrium. Midwest Studies in Philosophy of Science, 31: 68–89.

Felder, R.M. and L.K. Silverman. (1988). Learning and Teaching Styles in Engineering Education. Engr. Education, 78(7), 674–681.

Goodenough, Jeremy. (2011). The Trouble with Thought Experiments. Theoretical and Applied Ethics, 1(2), 7–12.

Gruenwald, Oskar. (1999). Philosophy as Creative Discovery: Science, Ethics, and Faith. Journal of Interdisciplinary Studies XI: 157–174.

––– (2011). The University as Quest for Truth. Journal of Interdisciplinary Studies XXIII: 1–18.

Horowitz, Tamara, and Massey, Gerald (eds.) (1991). Thought Experiments in Science and Philosophy, Lanham: Rowman & Littlefield.

Jesse, Jennifer G. (2011). Reflections on the Benefits and Risks of Interdisciplinary Study in Theology, Philosophy, and Literature. American Journal of Theology and Philosophy, 32(1), 62–73.

Machery, Edouard. (2011). Thought Experiments and Philosophical Knowledge. Metaphilosophy 42(3), 192–214.

Meinong, Alexius. (1907). Das Gedankenexperiment. in Über die Stellung der Gegenstandstheorie im System der Wissenschaften (reprinted in the fifth volume of the collected works of Meinong, edited by Rudolf Haller and Rudolf Kindinger, Graz-Austria: Akademische Druck und Verlagsanstalt, 1973, 273–283 [67–77]).

Meynell, Letitia. (2014). Imagination and insight: a new acount of the content of thought experiments. Synthese 191:4149–4168.

Norton, John D. (2004a). On Thought Experiments: Is There More to the Argument? Proceedings of the 2002 Biennial Meeting of the Philosophy of Science Association, Philosophy of Science, 71: 1139–1151.

––– (2004b). Why Thought Experiments Do Not Transcend Empiricism. In C. Hitchcock (ed.), Contemporary Debates in the Philosophy of Science, Oxford, UK: Blackwell, 44–66.

Perler, Dominik. (2008). Thought Experiments: The Methodological Function of Angels in Late Medieval Epistemology. in Isabel Iribarren and Markus Lenz (eds.), Angels in Medieval Philosophical Inquiry, Aldershot: Ashgate, 143–153.

Plato. (2002a). Crito. in G.M.A. Grube (tr.), Five Dialogues, Indianapolis, Indiana: Hackett, 45–57.

––– (2002b). Meno. in G.M.A. Grube (tr.), Five Dialogues, Indianapolis, Indiana: Hackett, 58–93.

Rescher, Nicholas. (2005). What If?: Thought Experimentation in Philosophy, New Brunswick, NJ: Transaction Publishers.

Schick, Theodore and Lewis Vaughn, (eds.) (2013). Doing Philosophy: An Introduction Through Thought Experiments [5th edition], Boston, MA: McGraw Hill Higher Education.

Stein, Zachary, Michael Connell, and Howard Gardner. (2008). Exercising Quality Control in Interdisciplinary Education: Toward an Epistemologically Responsible Approach. Journal of Philosophy of Education, 42(3–4), 401–414.

Stringham, Edward P. and Nicholas A. Snow. (2008). The broken trailer fallacy: Seeing the unseen effects of government policies in post-Katrina New Orleans. International Journal of Social Economics 35(7): 480–9.

Thomas Aquinas, Summa Theologica. (1996–1997). Fathers of the English Dominican Province (trs.), New Advent Inc.

Thomson, Judith Jarvis. (1971). A Defense of Abortion. Philosophy & Public Affairs, 1(1), 47–66.

Tittle, Peg. (2004). What if….Collected Thought Experiments in Philosophy, Upper Saddle River, NJ: Pearson.

Weber, Erik and Tim DeMey. (2003). Explanation and Thought Experiments in History. History and Theory, 42: 28–38.

Wirz, Dick. (2004). Students' Learning Styles vs. Professors' Teaching Styles. Inquiry, 9(1), pp. 1–5.

Sharon Kaye
John Carroll University
skaye@jcu.edu