

## How Do I Know My Hand Causes Movement?

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This title can be misleading. My hand causes movement but *indirectly*. We will see exactly what this means as we uncover the answer to this seemingly easy question. Indeed, the question can seem so trivial and obvious that it seems stupid to ask it. In fact, it is, in a way, so obvious that we have not paid enough attention to it to really know the answer in any kind of clear way. Deep confusion has beset the modern mind because we have not paid sufficient attention to such basic physics questions.

A recent conversation with a physicist colleague of mine provides an example of this confusion and provided impetus for me to write this article. My colleague thought that the *average* man did not think uniform motion, i.e. moving at a constant speed, needed a cause but thought accelerated motion did.<sup>2</sup> When asked why people think that uniform motion does not need a cause, he said they think there is no need because one only has to get a body going then it keeps going, since there is nothing to stop it.<sup>3</sup> When asked why the acceleration doesn't continue after you start a body accelerating, he simply answered that I don't see it continue to accelerate after I start it. So, he shifted from giving an explanation (there's nothing to stop it) to stating *what* happens (it doesn't do that). Next, I asked him why people think a ball, for example, needs a cause to move at all. He said that the "everyman" correlates seeing his hand near the ball whenever the ball begins to move and so *assumes* that his hand is, in some way, the cause of starting the ball's motion. In fact, of course, when I throw a ball, I *know* my hand is, in some way, responsible for the ball's motion.

Modern philosophy, inchoately basing itself on a misunderstanding of modern physics, began very early to think that causality of all kinds was solely a construct of the human mind. The fundamental architect of modern philosophy, Immanuel Kant, took causality to be a category of the mind, not of reality. Oddly, though Kant saw himself as rescuing philosophy from another father of modern philosophy, David Hume, Hume started this line of thinking by identifying causality with repeated patterns. He thinks seeing A along with B solely makes us say *A causes B*. Hume's claim reminds me of a scene in a popular movie in which a newspaper editor was berating a superman-like hero. Someone took up the defense of the hero, pointing out that he had saved many people around the city from various calamities. The editor's response was: "well, he was present at every evil event, so he probably caused them."

It can, of course, happen that one falls into this way of thinking, but my hand always being there when the water glass moves is not the reason, in the proper sense, that

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<sup>2</sup> I emphasize: this conversation was only about what my colleague thought the everyman thought, not about his own thinking.

<sup>3</sup> This description, in fact, is not typical of the everyman but peculiar to educated physicists who know Newton's first law which says, in part, that objects in uniform linear motion continue in uniform linear motion unless acted on by an outside force. The everyman sees things slow down and posits the need to keep pushing things to keep them moving, and has not sorted out the difference between friction and impetus (see my Kid's physics book referenced in footnote 4 for more on impetus and friction); of course, neither has the educated physicist, but he does know the effects at some abstract and real level.

## *How do I know my hand causes movement?*



we say my hand causes the glass to move across the table. What then is the reason? At a very, very young age, we are confronted with change,<sup>4</sup> including the most basic and immediately noticed type of change, locomotion, change of place. In seeing change, we note that a property is one thing, for example a ball *is* in a certain place, but sometimes becomes something else, when, for example, the ball moves to a different place. A moving ball has *this place* and a moment later does not have that place but another *new place*. Change, we see, implies the coming to be of something that was not there before. This, in turn, means that something must be causing it, otherwise we would have something coming from nothing. The question is now what is causing the changes we see. In particular, we want to know what is responsible for the new places that come about as a body moves.

A child sees, at some point, that moving his hand towards a ball so as to slap it causes a pressure by the ball on his hand. Furthermore, he feels and sees that his hand does not go into the ball. He thus senses and understands two things. The ball is pushing on his hand and the hand is not penetrating the ball. By placing his other hand on the opposing side of the ball, he sees that the pressure put by the first hand results in the ball exerting a pressure on the second.<sup>5</sup> This is seen to be true of a class of objects he will later call “solid” and “hard.” If his second hand is removed, the ball, or other solid object, begins to move. He thus sees that the cause of the motion is, at some level, his hand’s motion that leads to contact with the ball. It is true that the same set of sensations occurs every time, but it is not this bare abstracted pattern that makes us conclude causation. As an abstracted pattern, this set of sensations is a kind of derivative principle,<sup>6</sup> following from the essential principle that the ball and the hand cannot be at the same place at the same time<sup>7</sup> and thus the hand, to be successful at moving into the current place occupied by the ball, moves the ball, in some way direct or indirect, out of its way. Next, if his other hand is in the way, the ball then does the same thing to that hand, trying to move it out of the way to take its place. This insight is further deepened as one hears the sound, e.g. the smack, that further reveals the interaction of the hand with the ball.

What of the *indirect* action we spoke of? Further reflection on the situation reveals that the ball keeps moving *even after* your hand is no longer contacting it. Further throwing, hitting and general playing with balls or other objects and thinking about the role of air will lead one to conclude that one has given a new power to the ball, which we call *impetus*, that keeps that ball moving. Controlled experiments reveal that the impetus keeps the ball moving at a uniform speed in a straight line unless another body exerts a

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<sup>4</sup> See my *Kid’s Introduction to Physics (and Beyond)*

<sup>5</sup> After a modern level analysis of much more sense abstracted information, on one can understand this direct generic understanding more specifically. Namely, at the atomic level, roughly speaking, your hand pushing on one side of the ball microscopically moves parts of the atoms on the surface such that the equilibrium point is disturbed so that the next layer of atoms is moved. This continues through the ball until the motion reaches the layer of atoms on the other side which then pushes, again microscopically, into the fingers.

<sup>6</sup> We say it is accidentally related to the essential principle, for like proper accidents of a substance, it proceeds from the essential principle. The ball exerts pressure on the hand because the ball and the hand cannot occupy the same place at the same time. The ball has some integrity by which it resists being pushed into.

<sup>7</sup> The extension of one substance excludes that of another because extension is one part outside the next. More generally, two distinct things cannot be the same without violating the principle of identity (see footnote 4).

force on it, changing its impetus or giving it impetus of a different type. Your hand thus causes impetus in the ball and the impetus moves the ball. So, we say your hand causes the motion of the ball, but only indirectly. It is in fact the impetus that directly causes the motion of the ball. Again, if the hand were the direct cause it would cease to move as soon as one was no longer in contact with it.

In light of Hume's critique given above, we should raise an important possible objection. A skeptic may say: "You have not proven that these are the causes; how do we know that the causes are as you explain? Perhaps a powerful non-visible creature is really causing all these effects so that it is really the creature that moves the ball when I get near it and the creature that makes my hand feel pressure and makes the sound, etc?"<sup>8</sup> The answer to this is fairly simple if one keeps in mind the order in which we know things. In particular, it is only because one already has figured out that hands move balls and bodies move other bodies in the way described that one can think of the idea of another more powerful creature moving them instead.<sup>9</sup> This trick of thought can only be done after we have already understood how things are moved and then have forgotten (at least confusedly) that we know this.

Of course, because of the contingent nature of physical things, it is in principle possible to override the action of the natures of our hands and other bodies in this way, so we cannot exclude this sort of thing from happening (we call them miracles); though, we should not assume it with no evidence either.

Let me emphasize: we have directly seen the physical causes of the motion of bodies through our senses as explained earlier. And, logically, if we had not seen these physical causes, we would not even be able to conceive of the possibility of such an invisible creature, since it is built by analogy to those same physical causes that we then would not know. Again, such a creature is imagined by us by conceiving by analogy a creature that has abilities and capacities beyond ours, and one cannot go beyond that which one has never reached. This remains true if we speak of some non-intelligent substance causing the motion; namely, we have to make analogy to properties of physical substances that we do see.

So, answering the simple question of how I know my hand causes movement turns out to be a not-so-simple process that leads to a simple understanding. We answer it spontaneously as children, but this leaves us with a half understood, even confused understanding, of such a basic thing. Unless we replace our confused understanding with true understanding, this can, indeed will, lead to doubting the fundamentals of our sanity, such as the principle of causality. So, this article and ones like it that address the core of our knowledge are essentially important to our lives.

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<sup>8</sup> When such direct causation is attributed to God, it amounts to a denial of secondary causes and is called occassionalism. Furthermore, as shown in the *Kid's Introduction to Physics (and Beyond)*, the visible hand reveals the concomitant action of God's "invisible hand." That is, without an understanding of the causality exercised by visible objects such as your hand, one loses the starting point (secondary causality) that leads one to the First Cause, God.

<sup>9</sup> We see the visible hand moving into the place of the visible ball; we, by definition, do not see an invisible "hand." When the ball is moving uniformly through, for example, vacuum (*plana*), we no longer have one body pushing another out of the way, but we do have the *visible* moving body itself and/or the body through which it moves (the vacuum, which is also known through the senses, see Appendix IV of *Physics for Realists: Electricity and Magnetism*) to account for the motion. We must start with what we know first, i.e. what we sense.