Week 9

Laws

Cartwright, Lange

Slides for the lecture *Philosophy of Science* on 25 November 2014

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Outline

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1 Laws and explanations

Cartwright's claims

1. Many laws implicitly include a *ceteris paribus* clause.
2. Literally put, when stripped of that clause, they are false.
3. Nevertheless such laws can explain—in contrast to what the D-N model of explanation implies (as well as other models).
4. Covering laws required by the D-N model are scarce.

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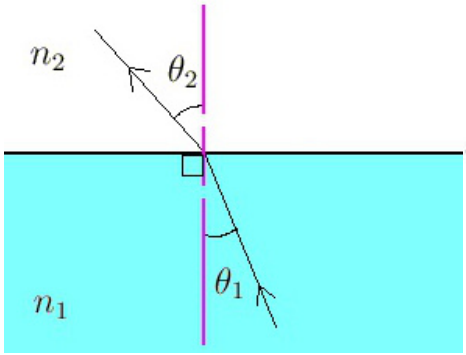
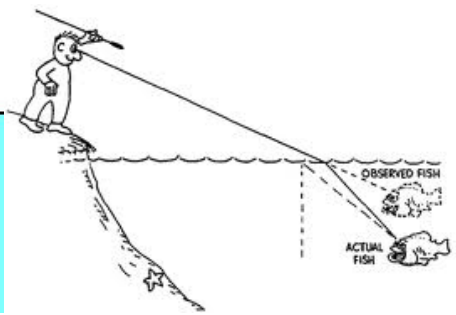
Snell's law

- When light transits to the medium where it travels slower, it bends toward the normal.
- The bending angle is calculated by Snell's law: $\sin\vartheta_1/\sin\vartheta_2 = n_2/n_1$.





Remark
Apparently broken objects in water (explained by Snell's law) are cited in Descartes' *Meditations* to show how senses are not reliable. See also Joyce and Joyce, 'Descartes, Newton, and Snell's law' (1976).

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Every law is born to fail

- But Snell's law has an implicit *ceteris paribus* clause: the media where light travels should be isotropic.
- In anisotropic media (crystals and also media submitted to external electromagnetic influences) where velocity depends on the direction of propagation the law no longer holds (since a light ray splits there into two).
- Hence Snell's law is literally false.
- Furthermore, the *ceteris paribus* clause cannot be interpreted as 'for the most part', since most media are anisotropic.

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2 Cartwright on the role of *ceteris paribus* laws

Using *ceteris paribus* laws

- The use of *ceteris paribus* laws is justified even though they are false.
- Explanations can invoke *ceteris paribus* laws to show what factors are relevant for explaining.
- Objection: but this means that *ceteris paribus* laws offer at most elliptical explanations.
- Reply: this idea presupposes extreme regularity in nature, so that most of it (or all) is governed by laws.
- This assumption is unwarranted.
- Another reply (more important, I think): *ceteris paribus* laws do in fact explain.
- This idea is familiar to us from van Fraassen.

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The irrelevance of covering laws

- When *ceteris paribus* laws conflict, very rarely we are able to produce covering laws.
- As Cartwright says, 'most real life cases involve some combination of causes; and general laws which describe what happens in these complex cases are not available.'
- But in any event, we are able to explain in their absence.
- This is further illustrated by the example of camelias.

Question
What is the story of camelias? How does it establish the explanatory role of *ceteris paribus* laws?

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3 The analysis of *ceteris paribus* laws

The meaning of *ceteris paribus*

- Lange begins with the observation that, for a *ceteris paribus* law to be meaningful, we must assign meaning to the qualifier.
- It seems that, for this to happen, there should be unanimity with regard to what factors are admitted as disturbing.
- That is, we should be able to say, unanimously, what factors are listed in the clause.
- But however hard we try, we will always include the unspecific clause 'something like that'.

Law of definite proportions
'Any chemical compound consists of elements in unvarying proportions by mass, unless the compound is like ruby or like polyoxyethylene or something like that.' We can paraphrase it as: 'Any chemical compound consists of elements in unvarying proportions by mass, unless the compound is a network solid or a polymer.' But consider DNA: it displays some characteristics of polymers and some of network solids, though it can properly be classified as neither of them. Still, it shares with polymers the reason for failing the law of definite proportions. Hence we should again include the clause 'something like that'.

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Making *ceteris paribus* precise

- An attempt to make *ceteris paribus* backfires, since it harms the accuracy of *ceteris paribus* laws.
- Apart from that, Lange argues that there is the application of terms, such as 'network solid', is similarly imprecise.
- Objection: the presence of a *ceteris paribus* clause allows scientists to reformulate laws at will.
- Thus it is a recipe for chaos in testing procedures.
- Reply: nothing prevents scientists from reinterpreting the precisified qualifiers.
- So, for example, they could treat DNA as a polymer.

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4 Defence of *ceteris paribus* laws

Advantages of *ceteris paribus* generalisations

- A primary requirement for laws is to lead to good predictions.
- Thus the scientists need not know all the disturbing factors included in *ceteris paribus* clause.
- They need to know only such factors that interfere with predictions.
- For example, at the time of its discovery, the users of the Boyle's law ($PV = k$) could not know facts about the molecular structure of gases.
- Hence they could not include them in the *ceteris paribus* clause.
- But they should have been able to recognise factors technologically available to them (Lange's example: low pressure, since molecular attractions are less pronounced).
- Since *ceteris paribus* laws are literally false, they are neither regularities, nor relations between universals.

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Problems with non-backtracking

- Laws of nature are supposed to remain invariant under different contingent scenarios (to paraphrase the Nomic Preservation in page 413).
- For example, had I listened to Mahler today, laws of nature would still have been the same.
- Trouble is, if we have deterministic laws, then somehow laws should allow the world to develop in an alternative way.
- Thus David Lewis rejects NP for flawless regularities.
- But we can very easily account for NP: for *ceteris paribus* laws are not flawless!
- They allow disturbances within the *ceteris paribus* clause.

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Island biogeography

- Lange illustrates the use of *ceteris paribus* laws in 'inexact sciences' with the case of island biogeography.
- The idea is to say that larger territories allow larger biodiversity (in accordance with the formula $S = cA^z$).
- But there are *ceteris paribus* factors involved.
- We can maintain the stability of the law, so far as we can rule out irrelevant disturbances.
- And the ability to rule out such disturbances shews the failure of the reduction from the given inexact science to fundamental disciplines.
- That is, each discipline is governed by its own laws.

Question
What are the factors mentioned?

Question
What are the supposed irrelevant disturbances? What makes them irrelevant?

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