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**Philosophy of Biology**

**6AANA050/7AAN2057**

**Semester 1 2021-22**

**Strand Building S -2.8 Mondays 1600-1700**

**Lecture 4**

**Lecture 3 (finished)**

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**Teleological/Functional *Explanation***

In biology we say: X is there so that/in order that/to Y, the function of X is to Y. We explain X by some *effect* it produces. This reverses the normal procedure of explaining by *causes*.

Until the 1970s—‘covering-law model of explanation’—causes are just one kind of explanation: causal explanation has *earlier* ‘initial’ conditions, teleological functional explanation has *later* ‘final’ ones.

No good. Hearts are not there to make thumping sounds. Nor does it help to add on requirements about the effect being beneficial: consider a trait (eg big mouse ears) which is now beneficial for thermoregulation but that’s not why it evolved.

This suggests that biological functional explanations are disguised references to past histories of natural selection: the function of X is to Y iff X is now present because in the past ancestors with X reproduced more in virtue of the fact that X yields Y. This is a complex *causal*-historical explanation in which X’s yielding Y plays a crucial role.

It is now generally agreed that – *when* biological *explanations in terms of effects* are good explanations – they are disguised references to past Darwinian histories of natural selection. That is, they are *complex* causal explanations.

Aristotle used to believe in *“final* causes”. (Cf “efficient”, “material” and “formal” causes.) Some things happened *so that* further results could occur. (The stone falls *so that* it can be at the centre of the earth.) This was basic and non-causal. The stone is destined to find its way to the earth. Similarly, for Aristotle, we are destined to have hands *so that* we can grasp things, and eyes *so that* we can see.

These final causes are now rejected. It’s now widely agreed that all good explanations of particular facts are (efficient) *causal* explanations. When we explain X by saying it happened *so that Y*, it’s either a Darwinian explanation, or a reference to an intelligent designer/agent, whose earlier *desire* for Y *caused* X.

So we have:

Darwinian explanations

Intelligent designer-desire explanations

Aristotelian explanations

We can agree the first two are often OK, the latter not.

**Meanings of “Teleology” and “Design”**

What should we *call* these explanations? Does “t*eleology*” only mean the last, or the last two, or all three?

Who cares? As long as you make it clear what you mean, you can use “teleology” as you like.

It is common to talk of natural selection as a “designer”, and to speak of selected biological traits as consequently “being there for a purpose”.

This is because of a natural analogy between intelligent designers and natural selection:

(a) intelligent designers pick X if they *believe* will cause Y, and they *desire* Y;

(b) natural selection produces traits X that have *shown themselves* to cause Y, where Y is natural selection’s favoured end of survival and reproduction.

Does this analogy justify talking about “natural design” and about biological traits “being there for a purpose”?

Who cares? As long as you make it clear what you mean, you can use “design” and “purpose” as you like.

***Notions* of Biological *Function***

Some argue that biologists don’t always use function “aetiologically” to refer to prior natural selection. Eg ecologists might well be inclined to say that some trait has a stabilising function even if it wasn’t selected for that effect. (Plants “have the function” of eliminating CO2 from the atmosphere.) (Cf Bigelow and Pargetter.)

No big issue here. If ecologists talk like this, so be it. Who cares? Note that it is agreed on all sides that these forward-looking functions don’t *explain*. If we are interested in *explanatory* functions, then we have to go aetiological.

**Lecture 4**

**Innateness**

**Initial Ideas of Innateness**

Genotypes and phenotypes. Let’s agree genotypes are innate. But are any phenotypic traits innate? Most people talk as if that question makes sense (is intelligence/height/criminality/sexual orientation . . . innate?). But it doesn’t.

**Different Notions**

(a) *Genetically determined*. But *no phenotypic traits* are genetically determined, if that literally means caused by genes alone.

(b) *Present at birth*. But *fetal alcohol syndrome* isn’t innate, whereas *male beards* are.

(c) *Universal in the species*. But *knowing about water* isn’t innate, whereas *eye colour* is.

(d) *Canalized*. A trait is canalized if its appearance is insensitive to environmental differences. But *knowing about water* isn’t innate, whereas *male rat spinal features* (which depend on maternal licking) are.

(e) *Genetic adapation* (genes have been selected to foster the trait). But genes have been selected to foster my *throwing stones*, but that’s not innate, while no genes have been selected to foster *philtra*, but they are innate.

(f) *Not learnt*. This is arguably how it’s used in cognitive science (by those like Chomsky and Fodor). But *mental changes due to injury* are not learnt but not innate, while *fear of snakes* is arguably learnt but innate.

(g) *Difficult to Change.* But *phoneme sensitivity* is difficult to change but not innate, while *gout* is arguably innate but easily fixed. (It is often supposed that environmental inequality is awful and must be rectified, while genetic inequality is only right and proper. I’ve never understood why.)

(h) *Highly heritable*. Interesting, but not even close. See below.

**Doing Without Innateness**

What notion of innateness am I using to show none of the above suggestions work? Maybe some average of the above.

Anyway, these are all different notions, which can be shown to dissociate in every way (I leave that as an exercise). By clumping them together under the heading of “innateness” we encourage fallacious and indeed pernicious inferences. (Such as: if it’s highly heritable, it’s difficult to change.)

There is no doubt a folk notion of organisms having an inner essence that encourages the idea of innateness, but that is no excuse.

**Heritability**

A trait is “heritable” to the extent that *differences* in the trait are due to *genetic* differences not *environmental* ones.

If phenotypes P are function of genotypes G and environment E

P = G + E

then the heritability of P is

H = √Var(G)/√Var(P)

Intuitively, ask “how much of the variance in P would remain if the variance in E were zero?”

But NOTE THAT this measure is very sensitive to the relative amounts of genetic and environmental differences in the population.

When the TB bacterium is rife, *getting tuberculosis* is highly heritable though not innate. When there’s little genetic variation, *height* has low heritability but is innate.

It is also worth noting that genetic differences can cause phenotypic differences via very environmental pathways. (Teachers responding more to noisy/white children.)

Here’s an interesting case. Cricket excellence runs in families, where footballing excellence doesn’t. Which is more “heritable”? It turns out *football* is.

The cricket-football difference must be due either to genes being more important in cricket, or family environments being more important. Surely it’s the latter. Genes matter the same way in both. So environments are more responsible for the differences in cricket than football. Cricketing variation would shrink hugely if all had the same cricketing environments, not so in football--kids already have pretty much the same footballing environments. So gene differences cause a greater *proportion* of the variation in football than they do in cricket. This means technically that footballing skills have higher “heritability”.

**Real Heritability Isn’t Generally Genetic**

Something’s very funny here. Intuitively it’s the cricketing skills that are being passed from parents to children, even if the footballing skills are more “heritable”. The oddity arises because technical “heritability” means specifically *genetic* heritability. Somehow when the idea was introduced it was assumed that the only way that children come to resemble their parents is via genes.

 P P P

G G G G

But of course that’s false. Parent-child resemblances can come from training too.

 P P P

G G G G

Let me finish with a related but different point. Maybe some things run in families because of training, as in cricket. Still, won’t at least some others run in families because of genes? But in fact that’s rather harder.

Consider sports where genes really do matter. Basketball. (If you’re 7 ft tall in the USA, you’ve got a 10% chance of playing in the NBA.) Interestingly, basketball doesn’t run in families so much. No doubt that’s because of regression to the mean due to non-assortative mating. (Extreme outliers mostly don’t mate with equally extreme outliers.)

So it’s much easier for environments to be tightly coupled across generations (cricket) than for genes to be.

In the 19C Francis Galton (Darwin’s cousin) wrote *Hereditary Genius*, citing families containing many eminent musicians, statesmen, rowers, painters, lawyers, etc. He thought this showed that exceptional attainment in these fields was due to exceptional genes. But in fact it shows the opposite. Exceptional environments can be transmitted down family lines, where exceptional genes can’t.