

Classifying Contingency in the Social Sciences: Diachronic, Synchronic, and Deterministic Contingency

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This article makes three claims concerning the concept of contingency. First, we argue that the word contingency is used in far too many ways to be useful. Its many meanings are detrimental to clarity of discussion and thought in history and the social sciences. We show how there are eight distinct uses of the word and illustrate this with numerous examples from the social sciences and history, highlighting the scope for confusion caused by the many, often contradictory uses of the term. Second, we impose some order on these uses through developing a threefold classification of contingency based on assumptions about possible worlds and determinism. Finally, we discuss why we believe that one of the classes is a special use of the word without relevance to the social sciences, while the two remaining classes are nothing more than a variety of the “no hidden factors” argument in the debate on indeterminism and determinism.

Keywords: contingency; conjuncture; possible worlds semantics; indeterminism

I. INTRODUCTION

The concept of contingency is widely invoked in the social sciences, sometimes even claimed to be central to an understanding of the social and historical sciences. Sociologist Wagner-Pacifici, for example, asks: “Might not one say that the whole project of sociology is to account theoretically for the contingent patterns and shapes of this mutable and mutating social stuff of life...? (Wagner-Pacifici 2000, 1). In economic geography, Plummer states that “In order to make any headway in empirical modelling...we need to formulate theories in which the nature of contingency and complexity...are specified more clearly” (Plummer 2001, 764). For the historical sciences more generally Stephen Jay Gould states that “the science of contingency must ultimately be integrated with the more conventional science of general theory” (Gould 2002, 46).

These views on contingency in the study of society, a concept already given importance by historians such as J.B. Bury and W.B. Gallie, seem to have been on the rise in recent decades. Consider, for example, the increasing reliance on the concept in the study of historical and industrial development by economic historians and economic geographers. In the study of the location of industrial development, economic geographers A.J. Scott and D.P. Angel write that “[t]he seeds of many of these growth sectors seem to have been planted at particular locations in what amounts to a set of highly contingent circumstances” (Scott and Angel 1987, 878) and Scott speaks of influences on development “as being channeled through complex local contingencies” (Scott 2000, 491). Historical sociologist Jack Goldstone, writing on the industrial revolution, argues that there is a growing consensus that the movement towards a modern industrial economy in Great Britain was “chiefly the result of a contingent and conjunctural pattern of events” (Goldstone 2002, 332). Comparing industrialization in China and Europe historian R. Bin Wong argues for “a set of contingent rather than causal connections between commercial development and industrial breakthroughs (Wong 1997, 279) and Pier de Vries states “I think there is an element of historical contingency—or better geographical contingency—that really mattered (Vries 2001,

439). The concept of contingency is frequently encountered in other areas in the social sciences as well. The concept is central to the counterfactual political science of Tetlock and Belkin (1996) and Lebow (2000a, 2000b) and the counterfactual history of Ferguson (1997). The concept of contingency has perhaps been still more important in recent decades in biology, associated with Gould's emphasis on the contingency of evolution. In turn, the emphasis on contingency in biology has had a substantial impact on all of the historical sciences, including the social sciences (e.g., Blaser 1999; there are countless references to Gould's emphasis on contingency in the social sciences).

In this article we make three claims concerning the concept of contingency, especially as related to the study of society. First, we argue that the word contingency is used in far too many ways to be useful; its many meanings are actually detrimental to clarity of discussion and thought in history and the social sciences. We show how there are eight distinct uses of the word supported by numerous examples from the social sciences and history. This alone we hope makes this article useful, bringing to light the extent of the many, often contradictory uses of the term in the social and historical sciences.

Second, we try to impose some order on these eight different uses. We develop a classification of contingency into three classes based on assumptions about possible worlds and determinism. We then show the relationship of the eight common uses of the term to these three classes. Finally, we discuss why we believe that one of the classes is a special use of the word without relevance to the social sciences, while the two remaining classes are nothing more than a variety of the "no hidden factors" argument in the debate on indeterminism and determinism.

II. THE MANY MEANINGS OF CONTINGENCY

In this section we illustrate eight common uses or connotations of the word "contingency" with examples drawn from the social sciences (including history).

1) *Modal Logic* In philosophy, a standard definition of "contingent" is "neither necessary nor impossible." This definition is sometimes explicitly used in the social sciences:

Contingency involves the “exclusion of necessity and impossibility” (Luhmann 1987, 152 in Schedler 2004, 7).

“Contingent means ‘neither necessary nor impossible’” (Sayer 2000, 123).¹

As we will discuss in greater detail in Section Three, a special type of modal logic usage occurs in *possible worlds semantics*. We sometimes find this specific usage in the social sciences:

“individuals or other phenomena have both necessary qualities, existing across all possible worlds, and contingent qualities, existing in only some possible worlds” (Sylvan and Majeski 1998, 82).

2) Popular Usage In popular usage “contingent” often means “depends on” as in “x is contingent upon y.” This popular use is also common in the social sciences:

“Globalization’s effects on democratization are thus indirect, contingent upon the scope and desirability of redistributive policies.” (Rudra 2005, 708).

3) *Chance*

Contingency in history is “[t]he view that chance and accident play as important a role as structure” (Brucker 2001, 1).

“In the literature, there is a pronounced tendency to conflate the concepts of chance and contingency” (Ben-Menahem 1997, 103).

“Contingency carries the mark of chance, uncertainty, unpredictability.” (Schedler 2004, 5).

¹ We maintain the use of quotation marks in the block quotes in this section to assure that there is no confusion between quotes and discussion.

“dominant themes [of contingency are] chance, uniqueness, unpredictability, and crucial episodes of unexpected change” (Gould in Bintliff 1999, xii).

4) *Free Will/Agency* Contingency is often viewed as related to or the result of free will/agency:

“Oakeshott argues that agents are “free” by virtue of their ability to choose particular contingent responses to their situations.” (Mapel 1990, 393).

“Aspiring to create space for contingency and free human action, Berlin criticises the notion of historical necessity.” (Ben-Menahem 1997, 103).

“Economic processes are ... contingent in that agents’ strategies and actions may deviate from existing development paths” and “context is related to structure and contingency associated with agency” (Bathelt and Glückler 2003, 128 and 128n).

5) *Path dependency*

“[P]ath dependence characterizes specifically those historical sequences in which contingent events set into motion institutional patterns or event chains that have deterministic properties” (Mahoney 2000, 507). “In a path-dependent pattern, selection processes during a critical juncture period are marked by contingency.” (Mahoney 2000, 513).

“QWERTY is a classic example of the power of history, and the meaning of contingency.” (Blaser 1999, 420).²

6) *Chaos*

² The QWERTY keyboard is, of course, virtually synonymous with path dependency following Paul David’s (1985) now classic “Clio and the Economics of QWERTY.”

“Chaos and contingent-necessity model phenomena in the same manner” (Shermer 1995, 72).

“The philosophical significance of chaos theory is that it reconciles the notions of causation and contingency” (Ferguson 1997, 79).

“[C]haos theory reconciles causation with contingency by linking causally unpredictable outcomes to initial conditions (Tucker 1999, 269).

Often found alongside the association of contingency with path dependency or chaos are assertions that contingency means momentous, sudden, or high degrees of change³ stemming from a small event. (The first example is from Pierson’s article on path dependency and political science, the second from Lindenfeld’s article on chaos theory and history):

“*Contingency*. Relatively small events, if they occur at the right moment, can have large and enduring consequences.” (Pierson 2000, 263)

“the butterfly effect does indeed appear to vindicate what we have known all along, that seemingly trivial events can have momentous consequences. This goes under the name of the role of contingency in human affairs” (Lindenfeld 1999, 287).

7) *Conjuncture*

“[Historical contingencies are] distinctive conjunctures of events or other singularities that theory cannot comprehend.” (Goldthorpe 1997, 22).

“In this analysis ‘contingency’ will be taken to mean *a conjuncture of events without perceptible design*” (Shermer 1995, 70).

³ This view is evident in the association of contingency with disasters and cataclysms (e.g., Krieger (1968) “Culture, Cataclysm, and Contingency”) and thus the popular usage “contingency planning” and “to prepare for any contingency.”

“Contingencies in the form of random events and *conjunctures of multiple chains of causation* are difficult to deal with theoretically (Lebow 2000a, 612, emphasis added).

Little’s (2000) “Conjunctural Contingent Meso History.”

A variety of the concept of “conjuncture” is *context*. This usage is found when there is a conjuncture of multiple factors, usually in a spatiotemporal context. Their concatenation in one place (also “locale,” “milieu,” etc.) is frequently described as contingent:

“sometimes contingency is used to mean context” (Blute 1997, 347). Blute is referring to Mann (1994):

“Many causal paths cross, and the combination of factors in each spatiotemporal location makes it unique – this is where contingency is the same as ‘context’” (Mann 1994, 47).

“Place as Historically Contingent Process: Structuration and the Time Geography of Becoming Places” (the title of Pred 1984).

“locality events are understandable, in the language of realism, as contingent” (Lovering 1989, 213).

“‘space’ or ‘the spatial’ is...an appealing commonsense shorthand way of signifying...‘the contingent effect of the uneven development of social process’” (Duncan and Goodwin 1988, 228-229).

“the contingency and complexity of place” (Plummer 2001, 761).

8) *Unpredictability* Finally, many of the above definitions – chance, free will, chaos—lead to *unpredictability*, and this is frequently associated with the concept of contingency:

“Gallie’s use of ‘contingent’ seems to be equal roughly to ‘unpredictable from the point of view of the main process’” (Arthur 1968, 208).

“As Gould notes, contingency is an unpredictable sequence of antecedent states” (Shermer 1999, 218).

“Contingency refers to the inability of theory to predict or explain, either deterministically or probabilistically, the occurrence of a specific outcome” (Mahoney 2000, 513).

In the preceding quotes we have shown that there are numerous uses of the word “contingency” in the social sciences, many closely related to other confusing or incompletely understood concepts such as chaos, chance, and path dependency. Adding to the confusion created by these different uses, they are frequently conflated in a single work:

“Path dependence is the application to economic systems of an intellectual movement that has lately come into fashion in several academic disciplines. In physics and mathematics, the related idea is called chaos — sensitive dependence on initial conditions...In biology, the related idea is called contingency” (Liebowitz and Margolis 1995, 33).

Even when not explicitly conflated as in the example above, chaos, path dependency, chance, free will and the other confusing concepts we find associated with contingency are so frequently found in such poorly defined association with one another as to *encourage* their conflation, e.g.:

“the pragmatist sensitivity to indeterminacy, contingency, and chaos.” (Shalin 1992, 238).

“the event structure displays the crucial role played by human agency, contingency, and path dependency” (Griffin 1993, 1117).

Not only are these concepts often conflated and ill-defined; frequently they are contradictory. For example, above were several examples that associate “context” with contingency, yet Bathelt and Glückler emphasize that “context is related to structure and contingency associated with agency” (2003, 128n). We find assertions that contingency signifies momentous changes from small effects (e.g., both Lindenfeld and Gould above) but we find Sayer warning that “[c]ontingency is also not to be confused with importance!” (2000, 124). There are countless examples where contingency is associated with chance, yet Shermer stresses that “contingency...is not randomness, chanciness, or accident.” (1999, 218). Sayer provides a modal logic definition of contingency, yet says that it is “virtually opposed” to the use of the word to mean “x is contingent upon y” (Sayer 2000, 28). The term frequently serves to elide clarity on all of these issues rather than commit the author to a clear position on any of them.

Section Three below introduces a classification of contingency into three types based on assumptions of possible worlds and determinism. In Section Four we then consider the relationship of the eight uses of contingency above to these three classes.

III. THREE CLASSES OF CONTINGENCY: DIACHRONIC, SYNCHRONIC, AND DETERMINISTIC

Above we have shown how there are an extraordinary number of uses of the word “contingency” variously used to mean, or in close association with, concepts such as conjuncture, context, chaos, chance, and path dependency. We now propose that the concept of “contingency” can be divided into three classes based on assumptions about

possible worlds and determinism. We introduce the classes here and then consider how the above uses relate to these classes in Section Four.

A. Diachronic Contingency

In ancient philosophy the concept of “possibility” referred only to possibilities in the *actual* world (Knuuttila 1993, 2003). Consider Figure One below:

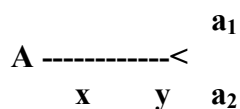


Figure One

Line “A” (with time moving from left to right) represents one world, the actual world. At point *x* we might consider the possibility of some outcome, say, Sally finding a treasure chest. In outcome *a*₁ Sally finds the treasure chest, whereas in *a*₂ she does not. Note that this implies that at *y* something happens that allows for either one outcome or another – for Sally to find the treasure chest (possibility *a*₁), she is either lucky, or chooses a particular area to search, implying that at *y* respectively either chance or free will caused outcome *a*₁ rather than the possible outcome *a*₂ (divine intervention being another possibility).

B. Synchronic Contingency

The above view of possibilities in the actual world is a *diachronic* view of possible worlds, with a single world with branches representing future possibilities. The concept of possibility as referring to *other* possible worlds was not developed until much later.⁴ Having multiple possible worlds allows for simultaneous alternatives and so is a

⁴ See, for example, Knuuttila 1993, 2003, Øhrstrøm, and Hasle 1995, and Wyatt 2000. We purposefully simplify here, ignoring such ancient modal concepts as “potency” and “statistical” interpretations of possible worlds as well as modern debates between “real,” “fictionalist,” “ersatz” etc. possible worlds (for these modern difficult and highly debated concepts see, for example, Stalnaker 1976, McMichael 1983, Rosen 1990, Roy 1993, Shapiro 1993, Baldwin 1998, Divers 2006).

synchronic view of possible worlds. In the synchronic conception of possibility, rather than think of outcomes a_1 and a_2 as different possibilities for the actual world A, we would think of them as different possible worlds. Thus we have a world A where Sally finds a treasure chest, and a completely unrelated world B where she does not.⁵ Following Figure One, this idea could be represented as in Figure Two below:

A -----
B -----

Figure Two

Note that in the synchronic view of possibility for Sally to find treasure or not to find treasure there is no need to appeal to something such as free will or chance (at point y in Figure One) to explain different outcomes in world A and world B. Because they are completely unrelated (causally, spatially, and temporally unrelated) there can be infinite worlds where treasure is found, is not found, and where an infinite number of other possibilities exist completely independent of each other.

C. Deterministic Contingency

A -----

Figure Three

Finally, consider Figure Three above. Here we have a single line representing just one world, the actual world. It is non-branching, depicting a deterministic world where there are no alternate possibilities. It might at first seem that the concept of contingency could not mean anything in this world because there are no alternate possibilities. However, as we saw in Section One, one use of the word contingency is to describe the result of a conjuncture. This is frequently expressed as the coming together of “separate causal paths.” These causal paths could, at least in theory, be traced unbroken; there is no claim made for a break in the historical causal chains of the factors in the conjunction as there

⁵ Again in the interest of simplicity we ignore debates on esoteric ideas such as indexicals and haccuity.

is when acausal chance or free will are called upon to account for a “contingent” outcome.⁶ A recent statement of this idea from biology expresses this view of contingency and deterministic causal chains well:

Contingency may be defined as the outcome of a particular set of concomitant effects that apply in a particular space-time situation and thus determines the outcome of a given event. In most of the epistemological literature, this word has aptly taken the place of the term ‘chance’ or ‘random event’, and in fact, it has a different texture. For example, a car accident can be seen as a chance event, but indeed it is due to the concomitance of many independent factors, like the car speed, the road conditions, the state of the tyres, the alcohol consumption of the driver, etc. These factors all sum together to give the final result, seen as a chance event. The same can be said for a stock-market crash, or the stormy weather of a particular summer day. Interestingly, each of these independent factors can actually be seen per se as a deterministic event, e.g. the bad state of the car tyres determines per se a car sliding off at a curve. The fact, however, that there are so many of these factors, and each with an unknown statistical weight, renders the complete accident unpredictable: a [non-ontological] chance event. (Luisi 2003, 1142)

What frequently causes mere conjuncture to be labeled “contingency” is the point of view of the agent. For example, one of Lamprecht’s examples of contingency in “Contingency in Nature” (1971) is a hunter with excellent aim who fires at a buck. To the hunter’s surprise the buck gallops off unharmed. Puzzled, the hunter follows the path of the bullet towards the prey, and finds a freshly broken branch in the path of the bullet. Apparently a breeze had blown the branch just as the hunter fired, deflecting the path of the bullet. This “contingent” event caused the hunter’s bullet to miss the buck. In this example, at least in theory if not in practice, the causal chain of the wind and growth of

⁶ Thus this type of contingency could take place under “causal determinism,” now usually equated, in our view correctly, with common Laplacian concepts of determinism (e.g., Hoefer 2003, para. 2). We call this category “deterministic” as an *ideal type* distinguishable from fundamentally indeterministic diachronic contingency. Whether one believes these various ideal types co-exist is a separate issue.

the tree branch could be traced (unlike in diachronic contingency where free will or ontological chance are acausal, representing a fundamental break with any causal history). But *to the hunter* who at the time of the event had no knowledge of the impending gust of wind or the existence of a wind-sensitive tree branch, the outcome seems contingent. This would not be so if the hunter had had full knowledge of the existence and impending confluence of these factors. In biology the extinction of the dinosaurs is frequently held up as prime example of a contingent outcome due to the K-T event 65 million years ago. Again, there is not necessarily ontological chance involved. From a terrestrial view the event is contingent; to aliens viewing the development of Earth but also with full knowledge of the trajectories of asteroids it would not be viewed as contingent.⁷

The view of “contingency” as ignorance of other causal streams or systems of the universe, and hence ignorance of how they will eventually impinge on each other, is common in the social sciences. For example, it is the view of one of the more influential social science discussions of contingency, J.B. Bury’s “Cleopatra’s Nose.” The view that contingency refers to an individual’s degree of knowledge about separate systems or causal streams is clear in his discussion of “pure” and “mixed” contingencies. Pure contingency results from seemingly completely unrelated systems interfering with one another; as we begin to deem the systems as more and more related, we think of the event as less and less contingent:

If Napoleon at an early stage in his career had been killed by a meteorite, that would have been the purest of pure contingencies...The meteorite was completely disinterested in his death...But suppose Napoleon would had been killed by the hand of an assassin who detested his policy. This would not be a pure contingency. For the assassin was interested in Napoleon’s death, and the causal sequence which led him to commit the act would have been connected with the causal sequence which rendered the great man’s death historically important. (Bury 1916, 67-68).

⁷ The similarity of this statement to the idea of a Laplacian demon is readily apparent, foreshadowing our later argument that views on contingency and views on hidden factors and determinism are varieties of the same problem.

In Bury's example, the more separate the causal paths that come together the more contingent an agent will view the outcome. Bury, like Luisi, emphasizes that the "chance" of contingency results from the collision "of two or more independent chains of causes" (Bury 1916, 61). There are numerous allusions to contingency as resulting from the conjuncture of multiple factors or systems in the social sciences, often stressing the *ignorance* of other systems (and thus their impending interference with one another). In addition to the examples in Section One, Mandel characterizes "contingent...historical accidents" as "occurrences that represent an unpredictable or fortuitous *confluence of factors*" (2003, 178, emphasis added) and Steinmetz writes that "contingency here means that complex events are codetermined by constellations of causal mechanisms." (Steinmetz 1998, 177). Jessop discusses contingency as meaning "indeterminable within the terms of a single theoretical system" (Jessop 1990, 12) and Arthur writes that "Gallie's use of 'contingent' seems to be equal roughly to 'unpredictable from the point of view of the main process'" (Arthur 1968, 208). These views of contingency are similar to those of Bury, Luisi, and Lamprecht above, as the (necessarily unexpected) influence of an outside system (or "exogenous factor") on the system the agent is apart of or is considering.

IV. THE THREE CLASSES AND EIGHT USES OF CONTINGENCY: PUTTING THEM TOGETHER

Above we have listed three ways to think about contingency – *diachronic contingency* (an indeterministic actual world, with contingency arising from ontologically indeterministic events such as freely willed action or ontological chance), *synchronic contingency* (simultaneous infinite possible worlds where non-necessary but possible things can exist in other worlds with no recourse to indeterminism necessary), and *deterministic contingency* (where a mere lack of knowledge of other systems and their impending interference as "conjunctures" or "exogenous factors" cause outcomes to appear contingent to an agent). We now briefly consider the relationship of the eight common uses of contingency from Section One with these three classes. We will then discuss the classes in greater detail in Section Five.

Four of the uses from Section One have obvious and straightforward relationships with of the classes of contingency from Section Two. Although the concepts themselves—especially possible worlds semantics, chance, and free will—are highly contested their position among the three classes of contingency is straightforward. The possible worlds semantics use clearly fits into the synchronic class of contingency (constituting the whole class). Similarly “chance” and “free will” easily fit into the diachronic class of contingency. (As discussed above, for there to be alternate possible futures in the *actual* world something—ontological chance, free will, or divine intervention—must occur at point *y* in Figure One). Finally, the relationship of conjuncture/context with the deterministic concept of contingency is relatively straightforward.

We believe the remaining four uses of the term “contingency” are, on closer examination, near-synonyms of contingency whose conflation with contingency nevertheless causes a great deal of confusion. Before moving on to discuss in greater detail the synchronic, diachronic, and deterministic classes of contingency we briefly consider why it is best to distinguish unpredictability, “depends on,” chaos and path dependency from the concept of contingency. Unpredictability is a general result or attribute of contingency, rather than a definition of the word itself. It applies to most conceptions of contingency and itself does not belong to any one class, while conversely, unpredictability can also arise from many other sources besides (some form of) contingency. Using the term “contingency” merely to express unpredictability permits far too many other connotations to be conveyed and if expressing precise ideas is the goal then would best be avoided. Similarly, using the phrase “contingent upon” in lieu of “depends on” is common in academic writing, but it risks reducing contingency simply to covariation. If everything that “depends on” something else is a form of contingency, then contingency is nothing more than a particularly obscure way to make a causal assertion.⁸ With both of these uses we think it would be better, in the interest of clarity, to

⁸ As Schedler observes: “To say something is contingent then is to say: It depends. It is to say: The empirical phenomenon *y* is variable / indeterminate / contingent because *it depends* on variable / indeterminate / contingent causal factors *x*. Contingency equals covariation. Intriguingly, in the methodological mainstream of contemporary social science, this simple notion of covariation provides the (orthodox and thus non-contingent) foundation of causal explanation. (Schedler 2004, 14).

avoid the term “contingency” altogether unless one wants to signify something more than simple unpredictability or “depends on” and is both willing to make clear precisely what additional meaning is intended with the word “contingency” (and, more onerously, what *is not* meant) and what metaphysical commitments one is willing to defend in its use. We doubt most social scientists or historians are prepared to do this.

This leaves two more examples from Section One—chaos and path dependency—that should not, for what we believe are similar reasons, be conflated with contingency. Chaos—unpredictable outcomes in deterministic systems resulting from small changes in the initial conditions of the system—is conflated with or closely linked with contingency primarily through the concept of unpredictability. However, we do not believe deterministic chaotic systems should be regarded as giving contingent outcomes, but merely outcomes that are unpredictable. This may seem counterintuitive at first. Because chaotic systems are deterministic, it is clear they are not a type of diachronic contingency, which is fundamentally indeterministic. Nor is there any relationship between chaos and synchronic contingency. It might seem, though, that chaos *is* a form of deterministic contingency, as neither relies on indeterminism for their unpredictability. However, the unpredictability of chaotic systems arises because of the *inherent* nature of chaotic systems which are always *closed*. For some reason these systems respond in surprising ways to small differences in initial conditions, and this is why they are interesting. In contrast, the unpredictability of deterministic contingency arises precisely because of (unexpected) *outside* interferences with the system under consideration. The unpredictability of deterministic contingency is not caused by anything inherent in the system under observation, but precisely the opposite. Conflating chaos and deterministic contingency diminishes what is distinct and interesting about both concepts.

Finally, path dependency is linked to contingency primarily through the concept of multiple equilibria, which is the same as saying there are multiple possible contingent outcomes. A common way of depicting path dependency is as a Polya urn process. Imagine a large urn with a red, a blue and a yellow ball in it. A ball is taken out, then that ball is returned to the urn with an additional ball of that same color. In the first turn, the probability that a ball of any color taken out is equal. However, if a red ball is taken out and then returned with an additional red ball, on the next turn there is a higher chance of

a red ball being taken out. If, as is increasingly likely, the next several turns extract a red ball, soon there is virtually no chance of drawing blue or yellow balls. The first few draws from the urn result in a “lock in” effect for either red, blue, or yellow. Thus the replacement rule simulates the concept of increasing returns leading to “lock in,” with early events leading to lasting later pathways. However, as with chaos, it is important not to conflate path dependency with contingency. Think of the Polya urn process again – what is interesting about it is the lock-in effect, which is caused by the replacement rule in the Polya urn example. The question, then, is why *that* replacement rule? Why are we returning two (or three or a hundred) balls for every ball withdrawn? (Just as in economic systems, we want to know *why* there are increasing returns). As with chaos, so too with path dependency—conflating path dependency with contingency obscures what is distinct about both concepts.

V. DISCUSSION AND CONCLUSION: THE THREE CLASSES OF CONTINGENCY—WHICH IS “BEST”?

To review, three of the concepts commonly associated with contingency—chaos, path dependency, and to mean “depends on”—are conceptually closely related yet subtly distinct near-synonyms whose conflation with contingency can only cause confusion. A fourth concept – unpredictability - is more of a description that fits many things (and happens to include contingency). In the interest of clarity it would be better to avoid conflating the word “contingency” with these four concepts; the original terms are more precise and diminish the likelihood of so many unintended meanings creeping into an argument. Eliminating these four uses leaves four other uses that do fit into the three classes of contingency - possible worlds semantics in the synchronic class, contingency resulting from chance or free will in the diachronic class, and conjuncture/context in the deterministic class.

We hope that by simply illustrating the degree of diversity of uses and hence endless opportunities for confusion will discourage all but the most careful and considered use of the word “contingency.” We introduced the classification system, however, to draw out important implications and make clear the various metaphysical commitments of the

different uses of the term. Beyond these efforts we cannot, of course, decree one class to be definitively correct. However, we would like to briefly suggest why we believe one class should not be used in the social sciences, and why we believe the remaining two classes can then more easily be seen as simply a variety of the familiar debate on determinism/indeterminism, specifically the “no hidden factors” debate.

The class of contingency we think is irrelevant to the social sciences is the synchronic class. In recent decades when the concept of contingency is raised it has been common to find references to possible worlds semantics and definitions of contingency that appear to be synchronic.⁹ This is not surprising given two facts: First, social scientists frequently look to philosophy for clarification of confusing terms, and second, in recent decades within philosophy possible worlds semantics have been “decidedly in philosophical vogue” (Rescher 1999, 403). Usually, turning to philosophy for definitions is to be commended given the rigor with which philosophers define their terms. However, in this particular case it has led to confusion. The possible worlds semantics definition social scientists have come away with from philosophy due to its high visibility in recent decades is not representative of the meaning of the word outside of the highly specialized field within intensional logic of possible worlds semantics, but rather a recent, technical, and highly contested concept.

Although a basic synchronic concept of possible worlds is frequently attributed to Leibniz (possibly with roots in early fourteenth century Scholasticism; see Knuuttila 1993, 2003, Wyatt 2000), the modern “contingency” derives from still older roots. Modal logic in general and possible worlds semantics in particular were very obscure areas of modern philosophy until well into the twentieth century,¹⁰ while the common English language term “contingency” has long held both popular and academic meanings related to the concept of “conjuncture” and derives from the Latin *contingere* from *con tangere*,

⁹ E.g., in Climo and Howells 1976, Elster 1978, essays in Tetlock and Belkin 1996, and Ferguson 1997. Sometimes references to possible worlds semantics are explicit, sometimes implied through reference to Saul Kripke, David Lewis, and others, and especially to Lewis (1973).

¹⁰ It was not until after the increase in attention to modal logic more generally following C.I. Lewis in the early twentieth century that the subsequent development of modern possible worlds semantics could even occur (built on in the 1950s and 1960s, following the work of Rudolf Carnap, by Jaakko Hintikka, Stig Kanger, Dagfinn Føllesdal, Richard Montague, Saul Kripke, and David Lewis among others).

“to touch closely” or “border on.” Other words from the same root are “contact” and “contiguous” (Oxford English Dictionary).¹¹

Even though many social scientists make explicit references to synchronic possible worlds semantics, we do not believe they are actually working within a true synchronic possible worlds framework or synchronic contingency. There are three reasons for this assertion.

A first reason we think that social scientists (this example is often associated with Gould and biology as well) are using a non-synchronic meaning of contingency is that allusions are frequently made to “rewinding the tape.” As we illustrated in Figure Two, in a synchronic view of possible worlds there is no need to consider going back in time to consider alternative possibilities (thus the term “synchronic”).

A second indicator that social scientists are using a non-synchronic meaning of contingency is that discussions of determinism and indeterminism are almost always found in social science (and biological) considerations of contingency. This is evident in the association of contingency with chance and free will in examples from Section One. There are countless remarks such as “[s]ynonyms for our usage [of chance] include the philosophical concepts of ‘accident’ and ‘contingency,’ [and] ‘indeterminism,’ ‘near-determinism’” (Manis and Meltzer 1994, 45) or claims that “[c]ontingency represents a third domain, between the determined and the random” (Blaser 1999, 415).

As illustrated in Figure One, when dealing with only one actual world (as in diachronic contingency) any discussion of multiple possible outcomes *necessarily* entails indeterminism, while as illustrated in Figure Two, the concept of indeterminism is superfluous in a synchronic view of contingency. Indeed, there is a complete absence of references to indeterminism in most discussions of modern synchronic modal logic. Terms related to indeterminism such as “indeterminism,” “determinism,” “free will,” “agency,” “chance,” “randomness,” “probability” or “stochastic” have no mention at all in the indexes of key works on synchronic possible worlds semantics such as Loux 1979, Forbes 1985 and 1989, Chihara 1998, Divers 2002 nor in many other similar works. The

¹¹ One can imagine a possible etymology where two things that come together or come into contact alter each other’s course giving a “contingent” outcome. “Contagious” and “contagion” also stem from the same Latin *contingere* and *con tangere*. Indeed, disease and epidemics (and disasters more generally) are still cited as prime examples of contingent events, with the common usage “to prepare for any contingency” or “contingency planning” reflecting this usage.

frequent discussions of indeterminism by social scientists when considering contingency and counterfactuals, unnecessary in possible worlds semantics, suggests that a synchronic meaning of contingency is not truly intended in these works.

Finally, and perhaps most tellingly, there is a constant emphasis on *plausibility* in the literature on counterfactual contingency (e.g., Hawthorn 1991, Tetlock and Belkin 1996, Ferguson 1997). Plausibility is a concept that has little meaning in possible worlds semantics and synchronic contingency. In infinite synchronic possible worlds, *everything*, if possible at all, is plausible. Possible worlds semantics explore the meanings of truth, necessity, and possibility, not of plausibility.

These three factors – the common references to “rewinding the tape,” the common association of contingency with discussions of indeterminism and determinism, and the frequent reference to the need for “plausibility” all suggest that in practice, despite conventional and seemingly obligatory references to Lewis (1973) and possible worlds in recent decades, the contingency used by and relevant to the social science of the actual world is not of the synchronic type.¹² Whatever use possible worlds semantics may have in the esoteric field of modal logic, it does not, and cannot, tell social scientists the things they want to know about the actual world.

Eliminating the synchronic possible worlds semantics class of contingency leaves us with two classes, diachronic and deterministic contingency. We believe that to assert that one or another of these meanings of contingency is correct is tantamount to taking a position in the “no hidden factors” argument regarding indeterminism.

A common example of a no hidden factors argument is that of roulette. One might believe that a large win at roulette is a (diachronically) contingent event, with the win due to chance. But although the minute factors of the spin of a roulette wheel and the toss of its ball might be epistemically impossible to trace, this may not be true ontologically. The

¹² One of the few exceptions to this assertion we have found –where synchronic contingency *is* clearly meant—is Sylvan and Majeski (1998). We believe the use of synchronic contingency fails to add anything useful to this work. Indeed, discussion in terms of synchronic possible worlds only transfers the labyrinthine and convoluted arguments of this branch of intensional logic with its innumerable unresolved (irresolvable?) problems to the already difficult realm of the social sciences.

perceived “chance” could just be ignorance of imperceptible hidden factors.¹³ An ostensibly diachronically contingent event such as winning at roulette might actually be a deterministically contingent event where the conjunction of hidden factors give a particular outcome.

When the term “contingent” is used, because it can possibly be either diachronic or deterministic, its use serves to obscure an author’s stance on these issues.¹⁴ This becomes a problem when the concept of contingency is central to the interpretation of arguments as has increasingly been the case in recent decades in works as diverse and influential in their fields as the those on comparative development in our introduction (e.g., by Goldstone, Scott, and Wong) and in other fields by Shermer, Gould and others.

Given the salience in recent years of the concepts of conjuncture (e.g., Little 2000, O’Brien 2000), open systems (e.g., Bhaskar 1975, Sayer 2000, Cartwright 1999, 2002a, 2002b) and their necessary component of “exogenous factors”¹⁵ (e.g., Przeworski 2004¹⁶) we find the deterministic class of contingency, related to all of these concepts, especially intriguing. The close relationship of concepts that would fall under our classification of deterministic contingency to debates in the social sciences and the philosophy of science concerning explanation and open systems (or *ceteris paribus* clauses [Cartwright 2002a;

¹³ This argument is of course at the heart of debates on quantum indeterminacy, where it is thought that true ontological chance exists, although heterodox positions believe that there may be hidden factors in this case as well. Earman (2004), however, shows that even in mainstream quantum physics the commonly held conception that indeterminism has been definitively shown is incorrect. In a careful survey of the topic asking the question “If we believe modern physics, is the world deterministic or not?” Earman concludes that “there is no simple and clean answer” (Earman 2004, 43). A diachronically contingent outcome might also be deemed the result of freely willed human action. As with quantum physics, there are debates within neuroscience as to whether there are hidden factors that deterministically account for human action. After a survey on this question Weber concludes that “for the time being it is necessary to set the record straight on indeterminism in neurobiology. At present, its prospects are not good” (Weber 2005, 672).

¹⁴ We discussed the popular but disputed concept of path dependency above, noting that part of its difference from the concept of contingency is that it has a built-in association with increasing returns. Another problem is that the term also serves to hide assumptions concerning determinism and indeterminism. Imagine the Polya Urn Process again - on each draw, the fact that one or another color ball is drawn could be due *either* to ontological chance *or* to hidden factors.

¹⁵ That “open systems” and “exogenous factors” are two sides of the same coin is insufficiently stressed in the literature on both.

¹⁶ “[W]e will need to confront problems of endogeneity. And here we confront a paradox. The recent theoretical developments consist of endogenizing factors previously considered as exogenous ... Yet if everything is endogenous, identification is impossible: everything is simply determined by the initial conditions” (Przeworski 2004, 20-21).

Earman, Roberts and Smith 2002] or “provisos” [Lange 1993, Earman and Roberts 1999]), laws of nature, and exogenous factors makes the deterministic concept of contingency especially worthy of careful study and clarification. Ballinger 2008a explores the significance of exogenous factors and open systems for explanation in greater depth). This project is significantly aided by having a classification system for the concept of contingency, such as that developed here, that makes explicit the crucial (but usually hidden) assumptions surrounding the term.

VI. CONCLUSION

In this article we have attempted to show three things. First, we demonstrate that there are at least eight common uses of the term “contingency” in the social sciences and illustrate this diversity with numerous examples drawn from the social sciences and history. We hope this alone is useful in highlighting the high possibility of misinterpretation when using the word. Second, we develop a classification system for the concept of contingency based on assumptions about possible world and indeterminism. Doing so allows for the metaphysical commitments of the various uses of the term “contingency” to be more evident, and helps to show the relationship of the many uses of the concept of contingency to each other and to other important concepts such as indeterminism. Finally, we discuss and critique the three classes of contingency in greater detail. Our main finding is that one of the three classes, synchronic contingency, although widely found in the social sciences, is a concept that is of little use beyond its specialization of possible worlds semantics within modal logic. The remaining two types of contingency, diachronic and deterministic contingency, are in fact nothing more than a variety of the “hidden factors” argument in the determinism/indeterminism debate. Our conclusion is that in most cases the word “contingency” is better avoided. We also find that its relationship (as deterministic contingency) to the concept of “open systems” and exogenous factors is especially interesting and in need of further elucidation. If Gould is correct that in the historical sciences “the science of contingency must ultimately be integrated with the more conventional science of general theory”

(Gould 2002, 46), then these issues surrounding contingency must be clarified and resolved. We hope to have made a step in that direction in this essay.

ADDENDUM: CONTINGENCY AND HUMAN ACTION

In this paper we have narrowed the classes of contingency down to two, a first class (diachronic contingency) where contingency is the result of ontological chance or free will and a second (deterministic contingency) where what is described as contingency is the result of the conjuncture of separate causal streams or “systems” (or, as it is often described, of a “system” and an “exogenous factor”). For the social sciences it is especially important to make clear what assumption is being made: is contingency arising from human actions diachronic contingency or deterministic contingency?

Essentially this discussion is the same as that of roulette above. Human actions might either be the result of free will and thus an example of diachronic contingency (with the freely willed action represented by point ‘y’ in Figure One above). Or it may be the result of hyper complex spacetime interaction of factors (genes, environment), so complex as to make the interactions leading to human actions impossible to understand (like the roulette ball, although far more complex still).

As with quantum physics, there are debates within neuroscience as to whether there is free will or whether there are hidden factors (including at the quantum level) that account for human action. After a survey on this question Weber concludes that ‘for the time being it is necessary to set the record straight on indeterminism in neurobiology. At present, its prospects are not good’ (Weber 2005, 672).

Human action is generally thought to be the result of some combination of ‘nature’ and ‘nurture’, that is, genetic inheritance and environment. The hyper complex interaction of these is conceivably sufficient to account for human actions yet sufficiently complex to render human action epistemically too difficult to understand.

What is of central interest here is that both long-term genetic development (“nature”) and short-term environmental influence (“nurture”) are plausibly ontologically the result of spacetime conjunctures, even if epistemically they are too complex to be easily

understood in this way.¹⁷ This brings even human action fully into the realm of deterministic contingency ontologically.¹⁸ The inevitable moral questions this concept of human action raises is discussed in Ballinger (2008b).

17 “Nature,” or a genetic view of behavior, is widely associated with determinism. Less appreciated, however, is that even pure “nurture” is just as easily fully deterministic. The spacetime biography of every individual could in theory be traced unbroken back through their life and on to their ancestors with no need for any appeal to indeterministic forces.

The view that an alternative to “nature” and genetic determinism is tantamount to an appeal to biography can be found, for example, in Rempel 2006. Developmental Systems Theory is an approach to developmental psychology that has in recent years developed as an alternative to “nature” oriented evolutionary psychology (notably, a key volume in Developmental Systems Theory, Oyama 2001, is titled *Cycles of Contingency*). “Developmental systems theorists criticize evolutionary psychology’s model of development...as overly deterministic. However, developmental systems theory can be criticized as not deterministic enough. By emphasizing the unique complexity of every individual, the theory risks reducing psychology to biography.” (Rempel 2006, 176). Contra Rempel, however, the biography of biological entities, including humans (and including their neurobiology, see Weber 2005), can be thought of as what physicists call “world lines,” and world lines can be thought of as fully deterministic (Burock 2004). Every biological organism is what has been called an “historical individual,” with an utterly unique genetic make-up resulting from very long-term processes, and a unique world line or biography over the short-term. Every biological entity is “spatio-temporally localized i.e. historically unique kinds of entities about which only idiographic rather than nomothetic statements can be made...This is now all so well understood that I only refer readers to the existing literature” (Blute 1997, 354; one might cite the work of Richard Dawkins more generally as well, as well as Cavalli-Sforza et. al. 1994 and related research). The idiographic statements that can be made about historical individuals are conceivably deterministic; Pred describes the concept of spacetime biographies: “[E]ach of the actions and events consecutively making up the existence of an individual has both temporal and spatial attributes. Consequently, the biography of a person can be conceptualized as a continuous path through time-space...the ‘biographies’ of other living creatures, natural phenomena, and humanly made objects can also be conceptualized in the same manner” (Pred 1984, 281). These spacetime trajectories come together (conjuncture) to create “space as historically contingent process” (282). It is conceivable that these trajectories, including in neurobiology, are the spacetime trends that ultimately result from irregular initial conditions (Ballinger 2008a) with no necessary recourse to free will to explain human actions. The inevitable moral questions this concept of human action raises is the subject of Ballinger (2008b).

It is interesting though unsurprising that the view that individual spacetime biographies are in theory important to understanding social outcomes has been especially important in geography, stemming largely from the work of Torsten Hägerstrand, e.g., Carlstein 1981; Pred 1977, 1981, 1984, Kellerman 1989; Stjernström 2004; see also Richards, Bithell and Bravo 2004. However, the reality of the complexity of the social realm seems to severely limit the study of society in this way.

¹⁸ We believe it is important to have a *theoretically* correct concept of explanation regardless of what the implications of this are for the possibility of knowledge of certain domains. The world is not always to our liking, and far too often theories of “explanation” in the social sciences seem to be based on desired ends rather than reality. As Rosenberg notes, the explanatory irreducibility of the human sciences is only epistemic, and “there are good arguments available to show that metaphysical’ reducibility is tenable (Rosenberg 2005, 18). Clearly, though, the type of society that could gather and process sufficient information to remotely begin to ‘explain’ or predict social processes would be extremely complex and most likely highly intrusive. Like many (e.g., economist Herman Daly and theologian John Cobb in their *For the Common Good*, 1989) we believe there are practical and moral reasons why it would be far better to voluntarily limit the complexity of society, which would likely preclude much social “science.” We view the rise in “happiness studies” in the social sciences, especially making measures of emotional well-being the goal of ‘development’ (Bruni and Luigi Porta 2005, Graham 2005), as a step in the right direction towards meaningful, sustainable, and *pragmatic* uses for the social sciences.

REFERENCES

- Arthur, C. J. 1968. On the historical understanding. *History and Theory* 7:203-216.
- Baldwin, Thomas (1998) Modal fictionalism and the imagination. *Analysis* 58 (2), 72-75.
- Ballinger, Clint. 2008a. Initial Conditions and the “Open Systems” Argument against Laws of Nature. *Metaphysica* 9(1): 17-31.
- Ballinger, Clint. (2008b). “Determinism and the Antiquated Deontology of the Social Sciences,” <http://philsci-archive.pitt.edu/archive/00004152/> .
- Bathelt, Harald and Johannes Glückler. 2003. Towards a relational economic geography. *Journal of Economic Geography* 3:117-144.
- Ben-Menahem, Yemima. 1997. Historical contingency. *Ratio* 10:99-107.
- Bhaskar, Roy (1975), *A Realist Theory of Science*. Leeds: Leeds Books.
- Bintliff, John ed. 1999. *Structure and Contingency: Evolutionary processes in life and human society*. London and New York: Leicester University Press.
- Blaser, Kent. 1999. The History of Nature and the Nature of History: Stephen Jay Gould on Science, Philosophy, and History. *The History Teacher* 32(3): 411-430.
- Blute, Marion. 1997. History versus science: The evolutionary solution. *Canadian Journal of Sociology* 22:345-364.
- Brucker, Gene A. 2001. “The horseshoe nail”: Structure and contingency in medieval and renaissance Italy. *Renaissance Quarterly* 54:1-19.
- Bruni, Luigino, Pier Luigi Porta. 2005. *Economics and Happiness: Framing the Analysis*. Oxford: Oxford University Press.
- Burock, Marc. 2004. ‘Determinism and Causation Examples’, Philosophy of Science Archive, University of Pittsburgh.
- Bury, J.B. [1916] 1930. Cleopatra’s nose. In *Selected essays of J.B. Bury*. Harold Temperley, ed., Cambridge: Cambridge University Press.
- Carlstein, T. 1981. *Time Resources, Society and Ecology: On the Capacity for Human Interaction in Space and Time*. London: Edward Arnold.
- Cartwright, Nancy (1999), *The Dappled World: A Study of the Boundaries of Science*. Cambridge: Cambridge University Press.
- Cartwright, Nancy (2002a), “In Favor of Laws that are not *Ceteris Paribus* After All”, *Erkenntnis* 57: 425-439.

- Cartwright, Nancy, (2002b), "The Limits of Causal Order, from Economics to Physics," in Mäki, Uskali (ed.), *Fact and Fiction in Economics*, Cambridge: Cambridge University Press.
- Cavalli-Sforza, Luigi Luca, Paolo Menozzi, and Alberto Piazza. 1994. *The History and Geography of Human Genes*. Princeton: Princeton University Press.
- Chihara, Charles S. 1998. *The worlds of possibility: Modal realism and the semantics of modal logic*. Oxford: Clarendon.
- Climo, T. A. and P. G. A. Howells. 1976. Possible worlds in historical explanation. *History and Theory* 15:1-20.
- Daly, Herman and John Cobb. 1989. *For the common good: Redirecting the economy toward community, the environment, and a sustainable future*. Boston: Beacon Press.
- David, Paul A. 1985. "Clio and the Economics of QWERTY." *American Economic Review* (Papers and Proceedings) 75: 332-37.
- Divers, John. 2002. *Possible Worlds*. London and New York: Routledge.
- Divers, John. 2006. Possible-Worlds Semantics Without Possible Worlds: The Agnostic Approach. *Mind* 115: 187–225.
- Duncan, S and M Goodwin. 1988. *The Local State and Uneven Development*. Oxford: Polity Press.
- Earman, John. 2004. Determinism: What we have learned and what we still don't know, in Joseph Keim Campbell, Michael O'Rourke, and David Shier (eds.), *Freedom and Determinism*. Cambridge, Mass: MIT Press, pp. 21-46.
- Earman, John, and John Roberts. 1999. *Ceteris Paribus*, There is no Problem of Provisos. *Synthese* 118: 439-478.
- Earman, John, John Roberts, and Sheldon Smith. 2002. *Ceteris Paribus* Lost. *Erkenntnis* 57: 281-301.
- Elster, Jon. 1978. *Logic and society: Contradictions and possible worlds*. Chichester and New York: John Wiley and Sons.
- Ferguson, Niall. 1997. Virtual history: Towards a 'chaotic' theory of the past. In *Virtual history: Alternatives and counterfactuals*, Niall Ferguson ed. London: Picador.
- Forbes, Graeme. 1985. *The metaphysics of modality*. Oxford: Clarendon.
- Forbes, Graeme. 1989. *Languages of possibility: An essay in philosophical logic*. Oxford: Basil Blackwell.

- Goldstone, Jack A. (2002) "Efflorescences and Economic Growth in World History: Rethinking the 'Rise of the West' and the Industrial Revolution." *Journal of World History* 13,2: 323-389.
- Goldthorpe, John H. 1997. Current issues in comparative macrosociology: A debate on methodological issues. *Comparative Social Research* 16:1-26.
- Gould, Stephen J. 2002. *The structure of evolutionary theory*. Cambridge, Mass.: Harvard University Press.
- Graham, Carol. 2005. 'Insights on Development from the Economics of Happiness'. The World Bank Research Observer Advance Access published on September 1, 2005, DOI 10.1093/wbro/lki010. *World Bank Res Obs* 20: 201-231.
- Griffin, Larry J. 1993. Narrative, Event-Structure Analysis, and Causal Interpretation in Historical Sociology. *The American Journal of Sociology* 98:1094-1133.
- Hawthorn, Geoffrey. [1991] 1995. *Plausible worlds: Possibility and understanding in history and the social sciences*. Cambridge: Cambridge University Press.
- Hoefer, Carl, "Causal Determinism", *The Stanford Encyclopedia of Philosophy (Summer 2005 Edition)*, Edward N. Zalta (ed.), URL =
 <<http://plato.stanford.edu/archives/sum2005/entries/determinism-causal/>>.
- Kellerman, Aharon. 1989. *Time, Space and Society: Geographical Societal Perspectives*. Dordrecht: Kluwer Academic.
- Knuuttila, Simo. 1993. *Modalities in medieval philosophy*. London and New York: Routledge.
- Knuuttila, Simo, "Medieval Theories of Modality", *The Stanford Encyclopedia of Philosophy (Fall 2003 Edition)*, Edward N. Zalta (ed.), URL =
 <<http://plato.stanford.edu/archives/fall2003/entries/modality-medieval/>>.
- Krieger, Leonard. 1968. Culture, Cataclysm, and Contingency. *The Journal of Modern History*, Vol. 40, No. 4. (Dec., 1968), pp. 447-473.
- Lamprecht, Sterling P. 1971. Contingency in nature. *Philosophy and Phenomenological Research* 32:1-14.
- Lange, M. 1993. Natural Laws and the Problem of Provisos. *Erkenntnis* 38: 233-248.
- Lebow, Ned. 2000a. Contingency, catalysts, and international system change. *Political Science Quarterly*, 115:591-616.
- Lebow, Ned. 2000b. What's So Different About A Counterfactual? *World Politics* 52: 550-585.

- Lewis, David. 1973. *Counterfactuals*, Blackwell, Oxford.
- Liebowitz, S. and Margolis, Stephen E. 1995. Policy and path dependence: From QWERTY to Windows 95. *Regulation: The Cato Review of Business and Government* 18(3):33-41.
- Little, Daniel. 2000. Explaining large-scale historical change. *Philosophy of the Social Sciences* 30:89-112.
- Loux, Michael J. (ed.). 1979. *The Possible and the Actual: Readings in the Metaphysics of Modality*. Ithaca: Cornell University Press.
- Lovering, John. 1989. The restructuring debate. In Peet, Richard and Nigel Thrift (eds.) *New Models in Geography Vol. 2*, pp.198-223. London: Unwin Hyman.
- Losos, Jonathan B., Todd R. Jackman, Allan Larson, Kevin de Queiroz, and Lourdes Rodríguez-Schettino. 1998. Contingency and determinism in replicated adaptive radiations of island lizards. *Science* 279:2115-2117.
- Luhmann, Niklas (1987), *Soziale Systeme: Grundriß einer allgemeinen Theorie*. Frankfurt am Main: Suhrkamp.
- Luisi, Pier Luigi. 2003. Contingency and Determinism. *Philosophical Transactions of the Royal Society of London, Series A: Mathematical, Physical and Engineering Sciences* 361(1807): 1141-1147.
- Mahoney, James. 2000. Path dependence in historical sociology. *Theory and Society* 29:507-548.
- Mandel D.R. 2003. Simulating history: The problem of contingency. *Analyses of Social Issues and Public Policy* 3:177-180.
- Manis, Jerome G. and Bernard N. Meltzer. 1994. Chance in Human Affairs *Sociological Theory* 12(1): 45-56.
- Mann, Michael. 1994. In Praise of Macro-Sociology: A Reply to Goldthorpe. *The British Journal of Sociology* 45(1): 37-54.
- Mapel, David R. 1990. Civil association and the idea of contingency. *Political Theory* 18:392-410.
- McCall, Storrs. 1984. Counterfactuals based on real possible worlds. *Noûs* 18:463-477.
- McMichael Alan. 1983. A Problem for Actualism About Possible Worlds. *The Philosophical Review*, Vol. 92, No. 1, pp. 49-66.
- Moore, Omar K. 1980. Review of *Logic and Society: Contradictions and Possible Worlds* by Jon Elster. *Contemporary Sociology*, Vol. 9, No. 1. pp. 92-93.

- O'Brien, Patrick 2000 The Reconstruction, The Rehabilitation, and Reconfiguration of the British Industrial Revolution as a Conjuncture in Global History, *Itinerario* 22.3/4: 117-134.
- Øhrstrøm, Peter and Hasle, Per. 1995. *Temporal Logic: From Ancient Ideas to Artificial Intelligence*. Dordrecht, Boston and London: Kluwer Academic.
- Oyama, Susan, Paul E. Griffiths and Russell D. Gray, eds. 2001. *Cycles of Contingency: Developmental Systems and Evolution*. Cambridge, Mass.: MIT Press.
- Pierson, Paul. 2000. Increasing Returns, Path Dependence, and the Study of Politics, *American Political Science Review* June.
- Plummer, Paul. 2001. Vague Theories, Sophisticated Techniques, and Poor Data *Environment and Planning A*, 33: 761-764.
- Pred, Alan. 1977. The Choreography of Existence: Comments on Hagerstrand's Time-Geography and Its Usefulness. *Economic Geography* 53(2): 207-221.
- Pred, Allan. 1981. Social Reproduction and the Time-Geography of Everyday Life. *Geografiska Annaler. Series B, Human Geography* 63(1): 5-22.
- Pred, Alan. 1984. Place as historically contingent process: Structuration and the time-geography of becoming places. *Annals of the Association of American Geographers* 74: 279-297.
- Przeworski, Adam. 2004. "Geography vs. Institutions Revisited: Were Fortunes Reversed?" Unpublished manuscript.
- Rommel, Ethan. 2006. Evo devo psych. *American Scientist* 94(2): 174-176. Review of *Origins of the social mind: Evolutionary psychology and child development*. Edited by Bruce J. Ellis and David F. Bjorklund. New York: Guilford Press.
- Rescher, Nicholas. 1999. How many possible worlds are there? *Philosophy and Phenomenological Research*, Vol. 59, No. 2. (Jun., 1999), pp. 403-420.
- Richards, Keith, Michael Bithell, and Michael Bravo. 2004. 'Space, Time and Science: Individuals, Emergence and Geographies of Space and Place', pp. 327-352 in Matthews, John A. and David T. Herbert (eds.) *Unifying Geography: Common Heritage, Shared Future*. London: Routledge.
- Rosen, Gideon 1990 Modal fictionalism *Mind*, New Series, Vol. 99, No. 395. (Jul.), pp. 327-354.
- Rosenberg, Alex. 2005. Lessons from biology for philosophy of the human sciences. *Philosophy of the Social Sciences* 35(1): 3-19.

- Roy, Tony 1993 Worlds and Modality *The Philosophical Review*, Vol. 102, No. 3. (Jul.), pp. 335-361.
- Rudra, Nita. 2005. Globalization and the Strengthening of Democracy in the Developing World *American Journal of Political Science* 49(4): 704-730.
- Sayer, Andrew. 2000. *Realism and Social Science*. London: Sage.
- Schedler, Andreas. 2004. Mapping Contingency. Seminar on “Contingency in the Study of Politics”, Yale University, Department of Political Science, New Haven, CT, 3–4 December 2004.
- Scott, A.J. and D.P. Angel. 1987. The U.S. semiconductor industry: A locational analysis. *Environment and Planning, A* 19: 875-912.
- Scott, A. J. 2000. Economic Geography: the Great Half Century. *Cambridge Journal of Economics* 24(4): 483-504.
- Shapiro, Stewart. 1993. Modality and Ontology. *Mind*, New Series, 102(407): 455-481.
- Shermer, Michael. 1995. Exorcising Laplace’s demon: Chaos and antichaos, history and metahistory. *History and Theory* 34(1): 59-83.
- Shermer, Michael. 1999. *How we believe: The search for God in an age of science*. New York: W. H. Freeman.
- Stalnaker, Robert C. 1976. Possible Worlds *Noûs*, Vol. 10, No. 1, pp. 65-75.
- Steinmetz, George. 1998. Critical realism and historical sociology: A review article. *Comparative Studies in Society and History* 40:170-186.
- Stjernström, Olof. 2004. Theory and Migration: Towards a Framework of Migration and Human Actions. *Cybergeo, European Journal of Geography*, article 254.
- Sylvan, David and Stephen Majeski. 1998. A Methodology for the Study of Historical Counterfactuals. *International Studies Quarterly*. 42:79-108.
- Tetlock, Philip E., and Aaron Belkin (eds.) 1996. *Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives*. Princeton: Princeton University Press.
- Tucker, Aviezer. 1999. Historiographical counterfactuals and historical contingency. *Theory and Society* 38:264-276.
- Vries, P.H.H., (2001) “Are Coal and Colonies Really Crucial? Kenneth Pomeranz and the Great Divergence.” *Journal of World History* 12, 2 407-446.
- Wagner-Pacifici, Robin. 2000. *Theorizing the Standoff: Contingency in Action*. Cambridge, Cambridge University Press.

- Weber, Marcel. 2005. Indeterminism in neurobiology. *Philosophy of Science* 72(5): 663-674.
- Wong, R. Bin (1997) *China Transformed: Historical Change and the Limits of the European Experience*. Ithaca: Cornell University Press.
- Wright, Georg Henrik von. 1984. *Truth, knowledge, and modality*. Oxford: Basil Blackwell.
- Wyatt, Nicole. 2000. "Did Duns Scotus invent possible worlds semantics?" *Australasian Journal of Philosophy* 78: 196-212.