2 Empiricist and realist perspectives on the world.

In this section, Ellis offers some motivations for preferring scientific essentialism.

2.1 Two views on science

- **Empiricism**

Aim: To *save* the phenomena, not to *explain* them.

- Its object is to 'summarise and classify logically' empirically discovered laws, developing theoretical structures in which they can be derived as special cases.
- It must stick to observed facts, and what can be inferred from them by rational argument.
- For Berkeley, such knowledge does not tell us how the world *really* is. For Hume, such knowledge tells us certain particular matters of fact, but we cannot make inferences.
- Empiricists of the 19th century were reluctant to believe in atoms, molecules, EM radiation, etc beyond being useful models.

A view of science widely held in the first half of the 20th century. Cf. logical positivism and instrumentalism.

Empiricism sets up a dividing wall between science and metaphysics.

- **Scientific realism**

Aim: to expose the underlying causes of things; to explain, not merely to represent.

- For Duhem, a scientist seeking to do this is illicitly engaged in metaphysics.

Elis claims scientific realism is better motivated in some sciences (eg. chemistry) than others (eg. 'space-time physics').

- The dynamics of Newton and Einstein are plausibly describable as **abstract model** theories.
- Chemical theories, however, are **casual process** theories that seek to describe the underlying causal processes in terms of actual, propertied entities involved in interactions.

Against Duhem, Ellis appeals to the 'no miracles' argument and Maxwell's 'mark of the real':

> 'If we were to suppose that these objects and processes were all fictitious, then we should be at a loss to explain how the explanations in they feature could possibly be so useful… it seems we are learning more and more about them in the process of studying them…. Maxwell once claimed that the mark of the real is that it manifests itself in more than one way.'

2.2 The 'natural kinds' structure of reality

Ellis contends that the case for realism about theoretical entities in chemistry is strong, and that the material world is 'fundamentally structured into natural kinds'. He offers **five criteria**:

i. The differences between the elements and their various compounds are **real** (manifesting in different ways) and **absolute** (not relative to anyone's epistemic perspectice).
ii. They are **categorically distinct** from each other; there is no gradual transition between kinds.
iii. The distinction and identity of chemical kinds is based on **intrinsic** (**internal**) **differences**.
iv. Chemical elements and compounds belong in **hierarchies**: isotopes, monatomic molecules, complex molecular structures.

v. They have distinctive **essential properties**, in virtue of which they are *what* they are.

The presence of structure in chemistry guarantees an objective way the world is, independent of human knowledge or language.

2.3 Fixed, variable and cluster kinds

- Ellis divides natural kinds into two sorts:

i. Kinds that allow no intrinsic variability (**fixed natural kinds**): the properties they possess cannot be lost of varied in any way. Eg. the properties of a copper atom.

ii. Kinds that permit intrinsic variability(**variable natural kinds**): their members have causal powers capable of being modified.

Variable kinds occur at higher levels of complexity. They are natural kind aggregates, with all the essential properties of the kind, but with properties that vary due to varying states of aggregation.

– Eg. crystals can become electrically charged, acquiring a new causal power.

- **Biological 'kinds'** (natural cluster kinds)

Ordinary species are clusters of genetically similar microspecies. Ellis argues *against* classifying biological species as natural kinds:

i. They fail the categorical distinctness test (Criterion 2).

– The distinctions between the extant species are not always clear. There is continuous variation between some different species.

– Darwinian evolution posits common ancestors, so distinctions do not hold through time.

ii. They lack any distinctive real essences (Criterion 5).

– The genetic constitutions of organisms are rarely the same even within the same species.

There appears to be no non-arbitrary solution to dividing up species by either their genetic constitutions or manifest (phonotypical) properties; a problem compacted by Darwinian evolution.

- Human beings are members of a (variable) natural kind cluster

However, humans have the distinction (probably shared with some other creatures) of deliberately modifiable causal powers – that is, of a **meta-causal power** to change our causal powers.

– The origin of our sense of freedom of choice and action.

- More complex systems

Ellis argues we have no reason to be realistic about the theoretical entities employed in ecology, economics or sociology. They have no natural kinds that satisfy the criteria.

2.4 The dynamical structure of the world

Since each natural kind has its own ways of behaving and interacting, the world must have a **dynamic structure** that reflects its natural kinds structure.

– This implies strong restrictions on the kinds of events or processes that can take place.

Chemical processes are categorically distinct **natural kinds** of processes.

- They issue from the causal interactions between chemical substances that are natural kinds.
- They depend upon only their intrinsic natures and the substance involved in them.
- They belong in hierarchies.

Eg. subatomic events producing the optical spectra of the elements belong to natural kinds.

> **Observation**: Spectra can be modified by background potentials, so the process does depend on the environment, but this point does not negate the existence of structurally distinct atomic spectra.

2.5 An objective, structured (hierarchical), powerful world

- **An objective world**

It is commonly supposed that "the view from nowhere" (Nagel) does not exist.

This is because it is also supposed that our knowledge of the world is ultimately dependent on how we 'carve it up' into objects and kinds, and how we use language to describe and classify it.

- Cf. postmodernism, social constructivism, and anti-realism.

However, (RE) entails that relativist or conceptualist conceptions of reality should be rejected.

i. If there is a natural kinds structure to the world then there *is* 'a network of **objective facts** existing <u>independently</u> of human language, thought and understanding'.
ii. Since we know some of these facts through the physical sciences, then part of our knowledge is objective; its status as *knowledge* does not depend upon a certain point of view.

- **A hierarchical world**

There is a hierarchy of natural kinds of events and processes.

- Eg. there is the natural kind chlorine, the halogens, all the elements, … the 'global kind'.
- In ascending the hierarchy, the behavioural and structural constraints are progressively relaxed.

The existence of a hierarchy of natural kinds of events and processes entails a **hierarchy of laws**:

i. The most general **causal laws** apply indiscriminately to all possible substances in our world.
- Eg. the conservation laws.

ii. The most general **structural principles** must be satisfied by all possible structures in our world.
- Eg. the principles of GR and QM (perhaps)

- **A powerful world**

Even the most general laws of law have a foundation in the natures of the most general kinds of things. They are immanent within the world, rather than extrinsically imposed upon it.

2.6 A world of natured things with necessary laws

Natural kinds are bound to behave according to their natures.

For (NE), since the laws derive from the essential natures of these things, the laws of nature are *not* contingent but **metaphysically necessary**.

For the passivist, anything can be made to do anything at all by something that is sufficiently powerful, because the laws of nature are contingent regularties. Ellis asserts, to the contrary:

> 'God cannot make a sample of hydrogen that yields a chlorine spectrum, not because he lacks the power to do so, but because there is no such thing'.

However, metaphysical necessity attaches to how things are *disposed* to act, not how they actually act. They may be prevented from so acting.

- The display of a causal power may be thwarted if intervention in the resulting **causal process** is possible.
- It is **contingent** whether or not 'the circumstances are apt' for the display of the causal power.

- **Rebooting the scientific image**

  However, the scientific image is also unacceptable: it is Humean and has no place for the human qualities and capacities that inform the manifest image.

  - eg. capacities pertaining to rational agency
  - eg. consciousness.

  For the essentialist, the scientific image needs rebuilding: what is often called the scientific image is really stuck in the 17th/18th centuries and portrays and impoverished picture of passive nature.

  New essentialism aims to reshape the scientific image and bring the manifest and scientific images closer together.

- **Causal powers vs. regularities**

  For the Humean, a case of causation is an instance of a universal generalisation, and the agent is cast as a spectator.

  For the essentialist, all effects are displays of causal powers, and everything is an agent of some kind with causal powers.

  - Simple things have fixed causal powers.
  - More complex things have *variable* causal powers (variable natural kinds), gaining or losing causal powers according to circumstance (eg. a piece of iron can become magnetised).
  - Some complex things have the power to change the dispositional properties of other things (eg. a bar magnet can magnetise a piece of iron).
  - Some complex things have meta-powers to change their own causal powers (perhaps humans and members of other advanced species).

  Human deliberation and action may be explicable in terms of such meta-powers.