

Dispositions and Powers

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Dispositions: their forms and varieties

Conditional properties in general

The great variety of kinds of properties that are comprehended by such terms as “disposition,” “power,” “potential,” “tendency,” “capacity,” “propensity,” and “capability” share a common generic structure. They are ascribed to things and substances. However in all cases the basic structure of that attribution is conditional in form. To attribute a disposition to a thing or substance is to say that if certain conditions obtain, then that thing or substance will behave in a certain way, or bring about a certain effect – that is, that a certain outcome will occur. A fertile soil is one of which it is true that if seeds are planted in it and properly cared for, they will grow into flourishing plants. A negatively charged particle is one of which it is true that, if brought into proximity to another negatively charged particle, it will experience a force of repulsion.

All the variety we find in this class of properties can be expressed either by adding a qualifying clause to the basic form, or by variations in the modality of the conditional clauses, from “is” and “will be” to “were to be” and “would.”

Bare and grounded dispositions

To say that chili peppers are “hot” is to say that if they are chewed (were to be chewed), one experiences (would experience) a tingling and burning sensation in the mouth. This simple conditional statement ascribes a bare disposition to these vegetables. However, one may raise two kinds of questions that lead to a natural elaboration of the matter. One may wish to know why chewing these seed pods and not others has (would have) this effect. And one may also wish to know how one can be justified in saying that the peppers *are* hot, when they are merely hanging from the kitchen ceiling, and not being chewed. Both these questions get the same answer: they have this effect because of their chemical constituents, and they possess these constituents even when not being chewed. The one question sets a problem for a biochemist, the other for an epistemologist. Their common answer is incorporated in a more elaborate formulation of dispositional ascriptions: namely, as grounded dispositions:

If conditions C obtain, then effect E will occur by virtue of the nature of the things or substances involved, *ceteris paribus*.

The addendum clause describes the grounding of the disposition. The *ceteris paribus* qualification is required to take account of the fact that, in general, the conditions specified in the antecedent of the conditional clause are local and presume the stability of a more comprehensive environment, such as the atmosphere, the gravitational field, and so on. In many cases the logical form of the addendum is an existential quantification over properties. It would read, when expanded, something like this:

There is some property, which we do not currently know, that is characteristic of the thing or substance involved, and the possession of that property is a necessary condition for the effect to occur in the defined circumstances.

It has been pointed out that the enrichment of a bare disposition to a grounded disposition is tantamount to the setting out of a scientific research program. The addendum asserts only that there is *some* grounding property, not which property it is. So it has the form of a hypothesis which could be further investigated, sometimes experimentally.

Affordances

The term was introduced by J. J. Gibson (1979) to distinguish those dispositions which we ascribe to material things, in which the conditional clause is expressed in terms of some human activity, requirement, and so on from all other kinds of dispositions. For instance, the declaration that the ice on a pond is safe means that it affords skating. A floor affords walking; scissors afford cutting; and a musical score affords performing. The notion has been generalized to include those dispositions which are ascribed to the material world on the basis of the reactions of a humanly constructed experimental apparatus. Thus a flow of current is that process in a conductor which affords a reaction of a galvanometer. Affordances are properties of the material world, but manifest themselves in circumstances devised and created by human beings. A central topic of concern to both physical and human scientists is whether the dispositions evoked by this or that experimental procedure are manifested in circumstances other than those devised by the investigator. Which affordances could be redefined as dispositions which could be manifested in circumstances other than those devised by human beings?

Liabilities and powers

From the very first uses of concepts that fit the "grounded disposition" schema in the seventeenth century, the distinction between passive dispositions, or liabilities, and active dispositions, or powers, has been important. Inertia is a passive disposition, or liability, since the capacity to resist acceleration becomes effective only when a body is subject to an impressed force. Weight is an active disposition, or power, since the tendency to accelerate towards the center of the Earth is continuously effective even when a body is prevented from falling, say, by a resting on a platform. This distinction, though of great importance in the way we structure explanations, is nevertheless relative. A material body has weight only when in a gravitational field, and that weight is proportional to the strength of the field. Relative to the gravitational field, weight is a liability. Elementary electric charges are counted among the fundamental entities

of the universe, since, at least in orthodox electromagnetic theory, they depend for neither their existence nor their strength upon each other. They are, then, pure, or fundamental, powers. Considered with respect to other like charged bodies, these basic powers can also be seen to be liabilities, in that an elementary particle, by virtue of the charge, is acted upon by others. The question of whether any human dispositions, tendencies, capacities, and so on are active powers is still much debated. Considered as mere spectators of the working of cognitive mechanisms, people are denied active powers; while considered, according to the new discursive psychology, as active users of sign systems, people are taken to be original sources of activity.

The historical development of dispositional concepts

Locke's doctrine of qualities

The modern interest in dispositional concepts can be dated to their use in Locke's essay, famously developed out of the distinction between primary and secondary qualities. Locke thought that our sensory experience could be analyzed into simple ideas, such as the idea of square and the idea of yellow. These ideas, he supposed, must be caused in us by material things. How are the ideas in the mind related to the qualities which cause them in material bodies? According to Locke, the ideas of primary qualities, such as shape and number, resemble the qualities which cause them, while the ideas of secondary qualities, such as taste, warmth, color, and so on, do not. Yet these are caused, as are the primary ones. What are the corresponding secondary qualities? These, says Locke, are powers in the body to cause the ideas (see LOCKE: QUALITIES, PRIMARY AND SECONDARY).

It was quickly pointed out by both the friends and the opponents of natural powers that Locke's distinction between primary and secondary qualities and their corresponding ideas would not do. Greene (1727) pointed out that the argument for the powers analysis applied as much to primary as to secondary qualities. So the scientific realist, claiming to penetrate beyond the mere sensory appearances of things, must necessarily turn to an ontology of powers, as the real substance of the world. Reid, adopting a distinction made central by Berkeley, partitioned powers into active and passive, the active characterizing rational and sentient beings. Matter, Berkeley declared, is just a collocation of ideas, and, like the ideas that constituted it, was inert. Physics followed Greene, rather than Berkeley (see BERKELEY). There are, in nature, active causal powers, not associated with sentience or discretion.

The dynamicist metaphysics of physical science

If all the qualities of bodies, relevant to our observing them, are best taken as powers, what are we to make of these bodies themselves? Is there any place for material stuff in the ultimate constitution of the world? The dynamicists, of which party Leibniz, Greene, and Boscovich were enthusiastic members, declared matter to be redundant. The fundamental physical beings are point-centered fields of force. A field of force is characterized by a pattern of spatially distributed dispositions. The illusion of materiality arises from the way we perceive those surfaces in space at which the forces of attraction and

repulsion are equal and opposite. A body will lie passively on a surface defined this way. The surface of forces in equilibrium will seem to enclose a volume of solid matter.

Dispositions and scientific realism

It can hardly be denied that we know the physical world, as scientists, through the reactions of our instruments. It is easy to slip into the positivist view that physical science is just the statistical study of the reactions of instruments, and our picture of the world a mere "as if." We cannot observe the states and processes that produce the reactions of instruments. "Yet the thing is not altogether desperate," as Newton once remarked (in the Scholium to Definition VIII), when faced with a similar impasse concerning our knowledge of space and time (see NEWTON). In this case, we know that the physical setup of world plus instrument *must* afford just those reactions. We can therefore ascribe a qualified disposition to the world. Our knowledge of the world as a system of powers is not wholly independent of human concepts and constructions, but is at least partially so. Our instruments do not behave in these ways unless "bolted to" the world.

Our confidence in this solution to the problem of defining an acceptable form of scientific realism rests on a historical observation about the development of a dispositionalist treatment of our knowledge of the physical world. Conceived in terms of dispositions, our knowledge presents itself in a hierarchical form, such that successive steps in the hierarchy are of epistemically different strengths; that is, as claims to knowledge. The dispositions of a substance to react in this or that way in appropriate circumstances are grounded in hypotheses about the constituents of that substance – for instance, in the arrangements of the elementary magnets that together constitute a bar magnet, whose active powers are revealed in the patterns it induces in a sea of iron filings. But the elementary magnets, revealed by metallurgists' microscopic techniques, are themselves bodies endowed with causal powers, which, in their turn, are grounded in molecular and submolecular constituents and their arrangements. The powers and dispositions of ions are grounded in structures of subatomic particles, each of which is endowed with its characteristic cluster of powers. The grounding of macro dispositions in the observable constituents of the material stuff in question lends inductive support to the next step: namely, grounding this level of disposition in the powers of further constituents, whose manipulability by a human agent gives weaker, but subtle, substantial inductive support to claims for their existence, and so on. The ultimate powers of matter are the elementary charges which define the nature of subatomic entities or beings of yet more subtle character. In this way the regress of dispositions and powers, structured by the intervening hypotheses as the groundings of the powers revealed or supposed at each level, confirms the general plan for ascribing dispositions, as real properties, even to the unobservable constituents of the universe.

The final step in setting up a dispositionalist ontology is to define a class of elementary beings, the only properties of which are their powers. The claim that any given kind of being is elementary is, of course, defeasible, by the discovery of some constituting structure of yet more elementary beings, properties of which ground the dispositions once taken as bedrock. The elementary beings that define the limits of a given ontology are its powerful particulars. In psychology these might be persons, and in physics certain classes of charged "particles."

References and further reading

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