**Contingency And History**

**Abstract**

In a series of publications, Stephen Gould has argued both that the history of life, and human history, are contingent. These ideas have sparked a considerable critical response, but this has largely focussed on the history of life. This paper targets the supposed contingency of human history, though it does so via evolutionary history, framing Gould’s ideas as a claim about explanatory strategies and the robustness of historical trajectories. This paper does not reject or defend a global claim about human history. Rather, it aims to identify and explain the difference between robust and fragile historical trajectories. It does so by considering a set of contrasting cases — the outbreak of World War I; the Nuer Conquest; the gradual containment of the Black Death; the European demographic transition — and identifying critical differences amongst the cases. The analysis links contingency to the historical emergence of command-and-control institutions; robustness to population-level processes structured by relatively stable institutions.

**Key Words**

Historical contingency, robustness, sensitive dependence, Gould, robust process explanation, actual sequence explanation, mechanisms and organisms

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**1. Plausible Worlds[[1]](#footnote-1)**

Geoffrey Hawthorn begins his Plausible Worlds by imaging a Europe in which Islam had retained Spain, and used it as a basis of empire. After a brief sketch of this alternative world, he even imagines how such a world might seem inevitable to its inhabitants.

“Islam is of the three great monotheisms, the one closest to modernity. Medieval Christianity, as Ibn Weber so persuasively put it in The Kharejite Ethic and the Spirit of Capitalism, with its “baroque, manipulative, patronage-ridden, quasi-animistic and disorderly vision of the world”, its belief that justice could be bought by donations and pious works, “could never have taught its adherents to rely on faith alone and to produce and accumulate in an impersonal, orderly and systematic manner” ((Hawthorn 1991) p2)

The professionals do not take such scenario-building seriously, and nor does he, though the aim of his book is to defend a much more modest version of this enterprise. But why not? It seems that when we understand why something happened — say, why Hitler came to power — we equally understand what would have sabotaged his ascent. Causal and counteractual analyses are intimately connected, so there should be circumstances in which scenario-building is serious theory. I shall stalk this problem through Stephen Jay Gould’s ideas of contingency. So in this first introductory section, I lay out some crucial machinery, developed from consideration of Gould’s ideas and then in section 2 introduce the puzzle as it applies to human history. Since one theme of this paper is to suggest that some but not all historical trajectories are contingent, Section 3 is organised around contrasting examples. Sections 4 and 5 aim to diagnose the basis of, and limits to, contingent human historical trajectories, after which I briefly conclude.

In 1989, Stephen Jay Gould published his classic Wonderful Life (Gould 1989). One central theme of this work was his case for the contingency of both evolutionary and human history. He developed his conception of contingency through a favourite metaphor of “replaying the tape of life”. If we could replay life’s story from the same beginnings (with minor modifications in the initial conditions, for the claim does not depend on causal indeterminism), he thought it was almost certain we would get an entirely different biota; perhaps with complex life organized in an entirely different set of morphologies; perhaps with nothing more complex than bacteria. Contingency, interpreted this way, is sensitive dependence on initial conditions: very small changes in those conditions could result in large and ramifying changes in historical trajectories. This view of contingency is developed and defended in (Ben-Menahen 1997; Sterelny and Griffiths 1999; Ben-Menahen 2009; Inkpen and Turner 2012)[[2]](#footnote-2).

Contingency remained an ongoing theme of Gould’s thought. For example, in Full House, he writes of the emergence of complex life:

“if we could replay the game of life again and again, always starting at the left wall and expanding thereafter in diversity, we would get a right tail almost every time, but the inhabitants of this region of greatest complexity would be wildly and unpredictably different each time …” (Gould 1996c) p175

Moreover, contingency did not disappear once the tape player got underway. A second theme of Wonderful Life was the idea that the disparity of multicelled animal life peaked through the Cambrian explosion, with much of that disparity lost at the Cambrian/Ordovician transition. In Gould’s eyes, extinction and survival through this transition was itself contingent. The organizational forms that disappeared (the anomalocarids, for example) were as complex and well-adapted as the survivors. Disparity was filtered in a lottery-like fashion, and hence if we replayed the tape from the beginnings of the Cambrian explosion, again with minor perturbations at some early point, the fauna of the Ordovician seas would have been very different. Quite likely, for example, the early Cambrian chordates would have been losers not winners, and there would have been nothing resembling the vertebrate radiation into keystone species: no teleost fish; no dinosaurs; no mammals; no us[[3]](#footnote-3).

Gould’s views are both puzzling and intriguing. There is no doubt that some episodes in evolutionary history are sensitively dependent on their preceding conditions. In particular, there are undeniably lottery-like effects at local, population-level scales. New genetic variants are necessarily rare, low-frequency forms when they first appear, and so can easily disappear for reasons unconnected to their phenotypic effects. Even once a variant becomes established in a local population, it is still vulnerable to bad luck, as local populations often disappear through processes insensitive to their specific phenotypes. For example, coral reefs are often destroyed by cyclones, and so a cyclone could easily eliminate a locally established adaptive response to global warming. That phenotype would disappear through the actions of a causal mechanism entirely blind to the specific phenotypes established at the reef[[4]](#footnote-4). But the Cambrian lineages winnowed at the Ordovician transition were the elements of a long-lived, multi-species, globally dispersed fauna. We do not know why the anomalocarids disappeared. But it was not because they were vulnerable to a local disturbance that just happened to strike where they lived. By the time they were represented in the fossil record, anomalocarids were not vulnerable to the fatal sampling effects that can strike down small populations and low frequency variants. So there is a relatively clear sense in which the origin and initial history of a specific new variants is indeed contingent; change the local conditions in relatively minor ways, and the variant will not appear or not survive. But this local, fine-grain contingency does not establish the contingency of macroevolutionary patterns of extinction and survival.

Notoriously, Simon Conway Morris is very sceptical about Gouldian contingency claims, and partly because microevolutionary contingency need not scale up to contingent macroevolutionary patterns. On his view, convergence is ubiquitous because possibility space is both constrained and explored efficiently ((Conway Morris 2003); see also (McGee 2011)). It is true that any given token of an innovation is vulnerable to lottery-like elimination. But other versions of the innovation will appear, and some version will survive the low-frequency, local population bottleneck. Contingency at the grain of populations does not sum to contingency at the grain of morphological and behavioural innovations. Simon Conway Morris’s impressive catalogue of supposed convergences includes many cases of parallel evolution, and many cases of convergence that exploit homologous genetic resources. So most are not examples of genuinely independent origins of the same adaptive complex. But parallel evolution illustrates his crucial point. At the level of local populations, the evolution of an adaptive response is causally fragile. But when we aggregate populations into lineages, and lineages into clades of closely related lineages, outcomes are much more robust. No doubt many local populations went extinct in the browning of Australia. But many lineages evolved somewhat similar suites of drought resistant, fire-tolerant phenotypes. So the contingency of local, population scale episodes does not imply that macroevolutionary phenomena are contingent. This issue of scale and scaling-up will be important when we turn to human history, too, but before we turn to human history, I shall reformulate the issue in a more tractable form: contingency depends not just on on sensitive dependence, but as well on explanatory stratagies.

In thinking through contingency, Frank Jackson and Philip Pettit have developed a helpul distinction (see (Jackson and Pettit 1992)). They introduce two explanatory strategies. An actual sequence explanation aims to identify the specific links in the causal chain connecting a cause to its effect. To reuse their example, an actual sequence explanation of the cracking of a flask of boiling water would identify a chain of microphysical events that lead to the breaking of a molecular bond in the surface of the glass. A robust process explanation specifies the resilience of that outcome[[5]](#footnote-5). The flask cracked because it was placed on a heat source. That source heated the water contents past their boiling point, and that in turn caused a crack. Robust process explanations both specify the range of alternative initial conditions across which we would still see a qualitatively similar outcome, and the limits on that range. In any (or perhaps almost any) situations in which we hold the general background fixed, and in which the water was boiled vigorously, the flask cracks. Again holding the general background fixed, unless the flask is heated beyond the water’s boiling point, it does not crack. What counts as a relevantly similar outcome depends on the explanatory interests of the explanation producers and consumers. If, for some reason, the exact moment and place of the crack is significant, the class of relevantly similar antecedent conditions in which we still get the effect of interest will shrink dramatically. In the limit, if every aspect of the effect is salient, it shrinks to the actual sequence.

So the robustness of a causal outcome is sensitive to how we specify that outcome; in particular, to our grain of description[[6]](#footnote-6). However, even if we have a coarse-grained specification of what counts as a relevantly similar outcome, there is no *a priori* guarantee that there is an informative robust process explanation to give. It is perfectly possible for the chain between cause and effect to be fragile, so very small interventions on the cause itself, or on the channel conditions between cause and effect, yield a very different outcome. This is especially likely when the effect depends on many independently acting factors, each of which is necessary. Very likely, there is no robust process explanation of the connection between my sexual behaviour 16+ years ago, and the genetic makeup of my child. Very small changes in the timing and nature of sexual behaviour, or of behaviour between sex and conception, would have resulted in a different gametic fusion, or in no conception at all. We are all triumphs of the improbable ; we are all just a kiss away from being merely possible. Holding genetic make-up fixed is of course a very fine-grained specification of “the same outcome”. But very likely, there is no robust process explanation of the connection between sexual behaviour, and our daughter’s sex. So even if “having a daughter” counts as “the same outcome”, very minor perturbations of the causal sequence would send a y-carrying gamete to the crucial rendezvous. So the availability of robust explanations is tied to both objective characteristics of the relevant causal network, and to our specifications of causes and outcomes within that network. Moreover, robustness is also a matter of degree. How many points of vulnerability are there in the causal chain? What is the probability of an intervention at each of those points? What must the magnitude of an intervention be, to substantially change the actual effect?[[7]](#footnote-7)

**2. Contingency and History.**

Armed with this distinction between actual sequence and robust process explanation, and the recognition that both contingency and robustness are sensitive to our grain of description, let’s turn to Gould’s historical claims. One of his central examples is the American civil war. The North had a much larger population, and a much larger economic and industrial base, and so Northern victory might seem to be robust: superior resources eventually tell. Even so, Gould suggests that the outcome was contingent, for the war aims of the South did not involve conquest of the North. Mere northern war-weariness would have sufficed for its independence, and there were signs of war-weariness in 1863, with an election with a due in 1864, and with a credible peace candidate aiming to run. It is widely accepted that Gettysburg was a close-run battle, and so Gould suggests that a southern victory might well have lead to a McClelland presidential victory in 1864, and an independent Confederacy. In turn, that would surely have reshaped world history in unfathomable ways in the next century. So, using Gould’s views and my language, historians can and have given actual sequence explanations of the course of the war, and, in particular, of the pivotal moment of Gettysburg. (See, for example (Coddington 1984), but there are many other detailed narratives of civil war military history.) But the fragility of battle means that there is no informative robust process explanation to give.

Importantly, if Gould is right about human history, we can make sense of an otherwise deeply puzzling feature of history as a discipline; the puzzle with which I began: historians’ deep scepticism about counterfactual history. That scepticism is famously exemplified in E.H Carr’s What is History? (Carr 1961). Academic historians have a deep professional distrust of attempts to say what would have happened if, say, the Persian fleet had been victorious at Salamis. This scepticism is prima facie puzzling. For historians produce causal analyses, not chronicles, of historical trajectories. These analyses imply counterfactuals. If the discovery of gold caused a boom in the Australian population, it follows that if gold had not been discovered, the population would not have boomed (then). There are complications due to causal over-determination[[8]](#footnote-8), but to a first approximation, there are no causal analyses without counterfactual implications. This point has been pressed very vigorously by the small minority of historians defending counterfactual history (see: (Hawthorn 1991; Bunzl 2004; Capoccia and Kelemen 2007; Lebow 2008; Tetlock, Lebow et al. 2009; Nolan 2013; Lebow 2014). Contingency makes sense of professional resistance to counterfactual history. We know that over the three days of Gettysburg, Lee’s army attacked on both flanks before failing in its final throw of the dice with Pickett’s charge. We know that had one of Lee’s attacks on day 1 or day 2 succeeded, the subsequent course of the battle would have been different. But we do not know the kind and extent of the immediate difference; still less, how those immediate differences would have ramified as events unfolded. We can know that our Gettysburg — the Gettysburg we had —depended on those attacks failing, without knowing the character of the Gettysburg we would have had, if one had succeeded[[9]](#footnote-9). To the extent that historical sequence depends in important ways on the precise character of a large number of factors, positive counterfactual projection is epistemically intractable.

Historians, notoriously, love detail. Contingency suggests that this may be more than a fetish, or a costly signal of disciplinary seriousness. In a famous paper on the problem of understanding causally complex systems, Richard Levins pointed out that no single model can be ideally general, realistic and precise ((Levins 1966); Geoffrey Hawthorn notes the implication of Levins’ insight for the discipline of history (Hawthorn 1991) pp 33-35). Historians *seem* to sacrifice generality for precision, but that is no sacrifice, if historical trajectories are pervasively contingent and particular; if different cases do not share a common causal structure. For then there would be no general model of (say) successful military organisation to be had.

However, though professional history is dominated by a focus on the particular, there are attempts to develop general models. Peter Turchin, for example, claims to identify patterns in the formation, life history and decline of empires. One of his supposed patterns is a “secular cycle”: he argues that empires have a chronic instability cycle (of a few centuries), and that this cycle results from the Malthusian cycles of the peasantry and of the elites being out of sync. In the initial, post-crisis, population-expansion cycle of the peasantry, the peasants’ bargaining position relative to the elites is at its best, and they secure a better share of the social surplus. As their population expands further (in part because of their better conditions of life), the land-to-population ratios become more favourable to landowners, with peasant incomes being squeezed as their numbers expand. Income flowing to elites triggers a Malthusian response of their own. But elite numbers tend to spike as peasant society hits a crisis-and-crash point. So elites move into a zone of increased numbers and falling total income. As a consequence, we repeatedly see reckless, intense, within-elite conflict. The model is driven by economic and demographic factors; insensitive to individual decision, and to the specific political and administrative organisation of empires (Turchin 2006)[[10]](#footnote-10). While Turchin’s model may not convince, I shall suggest that there is no single verdict on the contingency of human history. In the next section I discuss four examples (one in more detail): in the following sections, I use these examples to distinguish fragile from robust trajectories.

**3. The Shot Heard Around The World**

On June 28, 1914 Gavril Princip assassinated Franz Ferdinand, the heir to the Austro-Hungarian throne (and his wife), thus setting in train a sequence of events leading to World War I. Uncontroversially, this was a catastrophe which reshaped the political and economic geography of Europe, and since Europe was itself a dominant force in world affairs, its impact was global rather than regional. Was a major European war early in the twentieth century — followed by a shift in the economic, military, and technical centre of gravity to the USA (and Russia) — contingent? That is, would relatively minor differences in the circumstances of Ferdinand’s visit to Sarajevo, or in politico-military responses to that visit, have lead to a Europe that escaped a general war?

The standard historiographies of World War I once minimised the role of contingency in the origins of the war, downplaying the importance of accidents of individual circumstance and decision. The ingredients of a structural view of the war tended to include the following factors: (i) the tripwire military organisation of Europe into competing, mutually suspicious (perhaps even mutually hostile) camps; (ii) the fact that each side had, prudently, prepared for war, and those plans depended on mass armies, mobilised from reserves, and concentrated for action via rail networks. No-one could afford to let potential opponents mobilise and strike first. (iii) There was a long-established, institutionally stable, German war plan of striking France down first via Belgium, before Russia could complete mobilisation. This was not irrational: it was the only German hope of avoiding a long war on two fronts. So the structure of the European politico-military organisation made it likely that a local conflict would become general.

Moreover, political instabilities in the region provided a steady supply of local crises, each having the potential to escalate to local conflict. (a) Austro-Hungry (especially) and Russia were chronically vulnerable to internal unrest; a problem exacerbated by the fact that unrest in Austro-Hungry was encouraged by groups within Russia’s client states in the Balkans. (b) Russo-Austrian-Turkish rivalries continued in the Balkans. (c) Chronic instability persisted in the increasingly strategic Middle East, as Turkish power declined, (d) Imperial rivalries in Africa and Asia generated great power friction points. (e) The French continued to resent the loss of Alsace and Lorraine. (f) The Anglo-German naval race fuelled English suspicion of Germany, and a gradual shift of England into military involvement with France. On this analysis, we have to hand the ingredients of an informative robust process explanation of the origins of a general European war. This explanation identifies structural factors ensuring that a regional conflict would very likely become Europe-wide, and dynamic factors that generated local crises. Any of these could readily become a regional conflict. Our World War I was indeed as contingent as could be. The actual assassination was made possible only by a bizarre combination of pig-headed stubbornness, blundering incompetence, and ill-luck. But some World War I-like event was nearly inevitable.

Recent scholarship has taken serious issue with the idea that war was almost inevitable. Some recent work has emphasised the highly contingent, fragile sequence of events linking the Sarajevo crisis to the outbreak of war (Clark 2013). On this view, the road from local crisis to general war had many potential stopping points: the structure of Europe’s political organisation did not make the transition from local conflict to general war inevitable. Other work emphasises the specific policies and attitudes of key figures in the politico-military elite (Fischer 1968). For example, the German chief of staff, von Moltke, had the firm policy of fighting any war, if war came, as an aggressive war, rather than standing on the strategic defensive. On these views, war was far from inevitable. Moreover, even if a general conflict was a robust outcome of the European tripwire, perhaps its Europe-destroying outcome was contingent. The German attempt to knock out France in the first few weeks only just failed (Keegan 1998). The German army was turned back on the Marne, and that successful counterstroke was not called the “miracle on the Marne” for nothing. While we cannot say what would have happened had Paris fallen in September 1914, a short war ending with Germany firmly established as the dominant European power is one possibility.

Most particularly, Richard Lebow has mounted an explicit case for the contingency of World War I and its consequences (Lebow 2014). He argues that the assassination itself was critical in (i) posing such a severe challenge to the Austrian prestige that its status as a recognised great power depended on a forceful response; (ii) the death of Ferdinand in itself removed a key advocate of moderation and caution from the Austro-Hungarian leadership team; (iii) it shocked and outraged the German public enough to generate a political consensus in favour of support to Austro-Hungarian action; without this consensus, Bethmann Hollweg would have been unwilling to risk war (iv) finally, the assassination impacted the personal psychology of Franz Josef and Kaiser Wilhelm enough to shift them from their normal caution. Moreover, he argues that had war not occurred in 1914 or soon thereafter, the steady modernisation of Russia would soon have made it impossible for the German military leadership to risk a focused attack on France, leaving their eastern borders open. Military necessity would have forced upon Germany a more cautious approach to international affairs. The door to war was closing. On this view, the destruction of the European world was indeed sensitively dependent on the bizarre sequence of accidents and coincident in Sarajevo.

Suppose all of this is right. What would it show about the contingency of history more generally? Let me offer three contrasting cases to reinforce Turchin’s example: cases that suggest that human historical trajectories can be robust: not sensitive to small changes in initial or intermediate conditions. I shall begin with the Nuer Conquest, as analysed by Kelly (Kelly 1985). In the early nineteenth century, the Nuer and the Dinka were two ethnolinguistic groups occupying much of the Sudan. The Nuer occupied a southern/central area of the Upper Nile Basin; the Dinka tended to occupy northern and western areas, though early in this process, Nuer territory was effectively embedded within, and surrounded by, Dinka territory. Though ethnically and linguistically distinct, the two groupings were closely related linguistically and culturally, and they had a similar economic base, relying on cattle, which they moved seasonally between wet season and dry season pastures, and wet season agriculture. Between roughly 1818 and 1890 (when external events intervened), the Nuer expanded their territory roughly 10-fold at Dinka expense. Perhaps in the region of 200,000 Dinka were killed, absorbed or fled (apparently many were absorbed, fuelling Kelly’s scepticism about the idea that Nuer expansion was driven by famine).

The mechanism of expansion was through large scale raiding. As Kelly describes them, Nuer raids were formidably dangerous and destructive. Parties of around 1500 raiders, often divided into separate but loosely coordinated groups, would strike deep into Dinka territory (up to 80 miles), attacking numerous wet season Dinka settlements, aiming for and often achieving overwhelming numerical superiority at each settlement. The raiders stole Dinka cattle, burnt crops and dwellings; sometimes stayed for a while; often withdrew with their booty. These border zones became increasingly hazardous for Dinka. Though they could return to their territory after raids, their houses, their crops, and those of their cattle they could not flee with, were gone. So they returned to danger and to want, if not famine, and so those with other options often did not return. As each raid increased the vulnerability of those still in these zones, a pattern established of Dinka retreat and Nuer advance. The crucial question, of course, is: why did the Dinka not reply in kind, or organise their defence in numbers? As Kelly develops his analysis, the key factor was a differences in bridewealth payments. In the Nuer, brides were more expensive. These norms about marriage and bridewealth motivated territorial expansion, for the bridewealth norm increased the demand for cattle, and more cattle translates into greater territorial requirements, especially in the dry season. But the norms also built more effective links between villages; they increased the value of those connections. As a consequence, in both attack and defence, the Nuer could more readily put together multi-village coalitions, and over time, this advantage was decisive.

Kelly’s analysis has been widely accepted; the book is regarded as a classic[[11]](#footnote-11). If he is roughly right, so long as we hold fixed the economic, cultural and technical similarities of the Nuer and the Dinka, and so long as we hold fixed the crucial difference about bridewealth and its role, the Nuer conquest was not contingent. Indeed, Kelly has given an informative robust process explanation of the Nuer expansion. One crucial point is that it is a population-based explanation. The Nuer expanded as a result of a large number of small scale incidents. Very likely, the outcome of each particular incident was contingent, though with a significant bias in favour of the Nuer. But the historical trajectory did not depend on any of these specific interactions; none were essential to the Nuer expansion. Between the Dina and the Nuer, nothing major was at stake in any single interaction. So a fluke Dinka win made no difference to the overall outcome. If everything hangs on a single event, bad luck can make a huge difference.

The next example is less military. Geoffrey Hawthorn develops the idea that the retreat of the plague from western and central Europe was neither contingent, or independent of human agency[[12]](#footnote-12). In 1346, after a gap of many hundreds of years, the black death returned to Europe with brutal effect. The causal mechanisms through which it spread were not understood until late in the nineteenth century. But European administrations gradually learned that complete, relentless quarantine of infected zones could prevent the epidemic spreading. Beginning quite early, in northern Italy, elites gradually marshalled the resources (quarantine was very expensive), administrative efficiency, and centralised, coordinated decision-making to impose effective quarantines. The last major European outbreak was 1722; it continued as a major threat in the Ottoman Empire, to the east. In his analysis, Hawthorn developed a “middle range theory[[13]](#footnote-13)” of the plague and its containment. This model included (i) the critical biological and ecological factors that determine its potential to spread; (ii) informational factors: the realisation that quarantine needed to be complete and sustained; (iii) economic factors: control depended on resources both to physically impose quarantine, and to survive the costs of disrupted trade and exchange; (iv) institutional factors: decision-making needed to be rapid, co-ordinated, and effectively translated into action on the ground. Given this model, Hawthorn is able to counterfactually analyse the differing responses within Europe (polities varied greatly in the effectiveness of their response) and between Europe and the adjoining lands to the east.

A final example. The European demographic transition was one of the most fundamental social changes of the nineteenth century; first in the west, then in the southern and central Europe (and later in the east). It involved a dramatic reduction in fertility and family size, largely as the result of individual decisions within marriage (rather than by delaying marriage, or externally via child mortality). It began in France and England; with a similar trend appearing a little later north in Belgium and Holland; in Germany and Central Europe; in Italy and later Spain. Family size roughly halved. Families became smaller despite, often, pronatalist policies by church and state. It was not driven from the top, by coercion or ideology.

The cause of the transition remains somewhat controversial: in England, France and adjoining areas it began before the dramatic advances in public health, so at least originally it was not a response to the declining risk of loosing one’s first cohort of children. But while controversial, the classic explanation is economic (Becker 1960). Economic changes beginning in the late eighteenth century — the first elements of industrialization — encouraged a shift away from rural life. Urban life changes the costs and benefits of children. Children are a valuable labour force for quasi-subsistence farmers, and they require little investment beyond food and minimal clothing. An urban shift suppresses their benefit. There is less of a family economy, and especially as legal barriers to child labour grew in the century, it was difficult to place them in the cash economy. To the extent that education was necessary for their entry into that economy, their expense increased. To the extent that women could access the cash economy, the opportunity costs of pregnancy and infant care increased too. On this model, country by country, the transition was the aggregate outcome of a myriad of individual decisions. As with each Nuer-Dinka interaction, each individual’s family planning was contingent. But once again, there was a bias. Quite often, in their reproductive decision-making, agents responded to economic incentives, discarding the practices of previous generations, and ignoring the natalist propaganda of church and state.

Becker thus offers a robust process explanation of the demographic transition. We would see the transition if we hold fixed (i) the economic incentives for shifting to urban centres; (ii) the increased direct and indirect costs of children, and (iii) their reduced contribution to the family economy. Other factors could vary: the policies of state and church; the pre-existing practices of country life; even (presumably within limits) child mortality rates. However, had urban economies largely run on child labour, family size would not have declined. Becker’s picture is probably over-simplified (Mulder 1998; Spolaore and Wacziarg 2014). It fits England better than France, and may not predict well the order of the transition elsewhere in Europe. One suggestion is that it underplays the role of social transmission, and in particular, the galvanizing effect of successful early adopters of family limitation on others’ practices. So various forms of social learning bias may have played an important role too. But these, too, are population-level, aggregate effects, summed over large numbers of individually contingent but probabilistically weighted decisions. As with the Nuer expansion, no single event matters. Perhaps a pattern is emerging. We escape from contingency to the extent that macro-phenomena have many potential microfoundational realisations. We will see in the next section that this is part, but only part, of the explanation of why some historical trajectories are robust.

**4. Mechanisms and Populations**

I suggested in the last section that historical trajectories are robust when they depend only on aggregate effects of interactions in populations. For then historical trajectories are screened off from idiosyncratic individual decisions, improbable local outcomes, and outcomes that depend on tiny quirks of specific circumstances. That is partly but only partly right. The causal trajectories of well-designed mechanisms are often robust too, but not because mechanisms are populations of components. As we shall see, there is an echo of the explanation of causally robust mechanisms in the explanation of causally robust historical trajectories. Engineers make mechanisms, and the historical trajectories of their operations are (typically) robust, and are so by design. In a well-designed mechanism (a) a given component typically responds to changes only in one or a few causal ancestors; (b) its response is typically transparent. Causal ancestors act as switches, controlling response in a discrete way, or as levers, changing response in a smooth, often linear, way; (c) the components and their physical connections are designed to retain their core mechanical properties in the face of physical stresses at magnitudes generated at and near their normal conditions of operation. The (relative) structural simplicity of the causal map connecting components to ancestors and descendants; the physical resilience of the components; the orderliness of the causal influence of a component on its causal descendants; and, in complex mechanisms, the nested organisation of micro components into components into subsystems into systems, all combine to make causal pathways robust and counterfactual analysis tractable. Had the brakes been applied immediately, the car would have stopped before the level crossing.

So well-designed mechanisms support robust causal trajectories. Redundancy also makes robust explanation possible. Population-based trajectories are robust because populations are composed from an ensemble of relatively autonomous individuals, who often have many properties in common, so with respect to many population-level outcomes they are interchangeable ((Godfrey-Smith 2009) pp 147-150). The fate of a fish population under harvesting pressure rarely depends on which particular fish are caught; which escape. In contrast, designed mechanisms are not ensembles of autonomous individuals, but of organised, interconnected, and often quite distinct components. Typically, the behaviour of the mechanism depends on the presence and placement of all of its components, though if failure is very expensive, sometimes there are back-up systems. Robustness depends on the intrinsic reliability of each component; the reliability of the physical connections between the components; and of the local, modular character of the causal map that charts the relations between the components. Designed mechanisms with inadvertently fragile components, and/or with undesigned, unanticipated causal connections to other components, are not robust, and often not tractable for counterfactual analysis. In contemporary practice, this tends to be a problem with software engineering rather than hard material engineering: (Calcott 2014)).

Biological systems are often mechanism-population hybrids. Diagrams of cells, for example, make them seem as if they are biological versions of designed mechanisms; organised, differentiated, with physically rugged components, each of which plays a critical role that depends on its location. Where would the cell be, if the nuclear membrane failed? That impression is partly right. The structural, mechanistic components are causally resilient (at the relevant physical and energetic scales). Given the typical forces of intracellular interaction, the structural partitions of eukaryotic cells — the cell wall; the nucleus; the organelles; the DNA molecules — do not readily rupture or distort. But other aspects of cell function are population-based. For example, the DNA-RNA-amino acid transcription and translation process depends on the fact that these intracellular compartments contain large populations of the relevant molecules in flux. These move repeatedly across binding and amino acid chain construction sites. If the appropriate tRNA molecule, jostled at the wrong moment, does not happen to dock at the ribosome binding site this instant, another will be along the next instant. So cell behaviour is quite predictable and robust, through a hybrid of physically resilient components and population based redundancy.

Historical trajectories through human social worlds can also depend on, and be robust in virtue of, hybrid structures. Relatively persistent collective facts — norms, customs, habits, institutions — serve the same stabilising and organisational role that physically robust membranes play in cells. The emergence of a recognisably human social life depended on these stabilising social structures. For the outcome of one agents’ actions typically depends on what others do. Customs, norms, and the like help make the actions of others predictable enough to make decision making tractable (see Don Ross for an insightful account of the interaction between social stabilisation and individual psychology: (Ross 2005)). The outcome of the Nuer-Dinka conflict depended on population-level processes: the summed effects of many individual decisions. But it also depended on these institutional stabilisers: the dry season pastoralism-wet season grain economy; the kinship system; the two different bridewealth systems. Likewise, the other plausible examples of robust trajectories depend on the interplay between population-level effects and institutional stabilisers. Thus Becker’s model of the demographic transition depends on the institutional features of city life that reduce the role of the family economy. Once there are general, community-wide practices, individuals have incentives to conform: to ease coordination problems; to reduce transaction costs in otherwise cooperative social interactions; and, in some case, to avoid social penalties. Many societies do not reward eccentricity. Social practices are not, of course, absolutely stable. But in pre-state societies, they are stable in the face of perturbations from individual decision. So if we imagine agents making different decisions in the course of a raid and response, we can legitimately suppose in the counterfactual scenario that these institutional factors will be effective.

**5. The Fragility of Command.**

Another form of institution, however, explains the quite contingent nature of many historical trajectories of recorded human history. The emergence of large-scale society has bought with it command-and-control institutions (Flannery and Marcus 2012), and these are a source of contingency for two reasons. They make population-level trajectories sensitive to the actions of a few, and they make that few more likely to behave in erratic, unpredictable, hair-trigger ways. In hierarchically organised institutions, with topdown command and control structures, control flows from small numbers at the apex of the pyramid through ever larger numbers lower in the hierarchy. That organisation makes the lives of myriads of individuals causally sensitive to the decisions of those few (in the limit, one) at or near the top of the hierarchy. Such organisational charts are unlike the mechanisms discussed in the last section. The causal histories of well-designed physical mechanisms are robust, as (a) each component acts on only a few others; (b) the behaviour of each component is orderly and predictable; small differences in input or operating conditions result in small differences in behaviour; (c) the links between components are scrutible and well-behaved. None of this is true of hierarchical command and control institutions, though it can be approximately true of those in the middle and lower levels of hierarchical, bureaucratic systems. Typically, there are some customary and institutional constraints on the decisions and actions of those high in the hierarchy. Meade, the US general in command at Gettysburg, could not literally have any order obeyed. I have no idea what would have happened if he had ordered his entire army to strip naked and dance around bonfires at midnight, but obedience was not within the space of possible outcomes. The constraints on his immediate subordinates were tighter still. Even so, he had great freedom of action within the constraints of his role (otherwise, it would not matter who commanded armies), and his direct subordinates had considerable freedom. And his decisions ramified, affecting the downstream actions of just about everyone in his army (and hence in Lee’s army, as well). Moreover, small differences in his actions might well have lead to enormous differences in outcomes: for example, differences in the timing of his orders, and their audience. Of course, the strength of these institutional and customary constraints on those occupying senior positions in command-and-control hierarchies varies from case to case. The stronger the constraints, the less the specific character of the occupant of the role matters, and the more the flow of control depends on office rather than occupant. But the character of the occupant is typically be causally important.

So the causal map of command-and-control systems is neither modular nor smooth. Moreover, in Gettysburg-like interactions, world-changing decisions are made in decidedly suboptimal situations; situations close to the limits of component failure. Crucial components are likely to behave in erratic ways. The decision contexts are suboptimal not just in the game theoretic sense that agents act in contexts of imperfect information, but in situations of physical and psychological stress and exhaustion. In discussing command decisions in the Normandy campaign, Martin Bunzl suggests that we can, actually and counterfactually, model command decisions through game theory, treating commanders as rational agents maximising under risk (Bunzl 2004). I am sceptical. German command decisions were driven from the top by wishful thinking, leading to their catastrophe of the Falaise pocket. Rational actor models are most powerful when they sum over the activities of many agents, swamping the effects of individual idiosyncrasy (Sterelny 2012). In the cases under discussion, we expect idiosyncrasy, as the components are operating outside their design specs.

Military decision, admittedly, is an extreme context. Not all decision is as stressed and time pressured as those decisions. But in hierarchical, command and control contexts, many of the mechanisms which make decision making more reliable and predictable — shared interests supporting honest communication; robust and public assessment of alternative options; division of informational labour — are excluded or weakened. We are not *intrinsically rational agents*, with stable preference structures, and a stable grip of options and their cost-benefit profile. To the extent that we approximate such agents, we do so only as a result of social scaffolding and material culture[[14]](#footnote-14) (see for example: (Satz and Ferejohn 1984; Ross 2006; Menary 2010; Zawidzki 2013; Sterelny forthcoming). So hierarchical political institutions randomise history, both by amplifying the effects of the decisions of particular, key individuals in the group, and by making those decisions more erratic. Aberrant decisions by one individual in a traditional foraging culture make no difference. Not so, aberrant decisions by a Pharaoh. Moreover, the upbringing and environment of a Pharaoh up-regulates erratic decision making; no-one tells a pharaoh not to be a dickhead.

The upshot, then, is that *history made history contingent* (or more contingent), through the historical emergence of hierarchical command and control systems[[15]](#footnote-15). These systems make historical trajectories sensitive to the decisions of a few individuals, and to the accidents that place specific individuals, with their idiosyncrasies, in pivotal roles. Moreover, in those cases in which the customary, normative and institutional constraints on leadership are weak, these command and control systems accentuate the tendency for decision making to be erratic and unstable (and hence unpredictable), since these decisions are sensitively dependent on the momentary whims of the great and powerful[[16]](#footnote-16). Of course, even in hierarchical societies, many social processes depend on the interaction of population-level processes with stable institutional factors, as the demographic transition, and Turchin’s analysis of imperial cycles, illustrate. Contingency impacts mostly, or most directly, on the explicit targets of command and control decision making. Politics is the engine of contingency. That said, we should remember that the availability of a robust-process explanation does not depend solely on the objective character of the causal history of an event. It also depends on how coarsely or finely we characterise our explanatory project. No-one doubts the contingency of the fact that World War II began in September 1939. But bracketing this point, we should expect military, political and diplomatic historians to be most allergic to counterfactual scenario building; social and economic historians to be least allergic to it. For they can sensibly undertake the project of building middle range theories of their target domain, and sensibly assume that historical trajectories in their domains rarely depend on the decisions or attributes of specific individuals.

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1. Thanks to Adrian Currie and John Matthewson for their comments on an earlier version of this paper. [↑](#footnote-ref-1)
2. That said, (Beatty 2006) shows that there is a second notion of contingency in Gould. A change in a system is contingent if it could not be predicted from information about the prior state of that system. If dinosaur extinction was the result of an asteroid impact, extinction does not show the sensitive dependence of dinosaur evolution on initial conditions. Replaying the tape of life from the K/T boundary, but without impact, is not making a small, apparently inconsequential, change. But it is a plausible example of an external intrusion into the biosphere. In this paper, I will be concerned with the first of these notions of contingency [↑](#footnote-ref-2)
3. On the other hand, the overall pattern of an initial explosion of disparity being winnowed might well be robust. That there are winners, but more losers, is robust; the specific identity of the winners and losers, contingent. (Haufe 2015) reads Gould this was, thus reconciling Gould’s insistence on contingency with his interest in general patterns in the history of life. [↑](#footnote-ref-3)
4. Likewise, when ecological accidents result in new islands of habitat being colonised by a species not previously present, the genetic sample captured by the colonisers will probably be unrepresentative of the species as a whole. [↑](#footnote-ref-4)
5. The terminology is mine; their terms (“comparative” and “contrastive”) were already in use, but with different meanings. [↑](#footnote-ref-5)
6. The connection between contingency and grain of description is explored further in (Inkpen and Turner 2012; Haufe 2015). [↑](#footnote-ref-6)
7. The example above is of no scientific interest, but biologically important events are causally fragile. For example, the origins of any specific genetic mutation probably depends on biochemical interactions that are both very specific and of low probability. [↑](#footnote-ref-7)
8. See (Nolan 2013) for a guide both to the complications, and also to the ways that, not withstanding those complications, casual claims are intimately linked to counterfactuals. [↑](#footnote-ref-8)
9. For a very different analysis, see (Lebow 2008). He thinks historians have the opposite bias: they think of historical trajectories as much more inevitable than they really are. But so long as the causes are known and scrutible, as they are in his picture of historical thinking, deterministic causal systems are tractable subjects for counterfactual analysis. To recycle one of Bunzl’s examples, the collapse of the first Tacoma Narrows Bridge was not contingent, as it was structurally unstable in high winds, and so we can assess the truth of counterfactuals about its collapse, had its design been different. A conception of a historical trajectory’s inevitable unfolding puts counterfactuals on the table, rather than taking them off. [↑](#footnote-ref-9)
10. Turchin explicitly sees himself in doing history in a new way, and turning history into a science. He is involved in a new journal, *Cliodynamics: The Journal of Quantitative History and Cultural Evolution*. But few of the contributors to that journal are professional historians. Turchin himself is a population ecologist, and most of the others are from the social sciences. [↑](#footnote-ref-10)
11. Though see (de Wolf 1990) for a defence of population pressure as the driver). [↑](#footnote-ref-11)
12. It was not, for example, the result of the replacement of the black rat by the Norwegian rat. [↑](#footnote-ref-12)
13. This helpful framework is borrowed from Lewis Binford, and his attempt to identify a middle path between grand universal theory in the human sciences and embracing particularism, seeing every episode as unique, to be understood in its own terms (Binford 2002). [↑](#footnote-ref-13)
14. A recent interview published in the Sydney Morning Herald (19/11/2014) illustrated the decorticating effects of wealth and celebrity; our heads do not work well, unless we grow up with a continue to interact with peers:

    The deepest thinkers in the world, Deepak Chopra and Kanye West, can retire as their successors, Jaden and Willow Smith are ready to take their mantle.

    The teenage children of actors Will Smith and Jada Pinkett Smith have always been perceived as being ahead of their time.

    In 2012, 12-year-old Willow released a single called *Whip My Hair* which went platinum. Earlier this year she was photographed in bed with a shirtless 20-year-old male "friend", while Jaden, who is now 16, has starred alongside his father in numerous Hollywood blockbusters, recorded two albums and now created an app called "The Jaden Experience".

    However, speaking to *The New York Times'* *T Magazine*, time is a concept they don't believe in.

    "I mean, time for me, I can't make it go slow or fast, however I please, and that's how I know it doesn't exist," 14-year-old Willow said.

    "It's relative to beings and other places. But on the level of being here on earth, if you are aware in a moment, one second can last a year. And if you are unaware, your whole childhood, your whole life can pass by in six seconds," Jaden said.

    The siblings' first-ever joint Q&A session, took place "on a bluff overlooking the Pacific Ocean" and had to be "edited and condensed" due to the pair's long-winded thoughts on subjects such as Prana energy, happiness, the problems with kids who go to "normal school" and their various creative processes and outlets.

    Jaden, a prolific tweeter and Kendall Jenner's best friend, hopes to one day to be "just the most craziest person of all time" and do "Olympic-level things" while Willow is a little more philosophical.

    "I think by the time we're 30 or 20, we're going to be climbing as many mountains as we can possibly climb," she said.

    While many of their peers may still be making their way through the Harry Potter series, the Smith children have a variety of texts on their bedside tables. Willow is working her way through "Quantum physics. Osho" and Jaden is devouring a number of "ancient texts, things that can't be pre-dated".

    One explanation for Willow's choice of unusual reading material could be because she can't find any young adult fiction to inspire her, which is why at age six, she began writing her own according to Jaden.

    "There's no novels that I like to read so I write my own novels, and then I read them again, and it's the best thing," she said.

    It's hard to believe they understand what they are reading considering Jaden can't seem to execute a clean metaphor.

    "When you're thinking about something happy, you're thinking about something sad. When you think about an apple, you also think about the opposite of an apple. It's a tool for understanding mathematics and things with two separate realities. But for creativity: That comes from a place of oneness. That's not a duality consciousness. And you can't listen to your mind in those times — it'll tell you what you think and also what other people think," he said.

    Don't think a basic grasp on the English language is enough to send these teens to high school though. They are both homeschooled after the school they did attend – the non-traditional New Village Leadership Academy that was founded by their parents which taught aspects of Scientology – was shut down last year due to a lack of funding.

    "Here's the deal: School is not authentic because it ends...Kids who go to normal school are so teenagery, so angsty," Jaden said.

    "You never learn anything in school. Think about how many car accidents happen every day. Drivers ed? What's up? I still haven't been to driver's ed because everybody I know has been in accident. I can't see how driver's ed is really helping them out."

    "I went to school for one year. It was the best experience but the worst experience. The best experience because I was, like, 'Oh, now I know why kids are so depressed', but it was the worst experience because I was depressed," Willow added. [↑](#footnote-ref-14)
15. (Ben-Menahen 2009; Inkpen and Turner 2012) also point out that historical processes can themselves alter the sensitive dependence of later outcomes on intermediate conditions. [↑](#footnote-ref-15)
16. The flow and uptake of innovation may be another source of contingency. The Egyptians discovered steam power, but nothing came of it (Morris 2015) p93. Mesoamerican civilisations did not discover the wheel. Were there world-transforming technical opportunities not taken? Perhaps so, if innovation and uptake depend on rare, easily disrupted conjugations of individual insight and social support. Investigating the contingency of innovation is well beyond the scope of this paper. [↑](#footnote-ref-16)