

3 Properties and relations

3.1 The addition of causal powers

There are many different ways to classify and refer to reality. For essentialists, classification can be made on the basis of **similarities of intrinsic nature**.

(NE) accepts Galileo/Locke's distinction between primary/secondary properties, but recognises another kind of property inherent in things, *in addition* to primary qualities, that includes **causal powers**, capacities and propensities.

3.2 Properties and predicates

Properties exist independently of language.

- They are 'genuine existents'
- Aristotle's "universals".

Predicates, however, are linguistic items.

- They exist only as parts of a language.
- They have other purposes besides attributing properties, including evaluation, the name of social conventions, property-denial, ...

There are properties that have no names, and there are predicates that do not name actual properties. The fact that something is true does not mean it denotes a property.

3.3 Inherent dispositional properties

For essentialists, **dispositional properties**, though not immediately perceivable (unlike Locke's primary qualities) are central to an account of reality.

They divide into **causal powers**, **capacities** and **propensities**:

(1) **Causal powers** include 'all of the sources of all power and order in the world'.

- Eg. gravitational mass, the power of an object to generate gravitational fields
- Objectively describable properties that are intrinsic to the objects that possess them.
- At least as fundamental as Locke's primary qualities.

(2) **Intrinsic capacities** are properties that describe how things are disposed to *resist* causal influences of various kinds.

- Eg. inertial mass, resistance to acceleration.

(3) **Propensities** describe how things are disposed to *act*, independently of causal influences.

- Eg. the half-lives of atoms.

For an essentialist, such properties can be fundamental. For a passivist, such properties must always supervene on the primary qualities of matter and the laws of nature.

3.4 Causal powers

A **causal power** is a **disposition to engage in a certain kind of causal process**.

- It relates events of a causal kind (having the role of causes in the process) and of an effectual kind (having the role of effects in these processes).
 - In every kind of causal process there is a specific **functional relationship**, often quantitative, between the causes and the effects.
- Metaphysically, causal relations cannot be reduced to mere instances of regularities (a la Hume), but are to be explained by reference to powers.
 - Causal powers are primary, not events.
 - For (NE), a causal relation could still exist for a *single event*.
 - Epistemically, the **causal powers** of an object must be defined by specifying the **causal processes** in which it may be involved, which in turn requires us to define the relevant kinds of **events** and to specify the **causal relationship** between them.

This may be done objectively only if the kinds of events and processes involved are **natural kinds**.

- The distinctions between the specific kinds of changes in the world, which causal powers are disposed to produce, are *categorical* and *absolute*.

For Ellis, this rules out **secondary qualities** as causal powers.

- Eg. the power to produce a red visual sensation is not an event that belongs to a natural kind. It is a ‘combined and perceptually filtered effect of many different causal powers acting on us simultaneously’.

3.5 Intrinsic properties and structures

An **intrinsic** property is a property that something has independently of any other thing. The notion of *independence* in use here is **causal** rather than logical.

An actual property may be analysed into two parts: an intrinsic and an extrinsic contribution

- Eg. the actual mass of a body = rest mass + mass component due to relative motion
- Eg. the observed half-life of a body = intrinsic component + relativistic component

A **causally intrinsic** property is an ‘underlying’ property that exists independently of observers.

Causal intrinsicity reflects the structure of **model-theoretic explanations** in the sciences.

- Here, we abstract from the complex situation (eg. an array of external forces) in order to construct an isolated model of the system (ie. in the absence of these forces), then seek to explain the differences (effects).
- Ie. defining causal intrinsicity *defines* the range of effects to be causally explained.

3.6 Real essences

Essential properties are intrinsic properties that an object has *necessarily*.

- Eg. the atomic number of Uranium is an essential property.

Accidental properties are intrinsic properties possessed contingently (they need not have them).

- Eg. the state of electron excitation of Uranium is an accidental property.

Variable natural kinds admit structure and can exist in various states, so some of their intrinsic properties are accidental.

Fixed natural kinds are the most fundamental, possessing a stable set of intrinsic properties, all of which are essential.

Intuitively, most natural kinds are variable, and the degree of variability increases with complexity.

▪ **Nominal and Lockean essences**

Nominal essences often need extrinsic properties (eg. the Aurora Borealis is *localised*), but 'real' essences (of the sort uncovered by the sciences) deal in intrinsic properties.

Real essences answer the question, 'in virtue of what intrinsic properties or structures is this the sort of thing that it is?'. They are general.

Lockean real essences answer the question, 'in virtue of what intrinsic properties of structures does this particular thing have the manifest properties that it has?' They are more specific.

3.7 Quantitative properties

According to Ellis, most essential properties are quantitatively determinate.

- Eg. unit mass, the charge of an electron

Quantities are **generic kinds**.

The relationship between having a mass, and having *this* specific mass, is a **species relationship**.

- Continuous quantities are also generic: their infimic species form a continuum.

The instance of a property is a **trope**.

- a singular fact or state of affairs that must exist wherever the property is instantiated.

Properties (and relations) may be regarded as natural kinds of tropes.

4 Powers and dispositions

4.1 Essentialism vs. Humeanism

Essentialist theses:	Humean theses:
(a) Inanimate matter is essentially active	Inanimate matter is essentially passive.
(b) The actions of things depend on their dispositional properties, eg. causal powers	Things simply behave according to the laws of nature.
(c) Dispositional properties are real and intrinsic to the things that have them	Dispositional properties are neither real nor intrinsic to the things of which they are predicated
(d) The essential properties of things include dispositional properties.	The essential properties of things never include dispositional properties.
(e) Elementary causal relations involve necessary connections between events	Causal relations are always between logically independent events, and are contingent.
(f) The laws of nature describe the ways that members of natural kinds are logically required to act, given their essential natures.	The laws of nature are universal regularities imposed on things whose identities are independent of the laws.
(g) The laws of nature are therefore metaphysically necessary.	The laws of nature are contingent.

Disagreements between essentialists and Humeans hinge on different conception of **dispositional properties**, rooted in a fundamental dispute about the world's **sources of power** and activity.

4.2 The dead world of mechanism

▪ Old mechanism.

Perspective of 17th/18th century mechanism: the world is 'hard, cold, colourless, silent, and dead; a world of quantity, a world of mathematically computable motions in mechanical regularity' (Burtt).

For Locke, the only things that we know to possess active powers are God and created spirits.

▪ Question: Do active powers exist in inanimate nature?

For the mechanist, the answer is 'no'. Things do not themselves have causal powers; the powers lie outside them.

The world is (or has been set) in motion. Any *changes* we see occurring are the consequence of 'the inertial motions of things and their mutual impenetrabilities'.

4.3 External forces

▪ Old Mechanism.

All changes must *ultimately* be changes of position or changes in the states of motion of things.

- The elementary *parts* are rigid and unchanging.
- So all changes must be changes in the *arrangements* or *motions* of these elementary parts.

Nature consists of extrinsic push-pull forces (the sources of power) acting upon intrinsically rigid bodies (passive material).

The dispositions of things must ultimately depend on their underlying structures and how the laws of nature operate upon their most elementary parts (**categorical realism**).

However, natural philosophers of that period still used the *language* of active causal powers.

▪ **Humeanism**

All causal powers and forces generally regarded as occult. Causal powers (active or passive) are now held in suspicion.

- Hume denied there existed anything in nature other than regular patterns of behaviour.
- Causal talk can only be referring to such regularities.

There is just the underlying structures, to which the laws apply (but which they no longer *govern*, cf. Beebe 2000).

4.4 Dispositions and causal processes

Causal powers are genuine properties for (NE).

Dispositional properties are associated with natural kinds of **causal processes**.

- To say X has a disposition Y is to say that X is intrinsically disposed to participate in natural causal processes Y_c .
- It can be construed as a relationship (potential instantiation) between an object and a natural kind of process

4.5 Categorical and dispositional properties

Categorical properties and **dispositional properties** are *both* fundamental and should be distinguished.

Categorical properties are properties things have *independently* of how they may be disposed to behave: they are *structural*, not dispositional.

- Their identities depend on what they are, rather than how they are disposed to behave.
- They are more readily imaginable (pictured as structures in two or more dimensions) than dispositional properties (pictured only *in action*).

They can be motivated in two ways:

(1) The existence of **block structures**, eg. molecules.

- Block structural properties depend on relations between things that have identities independently of these relations.
- Such properties obtain iff the constituent things exist and are arranged in a certain way.
- The essence of an atom includes structure, even if the structure depends on other things being disposed to behave in certain ways.

(2) The existence of **intrinsic structures**, eg. fields, space-time, the quantum vacuum, etc.

- Structured, but have no parts capable of independent existence.
- Eg. an electric field is an intrinsic structure of electric and magnetic potentials, described by Maxwell's equations, on which boundary conditions are imposed, determining its directed field strength.

4.6 Categorical realism

According to **categorical realism** (Humeanism), the fundamental properties of nature are *all* categorical.

- It is the prerogative of laws of nature to tell things how to act.
- Therefore, things in themselves must be entirely neutral with regard to their dispositions; their intrinsic properties must be all categorical.

Categorical realists (Humeans) evince a strong commitment to the '**contingency thesis**'.

- The laws of nature are entirely *contingent*.
- Already implicit in the **divine command theory** accepted in the Middle Ages (Scotus).
- Widely believed among modern philosophers.

▪ **Newtonian form**

Causes are mediated by forces, but the causal laws are still contingent.

▪ **Humean form**

There are no forces, nor any other necessary connections in nature, only regular sequences of events. Causes are instances of these regularities (cf. the regularity theory of laws and causation).

The dispositions of things cannot be of their essence, because all dispositions depend on the laws of nature, and these laws are contingent and extrinsic to the things they act on.

Dispositions must be grounded in the categorical properties of the things that have them, but we are free to associate dispositions with categorical bases in a given possible world according to how the laws are in that world.

▪ **Arguments in favour of categorical realism**

(1) *The continuing existence argument.*

- Dispositions continue to exist even when they are not manifested.
- The fact that dispositions continue to exist even when they are not manifested needs an explanation.
- The continued existence of a disposition would be explained if it had a purely categorical basis.
- The continued existence of a dispositions cannot be explained in any other way.
- Therefore, dispositions must ultimately have categorical bases.

In reply: there seems no good reason why dispositions couldn't be fundamental, and therefore capable of existing unmanifested without a categorical basis.

(2) *The difference argument.*

- If two things differ in respect of any of their dispositions, they must also differ in respect of at least one of their nondispositional properties.
- Otherwise, the difference would be inexplicable.

In reply: one could accept there must be some other difference, yet deny it must be categorical.

Both arguments simply assume that real properties must be categorical, the sort of things capable of being visualised or imagined. There seems no reason to grant this.

▪ Arguments in favour of dispositional realism

(1) *The argument from science.*

The most fundamental things we know about all have dispositional properties.

- Block structures are not ontologically primary.
- Intrinsic structures are spatiotemporal structures of dispositional properties.

(2) *The argument from the nature of the laws of nature.*

Laws of nature refer more often to properties that are not structural, but to quantitative dispositional properties.

- Eg. mass, charge, magnetic field strength, moment of inertia, etc.

(3) *The ontological regress argument.*

Whenever a causal power is seen to depend on other properties, they must always include causal powers as well.

- Eg. an account of the dispositional property of brittleness in a crystal depends on the crystal's structure, but also on the cohesive powers of its atomic or molecular constituents... which are also explained in terms of causal powers at the subatomic level.

Causal powers do not drop out of the account at any point.

4.7 Analysis of dispositions: appearance and reality

We invoke dispositional properties in order to *explain* something's manifest dispositions.

However, they cannot be *identified* operationally with the dispositions they are postulated to explain.

- Eg. a person, by believing something to be soporific, may *experience* it as soporific: the disposition to sleep, however, is caused by the placebo effect.

A *real dispositional property* is displayed by a natural kind of **process**, which has a **real essence**.

- It grounds a **causal process** that exists independently of our classificatory schema.

The *manifest* dispositional properties of things may be best explained by an underlying dispositional property that is directly responsible, or may be the result of many kinds of processes.

Like all natural kinds, they exist independently of our schemes of classification:

- Natural processes that *appear* to be of the same kind may turn out to be essentially different.
 - eg. refraction through a prism and diffraction through a grating.
- Natural processes that appear to be very different may turn out to be species of the same kind.
 - Eg. falling to earth and orbiting the sun are essentially the same process.

Such dispositional properties have essential natures that must be explicated *a posteriori*. For (NE), natural science must describe these natures.

- Eg. the nature of water as H₂O, supplanting any nominal definition.

On this analysis, it is clear how dispositional properties

- i. support subjunctives,
- ii. can be feigned or frustrated, and
- iii. often obscured.