Two Kinds of Causal Explanation

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Abstract: To give a causal explanation is to give information about causal history. But a vast amount of causal history lies behind anything that happens, far too much to be included in any intelligible explanation. This is the Problem of Limitation for explanatory information. To cope with this problem, explanations must select for what is relevant to and adequate for answering particular inquiries. In the present paper this idea is used in order to distinguish two kinds of causal explanation, on the grounds of systematic differences in their conditions of relevance and adequacy. It is further argued that these two forms of causal explanation are interdependent and their interaction provides an instrument through which causal knowledge is acquired and enhanced. What we understand causation in the world to be is neither unconditioned regularity, nor counterfactual dependence, but the sum of correct answers to explanatory inquiries of these two interdependent kinds.

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1 Explanatory Questions and the Problem of Limitation

In the heyday of logical positivism it was sometimes claimed that genuinely scientific explanation should explain how something occurred, not why. This was a puzzling doctrine. For it seemed to disregard actual scientific practice. Scientists themselves ask ‘Why?’ and ‘How?’, and propose answers to both sorts of questions. It was also difficult to understand how the positivists’ own favoured model of explanation could be taken as complying with the doctrine. In general, positivism favoured an account of explanation according to which the *explanandum* was subsumed under some more general, lawlike principle (as in Hempel and Oppenheim, 1948; Hempel, 1965 — though the basic idea of explanation by subsumption under a law can be found a century earlier in Comte’s *Cours de Philosophie Positive*.). But did this guarantee that how the *explanandum* had taken place was accounted for? On the contrary, it became a standard objection to the positivistic Deductive-Nomological Model of explanation that, while it could display why the *explanandum* was to be expected in light of more

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general information and initial conditions, it might well fail to tell us anything about
how it had been brought about (Achinstein, 1971, pp. 99-109; Brody, 1972).

The idea that explanations are answers to why-questions has been popular with
philosophers. Braithwaite (1953, p.319), for example, wrote that,
‘Any proper answer to a Why? question may be said to be an
explanation of a sort. So the different kinds of explanations can best
be appreciated by considering the different sorts of answers that are
appropriate to the same or to different Why? questions.’

Scriven (1972, p.173) objected to this. One of his grounds for denying Braithwaite’s
thesis was that explanations can be given without any question being asked, as in the
course of an exposition or lecture, or when supporting some assertion. This is not
convincing as a point against the general idea that explanations are answers to
questions, since it is easy enough to deal with such putative counterexamples by
invoking an unspoken question. Indeed, surely the lecturer provides explanations
precisely because she imagines questions her audience will want to ask — or should
be asking. But Scriven adds the point that questions which are not why-questions can
also invite explanations as answers, as in ‘How can a neutrino be detected, when it has
zero mass and zero charge?’ and ‘What is it about cepheid variables that makes them
so useful for the determination of interstellar distances?’.

We can indeed ask both ‘How?’ and ‘Why?’, and we should acknowledge that
answers to both questions regularly qualify as explanations. This paper attempts to
make a contribution towards anatomising causal explanation by arguing that we need
to distinguish two different kinds of causal explanation. I adopt a broadly pragmatic
and erotetic approach to explanation, allowing that context can play a significant role
in structuring an explanatory inquiry. To a first approximation, the two sorts of
explanation can be taken to be, respectively, appropriate as answers to why-questions
and how-questions. My contention is that explanations of the former kind are
contrastive; and that even when no contrast is made explicit in an explanatory inquiry
they are still implicitly contrastive. Explanations of the latter kind are non-contrastive
and require a descriptive account of the causal mechanism or process involved in
production of the effect to be explained. Following a now standard terminology, I call
explanations of the former kind ‘contrastive explanations’\(^1\). Explanations of the latter
kind I dub ‘process explanations’, because they aim to account for the process by
which one gets from an initial state to some outcome or terminal condition.

One might equally call them ‘why-explanations’ and ‘how-explanations’ (and
sometimes I do fall back on these terms), on the grounds that the former are normally
required as answers to why-questions, the latter as answers to how-questions. But one
should not take the literal formulation given in some interrogative sentence as rigidly
pre-determining the kind of explanation sought. Context can play a large part in fixing
which kind of explanation is appropriate. Furthermore, with a little ingenuity, one can
find a way of phrasing an interrogative beginning with ‘how’ in such a way as to
make a why-explanation appropriate: e.g., ‘How can it be that ...?’.

Since the linguistic format of questions is flexible, it is better to make a
pragmatic approach depend primarily upon purpose and context, rather than the exact
wording of an explanatory inquiry.\(^2\) Part of the aim of a pragmatic approach to causal

\(^1\) This has become established terminology: otherwise, ‘difference explanations’ would be just as good
a label.

\(^2\) It is tempting to draw an analogy between questions and propositions, in that the same question can
be posed by more than one sentence. However, the analogy introduces distracting complications. As
explanation is to find a solution to ‘Mill’s Problem’, or the Problem of Limitation. This is the problem of selecting ‘the cause’ from a vast and complex set of causally relevant antecedents. Mill himself did not think the problem had any defensible solution, claiming:

‘The real Cause, is the whole of these antecedents; and we have, philosophically speaking, no right to give the name of cause to one of them, exclusively of the others. ... Nothing can better show the absence of any scientific ground for the distinction between the cause of a phenomenon and its conditions, than the capricious manner in which we select from among the conditions that which we choose to denominate the cause.’ (Mill, 1843/1973, Bk.III Ch.V, pp.328-9)

According to an erotetic and pragmatic approach to explanation, selection of what causally explains is inevitably going to be context-dependent and purpose-relative, but that does not make it ‘capricious’ and indefensible from a scientifically impartial perspective. It is inescapable that it should be limited in some way for creatures with cognitive limitations like ours. In general causal explanation must, as David Lewis (Lewis, 1986) observed, involve giving information about the causal history of the explanandum. But there is, as Lewis also observed, a vast backload of causal history behind anything that happens. The total antecedent causal history for any event may be available from a God-like perspective, but we must make do with something less. So any actual explanation needs to be constrained by some form of selection or limitation. Consequently accounts of causal explanation need to make clear how such explanations cope with the Problem of Limitation.

My thesis is that these two different kinds of explanation operate according to two different methods of limitation and selection for relevance and adequacy. Distinguishing these two kinds of explanation is intended as a contribution to an ‘erotetic-pragmatic’ account of causal explanation. By this I mean an approach to causal explanation which views explanation as a practice, structured by specific inquiries and particular human interests, which enables us to build up our understanding of causal processes, even though we may be starting out from a condition of fairly complete ignorance, in the face of systems of daunting complexity. Such an erotetic-pragmatic account takes explanation to be a cognitive tool for the investigation of causation.

Selection for explanatory relevance differentiates process explanations (how-explanations) from contrastive explanations (why-explanations) and so makes them distinct kinds of causal explanation. But, though different, they are clearly not independent. The way in which they are interdependent is a topic I take up in the third section of the paper. Before considering their interdependence we need to distinguish them. In attempting to differentiate process explanations and contrastive explanations, there are reasons for giving a certain priority to process or how-explanations. One reason is that more attention has been lavished on why-explanations. In particular, contrastive accounts of causal why-explanations have already been explored by a number of philosophers (see in particular: Hansson, 1974; van Fraassen, 1980, ch.5; Garfinkel, 1981; Hesslow, 1983; Lewis, 1986; Lipton, 1990, 1991/2004 ch.3; Barnes, 1994; Hitchcock, 1996, 1999; Schweder, 1999; Ylikoski, Bengt Hansson pointed out (Hansson, 1974), sentences which express the same proposition sometimes appear to yield distinct explananda -- as in: ‘It was John who ate the apple’ and ‘It was the apple that John ate’.
So paying some attention to the neglected partner may help redress the balance. Another consideration is that a case can be made for regarding process explanations as more intimately tied to the essential nature of causality. At least, if one asks what the difference is between the fact that $C$ preceded $E$ and the fact that $C$ caused $E$, it seems appropriate to say that if $C$ caused $E$ then one can always legitimately ask *how did C cause E?* It is also true that it is easy to come up with requests for why-explanations which are not causal at all — e.g., ‘Why are 7, 17, 37, 47 and 67 prime, whereas 27 and 57 are not?’.

There are non-causal contrastive explanations as well as causal contrastive explanations. While I will be maintaining that all explanatory answers to why-questions should be taken to be contrastive, it cannot be maintained that all explanations are contrastive. At any rate, how-explanations do not seem to be contrastive in anything like the same way why-explanations are. Yet it remains true that there must always be some limitation upon causal-explanatory relevance, if explanation is to be feasible at all. So in the remainder of the paper our first task is to investigate how limitations on relevance and requirements for adequacy differ between these two kinds of causal explanations. In the next section I attempt to anatomise these differences. Then in the final section we will consider why the difference between these two kinds of explanation matters, by offering a sketch of how contrastive and process explanations interact in order to provide causal understanding, as well as touching on particular applications of the distinction.

## 2 Differences between Process Explanations and Contrastive Explanations

We will consider three leading aspects of these explanations: *explanatory targets*, *spatio-temporal limitation*, and *sufficiency*, as well as noting some consequent effects upon *completeness* and *depth* of explanations. These are all large topics in their own right. It will constitute enough progress for now to have made a start on anatomising the ways in which contrastive and process explanations differ and to indicate how understanding of complex causal histories develops through the interaction between these two kinds of explanation.

### 2.1 Explanatory Targets

The basic difference between contrastive explanations and process explanations is to be found in their *explananda*, what they aim to explain. Although there may still be room for dispute about how many explanations are contrastive, it can at least be agreed that there are many explanations which can be described as ‘contrastive’ because they aim to account for a contrast: a contrast between what actually happened and something else which either *was* the outcome, in some parallel case, or which *might have* happened. There are interesting issues concerning fact-foil contrasts, only some of which we will be able to engage with here. One point worth noting is that such a contrast does require a cognitive contribution from those engaged in the explanatory inquiry. The very same happenings may be subject to varying contrastive explanations, depending upon what the inquirers conceive them as being contrasted with. The sort of inquiry involved in a process explanation requires less constructive effort, at least in order to initiate the inquiry. What one aims to explain in a process
explanation is the actual process by which a particular outcome came about or, in the
general case, the kind of process by which outcomes of a certain kind come about.

To illustrate the difference in explananda we can borrow an example given by
Paul (2000), the publication of a paper by Suzy, the injured philosopher. In this
example Suzy is a philosopher who has a skiing accident and breaks her right wrist,
then writes a philosophy paper, using her left hand only, and gets it published. But
finishing the paper that way comes at the cost of a cramping pain in her left wrist,
which proves persistent. Suzy ends up spending a lot of money on painkillers to
relieve the ache. This little episode affords many different explanatory targets. How
did Suzy come to have an accident? Why did she have an accident rather than
completing her skiing in safety? How did falling like that result in a fracture? Why did
she have an accident in the place where it occurred rather than at some other location
on the slope? Why did she break her right wrist rather than her left wrist? Why did she
break her wrist rather than merely spraining it? How did she finish her paper? Why
did writing it that way leave her with chronic pain, not just temporary discomfort?
How does the repetitive strain of one-handed typing produce cramping pains? And so
on.

The difference in the explananda between contrastive and process explanations
is the fundamental difference from which other differences flow. But it is, in fact, a
little awkward to term the explanatory target of a process explanation an
explanandum, since in giving such an an explanation what one does is to describe the
process by which the effect came about — or even just to specify the process, since in
some cases it is sufficient to say what sort of process it is, provided some
understanding of how such a process works to produce the effect in question can be
assumed. To illustrate by means of a pathological case in which the process is
described uninformatively: If the question is raised how did Detective identify
Perpetrator, the answer ‘By intuition’ is unsatisfactory to the extent that we have little
or no idea how an intuitive process of identification might work. The more colourful
answer ‘By playing the violin and smoking three pipefuls of dark shag’ is just as bad,
since we have little or nothing in the way of prior understanding of how identification
might result from such activities. But if the answer had been rather ‘By elimination’,
then we do get some idea of what sort of reasoning the detective used in order to
identify the perpetrator.

There is another point to be noted concerning what we are trying to explain in
process explanations. It might seem that what we are trying to explain is a particular
outcome. So while contrastive explanations do not have events themselves as their
explananda, it might seem process explanations do aim to explain events or states of
affairs. But that runs into the Problem of Limitation: what is then to make less than
the whole antecedent causal history explanatorily relevant? Part of the resolution of
this problem is to view the explanatory target of a process explanation as a transition
from some initial state of affairs to the outcome: How did this come about, starting
out from this earlier state? So every well-formed process-explanatory inquiry really
has the structure:

| Initial State | ? | Outcome |

But what the initial state is taken to be will often not be made explicit. We just ask:
How did that happen? This can lead to misunderstanding, when explainer and
explainee have different transitions in mind, as in such a commonplace exchange as:
A: ‘How did you get here?’
B: ‘Oh, I walked from the station.’
A: ‘Actually, I meant from London. But I gather you took the train, rather than
driving here by car.’

In other cases it may be far from clear what the initial state is assumed to be, thus
making the job of producing a process explanation intractable. For example, suppose
we naively ask: ‘How did the oceans and continents on Earth come to be the way they are?’.
The question is not clearly tractable as it stands. Anyone attempting to respond
would either have to select whatever part of causal history they thought of as
particularly important or interesting, or perhaps would fall back upon whatever
formative processes could be taken with some security to be well understood. But if
the question was rather: ‘Given that once all land on Earth was united in a single
continent, Pangaia, and all oceans joined in a single great sea, Panthalassa, how have
the oceans and continents come to be distributed about the planet as they now are?’,
then the explanatory inquiry would have proper process-explanatory structure:


Given the general structure of their explanatory-targets, process explanations
supply the information needed to fill the gaps in our knowledge of causal histories
concerning how various transitions occur. The explanatory-target of a contrastive
explanation, regularly conceived as the contrast between a fact and a foil (following
Lipton 1990, 1991/2004), is liable to be thought of as having the canonical form ‘Why
P rather than Q?’, in which the contrastive foil is explicitly mentioned. However,
contrasts are often silent: in fact, they are mostly tacit. The distinction between
process and contrastive explanations would be much less important than it is, if the
only contrastive explanations were those made explicitly contrastive.

In order to establish the existence of contrastive explanation of a-fact-rather-than-
some-particular-foil Lipton distinguished it from explanation of a fact simpliciter, by
arguing that sometimes the former and sometimes the latter can be the cognitively
more demanding task. In so arguing he was attempting to defend contrastive causal
explanation from reduction to non-contrastive explanation: i.e., from the suggestion
that to explain why P rather than Q? is just to explain both why P and why not-Q.
However, there is a problem concerning this strategy. Since the very point of fact-foil
contrast is to focus on some aspect of, or factor within, causal history, how can this
focus be supplied for non-contrastive why-explanations? If it cannot, then it is
difficult to see how non-contrastive why-explanations are supposed to work, short of
furnishing a complete recital of causal history. And that, of course, is simply not
possible. For causal explanation to work at all, there must be limitations upon causal-
explanatory relevance. So a better defence against the attempt to give a reductive
account of contrastive explanation is not to argue for a difference between contrastive
why-explanations and non-contrastive why-explanations, but rather to question
whether there are any non-contrastive causal why-explanations at all.

Of course, there are undoubtedly why-questions which invite an explanatory
response and which are not explicitly contrastive, in that they do not have a surface
form of ‘Why P rather than Q?’, or some variant thereon. There is no dispute about
that. But this leaves it open that in every specific context in which a why-explanation
is provided there is implicit some contrast to the target explanandum against which
the explanation is backgrounded. It is sometimes objected to this suggestion that it
entirely trivializes the idea of contrastive explanation since it must amount to the
proposal that, failing any explicit contrast, we can always resort to taking ‘Why P?’ as
‘Why P rather than not-P?’. But that is too narrowly linguistic a reading, which fails
to grasp what is being proposed. The suggestion is that when some event, E, occurs
and we go on to inquire ‘Why did E occur?’, this inquiry is projected against a moderately determinate conception of how events might have unfolded (at least for a short time into the future) if E had not occurred. That idea of an alternative possible course of events will not exhaust all the ways (or, if you favour ‘possible worlds’ formulations, all the possible worlds which share an initial segment of history with the actual world) in which E might not have occurred.

Beyond pointing out the Problem of Limitation, it is difficult to see how to give anything like a proof that all causal explanatory why-inquiries must be contrastive. I can only challenge the reader to come up with any example which is not: an example in which the explanandum does not require an implicit contrast. If the challenge cannot be met, then we need to explain away the apparent success of Lipton’s defence of contrastive why-explanation as something distinct from non-contrastive why-explanation, on the grounds that they differ in their cognitive demands. (See the example of this strategy given below in the paresis case.) This is not difficult to do. What these examples really show is that, unsurprisingly, sometimes it is harder to provide an explanation of an explicit contrast than of an implicit contrast, and sometimes it is easier to do so.

So a contrast is very often implied, even when not explicitly stated. It will be assumed that contrasts can either be compatible or incompatible. For example, Why did John contract tetanus when James did not? presents a compatible contrast since it is possible they should both have had tetanus. The inquiry Why did John die of tetanus? poses an incompatible contrast, the implicit foil being John’s suffering from tetanus but surviving. As we will see, in section 1.3 there is some difficulty over giving a uniform treatment for both compatible and incompatible contrasts. This is due to the fact that in the case of compatible contrasts independent causal histories allow a difference to be indicated which accounts for the difference in outcomes (John’s getting tetanus while James did not), whereas in the case of incompatible contrasts the explanatory factor will be something which makes the difference between the actual outcome and an unrealized possibility. Exactly what that unrealized possibility is can be somewhat unclear in the case of implicit contrasts. This is why making contrasts explicit serves the useful function of narrowing the explanatory target at which we should aim. Thus in Why did John die of tetanus?, in some contexts one would suppose that the contrast to be explained was John’s dying of tetanus as against his contracting the disease in much the same way as he did but recovering from it. In other contexts the contrast intended might rather be between his dying of tetanus as against his dying of some other cause, or his dying in that way rather than not contracting any disease at all.

So observing that explanatory contrasts are very often left unstated is not to deny that making a contrast explicit serves a useful function. The sharpening of explanatory contrasts is important as a way of progressing towards better and more informative contrastive explanations. For example, we might well wonder why the influenza pandemic of 1918 (referred to in Britain as ‘the Spanish flu’) was so particularly fatal to young adult males. That is something which strikes us as unusual and in need of explanation. But what exactly is the contrast to be explained? Should the foil be a null hypothesis, according to which mortality rates are the same for all age groups? Or should the contrasted possibility be one in which the risk of mortality increases with age? It is surely better to look at mortality data for influenza in other

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3 Only moderately determinate: introducing an explicit contrast can certainly help to make this more determinate.
years and ask why the 1918 strain differed from patterns associated with other forms of the virus.

2.2 Spatio-Temporal Limitation

A how-explanation or process explanation selects for a mechanism which approximates to satisfaction of Hume’s requirement of ‘contiguity’. In other words, the mechanism or process cited needs to culminate in a phase of the causal history which is at least spatio-temporally close to the outcome or terminal condition. Ideally it should terminate in a state which can be identified as the outcome to be explained, perhaps under another description. For example, we can explain how Xanthippe became a widow by recounting the process that resulted in Socrates’s death. The job of a process explanation is to inform about a transition between states. This imposes spatio-temporal constraints: it must not be too gappy at the effect end, and it must be based upon some understanding of what initial state the process of transition started from. In asking how something came about we are seeking information about a process which moves from an initial condition (either explicitly stated, or understood from context) to some specified outcome (such as fracture of a wrist or the publication of a philosophy paper). The general contribution of process explanations to causal inquiry is to describe the processes by which these transitions from initial conditions to outcomes occur. Obvious as this aspect of such explanations is, it imposes an important constraint upon the information which can be relevantly cited in a process explanation: it must be confined to what occurred in the spatio-temporal interval between initial condition and outcome.

This is a significant limitation and a major difference between process explanations and contrastive explanations, because it is entirely possible that what would be judged as the most important factor contributing to the outcome should lie outside that spatio-temporal interval. Consider our skiing-philosopher again and just suppose Suzy suffered from the brittle-bone condition, osteoporosis. (It may seem odd that someone with this condition should go skiing, but there’s no accounting for the things philosophers find diverting.) In this case it might well be that one should cite Suzy’s osteoporosis to explain why she broke her wrist. Indeed, that seems the right way to explain why Suzy broke her wrist, given that someone else might have fallen the way she did and yet not have suffered a fracture. But it will not explain why Suzy broke her wrist (rather than a bone somewhere else in her anatomy), unless the brittle-bone condition is localised in a peculiar way.

It is clear, however, that citing Suzy’s osteoporosis cannot explain how Suzy broke her wrist. Even if that condition has a claim to be judged the most important causal factor in producing the fracture, it does not explain how her wrist was fractured. This is because the process explanation must describe only processes which were occurring within the relevant temporal interval, and osteoporosis is a chronic condition from which Suzy was presumably already suffering before she went skiing. We can confirm this claim about the spatio-temporal restriction by considering whether there might be any circumstances in which it would be possible for such a condition to figure in an explanation of how someone fractured her wrist. Here is one rather fanciful way in which it could so figure: If there were some possible process by which one could very quickly contract osteoporosis — by skeletal condition being suddenly and grossly affected by altitude, atmospheric pressure, or temperature, for
example — then one could explain how someone broke their wrist, by relating that
they went through such a process and so came to be in a condition susceptible to
fracture. The way nature is, that just does not ever happen. The only naturalistically
plausible way in which we can get a chronic condition such as osteoporosis to figure
in a process explanation, is by altering the erotetic context so that the initial state is
sufficiently remote that acquiring such a condition in the first place can fall within the
temporal interval of the transition to be explained. For example: ‘I’m sorry to hear
your mother has broken her wrist. When I knew her back then I always thought of her
as such a healthy and active lady. How did it happen?’

The conclusion supported by such cases is that process explanations are
limited to a spatio-temporal interval between some initial state and the outcome of
interest. One might say the portion of causal history relevant to a how-question is
defined by the fact that such questions pertain only to a slice of causal history cut
horizontally to the temporal axis. ‘How did you get here?’ is a question only sensibly
posed in a context in which agreement about where the interrogatee was starting out
from can be assumed.

So there is a spatio-temporal limitation on how-explanations which restricts
the causal factors relevantly cited to those obtaining in a transition-process from an
initial state (often implicitly understood in the context) up to the explanandum
outcome. In the case of a how-explanation we can usually ignore causal factors of any
great antiquity, unless we are dealing with some very long-lasting process which
stretches far back into the past. Of course, if the inquiry is ‘How were spiral galaxies
formed?’ then the transition process will be one which lies in the distant past in
relation to our investigation, but not in relation to the formation of the galaxies. This
requirement of spatio-temporal contiguity does not apply at all to why-explanation. It
may be that the causal factor which made the difference lies at a great and gappy
distance in the past in relation to the target explanandum. The Big Bang cannot be
cited as part of a how-explanation of anything that is currently going on, not even of
how galaxies are receding from each other. But it can be cited in explanation of why
there is background cosmic radiation and also of why galaxies are receding from each
other. It is worth noting that those two explanatory targets are both obviously
contrastive, though only implicitly so. It is also worth noting that these are both
perfectly respectable explanations in cosmology, showing that selection from causal
history in relation to a specific explanatory target not only need not be ‘capricious’ (as
Mill alleged), but is also just as useful a tool in scientific inquiry as it is in relation to
commonsense investigation and the context of everyday purposes.

The reason restriction to a spatio-temporal interval does not apply to
contrastive explanations is that they have a different inquiry-structure from process
explanations. In a process-explanatory inquiry the transition to be accounted for (by
being described) is from an initial state to some outcome. But for contrastive
explanations no initial state is specified or supplied by context. So what explains a
fact-foil contrast may lie far back in causal history and we may well need to cite some
remote factor. Hence it can be conjectured that the reason why there is background
cosmic radiation is the occurrence of the Big Bang. To give another example, it has
been suggested that the reason why some states in the US experienced a falling
incidence of violent crime may be that approximately twenty years had elapsed since
abortion was legalized in those states (Donohue and Levitt, 2001).

4 Though apparently something analogous can happen to trees in an ice-storm, making them susceptible
to shattering through wind-pressure.
2.3 Sufficiency

How did Suzy break her wrist? She had a skiing accident. A shallow explanation. But there are many contexts in which it would be adequate, giving as much information as expected. Notice that while one might wish to hear more about exactly how the accident happened, the fact that skiing accidents can occur without wrists getting fractured gives no grounds for rejecting the explanation. Certainly Suzy might have skied, and might even have had an accident while doing so, and yet might not have broken her wrist. Nevertheless, that can be how it did in fact happen. There is a lesson to be learnt from this about the nomological strength required for a how-explanation, which may emerge more clearly if we consider them alongside contrastive explanations.

Why did Suzy break her wrist? The contrast space is supplied by an alternative course of events in which Suzy goes on living in much the same way, but without a broken wrist. Will it do to say merely: because she went skiing? That is part of the story of how she incurred the fracture. But surely it will not do as an explanation of why Suzy broke her wrist. The objection is simply: most skiers do not fracture their wrists. Will it do to say: Because she went skiing and had an accident? Again that seems less than adequate, since a skiing accident need not lead to a broken wrist. So it looks as if contrastive explanations are more demanding in this respect than process explanations.

A how-explanation works by describing the mechanism that was involved in the production of the target phenomenon. This mechanism need not necessitate the occurrence of the effect in question, even in the context of the assumed background causal field. It is enough if the mechanism is known (or, at any rate, reasonably believed) to have in general the causal power to produce such an effect, and that it was actually operative in production of the specific outcome to be explained. To put this another way, a how-explanation is concerned to inform as to the way in which a particular state of affairs did come about. As such it need not be committed to claims of necessity or sufficiency for the mechanism. What it is committed to are the claims that such a mechanism can bring about the effect in question, and that on this occasion that was how it happened.

So mechanisms cited in how-explanations need not necessitate. An illustration of this is supplied by the case of genetic drift, a mechanism invoked by evolutionary theorists to explain how some trait might have evolved, and in particular how it might have evolved so quickly. Genetic drift is especially likely to be at work in small, geographically isolated populations, such as Darwin’s Galapagos finches. Purely by statistical chance a particular trait might be expressed more frequently in one generation than might be expected in the long run (over a large number of trials). If that trait is then reinforced by some adaptive advantage it may become fixed in the population much more rapidly than might have been expected, if selection were only able to operate on a flat distribution of genetic variation.

Since this commonly cited mechanism of evolutionary transformation depends upon an accident of statistical distribution at a critical stage — rather like getting a run of heads on successive tosses of a coin — there is no guarantee that if evolutionary history could be rerun in the same causal environment, the result would be the same again. Take two island-bound populations of finches, on Island A and Island B. Some
striking shape of the finches’ beaks is found to predominate on Island A, but not on Island B, even though that shape would confer the same adaptive advantages in relation to the Island B environment and that particular beak-form was present ancestrally in finch populations on both islands. ‘Through genetic drift’ is an admissible answer to the question ‘How did those beaks come to predominate on Island A?’ But in response to the question ‘Why did those beaks become the dominant form on Island A and not on Island B?’, the reply ‘Through genetic drift’ seems not much better than a shrug: it just did not happen on Island B. It may be that without any nomological determination of evolutionary pathways there is no better answer than that.

It would make for a neat account of the difference between these two kinds of explanation if we could maintain that contrastive explanations are nomologically more stringent than process explanations. Hence it might be proposed that the following condition of adequacy applies to contrastive explanations:

Why-explanations must inform as to antecedent factors which necessitate distinct outcomes between fact and foil. In other words: contrastive explanations should meet a requirement of sufficiency in the given causal field.

It is not difficult to provide motivation for the idea that contrastive explanations should be subject to this condition of adequacy. One way of doing so is by invoking Lipton’s Difference Condition:

‘To explain why P rather than Q, we must cite a causal difference between P and not-Q, consisting of a cause of P, and the absence of a corresponding event in the history of not-Q.’ (Lipton, 1990, p.256; 1991, p.43)⁵

This principle directs us to find the ‘difference-maker’ between fact and foil. It appears doubtful that we can claim to have found the difference-maker, if that factor allowed it to be nomologically possible that fact and foil should not have differed after all. Further, it could be pointed out that if this condition is not met, then manipulation of the foil-situation by addition of the differentiating factor would not be guaranteed to yield the same outcome as the fact to be explained. Yet instances can be cited in which this methodology of difference-closure is employed in order to check on the correctness of a contrastive explanation, as in the examples given in Day and Botterill (2008).

So it is quite possible to make out an intuitive case in favour of this requirement of adequacy for contrastive explanations. Such a case has been endorsed in one way or another by a number of writers. Railton (1981, p.238), for example, points out that: ‘If there were a reason why one probabilistic outcome of a chance process was realized rather than another, we would not be dealing with a chance process. Salmon (1984, p.110) notes that: ‘If we assume that an explanation of why one outcome occurs must ipso facto be an explanation of why one rather than the other occurs, we run a serious chance of finding ourselves involved in the notion that only those events that are strictly determined can be explained.’ Christopher Hitchcock (Hitchcock, 1999), however, objects to such a requirement of deterministic causation. He labels the requirement ‘the CEID (Contrastive Explanation Implies Determinism) thesis’. In Hitchcock’s view any intuitions in favour of this thesis are merely ‘demons of determinism’: demons which we ought to be committed to

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⁵ This formulation of the Difference Condition is actually not entirely satisfactory: it needs to be generalized beyond causal explanation, and tidied up to resolve worries as to whether facts can be said to have causal histories. But that is work to be done in a further paper.
exorcising, once we have appreciated the force of the arguments in favour of indeterministic explanations.

The ‘CEID’ label seems to me to misrepresent what is at issue, which is why I have preferred to talk in terms of sufficiency. The requirement that a certain form of explanation should provide factors which necessitate the outcome to be explained does not imply universal determinism, unless one also maintains that absolutely everything which occurs at any level can be explained in that way. So the fact that some indeterministic explanations are acceptable is not in itself going to rule out a thesis that contrastive explanations are required to pick out nomologically necessitating differences. But Hitchcock can pose a more directly worrying challenge in terms of counterexamples: cases of contrastive explanation in which the explanatory factor cited fails to necessitate the fact-outcome. On the basis of such cases he concludes that ‘it is relatively easy to drive our intuitions against CEID’ (Hitchcock, 1999, p.590).

It is true one need not seek far for such examples. We can take one of the stock examples of contrastive why-explanation, viz.: ‘Why did Jones, rather than Smith, get paresis?’ The paresis case is used by Lipton in support of his claim that what is needed to explain a contrast may be less than what is needed to explain a fact simpliciter, as part of his strategy for defending contrastive explanation from the threat of reduction. Thus he observes:

‘... explaining a contrast is sometimes easier than explaining the fact alone... An explanation of “P rather than Q” is not always an explanation of P. This is particularly clear in examples of compatible contrasts. Jones’s syphilis does not explain why he got paresis, since the vast majority of people who get syphilis do not get paresis, but it does explain why Jones rather than Smith got paresis, since Smith did not have syphilis.’ (Lipton, 1990, p.251)

Most commentators have accepted that one can explain why Jones rather than Smith contracted paresis by pointing out Jones had syphilis whereas Smith did not, despite the fact that having syphilis is not a sufficient condition for contracting paresis since the majority of those suffering from syphilis do not go on to contract paresis. What should be said in response to this sort of example?

One option is to attempt to deal with such examples by claiming they are not full explanations. We could argue along the following lines: While syphilis is a causally necessary condition for paresis, we cannot fully explain why Jones, rather than Smith, got paresis by citing Jones’s syphilis, because that condition does not necessitate subsequent paresis. If it were possible to manipulate the foil in such a way as to ‘close the difference’ — in this case by giving Smith syphilis too — there would be no guarantee that Smith would also suffer from paresis. Chances are he would not. For this reason one might hold the answer commonly cited as an easy answer to this contrastive question a bit too easy to be satisfactory. We have not identified the difference which nomologically makes the difference. The answer: ‘Because Jones had syphilis and Smith did not’ is at best only partial.

This option might preserve the simplest way of differentiating between process and contrastive explanations in terms of sufficiency. But I doubt whether it is adequate. Apart from appearing uncomfortably ad hoc, it is also vulnerable to the production of

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6 The point of this example, originally mentioned by Scriven, is that paresis is a condition which only those who have contracted syphilis suffer from. However, most syphilitics do not go on to develop paresis.
further examples which cannot be plausibly explained away as merely partial. Consider for example the contrastive inquiry: ‘Why did life evolve on Earth rather than Mars?’ Supposing this question can be answered (in that its presupposition — that life did not, in fact, evolve on Mars — is correct), the answer to it will cite factors in the terrestrial environment favourable to the evolution of life. But surely we should not insist those factors must necessitate life’s evolving on Earth?

So there are examples which disturb intuitions that contrastive explanations must be deterministic (necessitating) in their nomological strength. What conclusion should we draw? Do we have to say that nomological strength is not a differentiating factor of these two kinds of explanation in the way their explanatory targets and spatio-temporal constraints are?

It is worth noting that these examples which ‘drive our intuitions against CEID’ are all examples of compatible contrasts. This raises the question whether there might be something special about the connection between compatible explanatory contrasts and sufficiency. Notice that in the Jones-Smith example, while Jones’s syphilis does not necessitate he should contract paresis, Smith’s not having syphilis does confer immunity. This suggests that compatible explanatory contrasts will allow an asymmetry: the foil could not have turned out the way its contrastive counterpart actually did. But the fact to be explained need not be nomologically necessitated by the explanatory factor cited, the difference-maker.

My proposal, therefore, is that contrastive explanations with compatible contrasts should be regarded as ‘one-sided non-deterministic’. In other words, it is allowed to be nomologically possible that the fact should not have been as it was, but not possible that the foil should have been as the fact turned out to be. This does indeed seem to be confirmed by what we are after by way of an answer to such an inquiry as: ‘Why did life evolve on Earth but not on Mars?’ Proposed explanations will nominate factors present in the Earth’s history which were favourable to the evolution of life, but whose absence on Mars precluded the evolution of life there. There is also a further general consideration which supports this proposal, and in particular its restriction to compatible contrasts. This is that we cannot apply the notion of ‘sufficiency within a given causal field’ in an exact way to compatible contrasts because the reason why they are compatible is that we are considering the outcomes of two distinct and non-intertwining causal histories. There will be many points of similarity between the two causal histories, since one of the great advantages of this form of explanation is that it can be deployed in the case of complex systems at a stage when we do not fully understand their structure and operations, and yet are justified in assuming extensive similarities. But such assumed extensive similarities are not the same as a given causal field.

The proposal I am advancing here is delicate and intricate and needs to be further investigated. One way of doing so is to consider whether it would be possible to provide an adequate contrastive explanation in the case of a compatible contrast which is ‘two-sided indeterministic’. Suppose there are two atoms, atom A and atom B, and both atoms have a probability of decaying within some time interval of n. Atom A is bombarded in such a way that the probability of its decaying is raised to n +δ. Particle A does indeed decay. Can we answer the compatible contrastive inquiry Why did atom A decay and atom B did not?, by citing the bombardment of atom A?7

7 A similar, one-atom example is sometimes discussed with the question at issue being: Did the bombardment cause the atom to decay? Cf. Hitchcock, 2003, p.17.
Given the bombardment of A, we then have a case in which all of the following outcomes are nomologically possible: that neither atom should have decayed; that they should both have decayed; or even that only B should have decayed. I submit that in such a scenario we cannot plausibly cite bombardment by atom A as the difference-maker. An analogous argument could be advanced to support the claim that incompatible contrasts, unlike compatible contrasts, cannot be asymmetrically non-deterministic. If they are non-deterministic for the fact, it would appear that they are also non-deterministic for the foil. That appears unacceptable because it would mean that the explanans for ‘Why P rather than Q?’ was some factor which was nomologically compatible with ‘Q rather than (and not) P’.

Having considered their explananda (or explanatory targets), applicable spatio-temporal restrictions, and their sufficiency, process and contrastive explanations can be firmly differentiated in the first two aspects. The situation is more complicated with regard to sufficiency. On the basis of the above discussion it is proposed that while process explanations are non-deterministic (i.e., they may either identify mechanisms which invariably produce the outcome to be explained or mechanisms which only do so sometimes), contrastive explanations with incompatible contrasts are deterministic, whereas contrastive explanations with compatible contrasts are one-sidedly non-deterministic. But this is an issue that merits further debate. Since some writers (e.g., Ylikoski, 2007) maintain that genuinely contrastive explananda have to be incompatible, it cannot be an uncontroversial matter.

2.4 Further Differentiation and the Question of Mechanism

In this section I add a few remarks concerning what more can be said in the way of distinguishing the parameters of process and contrastive explanations. While others will surely improve upon my initial efforts, there is a restriction of principle in regard to what philosophy alone can hope to achieve in terms of process explanations in particular. This is that philosophical accounts of process explanations can only set out some very general features before they give way to the substantive commitments of specific explanatory paradigms and their presuppositions concerning the sorts of mechanisms which produce various causal processes.

Before admitting the need for philosophical modesty concerning the mechanisms underpinning causal processes, we should pause to consider the extent to which explanations of these two kinds can be complete and how penetrating they need to be — or how superficial they can be without being non-explanatory. David Lewis remarked that for some questions ‘maximal’ answers, in the sense of answers which furnish the whole truth on the topic of the question, are available. But that is by no means always the case. The whole truth is often beyond our ken. Even if it is known, we might grudge the time required to hear it through. So we are often prepared to settle for less than all the information. Lewis thought it clear that why-questions were ‘among the questions that inevitably get partial answers’ (Lewis, 1986, p.229). I suggest this is not quite right, because it fails to distinguish between two different dimensions, which may be labelled ‘completeness’ and ‘depth’ (or ‘penetration’). An explanation fails to be complete if it is only partial: i.e., if it adverts to less than all the causal factors needed to give a fully adequate explanation of a particular explanandum.

We have seen there is a significant difference in explanatory targets for these two kinds of explanation. Indeed not only do they not have the same explananda, they
do not even have the same kinds of explananda. The explananda of why-explanations are contrasts between the way things turn out in some particular case, or kind of case, and some other situation or possibility: as Peter Lipton pointed out, these contrastive explananda are what are frequently referred to as phenomena. But the explananda of how-explanations are the transitions which result in some particular outcome. This is a major difference and it also leads to a difference in the explanatory task. In the case of contrastive explanations this is to identify the factor in antecedent causal history which accounts for the contrast, whereas in the case of process explanations the task is to describe the mechanisms which produce the transition from initial state to outcome.

An important consequence of this difference concerns the extent to which explanations of these two kinds can be penetrating and complete. Process explanations can be more or less penetrating, but there is no clear sense in which they can be complete. Contrastive explanations can be complete (or merely partial), but it is not so clear in what sense such explanations can be more or less penetrating. If the task is to identify the factor causally responsible, then once it has been identified the task is accomplished. Admittedly, there can be more and less informative ways of referring to the difference-making factor. But in general contrastive explanations cannot be more or less penetrating in the same way that process explanations can be. On the whole, it is really why-questions, rather than the answers to them, which differ in how penetrating they are.

Since a how-explanans is really a description of a transition-process, the idea of completeness is as elusive as it is in relation to any description. For this reason, the very idea of a complete how-explanation for any occurrence — an explanation so penetrating that no more penetrating explanation is possible at all — is the idea of something which lies at the very limit of inquiry. If we could ever penetrate to the ultimate level of causal interaction, then process explanations at that level would offer no scope for further augmentation. But short of such an ultimate level, the denial that there is any more penetrating explanation to be had is actually disturbing to our conception of causal process. At some stage in the transition-process it seems to leave us with the prospect of ‘action-at-a-distance’.

It may well be felt that the requirement of section 2.2 above that a process explanation should lie within the spatio-temporal interval between initial state and outcome is only a weak constraint on explanatory relevance. So one might well ask: what sets the shape of the spatio-temporal envelope for the intervening process? In general one can say that this is the mechanism which generates the process and secures its integrity and individuation as a continuing process through the transition. So while a contrastive explanation needs to identify the right difference, a process explanation needs to be secured by the right mechanism.

So can we say how mechanisms determine the relevant processes of causal transition? Some philosophical effort, in part inspired by the work of Wesley Salmon, has been devoted to this project, or the related project of developing a process—

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8 A notorious example of an uninformative identification is accounting for opium’s soporific effect in terms of its ‘virtus dormitiva’. But Molière’s point in Le Malade Imaginaire has been garbled in the philosophical literature. His objection was not that this was no explanation at all but rather that it was common knowledge, passed off as expertise through being dressed in Latin.
mechanical model of causation. However, it is difficult to retain much confidence in the prospect of an answer to the question of what makes a mechanism productive of a causal process which is at once informative and also purely philosophical in the face of the great variety of different mechanisms posited in different branches of science, in different historical periods, and even in different cultures. Thus John Locke, committed to the corpuscularian paradigm, was aware that he was engaged in an ‘excursion into natural philosophy’ when he used this premise in his argument concerning primary and secondary qualities: ‘The next thing to be consider’d is, how Bodies produce Ideas in us; and that is manifestly by impulse, the only way which we can conceive Bodies operate in.’ (Locke 1690/1975, pp. 135-6). Clearly we would not nowadays wish to share his commitment to impulse as an exclusive mechanism of transmission. Picking an example from current scientific disciplines, anthropologists might maintain that a process of faithful cultural transmission is sustained by conformity and xenophobia (or, in general, ‘in-group biases’). How very different will be the spatio-temporal constraints on processes of transition in geology, or biochemistry, or astrophysics.

The conclusion I draw from this is that within a particular paradigm there will be determinate presuppositions concerning the way mechanisms operate which will deliver corresponding spatio-temporal profiles for the intervening processes. In a general account of explanation, therefore, we both can and should leave a space here to be filled in by non-philosophical theories. As a scientific realist, I acknowledge that we might wish to enhance the bare philosophical account by combining it with those paradigmatic mechanisms which we take to be enduring discoveries. But I will refrain from adding further constraints to the spatio-temporal limitation on process explanation, apart from remarking that since I take a major function of process explanation to be the confirmation of contrastive explanations (by explaining how the selected difference produced the contrastive difference in outcome) it naturally follows that this function will play a frequent and dominant role in selection of the initial state for process explanations (i.e., the initial state will be one in which the alleged difference-maker is present, along with presumed background causal history).

3 The Interdependence of Contrastive and Process Explanations

Suppose we have said enough to give an initial characterisation of the ways in which contrastive and process explanations differ. Why does it matter? Why is it of importance to set out their differences? Are we in any danger of confounding explanatory inquiries and so providing the wrong sort of explanatory information, with inappropriate conditions of relevance or adequacy? In general the context of inquiry and the wording of an explanation-seeking question make clear enough what sort of explanation is needed. So in practical matters we are adept at distinguishing which kind of causal explanation is required. The main philosophical motive for making the distinction between these two kinds of causal explanation is so we can properly appreciate their interdependence. For only when that interdependence is discerned can we arrive at an integrated understanding of causal explanation. However, in theoretical discussions, in which we lack the context supplied by

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ordinary inquiries, failure to distinguish these two kinds of causal explanations does sometimes lead to confusion. So I will mention areas in which this sort of trouble can break out.

Let us warm up by looking first at a confound which has generated considerable dispute in discussions of functional explanation. In an influential paper Robert Cummins (Cummins, 1975) attacked existing philosophical accounts of functions on the grounds that they represented the role of functional attribution as providing explanations of why organisms possessed some particular trait. He maintained such accounts neglect attribution of functions to parts of systems in the biological and cognitive sciences as a way of explaining something else, namely the discharge of some capacity of that system. He singled out for criticism what he took to be a mistaken assumption that ‘the point of functional characterization in science is to explain the presence of the item … that is functionally characterized’. Cummins’ account of functions did not, however, deter Millikan and Neander from subsequently developing the concept of biological proper functions, which were advocated precisely in order to explain the prevalence of some trait or behaviour, a biological proper function being what that trait had historically been selected for, even if it was no longer making the same contribution to the life of an organism (Millikan, 1989; Neander, 1988, 1991a, 1991b).

In the light of our distinction between contrastive and process explanations we can appreciate why there is no need to choose between Cummins’ analytical functions and Millikan–Neander teleological functions. There is no need to enter into a debate over which is the ‘correct account’ of functions, for they are both correct (or approximately correct). It should be accepted that the term ‘function’ plays a role in two kinds of explanations: process explanations of how a part contributes to some capacity of the system as a whole, and contrastive explanations of why instances of some kind (members of a biological species) have some trait which distinguishes them from phylogenetically related kinds. There is no ground for an interesting dispute here, once we have appreciated the difference between explaining how a system, such as a biological organism, discharges some capacity, and why an organism has some particular trait. These are just examples of our two different kinds of explanation. So the term ‘functional explanation’ is ambiguous.

More troublesome problems have been produced through the use of exclusion arguments, such as those advanced in debates about the problem of mental exclusion. These arguments rely upon an assumption of uniqueness which can only apply to a putatively ‘complete explanation’. Thus Kim (1988, p.233) propounds the following Principle of Explanatory Exclusion in one of the best known contributions to this debate:

‘there can be no more than a single complete and independent explanation of any one event, and we may not accept two (or more) explanations of a single event unless we know, or have reason to believe, that they are appropriately related — that is, related in such a way that one of the explanations is either not complete in itself or dependent on the other.’

It needs to be asked what kind of explanation Kim is referring to here. He seems to assume there is only one kind of causal explanation. But is the Principle of Explanatory Exclusion true of contrastive explanations? In the light of our earlier discussion we can see that it is, at best, misleading to talk about ‘explanation of any one event’, since the explananda of contrastive explanations are not events in themselves, but contrastive phenomena. Why-explanations only achieve completeness
through being rather picky about their explananda. So this means that in assessing any claims for an alleged exclusion of one explanation by another, we must examine the explanatory targets of the two explanations very carefully to see whether they are in fact competing to account for the same explanandum. Perhaps Kim’s principle can be defended in relation to process explanations and it was that kind of explanation which he had in mind? Here there is an issue, of no little interest in its own right, as to whether ordinary mentalistic and psychological explanations are process or contrastive explanations.\footnote{I discuss this issue in relation to explanations of actions in terms of the agent’s reasons in (reference concealed).} But also it is unclear in what sense a process explanation can be ‘complete’, even though it would seem possible to defend the claim that two ‘independent’ process explanations of the same outcome cannot be tolerated ‘unless ... they are appropriately related’. Whether such considerations will enable physicalism in the philosophy of mind to deal with all supposed problems of explanatory exclusion is a topic which will have to be pursued elsewhere. It is at least clear that the distinction between these two kinds of causal explanation is of crucial relevance.

A theoretical area in which the distinction we have drawn is especially important is the study of biological and psychological development. In particular I would suggest that attention to this distinction gives a better appreciation of what is at dispute and what need not be disputed at all between nativists (who maintain that development is innately controlled) and their opponents. Nativists face a number of opponents, but among the more vociferous have been the advocates of Developmental Systems Theory (DST). Proponents of DST, such as Susan Oyama, Thelen and Smith, and Griffiths and Gray (Oyama 1985/2000, 2000; Thelen and Smith, 1994; Griffiths and Gray, 1994), object that it is overly simplistic to attempt to explain developmental outcomes in terms of genetic factors. Instead they advocate ‘causal democracy’, stressing just how sensitive the developmental expression of genetic factors can be to variations in environmental conditions, and urging there is no good reason why some causal contributions should be privileged ahead of others in accounting for ontogenetic development in biology.

In a review of the debate, while conceding that advocates of DST have rendered a service in revealing the rich causal complexity of processes of biological development, Andy Clark (Clark, 1998) points out that there is a difference between explaining why something has occurred and giving a fully detailed account of the workings of some causal system. This observation echoes remarks above about the need to distinguish between the completeness of an explanation and its depth. In consequence of this distinction, it simply is not true that where many different causal factors are at work, we cannot be justified in citing just a small selection of them — perhaps just one — for some particular explanatory purpose. Anyone who supposes that is true is subscribing to what Clark dubs ‘the Myth of Explanatory Equality’. To be sure, many causal factors may interact in subtle and intricate ways, but:

‘Explanatory priority (in a given context) ... turns not upon which factor (if any) does the greatest amount of actual work but on where we should look for the differences that make the difference between the cases where the outcome obtains and those where it does not.’

(Clark, 1998, p.93)

It is clear enough that this coheres neatly with the distinction drawn here between two kinds of causal explanation. Advocates of DST may maintain that there
are no privileged difference-makers. However, that claim is either trivial or false. It is trivially true that every contributory part of a causal history is a causal factor. But selection of a particular explanandum will always privilege some difference-makers: all difference-makers are privileged in this sense. So even if the process of development is complex and influenced by many causal factors, nativists can postulate an innate difference-maker — provided they can identify a suitable contrastive explanandum. It is clear enough in general terms what the nativists’ contrastive explananda are: species-specific, and in some cases gender-specific, similarities in cognitive capacities. In the domain of language-acquisition there is, thanks to the work of Chomsky and his followers, a detailed empirical specification of what those similarities are. In other domains it might be complained that the nativists’ position looks rather like an explanans in search of a contrastive explanandum. But there do appear to be grounds for thinking there are fundamental similarities in cognitive capacities in various domains, such as theory of mind and moral evaluation, rather than unconstrained individual and cultural variation. Also the nativists can take encouragement from the thought that scientific progress regularly consists in the enhancement of causal explanations through making more exact and explicit the contrasts to be explained. In any case, the present purpose is not to vindicate the nativists, but to arrive at a better appreciation of what is at issue between them and their opponents, and it seems that the distinction between contrastive and process explanations is clearly of relevance to disputes about nativism.

We have seen that in theoretical debates it is possible to confound these two forms of causal explanation, and that wasted argument at cross-purposes can be avoided by marking their differences. That gives some reason why it is worth distinguishing them. But an even more important motivation is supplied by the interdependence of process and contrastive explanations. Some may think that what I have called process explanations do not deserve to be regarded as explanations proper, being really descriptions of causal processes. An ordinary language rejoinder is that in answering a how-question one can be said to explain how something came about. It can also be said that narratives are often regarded as providing explanations, and narratives appear to be process explanations which involve exercises of agency. But whether the title of “explanation” is awarded or not, the important matter is really the interdependence of process and contrastive explanations.

The fundamental point to be noted is that a process explanation can be used to correct or confirm a why-explanation. For example, on the side of correction, if you ask Jones why he was appointed to the post he may tell you it was because of his superior qualifications and the impression he gave at interview of his capacity for shrewd and rapid decision-making. But if you know he was selected by a simple drawing of lots, or because nobody else applied and the appointment committee could not leave the post unfilled, Jones’s explanation cannot be right. It cannot be right even if he actually possesses those important attributes and displayed them at interview. For such factors could not have been productive of the outcome by the process that actually led to that outcome, and so could not have made the difference.

On the side of confirmation, any explanation why something happened as it did rather than in some contrasted way is a hypothesis that the difference identified was the causal difference-maker. The most effective form of confirmation for such explanations, therefore, comes from confirmation of an account of how the explanatory factor brought about the phenomenon to be explained. We always believe there is a process by which this was brought about: as Ahn and Kalish (2000) point
out, when we suspect someone caught a cold because someone else sneezed in the patient’s vicinity we think there is a way in which the sneezing produced the infection. People hold countless promissory beliefs of this kind in causal mechanisms, whether or not descriptive knowledge of the mechanism has been attained. Moreover, in cases in which we are sceptical about the existence of any such mechanism, or find it difficult to conceive of what a process explanation of the transition could be like, a proposed difference will fail to convince as providing a satisfactory contrastive explanation. Thus, even if the inhabitants feel the atmosphere of their house has been changed for the better and no longer report apparitions, we remain resistant to the suggestion that this could be explained by the exorcism of a malign spirit. Equally, Russell’s suggestion that their could be such a thing as ‘mnemonic causation’ in which past experiences directly produce present recollections is not made any more palatable by the fact that mechanisms of episodic memory are still poorly understood. There must still be a possible process explanation, if the fact that we had some experience is to account for an apparent recollection.

The interdependence of contrastive and process explanations is of fundamental importance for the growth of causal knowledge, operating a sort of causal-explanatory ratchet which enables us to crank up our comprehension of causal connection. Contrastive explanation provides a good starting-point because it has the great virtue of being extremely tolerant of ignorance. We do not need to know much about the causal workings of some system in order to spot a difference which may be hypothesised to account for a contrastive explanandum. But that hypothesis needs to be backed up by an account of the process by means of which that factor brought about the outcome it did. For there may well be differences which are not causally efficacious in producing the contrast in outcome, even after we have operated some initial filter, eliminating differences which background principles and theories exclude as suitable candidates for being the difference-maker. In some cases we are able to check the hypothesis that some difference was the contrastive difference-maker in an experimental fashion, by employing ‘difference closure’. In difference closure either the foil-system is made like the fact-system to see if the outcome of interest can be generated, or the fact-system is made like the foil-system to see if the outcome can be suppressed. However, this is often not practicable, and when practicable may not eliminate all possible confounding differences.

So the epistemology of causal investigation requires that it should be possible to support contrastive explanations through process-explanatory accounts of the transition through which the alleged difference-maker produced the fact-outcome. That account may be confirmed, giving strong confirmation to the proposed contrastive explanation. But the process of causal investigation does not rest there since: the process explanation is a candidate explanation, itself in need of confirmation. The confirmation of a process-explanatory account will make accessible further questions as to why the process takes the course it does rather than some other possible course. So again, if we are curious enough, we seek for a difference-maker and that leads us to investigate the process by which it makes the difference it does.

It would be possible to illustrate this story of causal understanding developing through contrastive explanations which are confirmed by process explanations, leading on to further contrastive explanations and more detailed process explanations, in many domains. In some of these we have very well developed causal understanding, while in others a few iterations of why- and how-questions will suffice
to carry us to the frontiers of research. However, to give such illustrations in a satisfying way would make this paper too protracted, so such exercises had better be left for another occasion. Instead I will conclude by mentioning the bearing of the present account on one other major issue.

Hitchcock (2003) has argued the case for thinking there is no such thing as the relation between cause and effect. He presents a series of puzzle cases (such as one in which a process is interfered with by an outside agency, but that interference just happens to bring about the same outcome as the process would have done anyway) in which inability to determine the presence of the cause-effect relation does not seem to hinge upon any lack of causal information. Given all that can be known about causal dependence it is questionable whether we should think in terms of a particular cause-effect relation at all. So perhaps Mill was right after all in maintaining that there was no such thing as ‘the’ cause and selection of a particular factor was a subjective and capricious affair? Not quite, for Mill still believed that there were total philosophical causes, vast conjunctive states of invariable antecedents. His view seems to overlook the duration of causal history and to presuppose some privileged stage at which causal antecedents can be surveyed.

So it may be better to solve Mill’s Problem by saying we do not need to assign causal relations other than those which can be discovered as answers to causal explanatory inquiries. There is no cement of the universe. That is a misleading metaphor because the universe hangs together causally in innumerable different ways: causation is a motley of many different kinds of transition and process. It is the suggestion of the present paper that the difference and interdependence of these two kinds of causal explanation is the key to our understanding of those diverse forms of causal interconnection.

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11 For example, if one were assembling an account of our understanding of the causal story of alcohol, from grain to brain, it would be striking how much better understood the production of alcohol is than are its effects on the human brain — even though these neurophysiological changes could also be regarded as industrial products.


