DELAYED CAUSATION

Graeme A Forbes
Veli-Pekka Parkkinen
The Problem

- We often get taken by surprise by events that we did not expect.
- In particular, we get taken by surprise by effects of causes that took place a long time ago.
- We shall call such cases instances of ‘delayed causation’
**No Action at a Distance**

**Locality:** ‘There is no spatial or temporal gap between causes and effects’

- Something like *Locality* has been defended by Descartes, Newton, and Hume.

- As Le Poidevin (2007) points out, even those who reject *Locality* accept that causes must be temporally local to their effects.

- Moreover, it is often assumed that effects are fully accounted for by their proximate/direct causes
  - *one of the intuitions behind inference principles such as the Causal Markov Condition*
The Exxon Valdez Case

- In 1989 the Exxon Valdez ran aground causing a major oil spill.
- No unexpected (assuming minor effect) reductions in the fish populations were observed in 1991 and 1992.
- It was concluded that the spill had not harmed fish stocks.
- There was a collapse in fish stocks 1993.
The problem: presumably, the direct cause of each year’s population size is the previous year’s population (cf. Goodman-Wilson 2011)

- *No spill*

```
89  90  91  92  93
```

- *Spill*

```
89  90  91  92  93
   EV
```
Exxon Valdez

  - Did causation jump a number of steps in the temporal chain from the 1989 population to 1992?
  - The direct cause fails to screen the effect off from its distal cause
  - Can we save the locality intuitions by considering the mere passage of time as causally relevant for the effect?
Some forms of ecological succession

- Autogenic succession: causes of succession (via habitat modification) are the changes in the habitat caused by e.g. the plants living in it.
  - E.g. changes in soil structure, forest canopy blocks sunlight...
- Type of habitat change – and thus the sorts of ecological effects that follow – partly depend on the duration of the causes responsible for them
Time is not a cause

- Where there is delayed causation, it can be explained in terms of causal mechanisms and processes, rather than as a result of something being directly caused by the passage of time (i.e. a change in what time it objectively is).

- Some, such as Benovsky (2012) think that the mere passage of time can causally efficient. Shoemaker (1969); Lewis (1976); Newton-Smith (1980); and Mellor (1998) disagree.

- Benovsky’s argument only works if we find ourselves in a situation where only the direct causal efficacy of passage of time will explain a phenomenon. We are not in such a situation.
This rejection of the causal efficacy of time can be understood as the rejection of two claims:

**Date Causality:**

“For instance, suppose some substance, S, is introduced into a flame and turns green. We would never dream of thinking that it turned green because it was put into a flame at just that time. To think that the date was causally relevant in this case is to take quite literally the idea that the time was ripe for change.”

(Newton-Smith (1980, p. 29))
“We do not take seriously the suggestion that the mere passage of time is causally relevant to anything. If some object changes its state after having been in that state for some period of time, \( t \), we would not think that its having been in that state for that period was causally sufficient for it to change. [...] duration causality [...] is excluded \textit{ab initio} as we cannot see how the mere passage of time could bring about a change in the state of the system.”

(Newton-Smith(1980, p. 29))
Lengthy Processes

- Although we reject **Duration Causality** we accept that some causal processes or mechanisms take a while to process/operate.

- This explains some cases of delayed causation.

- E.g. we can explain the release of scandalous documents about Margaret Thatcher under the Thirty Year Rule by appeal to mechanisms within Whitehall for measuring time, and releasing archives after 30 years.

- E.g. we can explain a loss of skills in undergraduates 13 years after a new education policy was introduced.
Cumulative Causes

- Photographs are created by lots of individual photons hitting a photoreceptor/photo sensitive paper.
- We can have an experience of suddenly seeing a picture emerge of from lots of individual points: a gestalt shift.
- This is a basic case where a series of small causes might be perceived to have a sudden effect.
Cumulative Causes

- One way in which delayed causation can take us by surprise is when the effects of lots of apparently individual causes suddenly add up.

- E.g. a path forming across a field

- Each individual crossing of the field is not responsible for much soil erosion.

- As a path becomes clear, more people walk on it, causing much more soil erosion in that area.

- This involves a feedback mechanism, between the effects of soil erosion and further similar causes of soil erosion.
Threshold Triggers

- Some instances of delayed causation can involve multiple different kinds of processes, where one (lengthy) process triggers a sudden dramatic process.
- E.g. a fusewire burning, to ignite an explosive charge
Threshold Triggers

- Some cases, the magnitude of the effect is related to the magnitude of the initial lengthy process (e.g. cricket ball through window) in other cases not (e.g. volume of burglar alarm)

- Sometime the mechanism that triggers the sudden effect breaks in triggering it (e.g. fusewire) other times it resets (e.g. neuron firing), or simply remains operative (e.g. infarction due to coronary narrowing)
Hybrid Cases

- Some cases can combine lengthy processes, cumulative causes with feedback mechanisms, and threshold triggers.
- E.g. ontogeny – requires correct spatial and temporal organization of developmental changes - realized by cumulative causes, feedback and threshold triggers that create temporal and spatial buffers
  - “Dormant” causes all over the place
Exxon Valdez (reprise)

- We set out to explain cases of delayed causation.
- We came up with three suggested ways in which we could explain it:
  - Lengthy Processes
  - Cumulative Causes
  - Threshold Triggers
- And ruled out three ways:
  - Action at a temporal distance
  - Date Causality
  - Duration Causality
Exxon Valdez (reprise)

- Thorne & Thomas (2008): The Exxon Valdez spill triggered a downward trend which is not visible by looking at data from any particular year
  - The population size at a given year depends partly on this multi-year trend, partly on previous year’s population
- But can a temporal trend itself be a cause – we seem to have ruled this option out?
- Lengthy process that should be unpacked into mechanisms responsible for the downward trend
Exxon Valdez (reprise)

- Even a small sudden reduction in population size is likely to increase natural mortality of a population under intense predation – and alter the balance between natural and fishing mortality
  - Initial small reduction attributable based on known behavioral mechanisms responsible for exposure, and exposure leading to reduced immune function and premature spawning

- Sudden change in age group composition will impact recruitment over following years, not just in the next generation
  - Not just absolute pop. size, but the proportion of the spawning stock to the whole population determines recruitment
  - Reduction in spawning stock leads to subsequent predation hurting recruitment in the future even more

- The influence of the oil spill alters the structure underlying the causal dependence between subsequent years’ populations
  - the ecological mechanisms not represented in the causal chain with subsequent years’ population sizes as variables
References:


