On Billiard Balls – Hume Against The Mechanists

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I would like to approach David Hume's theory of causation from an historical angle. That does not mean of course that I take the question of whether Hume was right or not to have an historical answer, true only in a certain place at a certain time. What it means is that to understand Hume on causation I think it can help to appreciate the context in which he was writing - against whom he was primarily arguing and what the significance of certain examples and terms might have been at the time. This kind of contextual understanding is needed to help us judge what exactly Hume was saying, and that must be a first step towards deciding whether or not he is right.[1]

Let us begin with a point that may puzzle modern readers new to the First *Enquiry*.[2] Hume seems curiously concerned with goings-on on the billiard table. Of the innumerable cases of causal links that he might have chosen, Hume seems to find conclusions about the actions of billiard-balls - or, more exactly, of one billiard ball hitting another causing the second to be set in motion - sufficiently representative to stand in for causal relations *per se*. Someone picking up the *Enquiry* when it was first published, however, would find the significance of Hume's choice of example unmistakable. Why? Because at the time, 1748, the billiard-ball model had become standard in explaining the nature of the universe. Atomism ruled.

This doctrine was essentially a revival of the physics of Democritus and Epicurus which thought of nature as reducible to minute particles of impenetrable matter (atoms) and empty space (the void). It gathered support throughout the seventeenth century and by the time of John Locke's death in 1704, it had taken the British intellectual world by storm. Locke himself was a cautious proponent of atomism, or 'corpuscularianism' as it was now more often called. Locke might just have had time to read Isaac Newton's *Opticks*, which came out in that same year and pronounced that 'God in the Beginning form'd Matter in solid, massy, hard, impenetrable, moveable Particles'.[3] Newton's public endorsement of atomism was highly influential in the following decades because he was a thinker of such towering authority. It is likely that Hume introduced the billiard balls with one eye on the ultimate particles advocated by Sir Isaac and others.

The billiard-ball example had another significance, however, in addition to being a model of atoms in the void, and it is this that I wish to concentrate on. It stood for a kind of causal action that was thought to be transparent. It was an example of 'impulse', that is of one body causing changes in another body by means of contact - by pushing it or striking it. 'Impulse', Locke wrote in his *Essay concerning Human Understanding*, is 'the only way which we can conceive Bodies operate in.'[4] The peculiar intelligibility of impulse was thought to consist in our being able to perceive how the first body acts on the second to bring about the change. Nothing is mysterious or hidden. If we know the perceivable qualities of both objects we can foresee exactly how they will interact.

That impulse was the only intelligible physical causality was a central principle in 'the mechanical philosophy', which was endorsed in differing forms by almost all of Hume's immediate predecessors and which Hume himself was implicitly challenging.

The Mechanists contrasted the transparency of impulse with our experience of other more opaque causal relations. For example, when we see a magnet attract iron-filings we see a sequence of events - the magnet is placed in the vicinity of the filings, the filings move towards the magnet, sticking to it or clumping round it - but we do not perceive how the magnet manages to make the filings move towards it. The magnet's *modus operandi,* or way of operation, remains obscure. Or to take another example, if we light a firework, the flame ignites gunpowder within the rocket (this is a seventeenth century firework!) leading to its take off. We are not really able to discern by what means the take off is brought about. We know that it *follows* the burning of the fuse and various characteristic sounds and flashes, but not *how* it is produced.[5] In the case of impulse, however, the mechanists were convinced that the 'how' was known. To return to Hume's favoured example, the mechanist would say it was because one solid object of the same size as another was pushing into the same space that the second ball was forced to move off.

So Hume homed in on the interaction of billiard balls because it represented for others a *fundamental* and *transparent* case of the operation of causal power. In the light of this context, Hume's strategy can be expressed as follows. He set out to show that the transparency that mechanists claimed to find in impulse was really a kind of illusion produced by habit or 'custom'. So much of our experience of causality is of contact-action, Hume argues, that our very familiarity with these cases makes us feel that they have a transparency that they do not really possess. In fact, Adam, on first perceiving the impulse of one billiard-ball on another, would find the resulting motion of the second ball just as surprising and mysterious as, say, the action of the magnet on the iron-filings. It is custom that blinds us to this truth.

We fancy, that were we brought on a sudden into this world, we could at first have inferred that one Billiard-ball would communicate motion to another upon impulse; and that we needed not to have waited for the event, in order to pronounce with certainty concerning it. Such is the influence of custom, that, where it is strongest, it not only covers our natural ignorance, but even conceals itself, and seems not to take place, merely because it is found in the highest degree.[6]

On causation, Hume is the great leveller. He denies any sort of hierarchy between more and less transparent cases of causal relation. All causal relations, in his view, are equally untransparent. All of them amount to constant conjunctions and our perceptions of them never give us insight into the *modus operandi* of the connexion. The only distinction between the different constant conjunctions is that some are perceived more often and thus we have more developed expectations about how the chain of events will continue.

Now, to be a mechanist or a Democritean atomist today would be foolish. It would be comparable to believing that the earth is flat or that the sun literally rises in the morning. Science has moved on and though in modern physics there is still talk of 'atoms', they have very little in common with the hard 'massy' little particles of matter that Democritus, Epicurus, Newton *et al* imagined. But there may still be insight in the mechanists' analysis of natural causation: indeed I think there is one important truth that Hume's critique does not do proper justice to.

To appreciate this insight, let us take another example of impulse, this time from the railways. At the end of the line we can watch a train slowing down before hitting the buffers, which bring it to an abrupt halt. The buffers - although they have a bit of give - obstruct the train. How? By being made of hard, inflexible matter of the right shape and size to get in the way. This uncontroversial reflection suffices to show that there is something wrong with at least one of Hume's negative claims:

In reality, there is no part of matter, that does ever, by its sensible qualities, discover any power or energy, or give us ground to imagine, that it could produce any thing, or be followed by any other object, which we could denominate its effect. Solidity, extension, motion; these qualities are all complete in themselves, and never point out any other event which may result from them.[7] *Pace* Hume, the solidity, extension and motion of the buffers and the train combine to make the stopping of the train a necessary effect of the buffers being in its way.

A Humean might object as follows: 'we can easily imagine that the train continues in the same direction through the buffers and the end of the line; our expectation that it will not is based on custom, not on a perceived necessity.' But what exactly are we imagining when we imagine the train continuing regardless of the buffers? We can certainly imagine this happening if the buffers and their supports suddenly become as soft as butter, or if they were already cracked and so break up on impact, or if the buffers themselves moved with the train in the same direction indefinitely, or any number of other possibilities. But notice, in order to imagine the train not stopping we have to change the *qualities* of the buffers. We have to imagine that that they were not solid after all (but like butter, or cracked), or that they are not at rest (but in motion along with the train). But can we imagine that the buffers remain solid, at rest and undiminished in size *and* that the train simply continues? If the train is imagined as a hard, material object - and not a phantom - I think this is impossible. In our example certain qualities of objects determine the kind of effects those objects - trains and buffers - can have. This is true, I think, of almost all the kinds of causal interaction involving impulse that the mechanists thought were transparent and fundamental. To take the case of the billiard balls again, when we see one ball moving towards another, and we know that the balls are solid and that the second ball stands in the way, then certain effects are quite excluded. The moving ball cannot, for example, just pass through the second ball and come out the other side continuing at the same speed; nor can the first ball stop at *exactly* the same place as the second ball (at best they must be adjacent); nor can one of the balls suddenly vanish, and so on and so forth. The qualities of the balls determine the kind of effect that the impulse of the first ball will have on the second. We can only imagine radically different effects by imagining the balls as having - or suddenly adopting - radically different qualities.

This is not true in the case of the magnet. Here the effect does seem to be genuinely opaque. One could study the magnet - a small lump of metal - for as long as one liked and one would discern no quality by means of which the attractive power could be predicted. In the case of magnetism it seems fair to say, that the effect is known, at least in the first place, by a constant conjunction of events: if we put this lump of metal near the iron filings they will be drawn to it in a characteristic way, but the nature of the power is hidden. For this case Hume's theory works very well.

Of course, we might be able to set up the *appearance* of a necessary connection by saying that the magnet must draw the iron-filings because it has the quality, or power, of attraction. But this would be to play a game with words. It would be like the medical student in Molière's play *Le Malade Imaginaire* responding to the question 'how does opium make a person sleep?' by saying 'because it has a soporific power *(virtus dormitiva)*'. This may have satisfied the scholastic examiners in Molière's satire, but it would not satisfy someone who really wanted to know how opium acts on us. Likewise, saying that a magnet draws iron-filings because it has an attractive power does not make the cause in the least bit transparent.

A distinction can, then, be drawn between relatively transparent causal connections which arise from the observable qualities of the objects involved and causal connections which do not arise from any perceivable qualities and are known by the constant conjunction of events.

I now wish to ask why Hume was led to ignore this distinction in intuitive transparency and to proceed with his levelling definition of all causal connections in terms of constant conjunction. Part of the answer, I think, lies in his definition of a cause. For Hume it is a 'necessary connection'. When Hume searches his experience of the inner and outer worlds for an impression of the causal nexus he has a very demanding conception of what he is looking for. So demanding that it is not really surprising that he ends up with nothing. A cause, on Hume's view, must produce its effect with an absolute necessity comparable with geometry or logic. If we really had a grasp of what is a cause in the strong, traditional sense, Hume argues, we would know why there cannot arise anything else other than the predetermined effect.

So far I have been careful to describe the impulse of billiard-balls as 'relatively' transparent. It is not completely so and thus fails to meet Hume's rigid requirement. Although we can exclude certain effects (such as the first billiard ball passing through the second or the train passing through the buffers) we cannot exclude *all* possibilities. Perception of the qualities of the two balls gives us only a framework within which we can narrow down the kind of effects that are conceivable. Hume is certainly right to say that there is still indeterminacy for someone relying on a knowledge of the perceivable qualities of the balls. For example, there is no reason why the first ball should not stop just before hitting the second, or why the motion of the second ball should not take any number of directions. The necessary connection Hume is seeking is 'all or nothing': either we can say exactly and incontrovertibly what will happen when we have knowledge of a cause, or we must accept there is no connection, but only a conjunction of quite independent events. It is because we cannot specify exactly what the effect will be of the collision of two billiard balls (but only a framework to which the effect must conform) that, in Hume's view, we are dealing with a customary sequence not a necessary relation.

Hume would have whole-heartedly agreed with the early Wittgenstein, who in his *Tractatus Logico- Philosophicus* wrote, 'A necessity for one thing to happen because another has happened does not exist. There is only *logical* necessity.'[8] But of course if one looks for logical necessity outside logic one should not be surprised when one cannot find it.

But there is another deeper reason for Hume's dismissal of the relative transparency of mechanical causation. When Hume is thinking of causal relations he is not thinking of them as primarily being between objects. It is true he still talks of 'objects'. But he cannot mean objects in the sense of three-dimensional bits of matter. He has in mind 'objects of perception', or more precisely the content of 'ideas'. This can be seen in his two definitions of causation which both speak of relations between 'objects', and when Hume supplies examples it becomes clear that these 'objects' are actually perceived events. For example his first definition of causal connection runs as follows:

An object followed by another, and where all the objects similar to the first are followed by objects similar to the second.[9]

The example that Hume then gives of this is:

this vibration [of a string] is followed by this sound, and … all similar vibrations have been followed by similar sounds.[10]

Vibrations and sounds are events. It is true that they may be, at least on one interpretation, reducible to objects in the traditional sense: the vibration is presumably a quality of the string in question and the sound might be thought of as constituted by waves of movement in the particles of air. But this is not what Hume has in mind. He is thinking of events as contents of perception. In fact he is quite explicit about this elsewhere in chapter VII of the first *Enquiry* 'Of the idea of necessary connexion'. In one passage, for example, he moves from talking about 'events' to talking about 'objects' in the sense I have outlined:

It appears, then, that this idea of a necessary connexion among *events* arises from a number of similar instances which occur of the constant conjunction of these *events*; nor can that idea ever be suggested by any one of these instances, surveyed in all possible lights and positions. But there is nothing in a number of instances, different from every single instance, which is supposed to be exactly similar; except only, that after a repetition of similar instances, the mind is carried by habit, upon the appearance of one *event*, to expect its usual attendant, and to believe that it will exist. This connexion, therefore, which we feel in the mind, this customary transition of the imagination from one *object* to its usual attendant, is the sentiment or impression from which we form the idea of power or necessary connexion.[11]

What influence does the primacy of events in causality have? One thing is clear, if we think primarily of perceived events rather than enduring physical objects, then the mechanical cause of impulse loses its transparency. This is because events are not the kind of things that bring certain qualities to different situations; they are rather 'moments of happening'. This makes it very easy to pass from one kind of happening to another quite different one. Even an enduring object can be understood as a succession of events. For example a banana might be loosely described as yellowness of a characteristic curved shape and tactile feel perceived here at times t, t1, t2 and so on.[12] A moving train would be a large, streamlined, appearance of a characteristic shape and feel, perceived in a progression of places at times t, t1, t2 and so on. There is no reason why a train understood thus should not suddenly appear beyond the buffers. An event-train is really a ghost-train.

Roy Holland, in a valuable, neglected article, 'The Link between Cause and Effect',[13] points out how the analysis of causation in terms of discrete events rather than in terms of the qualities of objects, or 'stuff', makes constant conjunction the only viable account of causal connection. He writes that 'the wonderfully diaphanous relationship that [causality] turns out to be is a consequence of the style of analysis and is really only what was to be expected of a relationship whose terms are…events. Since events lack all such properties as hardness, springiness, liquidity, porosity, causticity and tensile strength…'

For someone, like myself, naïve enough to start from an ontology of physical objects, Hume's reduction of all causal connections to constant conjunction is not as compelling as it might otherwise seem. In fact the mechanical philosophy, despite its many shortcomings, still has at least one thing to be said for it: it recognised that some causal interactions of external objects are more transparent than others.

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1 For someone interested in the historical significance of the *Enquiry* two recent and very useful sources are: Peter Millican (ed.), *Reading Hume on Human Understanding* (Oxford: OUP, 2002), essays 1 and 2 (27-96) and Stephen Buckle, *Hume's Enlightenment Tract* (Oxford: OUP, 2001).

2 I will refer here only to the *Enquiry concerning Human Understanding*, Third Edition, ed. Peter Nidditch (Oxford: OUP, 1975). This article is meant only as an interpretation and critique of the account of causation presented in the *Enquiry*. What the *Treatise* has to say is not, I think, always in harmony with the *Enquiry*. Since Hume himself wrote, towards the end of his life, that the *Enquiry* 'may alone be regarded as containing his philosophical sentiments and principles' *(Enquiry, 2)*, I find exclusive concentration on the account there justifiable.

3 See Newton, *Opticks*, Query 31, reprinted in Cohen, I.B. and Westfall, R.S. (ed.), *Newton: Texts, Backgrounds, Commentaries* (Norton, 1995), 40-55.

4 *An Essay concerning Human Understanding*, ed. Peter Nidditch, (Oxford: OUP, 1975), II.viii.11.

5 Of course, there were many hypotheses about how the firework and the magnet worked. The point being made here is just that these cases must be explained using some kind of imperceptible mechanism since what is detected by the senses does not make the causal relation transparent.

6 *Enquiry*, 28-29.

7 *Enquiry*, 63.

8 *Tractatus Logico-Philosophicus*, trans. C.K. Ogden (London: Routledge, 1922), 6.37.

9 *Enquiry*, 76. (The original is in italics.)

10 *Enquiry*, 77.(The original is in italics.)

11 To highlight the terminological point I am making, I have removed Hume's emphases and added my own.

12 This kind of analysis is offered in the *Treatise* (I.iv.2) where Hume argues that an enduring object is constructed by the imagination by running together distinct but resembling, perceptions.

13 This is contained in his collection *Against Empiricism: On Education, Epistemology and Value* (Oxford: Blackwell, 1980), 210-228.