Philosophy of Science // Fall 2015

Handout 1

Introduction — Origins of modern empiricism: Helmholtz

Philosophy and science. Can there be a philosophy of science? Or can there only be philosophy of individual sciences? Philosophy of physics, philosophy of biology, philosophy of chemistry, philosophy of medicine? And then what about philosophy of mathematics, philosophy of economics, philosophy of history?

An assumption behind much of the classical philosophy of science (1920s–1950s) was that various scientific disciplines can be reduced to just one discipline. We are going to explore later what 'reduces' can mean. In any case, that one discipline was thought to be physics. Hence an especially close attention that was paid to physics and mechanics. More recent philosophy of science tends to dismiss this kind of reductionism. Hence much more attention is paid to particular disciplines. Philosophies of physics, of biology, of chemistry, of economics, of medicine, have become pretty much autonomous disciplines. Meanwhile many subjects in contemporary philosophy of science belong more properly to metaphysics, decision theory, philosophical logic.

Composition of this course. As you see from the syllabus, we begin with pre-history, with the question how philosophy of science emerged from the scientific and philosophical debates of the 19th century. This will bring us to the debate over the nature of space, geometry, and the foundations of physics. We will then explore the ideas of logical positivism and, more specifically, its key doctrine of verificationism. After looking at the reactions to various doctrines of logical positivism, we will discuss the staple subjects of philosophy of science, such as explanation, laws, and reduction. In the last part of the course we will address issues in the philosophy of biology. In the unlikely event that we finish the syllabus before the end of the semester we will wrap up with the discussion of scientific realism.

The epistemological debate. How does our thought correspond to external reality? Is it possible to represent reality correctly in our thought (and speech)? Is it possible to know reality? Helmholtz intends to provide answers, not necessarily conclusive ones, to these questions based on the then recent research into physiology of perception. His initial stance is remarkably modest: scientists are in no better position than philosophers. Sometimes their conclusions confirm the already received view. Yet sometimes they are able to further elucidate the already available concept.

Sensations. Sensations are distinguished by their modalities (sight, hearing, touch etc.). But sensations of every modality are produced by the excitation of a relevant nerve (e.g., the optical nerve). Thus the same kind of sensation, such as sensation of light, can be produced by the physical light (a certain electromagnetic wave) or by pressing on the eyeball. So: different kinds of objective factors can cause the same sensation. And on the contrary: same kinds of factors can cause different kinds of sensations. For example: a heated metal can produce a sensation of light, or a sensation of burn, depending on which nerve is excited.

The sign theory of perception. Sensations do not deliver *images* of external objects. That is, our sensory data bear no resemblance to external objects, in the sense in which a photocopy resembles the original. But we can still obtain *signs* of reality: we can discover connections between objects. We can assert that situations of type A are followed by situations of type B. We cannot tell whether what we represent to ourselves as A-situations or B-situations are *really* in nature—whether A-situations and B-situations are similar to R(A)-situations and R(B)-situations. But we *can* tell that R(A)-situations are followed by R(B)-situations. Hence we have an *image of a causal law* (more on this below).

Remark 1. This argument is in effect the same as Berkeley's argument (or rather, one of his arguments) against Locke's doctrine of primary and secondary qualities.

Spatial perception. Helmholtz's question is, what is the origin of our spatial perception? Kant's answer was: pure outer intuition, sharply distinguished from physical sensation. Helmholtz's answer, once again, is based on physiological analysis. Spatial perceptions are characterised by the fact that our motion puts us in different relations to objects. This is not the case with our 'psychic states' (Kant's forms of inner intuition). This is achieved by the stimulation of our motor nerves that transmit stimulations to our muscles that, in turn, contract the limbs. Vision is not a unique route to spatial perception: tactile and audio modalities can similarly lead to spatial perception.

Remark 2. Spatial perception is not given to us immediately. It involves interpretation of sensations. This, again, is one of the claims in Berkeley's *New Theory of Vision*.

Spatial co-existence. We say that objects co-exist in space. But what does this mean? Again, we have to approach the matter physiologically. Suppose an observer is provided with a set of sensations, each of which he can bring to his attention by an act of will. These are 'presentables'. From this set of presentables, at any given moment, we select a subset containing the sensations is 'presently' brought to his attention (by his own will). These 'presents' will be said to be *enduring* at the time of his perceiving them. The presentables, on the other hand, will be said to *co-exist* one beside the other and thus being spatially related to each other.

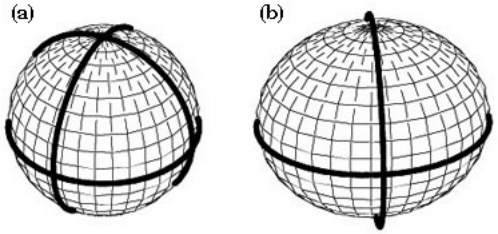
Example 3. Look at this door and the window…

Transition to geometry. The question Helmholtz now addresses is: What is the origin of our idea of spatial objecthood? He gives a rather lame defence of Kant, with the following paraphrase of familiar Kantian claims: Spatial intuition is subjective (depends on our physiology), necessary (we identify the external world with the totality of spatial object), and prior to experience (our motoric and neurological capacities are given to us before we could have any experience, and thus in effect condition our experience).

All these claims are manifestly non-Kantian (see Schlick's notes for details). Kant made another claim, of the necessary validity of the Euclidean geometry. Helmholtz disagrees and observes that the issue of spatial intuition is separate from the issue of the validity of axioms.

Intuiting alternative geometries. Kant claimed that we can not fail to represent to ourselves Euclidean axioms. That is: only Euclidean geometry is intuitable. Helmholtz objects: we can coherently describe the conditions under which creatures capable of spatial intuition would reject Euclidean axioms. Therefore, non-Euclidean geometries are also intuitable. To demonstrate this, Helmholtz uses a thought-experiment of Flatland (since then repeated by many authors).

Example 4 (Flatland). Imagine creatures located on a two-dimensional surface. We already know, in accordance with Helmholtz's account of spatial perception, that they may be able to possess such perception. Their visual space will be two-dimensional. If they live on a surface of a sphere, their geodesics (corresponding to stretched strings) will not be *our* Euclidean geodetics. How many straight lines they can draw between two points? Well, one will be the smaller arc of a great circle (see picture (a)). Another will be the greater part of that circle. So straight lines are not the same as shortest lines. Moreover, between the poles infinitely many straight lines can be drawn. (Compare picture (b) of an ellipsoid.)



Realism and idealism. Spatial perception is not simply given to us. There is rather a causal link between the voluntrary stimulation of our nerves (innervations) and spatial order. But if so, could not space—that is, the external world itself—be entirely of our own creation? This will open the floodgates of idealism. Helmholtz admits that there is no refutation of idealism (see the discussion of the dream argument). We have no proof of realism either, because we have no direct perception of external objects (as we saw above). Instead, we should prefer the realist hypothesis because it is (1) simplest, (2) best confirmed, (3) fruitful.

Remark 5. Compare the discussion of empirism and nativism and the reasons to favour empirism.

Scientific knowledge. Even though we have no direct perception of objects, we have direct perception of causal connections (their 'image'). Our grasp of causal connections is the limit of how far our knowledge can extend. But why to think that we *indeed* grasp these connections? Helmholtz thinks that there is *practical* evidence of this: our success in prediction and manipulation. If we were uniformly in error about causal connections, science would not have been able to deliver predictions, and technology would have been impossible.

General comments. Helmholtz argues from the position of a working scientist, from a broadly empiricist perspective, having no time for metaphysical speculations. It is, therefore, striking that he in effect concedes the force of scepticism about the external world. This, above all, testifies to his intellectual honesty. He is ahead of his time in (among other things) embracing *instrumentalism*. This doctrine contains the same criteria of scientific choice listed by Helmholtz, as well as a commitment to the 'fictional' character of scientific claims (observe Helmholtz's mention of 'as if' claims). But the emphasis on causality completely ignores (in our selection) any mention of Hume's doubts about induction. More on this later.

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