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Benjamin Goldberg

*University of South Florida*, [metabenny@gmail.com](mailto:metabenny@gmail.com)

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## The Problem of Obviousness

Benjamin Goldberg

### 1. The Problem of Obviousness

There's no such thing as obviousness.

This isn't, of course, itself obvious; nor is it clear why it should be a *problem*. So let me start elsewhere, with the anti-vaccine movement. A friend of mine laid out the 'obvious' position: there are facts and rationality on one side, unenlightened ignorance and bigotry on the other. Scientists versus fools, and the fools don't even know what game is being played.

I get it. Vaccination is important, and the anti-vax crowd has had real and devastating effects. It's certainly easy to accuse them of being fools, fools who deny things that are plainly true in favor of the obviously false. Rhetorically, this is powerful: it's an accusation that our opponents here—the fools—suffer from some sort of epistemic impairment, an accusation that they cannot recognize truths that should be obvious. If our opponents are so afflicted, we can dismiss them from our conversations, can exile them from our communities. They are beyond the space of reasons, immune to facts. We can ignore them because, as my father used to say, you just can't argue with a sick mind. They are fools, and they are doomed (perhaps us with them).

But I think this is a mistaken attitude, not because the anti-vaccine folks are reasonable or correct or even honest—but rather because of the perspective gained through the study of the history and philosophy of science. The problem of obviousness presents a number of subtle issues of epistemology that have not yet been absorbed by philosophers more generally, let alone by the public at large. Here I hope to show how the rhetoric in these sorts of debates about science and culture is based upon a faulty premise: that of obviousness. When we assume that something is obvious, or should be obvious once we've explained it, we make this error, an error of assuming that we share a set of background beliefs that could *make* some fact or theory reasonable or obvious. Obviousness is never obviousness *tout court*; there is only ever obviousness in context. Making a claim about how something is obvious is (often if not always) a way of rhetorically bullying your opponent.

The problem of obviousness, indeed the concept of the obvious itself, is not one often directly addressed in academic philosophy, nor have I seen it discussed in any real detail or breadth outside of academia.<sup>1</sup> However, while obviousness has not been directly addressed, philosophers of science have, I believe, provided the intellectual resources needed to understand this phenomenon, and in what follows I shall make use of some of the resources of philosophy of science, in particular interpretations of the problem of underdetermination.

Though the problem of obviousness is not well acknowledged, it plagues many deeply important discussions about science (among other things): not just vaccines, but evolution and creationism, global warming, genetically modified foods, and so forth. What I hope to do in this essay is to describe and diagnose this problem, to argue that it is a real and important phenomenon. I do so in an abstract way, as I'm not interested in the specifics of any of these particular debates, but rather in how obviousness, as a general historical and epistemological issue, can be seen as contributing to the intractability of these debates. The goal of this essay, then, is to expand upon this rather subtle point of history and epistemology in order to make a clear case against obviousness, to explain how I think it works, and to make room for the idea of epistemic history in accounting for how different groups might understand and evaluate claims in light of those histories. Using a wide variety of novel examples not often noted in these discussions, I hope to demonstrate that the problem of obviousness exists and that it could potentially affect any and every domain of human knowledge, from animal ethnology to writing systems. In other words, I hope to challenge the rhetoric of obviousness.

## 2. Undermining Obviousness

So let us come to the main concern of *obviousness*: it's *obvious* that vaccines work; that they don't cause autism; it's *obvious* that creationism is false; it's *obvious* that the world is undergoing climate change. Obviousness seems...well, *obvious*. Some things are just simply and immediately available to us, present and apparent. If you don't see or understand something, the problem must be with you, your education, and, probably, your terrible upbringing—a definite case, we surmise, of epistemic abuse.

In my own, recondite, corner of academia, I have often witnessed a claim of obviousness wielded, rapier-like, to skewer argumentative opponents. This version of the mistake of obviousness is slightly different than my main concern, and is expressed in terms of the *intuitiveness* of certain propositions, claims that the burgeoning

empirical field of experimental philosophy has, to my mind, convincingly demonstrated to be largely what the Irish call *blarney*.<sup>ii</sup> For instance, research by Edouard Machery and others has indicated that intuitions about reference vary cross-culturally, and that what (say) North American philosophers find obvious about certain semantic situations depends on enculturation and language.<sup>iii</sup> Other research, initiated by Joshua Knobe, has shown that there are asymmetries in our attributions of intentionality, and that in these situations non-moral evaluation seems to depend upon moral evaluation, known now as the Knobe effect.<sup>iv</sup> So, it seems, what smart folks think is obvious or intuitive is a terrible guide to the truth, and that, despite what many academics seem to think, cleverness is not at all an epistemological oracle. We've all been led desperately astray by the myth of Newton's apple: intuition and insight are important, but true knowledge never springs into the world fully formed, as Athena did from Zeus' head. No: knowing requires doing, it requires hard work, empirical and experimental research.

If the experimental philosophers are right, then intuitions, and with them claims to obviousness, are to be viewed with suspicion. That is, a claim that X is intuitive provides no evidence that X is true! And while the experimental philosophers have gotten there through the methods of experimental psychology, there is another, also empirical mode by which we can make our claims against obviousness: history. And thus we come to a most interesting set of examples and observations on just this subject in a delightful blog about the history of scientific books and papers (and other sundry items), *J.F. Ptak Science Books*. John Ptak notes that,

... 'the obvious' isn't until it is. For example, Etienne Durand was the first architect to include examples of plans of different buildings on the same scale side-by-side, and that wasn't until the mid-19th century—clearly this would be *pro forma* for just about describing two elements of anything, but it just simply wasn't done until 160 years ago or so. This also applies in a way (though there are more complexities involved as to why this is different) to the antisepsis practices of Joseph Lister who in simply washing surgical tools between use on different patients (and hand-washing and the use of surgical masks and so on) increased the chances of surviving surgery by at least 50%...and these practices weren't begun until the mid-19th century.<sup>v</sup>

Ptak's examples are revealing and important, for they show how making progress—be it in architecture or surgery—has little place for obviousness; an important lesson for our debates. Something we take for granted, something we see as basic common sense is revealed to be not at all obvious but in fact a deeply novel and world changing *discovery*. The results of science are not the result of genius (at least alone), they are the result of hard work, a multitude of observations, failures, and a good bit of luck. The 'obvious' is a result of *progress*, and it is often the result of technological change.

The example of Lister is particularly instructive, for American children are brought up with the gospel of hygiene, and washing one's hands seems as obvious as the heat of the sun. But, even today, the importance of such hygienic habits is not obvious everywhere and to everyone—in populations suffering in extreme poverty, the education that becomes every American child's 'common sense' is simply not available, nor is access to clean water. People don't wash in filthy water because they are stupid, or because they cannot see an obvious harm; rather, they do so because they have no option, and are often ignorant of the true harm. The choices we make, the beliefs we hold are a matter of opportunity: you cannot know something if you've never been presented with an occasion to learn about it before.

So how does something become obvious? I think the basic story is a simple one: we are told or we learn in some way some fact, or strategy, or procedure. Once so exposed and indoctrinated, this knowledge becomes, as it were, natural, and the fact that it *was learned*, that we had to be led into it, fades into the background. We're probably all familiar with a kind of basic version of this idea from the realm of optical illusions, most famously perhaps the following picture:



Figure 1: Just some dots? (The first example I have found is from *Life Magazine* 58:7, February 19 1965, 120)

At first the image seems a series of random, meaningless dots. But, eventually, or if someone points it out, one realizes that it is the picture of a Dalmatian, and the image snaps into focus: you cannot unsee it once seen you have seen it, in the same way that an obvious idea is hard to image as anything but obvious, as anything but an edict direct from Nature or Reason. So what we see is partially a function of our expectations, of our knowledge, of our observations and, importantly, our epistemic history, our experiences and memories. The path we take through the world affects us and deeply shapes the beliefs we hold true and those we think false.

It is, perhaps, the sign of a truly brilliant idea that, once it is revealed to the world, it strikes us as so astoundingly obvious and apparent that we can hardly wrap our minds around any other way of doing or seeing things. That is, some things become obvious more quickly than others. Examples abound in the realm of technology, where innovation has become a meaningless buzzword, examples that have led to the enrichment of many a patent lawyer. The best example is perhaps the invention of the modern touchscreen smartphone by Apple—an idea that, in retrospect, seems blindingly obvious, whose component parts were all available, but whose form and integration was not apparent, and, indeed, was greeted with suspicion, derision, and scorn.

Indeed, obviousness is a part and parcel of patent law—there are a host of legal scholars and lawyers who have written hundreds of thousands of words on it, deciding nothing, perhaps, but struggling to come up with something that even an American jury might be able to use in trials. A vain hope.

But, perhaps, as I've been urging, obviousness is a myth, a fact about the psychology of learning and knowledge, not a fact about epistemic intuitiveness and transparency. Obviousness is something that, when we accuse our opponents of mistaking it, is not just uncharitable, but epistemically unjust, a fact more often about our lack of empathy for people who think differently than about epistemic saintliness.

I now want to discuss a number of interesting and novel examples of how obviousness *isn't*. I start with two from the history of writing systems. These are, to my mind, particularly striking.

Writing systems did not develop until relatively recently in the history of *homo sapiens* (who appeared roughly 200,000 years ago, on a Thursday), in a case of independent co-creation that occurred around 3500 B.C.E. in Egypt and Mesopotamia. Given this late arrival, writing is not an obvious invention, nor perhaps a necessary one, and seems deeply related to the introduction of other technologies like agriculture and

bureaucracy. But, further, the development of writing systems demonstrates that many seemingly obvious aspects of our modern systems are not in fact so obvious. Ancient Greek provides a truly wonderful (and wonderfully named) example in *boustrophedon*, which literally means ‘ox-turning,’ and which also describes the phenomenon in question.

Ancient scripts, including Saffaitic and Sabaean, but most commonly Greek, did not have preferred orientations: they were often written left to right or right to left. But, most shocking to the modern mind, such scripts were also often written in a meandering, alternating method we call boustrophedon, going from left to right, to right to left, and back to left to right. My first encounter with this idea was true and deep befuddlement: surely, I thought, writers must have picked a direction and stuck with it, surely such examples as might exist are the work of a few, mad writers? But, upon reflection, as is often the case when we begin to take seriously other ways of doing and seeing things, there is a logic here: if one is writing, say left to right, there is a kind of convenience to just starting on the side you end up on, and then going the other way. Indeed, there is an efficiency of motion, a conservation of energy, found in boustrophedon that is lost when we choose a single direction from which to write.

Another example, equally puzzling, at least at first, concerns the invention of another writing technology, something we don’t even really *see* anymore: the spaces between words. Paul Saenger has beautifully and exhaustingly discussed this idea in his 1997 *Space Between Words*.<sup>vi</sup> Saenger describes how, after the fall of Rome, we see the gradual development and invention of the separation of words, something so obvious that if I did not do it you might think I was mad! Up until this point, Saenger notes that the separation of words was a task for a particular reader’s mind and voice, in part because of the very different cultural context in which writing was used and understood. Reading took place out loud, in an oral context—silent reading, too, is a non-obvious invention, and is central to Saenger’s account. This particular social context is fundamental for understanding not just reading, but writing systems and readers’ relationships to them. In the context of the ancient world, some of the very attributes we see as fundamental to reading, such as easy access and retrieval of information, or the diffusion of literacy across the population by making it easier to understand difficult texts, were simply not seen as advantageous. The ancient literary world was elitist, and this mentality figures significantly in the history of writing and the development of silent reading.

Thus we see that facts about the organization of society—here in particular convenience and elitism—affected the development of writing, and deeply so. Such themes are omnipresent in the histories of technology and science. Indeed, the very methods and definition of science, of inquiry into nature, are the result of historical processes, and take on particular meanings and have different consequences in different places and times.

My next example concerns something about science and its methodology that seems obvious from a modern point of view: the need to inquire into the material constituents and causes of natural things. Indeed, many might (and, indeed, have) taken these to be *definitions* of what natural inquiry means. But, as Nathan Sivin and Geoffrey Lloyd point out in their wonderful effort in cross-cultural history of philosophy and science, these questions are not obvious at all, at least once we begin to ask the right sorts of questions:

Why did Greek philosophers and scientists focus so often on the constituent elements of material objects, on their natures, on the imperceptible reality that underlies the appearances? Why was there so much concern for the causes of phenomena and for the representation of the cosmos as an ordered whole? At first sight it might seem absurd to pose that problem. For are not these among the most obvious and unavoidable questions that any philosophy or science must tackle? If so, is it not utterly superfluous to ask why Greek philosophers and scientists did so?<sup>vii</sup>

And they respond that, indeed, it is not superfluous but in fact a central question. They provide three reasons:

First, these questions were not obvious and explicit at the very beginnings of Greek philosophy and science; we can certainly investigate how they came to acquire the central importance that they later possessed.

Second, reflection on early philosophy and science elsewhere— especially in China—confirms that it is perfectly possible to treat quite different concepts as central. The Chinese, as we will see, spoke of phases (*hsing*), not elements; they had no single concept that corresponds to “nature.”



According to one view, they were concerned not so much with causes as with correlations and configurations of Change... at a first stage of discussion...there was nothing inevitable about most of the Greek ways of formulating the principal questions.

Third and most directly, the problems that the ancient Greeks used these concepts to address have not remained constant and do not look the same to us today. Although many Greek terms, as conventionally translated into English, may generate the impression that they persist unchanged over time, that, too, is a trap. Even when the scientists and philosophers who use the concepts today see them as continuous with ancient Greek speculation, the concepts in question have in every case changed their meaning. The fortunes of the term “physics” illustrate the point. The modern word is derived from the Greek *phusike*, “the study of nature,”...But hardly a single component of Greek *phusike* survives in what physicists of today would recognize as their subject matter.<sup>viii</sup>

Lloyd and Sivin demonstrate how the organization and structure of the two societies they discuss, Greece and China, play a fundamental role in the construction of the meaning, goals, and methods of scientific inquiry. For instance, the top-down and conservative, authoritarian nature of Chinese imperial government played a powerful role in financing and organizing scholars and scholarship, down even to the modes of scientific writing, which often took the form of private discussion among elites, or a letter to the Emperor, or commentary on a traditional text. In the case of Greece, we can see the particular importance of Athenian democracy in structuring the role of literacy in society, which allowed for opportunities of teaching, debate, and modes of scholarship not preponderant in China, such as argumentative philosophical treatises and public debates on metaphysical subjects.

History, then, provides a powerful solvent to break apart seemingly obvious connections, to dissolve things that seem apparent and necessary. Science, language, technology, we learn, are all deeply embedded in our culture and history, as are we, we who understand and interpret and manipulate the world and ourselves and each other in light of larger categories and concepts. This isn't to say that science does not lead to the truth, or that technology isn't wonderful, though I think the history of science provides a powerful antidote to the poisonous idea that science and technology do so

*necessarily* and *ineluctably*. Rather, it serves to remind us of the important historical path dependency of our conceptions about our technology and science. That is, the concepts we use to think about science, and, indeed, about the world, come about through specific historical processes. These processes do not shed their history—that history affects deeply the shape of those ideas, as we’ve seen here in the case of obviousness. The upshot is not relativism, but humility.

Now that I’ve given some, hopefully provocative, examples of the non-obviousness of the seemingly obvious, let me add a more sophisticated example that will also suggest a way of understanding this situation. The idea is simple: the light of obviousness can only be seen against the dark background of assumptions, often hidden or ignored.

The brilliant philosopher of science Helen Longino has argued that these *background assumptions* are essential for understanding science, for assumptions are what connect our observations, our data, to our theories: some piece of evidence is only evidence for a particular theory given certain assumptions about the nature of the world, about what we know, and how we think it all fits together.<sup>ix</sup> For example, to see a particular piece of flint as an arrowhead, and to use it in constructing some theory about tool use, one must have all sorts of assumptions about the formation of certain kinds of stones, their likely and unlikely shapes, how ancient peoples might manipulate flint, the shape needed for hunting certain sorts of creatures, and so on and so forth.

The point isn’t that these assumptions are made up, or are non-empirical or unverifiable. The idea is that what we see and understand is a function of a whole host of complex and multifaceted suppositions. To put the point rather simply, why we think we know some proposition or another depends upon a whole host of other propositions that we think we know. As philosophers have pointed out since (at least) Pierre Duhem and W.V.O. Quine, the justification of our beliefs forms a web of interconnected propositions.

So obviousness is only obviousness within a certain cultural-epistemic system, only within a certain scientific paradigm and world-view, only at a certain state of technological development, always within a particular historical moment. If and when these assumptions are articulated and challenged, what we see and describe in the natural world, our scientific theories, our abilities to manipulate and understand the world technologically, *change* and often change *radically*. Let’s not get carried away, however, in thinking that this leads to some sort of severe cultural relativism, or some sort of deep skepticism about science. Instead, understanding science in this way helps

us, as Longino points out, account for scientific change, for scientific disagreement, and can help us understand the role of ideology and bias in science, can help us understand when and where and how science goes wrong.

I end with a striking example of the harm of obviousness, understood in terms of background assumptions. Primatologists and other scientists studying the behavior of animals in the 1960s through the 1980s interpreted their observations as supporting a concept of patriarchal dominance in primates and other animals, patriarchy being a natural—obvious—fact. Upon investigation, however, these inferences were based on a set of androcentric assumptions, assumptions that affected our understanding of animal breeding systems in certain systematically biased ways. Biologist Sarah Blaffer Hrdy calls this scientific community’s set of unquestioned background assumptions “the myth of the coy female.”<sup>x</sup>

The myth consisted in the supposed existence of a highly discriminating, sexually coy female that was courted by completely indiscriminating males. Females were assumed to have a very specific, and utterly passive role in sexual relations, and all mating behavior was interpreted in light of this assumption about a female’s ‘natural’ role. There were three assumptions:

1. The relative male contribution to offspring is small.
2. There is little variance in female reproductive success compared to great variance among males.
3. Females are not promiscuous, and fertilization is the only reason for females to mate.

These three components of the myth deeply affected the interpretation of observations made by those working under its spell: what was obvious for these (exclusively male) scientists turned out, with the introduction of female researchers, to be an unsubstantiated and unwarranted background assumption.

Take the first assumption: the male contribution to the offspring is small, which means that males play little role in caring for offspring. Hrdy, however, noted that male care is far more extensive in primates than previously theorized. Indeed, in some species of primates, promiscuity on the part of females serves to help ensure male care for offspring, thus undermining both the first and third components of the myth. For example, Goldizen and Terborgh noted promiscuous behavior in female saddle-backed tamarins.<sup>xi</sup> They interpreted this behavior as a mating strategy to confuse the males in a

troop about the parentage of offspring, thus helping guarantee the care and safety of those offspring by a large number of males even when they are not the offspring's biological parent.

Or take the third assumption: this caused researchers to interpret all sexual behavior on the part of females as about fertilization. Yet, for primates, there was growing evidence since at least the 1960s that females in many prosimian, monkey, and ape species managed their own reproductive careers *actively* to solicit and mate with a number of different males. Later fieldwork extended this result to females in other species: for instance, Bray, Kennelly, Guarino demonstrated that when the master of a red-winged Blackbird harem was vasectomized, his females still conceived, demonstrating that female Blackbirds are promiscuous.<sup>xii</sup> In a review of literature on female sexual behavior, Evelyn Shaw and Joan Darling noted that female shiner perch mate with many males even when they are not producing eggs.<sup>xiii</sup> Prior to the work of these and other researchers, scientists quite literally ignored these (obvious?) behaviors, for they simply could not exist. Often what we see is limited by what we *expect* to see.

These bits of evidence stand in stark contrast to the assumptions of the myth of the coy female, and the inferences made on the basis of these assumptions about female sexual behavior are thus undermined. By not using these assumptions to interpret the evidence, these mostly female researchers questioned and ultimately undermined the myth. What had been obvious to a generation of (mostly male) primatologists had been exposed as a systematic bias born of androcentric assumptions.

### **3. Overcoming the Rhetoric of Obviousness**

So obviousness turns out to be a function of our other beliefs, of our assumptions. Belief is a web, a complex network with all sorts of dependencies, and different individuals, because of different educational and epistemic life histories, have quite different networks. Obvious truths to one person are obvious falsehoods to another.

So what does this tell us about debates like those concerning vaccination? I think the fact that obviousness *isn't* obvious leads us to three conclusions, conclusions that, if internalized, might help us overcome the rhetoric of obviousness.

First, different individuals and different communities have different sets of background assumptions. So the most important question to ask in confronting resistance to, say, vaccination or evolution, concerns the set of background assumptions that lead them to reject vaccination, or evolution. It's not idiocy, or the

inability to grasp obvious truths, that is at issue (at least not always), but rather the relative weighing of, say, the trustworthiness of different authorities, of different texts. If you grew up in a household that truly and deeply believed the earth is only a few thousand years old, then evolution is not obvious at all, far from it. In many cases, what people believe and think about the nature of the world has a certain inner-logic, it makes sense against the background assumptions they hold. In such cases, there is no way that being confronted with the evidence (of, say, vaccination or evolution) can automatically lead directly to the acceptance of scientific truths, for there just isn't any such thing as being 'confronted with the evidence;' there is only being confronted in the context of a whole host of other assumptions.

So what needs to be done in these situations is careful analysis of what these people believe and why, so that we can pick apart the kinds of assumptions they hold that affect the way they understand scientific theories and observations. Simply bombarding people with data, observations, charts and graphs, is not helpful in light of the fact that the interpretation, the meaning of all this information, is contextually determined, is determined by all the myriad beliefs, ideas, and assumptions that complex, multifaceted people have. Claims of obviousness that ignore the context-sensitivity of our evaluations of evidence, then, are mere rhetorical intimidation, and often serve only as signals as to which epistemic and social community one belongs to: what is needed is charity, not chastising. Part of the explanation, then, of why debates on issues of scientific literacy and the like have proven so unproductive and irreconcilable, comes from the fact that these debates only confront peoples' surface beliefs, the very beliefs under issue, and not upon other, essential, nodes in our epistemic networks. Our understanding and interpretation of evidence depend upon these nodes. The debate thus needs to move to consider not just facts and theories in isolation, but ways of seeing and interpreting facts and theories, from observation to interpretation.

Of course, many times, people hold inconsistent beliefs, act irrationally, or refuse to learn or change their mind; perhaps nothing can be done in these situations. Maybe these folks can safely be ignored, dismissed, banished from our 'reality based' community. But, if we are optimistic, perhaps a more empathetic way of understanding their worldview can help redress the situation. So, second, the non-existence of obviousness should lead us to adopting a more empathetic view of other ways of viewing the world. In this, I think everyone can benefit from cultural anthropology, which is founded upon a method that involves the bracketing of one's own beliefs and ways of seeing in favor of truly trying to comprehend another's. This isn't to say that

it's always possible, or to reject the idea that some ways of doing and seeing things are superior to others. We can't go back to our flip phones (unless we are hipsters), and, overall, hand-washing has proven to be a pretty good idea. But if and when we want to convince others of our way, truly understanding their way seems a necessary first step. Communication, at least fruitful, productive communication, has to stem from understanding or at least the attempt at understanding. A second aspect of the explanation for the resoluteness of these debates is thus the fact that they have, on both sides, insisted upon the stern enunciation of competing world views, instead of attempts at finding points of contact and, perhaps, resolution. Perhaps some views can never be made to cohere, but this is not something that can be decided before trying.

The final lesson is one of skepticism and humbleness. History teaches contingency. What we know, or what we think we know, depends a lot on the course of our lives, and the time and culture we grow up in. There is, in fact, a kind of disrespect of science at the core of the pro-science community in their invocation of obviousness: it discounts the work that has been done in order for us to get where we are. One of the prime lessons of the history of science and technology—or its current practice, just ask any scientist—is that it's hard, damnably and frustratingly hard. Figuring out nature, understanding reality, is and has been the task of generations, and so the obviousness of current scientific truths is the result of blood, sweat, and tears. To insist upon the utter obviousness of some claim, and to deride an opponent for denying it, betrays this history, these hard won truths. Knowledge of the history of science, then, teaches us a kind of respect for that history, for that struggle. It also helps define who we are and why we think what we think: for we are, both individually and culturally, the sum of all those past experiences, ideas, and discoveries, all of that hard work and effort. Historicity teaches us that there is no such thing as the obvious, and so our debates, even debates with a clear scientific answer should be conducted in light the situatedness of both sides of the debate. Obviousness is an achievement.

Either that, or we're all doomed fools.

Benjamin Goldberg  
University of South Florida  
metabenny@gmail.com

## Notes

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<sup>i</sup> Obviousness of a sort is sometimes considered in discussions of consciousness and phenomenology, but I'm not here concerned with this sense of the word. See: Sytsma, Justin (2009), "Phenomenological obviousness and the new science of consciousness," *Philosophy of Science*, 76.5: 958-969. Obviousness is also a key concept in patent law, and, indeed, there is much to be learned from that literature; I am not here, however, concerned with it.

<sup>ii</sup> For more info on this movement, see Joshua Knobe's (2004) "What is Experimental Philosophy?" in *The Philosopher's Magazine*, 28. For a how-to guide see, Sytsma, Justin and Jonathan Livengood (2016), *The Theory and Practice of Experimental Philosophy*, Broadview Press.

<sup>iii</sup> Machery, Edouard, Ron Mallon, Shaun Nichols, and Stephen P. Stich (2004), "Semantics, cross-cultural style," *Cognition* 92.3: B1-B12. See also, Machery, Edouard, Christopher Y. Olivola, and Molly De Blanc (2009), "Linguistic and metalinguistic intuitions in the philosophy of language," *Analysis* 69.4: 689-694.

<sup>iv</sup> Knobe, Joshua (2003), "Intentional action and side effects in ordinary language," *Analysis* 63.279: 190-194.

<sup>v</sup> J.F. Ptak (2012), "Blank and Missing Things: Life. An Example in the Discovery of the Obvious November," On: *JF Ptak Science Books*, <http://longstreet.typepad.com>

<sup>vi</sup> Saenger, Paul (2000), *Space between words: The origins of silent reading*, Stanford University Press.

<sup>vii</sup> Lloyd, Geoffrey and Nathan Sivin (2003), *The Way and the Word: Science and medicine in early China and Greece*, Yale University Press, 141.

<sup>viii</sup> Lloyd and Sivin 2003, 141.

<sup>ix</sup> Longino, Helen (1990), *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry*, Princeton University Press. She discusses underdetermination in a number of works, but, to my mind, this contains the best and clearest discussion.

<sup>x</sup> Hrdy, Sarah B. (1986), "Empathy, polyandry, and the myth of the coy female," *Feminist Approaches to Science*, Ed. Ruth Bleir, Pergamon.

<sup>xi</sup> Goldizen, Anne Wilson and J. Terborgh (1986), "Cooperative polyandry and helping behavior in saddle-backed tamarins (*Saguinas fuscicollis*), In: *Primate Ecology and Conservation, Vol. II*, Eds. J. Else and P.C. Lee, Cambridge: Cambridge University Press. 191-198.

<sup>xii</sup> Bray, Olin, James Kennelly, Joseph Guarino (1975), "Fertility of Eggs Produced on Territories of Vasectomized Red-Winged Blackbirds," *The Wilson Bulletin*, 87(2): 187-195.

<sup>xiii</sup> Shaw, Evelyn and Joan Darling (1985), *Strategies of Being Female*, Harvester Press.