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SOCIAL MOBILITY AS A PROCESS OF SELF-ORGANISED CRITICALITY

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ABSTRACT

Social mobility studies reveal remarkably stable patterns as far as relative mobility chances are concerned, both over time and as between different industrial nations, even while absolute mobility rates reveal considerable diversity. At the same time, there is evidence that vigorous social policies aimed at promoting greater equality have some effect in reducing the ruggedness of these otherwise similar inequality landscapes. This paper questions the theoretical account that has so far been offered to account on the one hand for the afore-mentioned stability, on the other for the muting effects of egalitarian policies: it offers instead an account in terms of ‘self-organised criticality’, as expounded by writers on complexity science. It seeks to demonstrate thereby the utility of such complexity perspectives and the scope for deploying them to good explanatory effect in social policy studies.

1 INTRODUCTION

Over recent decades sociological investigations of social mobility have demonstrated a rather impressive conjunction of theoretical, methodological and empirical rigour. At the same time, it is evident that patterns and rates of social mobility have a high level of relevance for social policy debates: whether concerned, for example, with trends and mechanisms of inequality, with the relationship between equality of opportunity and equality of outcome, or with the optimal utilisation of human resources. Whether therefore our interest is primarily sociological or social policy-related, this body of scholarly work merits our attention.

Goldthorpe’s work, concerned principally with inter-generational mobility, has been central to this scholarship. Occupations are grouped into social classes according to the CASMIN scheme of which he has been the principal developer: movements from particular class origins to class destinations are then cross-tabulated (Erikson and Goldthorpe, 1993: Ch 2). The resulting flows can then be analysed using log-linear modelling (Hauser, 1978; Hout, 1983; Sloane and Morgan, 1996).

Consider a mobility matrix whose rows refer to origins, the columns to destinations: the matrix is symmetrical, with the same class categories applying to both. Individual cell values are denoted f_{ij} (where i and j each ranges from 1 to N). Now let us express the value f_{ij} thus:

$$f_{ij} = a * b_i * c_j * u_{ij} \quad (1)$$

where a is the total number of – in this case – persons sampled, b_i and c_j are respectively the row and column marginal totals (expressed as proportions of the sample total) and u_{ij} expresses the interaction between row and column variables.

This may be turned into the linear logarithmic equation

$$\log f_{ij} = \log a + \log b_i + \log c_j + \log u_{ij} \quad (2)$$

If $\log u_{ij}$ is zero (and thus u_{ij} is 1) there is no association or interaction between origins and destinations: the value of f_{ij} is determined wholly by the corresponding marginal totals and the overall population. This provides a convenient null hypothesis against which other situations - for non-zero $\log u_{ij}$ - can be compared. These are situations where row and column variables interact: where the chances of moving into different destinations depend in part upon social origins. Loglinear models provide us with a convenient and appropriate means of laying bare such u_{ij} interaction effects and examining whether, for example, they vary over time or between countries (Goldthorpe, 1980: 80).

Equations (1) and (2) represent the simplest case. Additional variables enter these equations when we seek to make comparisons over time, between successive cohorts, or between countries. The possible interaction terms also grow in number: first the bilateral interactions between any two variables in the equation, then those of higher order. If for example we include both cohorts and countries, this will (alongside origins and destinations) yield four variables, so that the highest order interaction term u_{ijkl} - when all other 'marginal' totals have been dealt with - will have four terms within it. Such equations completely specify the value of f_{ij} and reveal the extent to which f_{ij} is determined by the various marginal totals and interaction effects.

However, while such an equation can offer a perfect 'fit', it does so without any economy in the range of explanatory variable employed: everything that could be mobilised has been. The next task therefore is to try for a more parsimonious explanation of the f_{ij} cell values, aiming for a less than perfect - but still sufficiently good - fit. As we have already seen, one approach is to check whether there is a good enough fit when we entirely disregard u_{ij} (the interaction element): when, in other words, we adopt the null hypothesis of no interaction between origins and destinations. If this is rejected, we then have to consider how to develop a model which includes a substantial amount of the u_{ij} interaction but with some parsimony.

Log-linear analysis allows us to posit different degrees (or 'density') of interaction - thus different values of u_{ij} - for different zones of the matrix. On the one hand this recognizes that the null hypothesis has to be rejected: on the other, in the interests of parsimony it is content to capture the main features of the interaction topography and to forego a finer-grained account. Thus, for example, we might posit a relatively high level of interaction down the leading diagonal (self-recruitment by each class) but lesser degrees everywhere else: thus two zones or levels of interaction. Progressively more refined designation of zones is then possible, assessing at each stage the goodness of fit that the model affords. For a given target level of goodness of fit, we will then prefer on grounds of parsimony the model with the fewest zones - these will in general be the zones that offer the highest levels of interaction, the highest values of u_{ij} - as being the most elegant and powerful of the models that meet our requirements.

Nevertheless, while parsimony and goodness of fit are the two principal criteria as far as modelling procedure is concerned, what also matters is that the model with which we end up makes sense in theoretical terms, in relation to the subject matter in question (Hauser, 1978: 937; Goldthorpe, 1980: 98; Erikson and Goldthorpe, 1993: Ch 2; Sloane and Morgan, 1996: 335-6). We might, therefore, produce a list of candidate models which meet our minimum target level of goodness of fit; from these select those that are relatively parsimonious; and from these select the model that can most readily be given a theoretically meaningful interpretation. What this does mean is that an element of social scientific judgment is required: simple formulaic procedures to select in terms of fitness and parsimony will not do.

Loglinear analysis has been employed to particularly good effect within social mobility studies of recent decades, building in particular on the work of Goodman, Hauser and Hout. Such modelling has permitted a clearer critique of the former distinctions between ‘structural’ and ‘exchange mobility’ as being ill-conceived, leaving the distinction between ‘absolute’ and ‘relative’ rates much to be preferred. With log-linear modelling now given pride of methodological place, mobility scholars have been able to devote their energies more single-mindedly to such substantive questions as the existence and degree of cross-national and inter-temporal differences in mobility. It is to these questions that we now turn. We concentrate on the work of Goldthorpe and his colleagues, including Erikson and Breen, dealing only in passing with other contributors such as Hauser, Hout and Sørensen (see for example Hout and Hauser, 1992; Sørensen, 1992; Beller and Hout, 2006). Although there is much critical exchange among these various scholars, this is concerned with methodological refinements and substantive interpretations which do not however significantly affect the line of analysis which the present chapter seeks to develop. We will however question whether the patterns and dynamics of mobility this work reveals have been adequately theorised and we argue for an account in terms of ‘self-organised criticality’, as expounded by writers on complexity science.

2 THE DYNAMIC ANALYSIS OF SOCIAL MOBILITY

Goldthorpe first draws attention to the significant variation in overall (or absolute) rates of social mobility as between different industrial societies and, indeed, the variations within any one of these societies over time. This variation, as he observes, is scarcely surprising, given the wide variations in occupational and employment structures of different industrial nations and in the rate and phasing of their development (Erikson and Goldthorpe, 1993: 23-4). These structures and the mobility opportunities they afford are shaped by a multitude of wider ‘economic, technological and demographic circumstances’ (p 24).

Goldthorpe uses log-linear modelling to abstract from the effects of such structural changes and variations, allowing him to examine mobility *net* of such effects. Net or relative mobility measures the mobility chances of sons from different classes *relative to each other*. Relative mobility thus refers to what Goldthorpe terms the ‘endogenous mobility regime’, as distinct from the rates of absolute mobility which sons in different classes enjoy, as a result of both relative mobility and the mobility effects of the aforesaid structural changes. In the above equations, it is the u_{ij} interaction terms that measure this relative mobility and the others that capture the mobility effects of wider structural changes.

Goldthorpe finds that relative mobility rates show a rather high level of stability over time in the various industrial societies his data cover, even if there are some transient variations (Erikson and Goldthorpe, 1993: 86-96, 147, 175). Following Featherman, Jones and Hauser (1975), he also finds that as between different societies, there is a high degree of commonality, with the various ‘zones’ of log-linear interaction revealing a very similar topography (Erikson and Goldthorpe, 1993: Ch 4 and especially Table 4.4): where there are national deviations these are readily explicable (Erikson and Goldthorpe, 1993: 143). It is the high level of explanatory fit, coupled with these theoretically plausible accounts, that serves to vindicate the chosen topography and the national adjustments.

As we have already noted, fitting these models involves not only considerations of parsimony and goodness of fit, but also attention to the sense that can be given to them in theoretical terms. It is therefore to Goldthorpe’s theoretical account that we now turn.

2.1 The stability of relative mobility

If the pattern of relative mobility rates, as captured by loglinear analysis, is so invariable, why is this? Why, in particular, have expectations of a more open society, with ‘more universalistic, achievement-oriented processes of social selection’, not materialised, notwithstanding the efficiency benefits that this would presumably bring to advanced industrial societies? Goldthorpe argues that countervailing pressures from those who are already advantaged, so as to secure the life chances of their own children, have frustrated any such efficiency requirements (Erikson and Goldthorpe, 1993: 368-9,393-7). It is these countervailing pressures that he sets out to understand.

Goldthorpe points out, first, that occupational hierarchies are very similar in different industrial countries and that these produce similar relativities of advantage and power (Erikson and Goldthorpe, 1993: 24, 376). He proceeds to argue that in understanding how these relativities are converted into differential mobility chances, it is necessary to take account of three factors (Goldthorpe, 1980: 98-9; Erikson and Goldthorpe, 1993: 122-3,302,391ff). First, across the populations of different industrial societies there is a widely shared perception of the occupational destinations that are most desirable. There is therefore no reason to explain class variations in mobility experience by reference to differences in their assessments of such desirability: on the contrary, aspiration for rather similar occupational destinations must be expected. Differential chances of reaching those destinations must instead be explained on the one hand by reference to the relative advantages enjoyed by individuals of different class origin, in terms of their economic, cultural and social resources, and on the other hand the relative barriers to access that different class positions present, in terms of those same resources. (The most recent summary of his position is to be found in Goldthorpe (2007), Ch 7).

A mobility matrix summarises the outcome of a competition for valued positions. However, the mobility matrix itself is agnostic as to the processes whereby one person’s mobility reinforces another’s immobility. It simply offers the truism that if one person attains a highly valued position there is in consequence one less place for others. This may be sufficient if our aim is simply to calculate mobility rates. Nevertheless, if we are properly to explain such rates – and to understand the relationship between agency and structure – we need a theory of positional allocation, identifying the process by which one person’s mobility reinforces another’s immobility.

Some elements of such a theory are evident in Goldthorpe’s own account. Those who are relatively advantaged, in terms of the resources and networks of influence at their disposal, can if necessary bring these reserves to bear, in order to secure key positions and careers for their offspring: trumping the bids of other social classes and obliging them to make do with unoccupied – and less attractive – positions. Indeed, these reserves may also allow them to shape the rules which define what the trumps are, in the interests of their dynastic successors. It is not just that they can throw greater reserves into the fray, they are also able to establish the priority of their claims, by reference to a pecking order. These are fundamentally status claims, albeit made in the shadow of their greater resources and their greater scope for exit and voice. This all adds up to first mover advantage in a positional competition (Hirsch, 1977).

This supplements, rather than contradicting, Goldthorpe’s own position. He does, after all, give particular attention to those positional resources which grant more advantaged groups an enhanced capacity to exclude (Goldthorpe, 1980: 100). He also, by reference to Lieberman (1987), recognises the importance of the capacity to ‘write the rules’ of the positional game (Erikson and Goldthorpe, 1993: 394). Throughout, indeed, his focus is on strategic action by the advantaged, with others reduced to being mere change-takers. It is also worth noticing that in his subsequent treatise *On Sociology*, Goldthorpe offers a model where each social class aims at all

costs to avoid downward mobility on the part of its offspring (pp 238-243). Thus while relatively advantaged actors have greater resources in reserve, to throw into the positional fray, the minimum outcome which they are ready to tolerate – the *Verdun* which at all costs they defend - is also much greater. This is also in effect a first mover model: the more advantaged are ready and able to raise the stakes to whatever level is necessary in order to secure their minimum demands, out-bidding less advantaged competitors, who are thus placed in the position of ‘last-mover’ or ‘change-taker’.¹ It follows that we must think of the ‘relative barriers’ involved in gaining access to different class positions not simply in terms of the economic, cultural and social resources that such access requires but also the institutional rules involved: and we must recognise that the power to maintain or change those rules – and thus to re-design the barriers – is itself socially distributed. Not least, the institutional rules which govern the systems of social selection and express these first choice privileges come to the centre of attention, including in particular the system of education and training and the award of credentials.

Finally, Goldthorpe argues that the empirical evidence reveals some scope for purposive political action that could, in principle, modify these relativities of advantage and disadvantage - and, we might now add, the institutional rules of the positional competition (Erikson and Goldthorpe, 1993: 26). This he adduces from inspection of the aforesaid national variations in the general pattern of commonality. (Erikson and Goldthorpe, 1993: Ch 5).

Consider first the national deviations themselves. Within the range of countries with which Goldthorpe is concerned, three such deviations stand out and ‘find ... support in ... sociological or historical studies of the national society in question’ (Erikson and Goldthorpe, 1993: 145). In Germany the mobility landscape, while having a topography congruent with that of other nations, is in general somewhat more rugged. More precisely, while the zone of white collar self-recruitment is relatively broad, the mobility chances between agricultural and industrial occupations are reduced and there are long-entrenched sub-cultural and status divisions between white collar and manual workers, as well as divisions between skilled and unskilled manual workers, reinforced through the system of vocational education and training and apprenticeships, which serve to increase inequalities in their mobility chances. Such status divisions, we might add, constitute *par excellence* institutionalised first mover positional advantage.

In Sweden, the mobility landscape is generally gentler, especially along the diagonal ‘ridge’ of self-recruitment, with a relatively high degree of openness. This Goldthorpe explains by reference to the lesser inequalities that characterise Sweden, as a result of strongly egalitarian Social Democratic policies: this reduces the scope for more advantaged groups to shape the positional competition. Changes in the institutional rules on social - and in particular educational selection – have also helped (Goldthorpe, 2000: 180). Finally, in the cases of Hungary, Poland and Czechoslovakia Goldthorpe finds deviations from the common pattern which are associated, as in Sweden, with political interventions, albeit not according to a standard pattern of ‘State socialism’. It is the Swedish and east European cases that lead Goldthorpe to conclude that relative mobility chances may be susceptible to modification through deliberate and sustained political action, albeit still within the broadly common topography of such relative mobility chances that his log-linear modelling has otherwise revealed (Erikson and Goldthorpe, 1993: 176-80).

¹ Notice also that the occupational destinations which service class parents target for their offspring tend to be in the long upper tail of the distribution: the rational parent may judge that some extra investment on their part may well be worthwhile if it moves the likely destination significantly along that tail. Contrast the situation of a parent from, let us say, the skilled working class, where not only are spare resources more modest, but also the range of occupations which are potential targets offer a narrower ‘spread’ and thus a lesser likely return on any extra investment.

2.2 Variations in absolute mobility

Goldthorpe turns next to variations in absolute rates of mobility and their association with nationally variable occupational and employment structures, the rate and phasing of their development and the variety of wider 'economic, technological and demographic circumstances' which shape them (Erikson and Goldthorpe, 1993: 23-4). His argument, in brief, is that while the variation in absolute rates springs in part from the national deviations just discussed in the common pattern of relative mobility, it is predominantly on these wider structural variations that they depend; but that the latter are hardly amenable to sociological explanation, the best that can be offered is historical description (Erikson and Goldthorpe, 1993: 188-9).

One problem, he argues, is disagreement over the conceptualisation and measurement of the structural changes in question (Erikson and Goldthorpe, 1993: 62). A closely related problem concerns the very factors that Goldthorpe identifies as being implicated in the national deviations from the common pattern of relative mobility rates – the long-standing status divisions in Germany and the political efforts at producing greater equality in Sweden, both mediated in particular through the education and training systems. These factors must be treated as national specificities that can hardly be subsumed within more general concepts or variables (Erikson and Goldthorpe, 1993: 172-81).

Nevertheless, as he demonstrates, the problem lies deeper than this. Among the major structural changes to which he refers are the shifts of employment from primary to secondary and eventually tertiary sectors. These shifts have had very varied speeds and phasing in relation to other aspects of structural change, including changes in international political economy, trading relations and patterns of economic dominance and dependence (Erikson and Goldthorpe (1993: 103). There have also been great variations in the extent to which they have resulted from specific political interventions by a modernising State. Goldthorpe shows that differences in the speed and phasing of these shifts have therefore produced quite different development paths, shaping inflows and outflows between different occupations and classes and hence also the patterns and rates of absolute mobility: differences that persist long-term (Erikson and Goldthorpe, 1993: 189-204).

Goldthorpe judges that with timing and sequencing of such significance, it is not so much difficult as misguided in principle to venture any macro-sociological explanation of the consequences of these structural shifts for patterns and rates of absolute mobility (Erikson and Goldthorpe, 1993: 213-6). His principal focus is, to repeat, on the shifts in employment between sectors. If we also include the diverse development trajectories of working class organisation on the one hand, social welfare and educational provision on the other, and indeed the unintended effects on mobility that may follow from other public policies (Erikson and Goldthorpe, 1993: 177), the task of unpicking the contingent relationships among these diverse changes and, more specifically, their consequences for overall rates of mobility, becomes even more challenging. Certainly we cannot hope to explain the differences in such rates by reference to systematic variations among nations in their other macro-social attributes, or in terms of successive 'developmental stages', without reference to these contingencies (Erikson and Goldthorpe, 1993: 61, Ch 11).

2.3 Individual mobility strategies and the 'natural history' of classes

As we have seen, for Goldthorpe it is the pattern of relative mobility – and in particular its stability over time and across a variety of industrial nations - that is of the greatest sociological interest. Nevertheless, it is the overall pattern of inflows and outflows among social classes – and thus absolute rates of mobility - that dictates whether, for example, a given class grows or shrinks in numbers and whether it becomes more or less homogeneous in its origins. It is this 'natural

history' of different classes that tends moreover to shape the subjective experiences of individuals: their readiness, for example, to make common cause with those of the same class and the response they make to shrinking opportunities for their offspring (Goldthorpe, 1980: Ch 9; Erikson and Goldthorpe, 1993: Ch 6). In contrast, 'trends and patterns in relative mobility rates represent aspects of inequality that are of extremely low social visibility' (Goldthorpe, 1980: 266), whatever their significance for sociological analysis.

Moreover, notwithstanding the invariance of relative mobility rates, inter- and intragenerational mobility can, from the standpoint of the individual, appear as a series of critical junctures which have arisen variously from personal effort, good or bad luck and general collective progress. Goldthorpe here adopts what is essentially a Weberian method of *Verstehen*, in terms of the 'rational intelligibility' of action (Goldthorpe, 1980: 221) and the 'subjective logic' of the choices that individuals make (in his more recent work this is couched in terms of rational action: see especially *On Sociology*).

Goldthorpe recognises that in making these choices, individuals develop 'mobility strategies' for themselves and their offspring adjusted to the specificities of institutions in their particular societies. To this extent, the life-time trajectories that they follow are likely to display significant cross-national variations. Such variations have been highlighted by some scholars embracing a life-course perspective to put in question an account in terms of inter-generational mobility tables (see for example Sørensen, 1992). Nevertheless, what Goldthorpe then highlights as significant is that, notwithstanding these diversities of route and mobility strategy, the cross-national stability of relative mobility rates attests to overriding constraints on mobility outcomes.

It is of course those who are more advantaged who have the variety of resources that a flexible mobility strategy requires and knowledge of the institutional routes that are most promising. In addition, they are the ones whose experience has, we might say, most disposed them to see themselves as agile 'first movers', rather than simply adjusting to changes imposed by their wider situation (Goldthorpe, 1980: 234-5). This has also made them ready to defend their positions of advantage and that of their offspring through a variety of 'strategies of exclusion' (Goldthorpe, 1980: 276): strategies that may involve individual but also collective responses, variously mediated by political leaders. Such strategies of defence, exclusion and institutional contestation are, as Goldthorpe argues elsewhere, liable to range across a variety of socio-economic terrains: from education to the labour market, to the social security system and the housing market (Goldthorpe, 1974; 1978; 1984; 1985). An advantage gained by changing the terms of one settlement will shift the balance of forces which can contest another; old and relatively stable institutional arrangements are liable to be set in turmoil and new opportunities for leverage to emerge.

3 THE CONTINGENT BALANCE

It may be, as Goldthorpe proposes, that the stability of relative mobility rates is the central sociological puzzle that emerges from these data and that calls for explanation. Nevertheless, this stability is itself contingent. The class structures of industrial societies tend to sustain and, indeed, to reinforce inequality and to subvert, resist or by-pass political interventions aimed at promoting greater equality of opportunity. If in much of the post-war period relative mobility chances have been stable, rather than worsening, this has been because efforts in social and educational policies have been sufficient to offset the efforts of the advantaged to defend and reinforce their position and that of their offspring: in their absence, relative mobility rates might well have worsened (Goldthorpe, 1980: 275). The puzzle is therefore why, across so many countries, travelling along

such diverse development trajectories, and over such an extended period, these two effects have apparently balanced each other out so neatly?

It is of course possible that Goldthorpe has over-stated the stability. The data sets he used for *The Constant Flux* (1993) were obtained at various points in the 1970s. Breen (2005) in his more recent study of European countries finds greater cross-national variation in relative mobility rates in the later decades of the 20th Century, as well as a general temporal trend to greater openness. This is not however confirmed, for Britain at least, by Goldthorpe's own most recent findings (Goldthorpe and Jackson, 2007; Goldthorpe and Mills, 2008). Goldthorpe himself acknowledges significant instability over time in relative mobility rates only in the case of Hungary: both in *The Constant Flux* (Erikson and Goldthorpe, 1993: 94-5) and his analysis of trends there before and after the fall of the socialist regime (Bukodi and Goldthorpe, forthcoming). He demonstrates a steady fall in the inequality of such rates for those cohorts educated and entering the labour market during the socialist period, but a reversal of this trend thereafter. Goldthorpe again explains this by reference to the vigorous efforts of the socialist regime to counter class inequalities but the retreat from such interventionism post-1989. These departures from stability serve further to underline the contingent nature of the relationship between changing mobility opportunities, arising in part from social and educational policies but also from the unanticipated consequences for mobility of other public policies, and the strategies pursued by more advantaged groups to consolidate their dynastic privileges.

For our present purposes therefore we take as a given the general stability of relative mobility patterns within the various countries with which Goldthorpe deals and consider how this stability is to be explained. We start by recognising, with Goldthorpe, that variations in mobility experiences should be explained by reference to differences not in the aspirations of different social classes but in the range of opportunities and costs and barriers which they confront. We accept, further, that individuals develop mobility strategies for themselves and that these are adjusted to the institutional specificities of their social contexts. However, it is then necessary to recognise that there are socially structured differences in people's ability to shape the rules of these institutions and to fashion alternative institutional channels by which to achieve their goals. These differences arise in part from some of the rules embedded within existing institutions; in part from the greater skills, resources, and social contacts which some are able to bring to their projects of institutional change; in part from variations in their readiness to venture forth as agile first movers. This is institutional entrepreneurship, aiming to secure new leverage over key institutions; to shift barriers to access so as to improve their own mobility prospects; to by-pass and outflank the existing mechanisms of transformation of origins into destinations.

These efforts are not costless and they involve careful strategic consideration, before they are undertaken. As Goldthorpe argues, they are likely to be set in motion most obviously when parents – in this case – fear that their offspring are at risk of being downwardly mobile. Once that fear arises, these efforts are liable to open up a succession of new institutional fronts in the positional struggle, in a race against time: a race therefore which may need to be measured not only in quantitative terms, as the private resources such parents are willing to throw into the balance, but also in qualitative terms, the degree of institutional 'deepening' in which they are ready to engage. Nevertheless, the extent to which this response remains a private one, at the level of the individual family, or becomes a generalised one across the social classes thus threatened, depends of course not only on the scale of the panic but also the mobilisation and management of those collective fears by political leadership.

It is therefore not difficult to make sense of the pressures coming from the more advantaged, to defend the position of their offspring. However, while individual families may adopt a defensive strategy, once generalised across the classes concerned this can readily become more than merely

defensive: hence Goldthorpe's judgement that but for the social and educational policies pursued during modern times, relative mobility rates might well have become still more unequal. We can therefore interpret these policies in not dissimilar terms, as efforts at institutional reconfiguration opening new counter-fronts in the positional struggle: albeit sponsored by the State, with some backing at least from the less advantaged sections of the population.

The puzzle however remains: how have these two countervailing forces apparently balanced each other out so neatly, in so many countries with such diverse development trajectories? How should this 'social regularity' be modelled and explained? Goldthorpe himself points to the enduring inequalities of advantage that different classes are able to confer upon their offspring, including those inequalities that spring from the contrast between those who enjoy a 'service contract' and those engaged through a 'labour contract' (Goldthorpe, 2000: Ch 10). This is however only one side of the 'contingent balance': it is surely necessary to model both sides. It is to this challenge that we now turn.

4 SELF-ORGANISED CRITICALITY

Some of the dominant paradigms in the natural sciences have shaped the ways in which social scientists approach the analysis of social dynamics. The triumph of Newtonian mechanics encouraged social scientists to look for the conditions of social equilibrium and stability, as well as those under which social systems would maintain their inertia, even in face of pressures for change. Darwinian evolution suggested mechanisms of variation and selection by reference to fitness and has variously infused social science. Thermodynamics carried a message of ever-increasing entropy or disorder: much of social science has been an enquiry into hidden sources of order. At the same time, social scientists have – albeit in varying degrees – treated this interchange of ideas with some caution.

The last quarter century has seen a noteworthy coming together around a new paradigm of 'complexity'. Ball (2004) argues that it can be applied to a wide range of issues with which social scientists have long been concerned: markets, international relations, social networks, urban development, traffic management, racial zoning in cities. At the very least it provides a fertile source of metaphors on which social scientists can draw. It may however, as will be argued here, serve to advance social science and policy analysis in terms of theorising, model-building and empirical testing.

We concentrate here on one strand in the 'complexity' paradigm. Classical mechanics involved the study of closed systems that could be expressed as a set of simple differential equations. Once the initial conditions were known, the equations provided a precise description of how the system and its constituent elements would behave. In particular, the stability and equilibrium conditions of the system could be identified. However, many physical and biological systems are open and exchange energy and matter with their environment: an exchange that pushes and keeps them far from equilibrium. This poses the question: what types of order and organisation are possible in such 'far from equilibrium' systems: physical, biological and maybe even social?

In one of the key contributions to the literature on complex systems, Bak addresses these questions in terms of 'self-organised criticality' (Bak, 1997). He argues that far from equilibrium systems commonly get themselves into a delicately poised state – a contingent balance - where minor disturbances can occasionally lead to major changes, even catastrophes. This is a dynamic model which Bak applies across a wide range of physical, biological and social phenomena, including earthquakes, sand piles and avalanches, river basins, speciation and extinction events, economic functioning and traffic jams.

For any far from equilibrium system, we start with a source of energy on the one hand, abrasion or friction on the other. Bak uses physical experiment, computer simulation and empirical data sets to observe and test what happens. His general thesis is that even with a source of energy constantly applied, the behaviour of the system is discontinuous or ‘punctuated’: there is a succession of discrete events, as the energy input overwhelms the frictional inertia, and then builds up again, sufficiently to generate the next such event.

In the case of earthquakes this seems intuitively obvious. There is a gradual and progressive increase of subterranean pressure whose effect is initially arrested by the frictional resistance of existing geological formations, but which in due course proves overwhelming. In the case of sand piles and avalanches, the progressive build-up of material renders the slope ever steeper, with a landslide the eventual consequence. In the case of river basins, water flow builds up pressure at particular stress points on the river bank, so as to produce erosion and, from time to time, smaller or larger reconfigurations of the whole network.

Something similar seems to characterise speciation and extinction events in the course of biological evolution. The fossil record reveals a pattern of ‘punctuated equilibria’: periods of stasis followed by sudden and widespread change, rather than a smooth and continuous process of adaptation and increasing fitness (Gould and Eldridge, 1977). Here the source of energy is the stream of genetic variation or novelty that each fresh generation throws up: but while competition from these novelties may mean constant pressure on established species to meet ever higher levels of fitness, their existing characteristics already bear witness to their resilience and capacity to survive, without going on any evolutionary journey. Their survival also bears witness to the resilience of the eco-system they share with other species. This inertia provides the frictional resistance to novelty which self-organised criticality entails. Only when genetic novelty removes a key species from the eco-system, undermining the survival prospects for all concerned, does an avalanche of extinction and fresh speciation occur.

The model has also been applied to forest fires (Solé and Bascompte, 2006: 165-6). On the one hand afforestation progressively connects abutting neighbourhoods, until the ‘percolation threshold’ is reached, and fires can travel, if not everywhere, at least between widely scattered neighbourhoods. On the other hand there is a recurrent source of instability (spontaneous ignition caused by lightning or barbecues) which breaks up these connections. As a landscape approaches the percolation threshold, it becomes increasingly probable that random sparks will produce, not just a local blaze of the sort that are regularly encountered during the summer months, but a forest fire that causes more general devastation. Even so, the scale of these fires can even then not be predicted: the percolation threshold leaves many clusters of forest only feebly connected and depending on where the fire starts, many clusters of varying sizes will be left standing. This self-organised criticality obtains however only for a certain range of the underlying parameters. Spontaneous ignition must not be so frequent and widespread that neighbourhoods of trees rarely survive to abut; on the other hand, they must not be so rare that forestation becomes so dense as to cover every square meter of land, so that when a fire does eventually start, nothing is left standing from which new growths can then begin afresh.

In none of these cases are the scale and timing of successive events predictable, at least in terms of our current knowledge base. Nevertheless, viewed in the aggregate, it is found that they typically display a ‘power law’ distribution, according to the equation

$$y = x^a$$

where x distinguishes the events according to their scale and y indicates how many of the events there were that exceeded each value of x (for example, the number of earthquakes above a certain magnitude). The above equation can be re-written as

$$\log y = a \log x$$

If this is plotted on double log graph paper, we obtain a straight line graph whose gradient is 'a', the 'power' of the case in question. Such power laws are the 'signature' of self-organisation in far from equilibrium systems: whether we watch the sand pile avalanches in the laboratory, revisit the fossil record for mass speciation and extinction events, or conduct computer simulations of far from equilibrium systems and count the number and size of their 'punctuations' (Bak, 1997: Ch 1).

A power law means that earthquakes, avalanches, the branching of a river network, etc do not follow a normal or Gaussian distribution in their scale or timing. The 'tails' of the distribution are 'fatter' than in a Gaussian: there are more very large and more very small earthquakes. What also follows is that they are 'scale-free'. Scale-free means that large, intermediate and small-scale earthquakes and avalanches are forever at risk of taking place: there is no typical and average size to an event. In the case of ecological systems, scale-free means that as well as there being finely balanced food webs involving large predators and their prey, there will also, nested in the interstices of their habitats, be no less complex and finely balanced food webs involving micro-predators and their prey.

Nevertheless, it is also important to note that 'self-organised criticality' occurs only within a certain range of the system parameters. If the sand is too damp – or if rice grains of a certain size are substituted – the avalanche behaviour described above will not ensue (Bak, 1997: Ch 4). Likewise, if the rate of genetic mutation is too high, the evolutionary survival information that can be encoded in the genetic inheritance of each organism will be too rudimentary (Bak and Paczuski, 1996).

Even in this brief review of Bak's argument, we have seen that the energy source and the abrasion or friction which together make for a far from equilibrium system, and possibly for 'self-organised criticality', take very different forms in different cases. In the case of earthquakes the energy source was the progressive increase of subterranean pressure; the friction was the resistance of existing geological formations. In the case of biological evolution, the energy source was the stream of genetic novelty; the friction was the inertia of resilient eco-systems. It remains to be seen what sense we might make of this in relation to human societies.

5 MODELLING THE CONTINGENT BALANCE

In Bak's account of self-organised criticality there is, on the one hand, a source of energy, on the other abrasion or friction. Both are constantly applied: however, the behaviour of the system is discontinuous or 'punctuated': there is a succession of discrete events, as the energy input overwhelms the frictional inertia, and then builds up again, sufficiently to generate the next such event.

The system of social and occupational recruitment described by Goldthorpe embodies a similar set of elements. Consider first the strategies of those in the more advantaged social classes. Faced with the widening intrusion of working class families into traditionally middle class institutions (selective schools, white collar and professional occupations), as egalitarian policies by the State take effect, we might posit a critical threshold to such widening.² Here more advantaged families bestir themselves in outflanking strategies, whose effect will be to block and disconnect - or at least constrain - existing access routes, as used by working class families, in favour of new institutional by-passes that the more advantaged expect to reserve for themselves. These

² We do not of course imply that all States engage in egalitarian policies, nor that all the policies of a given State will tend to be equally egalitarian or inegalitarian.

institutional by-passes may remain at the individual level (with individual parents for example coaching their children in the period leading up to secondary school entry); however, they may become generalised in new institutional arrangements (shared networks of private tutors) or in wholesale adjustments in local and national policy (in regards for example to selection for secondary school places). The consequences of these generalised developments may themselves be limited and specific: or they may produce cascades of larger and unforeseen transformations in the terms on which different social classes gain access to these more privileged opportunities.

Such efforts at institutional entrepreneurship are by no means limited to the educational sphere, even if it is from there that we have drawn these illustrations. They are, rather, liable to encompass the whole range of life chance distributing mechanisms, including housing, fiscal and occupational welfare, investment of capital and health security. Indeed, not the least of the skills which more advantaged families are able to deploy – or which they are able to purchase from others – is the agile re-weaving of the interdependencies among these various mechanisms so as to optimise the return they achieve.

This is self-organised criticality: on the one hand, the progressive widening of access by working class families: but then, as some critical threshold is reached, new institutional routes blazed by more advantaged households, so as to limit that access. As with forest fires, these actions may have some merely local and limited consequences: they may also, however, ignite cascades of larger institutional change. As we saw with Solé and Bascompte, the process of percolation exhibits a clear threshold or phase change, at which the dynamics of connectivity change dramatically. It is therefore pertinent to notice Pierson's comment, made with explicit reference to Goldstone and in turn to Hirsch's notion of 'positional competition', that it is when there are, so to speak, just a few valued positions still vacant that the competition among those poised to occupy them will increase in dramatic and non-linear fashion (Pierson, 2004: 83).

Consider now the egalitarian strategies of the State, faced with what may appear to be the gradual generalisation of efforts by the more advantaged to block or at least constrain working class access routes. Here we might posit a critical threshold in such blockages, with the State now bestirring itself in new outflanking strategies, designed to open to all (or, alternatively, to close down altogether) the new institutional by-passes that have developed. Here again, such strategies may be rather limited in their scope (competitive scholarships for working class children to go to private schools); or they may be more general and wide-ranging (common schools for all), with cascades of wider and much less predictable institutional change thereby set in motion.

Solé and Bascompte demonstrate that self-organised criticality depends upon the system parameters in question falling within some intermediate range. The same will apply to the social mobility processes with which we are here concerned. If the critical threshold is low, with more advantaged families taking outflanking action in face of even modest working class advance and doing so on an individual basis, that advance may be contained and may not prompt pressures for more general defensive institutional reconfiguration: reconfiguration which could in turn produce wider and unpredictable cascades of change. If the critical threshold is high, with the more advantaged reacting only when the perceived threat is overwhelming, that reaction is liable to tear up the whole of the existing socio-political settlement, root and branch.

Likewise in regards to the egalitarian strategies of the State, self-organised criticality depends upon the system parameters falling within some intermediate range. If the critical threshold is low, with any new middle class initiatives bubbling up from local initiative (for example, parent teacher associations) being stifled for fear that they will disadvantage working class families and pupils, innovation and adaptation within the education system may diminish. If the critical threshold is high, with the State slow to react to the undermining of working class opportunities,

working class children and their families may make the rational judgement that education is hardly worthy of their investment as part of their mobility strategies.

Nevertheless, all this may well be too simplistic, requiring a strong caveat. In the case of forest fires, it may be possible to produce some useful models of percolation and fire risks. In the case of social dynamics, there are many more possible responses than those just indicated, involving various strategies of exit, voice and loyalty (Hirschman, 1970). Which of these is employed will depend in part on fateful choices by political leadership. It is precisely because of the institutional creativity of social actors, to which we have repeatedly pointed, that simple models of the sort deployed above are of only limited value (albeit this arguably applies to all models of social interaction).

While simple, the model we have suggested is nevertheless already somewhat more elaborate than those of Bak, or of Solé and Bascompte, inasmuch as two countervailing processes of self-organised criticality are involved, each driven by social actions that in some degree respond to the effects of the other. Depending on how we construct such a model, we might see these countervailing projects as offsetting each other to some degree, leaving only the stronger to exercise some net effect. More likely however, we should regard each as modifying the terrain on which the other unfolds, with political egalitarianism serving not so much to block as to displace the terrains on which the advantaged will henceforth seek to secure their own position. The respective contenders – the advantaged and the egalitarian policies of the State - thereby lock each other into a ‘race against time’, with each seeking to weave its own preferred pattern into the life chance distributing institutions of the society.

Finally, the model seems able to throw fresh light on two additional questions.

The first relates to the national variations in endogenous mobility regimes to which Goldthorpe refers: in particular, those that characterise Sweden and Germany and the three countries of eastern Europe. Goldthorpe’s argument, it will be recalled, is that while the general topography of the endogenous mobility regime is to a large extent invariant, its ruggedness varies, being greater in the case of Germany, gentler in the case of Sweden and the countries of eastern Europe. It seems plausible to relate this ruggedness to the various critical thresholds to which we have just referred. In particular, in those countries where the critical threshold for State intervention in face of working class exclusion is rather low and/or the critical threshold for action by the more advantaged to resist working class incursion is rather high, levels of inequality will be reduced and the topography more subdued.

Secondly, our model assists in making ‘rationally intelligible’ the mobility strategies in which individuals and their families engage. This we earlier set in the context of Goldthorpe’s account of the ‘natural history’ of social classes. We saw that while it is relative mobility chances that have been stable – and this stability is what it is of greatest sociological interest – they are of ‘extremely low social visibility’. It is more likely that individuals frame their mobility strategies by reference to the much more visible changes in absolute mobility rates, including the overall patterns of inflow and outflow among different social classes: this, at least, would give a ‘subjective logic’ to those strategies. The puzzle is how individual strategies that are addressed to absolute mobility flows – flows that vary greatly, over time and between countries - can enable us to explain the stability of *relative* mobility rates.

In the model of positional struggle we have proposed, it is service class parents who have the motivation, the resources and the first choice privileges to ensure with high probability that their children will avoid having to exit that class. Other classes then variously find a place in their wake. At some point – but this will depend upon whether the overall number of service class positions is growing or declining – the remaining such positions will become few in number,

relative mobility chances become visible, and inter-class clashes occur. We again recall Pierson's argument that it is when just a few valued positions are still vacant that there will be a non-linear increase in competition for them. It is at this point that the goal of securing benefit for offspring in the absolute levels of opportunity – and continuing thereby to participate as a family in the status privileges and cohesion of the more advantaged – is liable to be redefined by reference to relative opportunities and the imperative of excluding intruders from other social classes.

The question remains as to the signals by means of which individuals become alert to such 'tightening' of the positional competition and to the *locales* in which this competition is being played out. It is perhaps here that the education system is of particular significance. It is here that parents can see the social mix – not least in conversation with fellow parents at the school gate – and can form judgements as to how this is changing; can judge, indeed, whether participation in the school concerned by those of other social classes has or has not breached some rule of thumb threshold; can judge – rightly or wrongly – whether such breaches are responsible for changes in the school's performance as measured by published league tables; can express in practical terms the 'inter-class clashes' to which we have previously referred only in abstract and hypothetical terms.

6 VALIDATION AND TESTING

Goldthorpe's principal concern is to explain the stability in the endogenous mobility regimes of different industrial countries. We have sought to build on this, by focussing attention on the 'contingent balance' that this stability reveals: and to do so by reference to a theory of action in terms of positional struggle. Our account seems consistent with that of Goldthorpe: however, to locate this within a model of self-organised criticality perhaps provides some analytical added value.

Nevertheless, even if the model is of some value in this regard, we should not be over-hasty in embracing it. How might its robustness and validity be checked?

One empirical development, in terms of 'micro-motives', would be to complement the survey questions that are now standard in social mobility enquiries informed by Goldthorpe's approach with questions relating to household strategies of institutional entrepreneurship. Which *Verduns* have been put under threat? In what race against time are these households thereby involved? What additional arrangements have they put in place to protect and secure the opportunities that their offspring will enjoy? Have these arrangements been made in conjunction with other households – and, if so, which? What critical thresholds – and what signals of such thresholds – do households variously employ in regards to the tightening of opportunities and the looming of risks of downward mobility for their offspring? How stable are these over time and as between different countries? This amounts, admittedly, to a not insubstantial research programme.

Alongside this, it should surely also be possible to assess, at the level of 'macro-behaviour', whether the self-organised criticality that we have posited is evidenced – as Bak would anticipate – by a power law distribution. Drawing on the analogy of the avalanche, in Bak's sand pile experiment, we might expect – and might set out to test empirically – whether the scale of threshold-related events displays a power law: advantaged households bestirring themselves against the steady encroachment of working class families, State policy makers bestirring themselves to counter the steady growth in institutional by-passes that more advantaged households have been building for themselves.

Nevertheless, there is a more immediate and obvious point of reference in Goldthorpe's own data. A power law attests to a micro-interaction effect among the elements whose macro-behaviour we

seek to explain. It is also of course with interaction effects that Goldthorpe's investigation of the u_{ij} parameters is concerned, in equations (1) and (2) above. Where interaction is absent, u_{ij} has a value of one and $\log u_{ij}$ is zero. Where $\log u_{ij}$ departs from zero, interaction is present, either positive or negative.

Goldthorpe provides a matrix of u_{ij} parameters: these parameters have delivered a high level of 'goodness of fit' (Erikson and Goldthorpe, 1993: Table 4.4). First and foremost, this reveals positive interaction parameters all along the lead diagonal: each class in some degree self-recruits. This is most marked in the case of the service class, the petty bourgeoisie and farmers. Nevertheless, in all other classes self-recruitment also obtains. Thus, we might conclude, Goldthorpe's data reveal self-recruitment to be 'scale-free': and this is the case even for skilled and unskilled manual workers and agricultural labourers, the 'change takers' rather than the 'change makers' of industrial societies. It may of course be objected that among these various categories of blue collar workers, such self-recruitment is hardly evidence of agile and successful positioning on their part: rather, it is thrust upon their offspring by their lack of resources and the barriers that they face in the positional competition. Nevertheless, mobility among these different categories is far from random: albeit on this reduced canvas, skilled workers are able to ensure that their offspring have a better chance of entering skilled occupations than do the children of unskilled workers: here there is evidence of a positional competition no less than we find 'scaled up' across the matrix as a whole.

This is not however the whole story. Under self-organised criticality, a single power law pervades the whole system and its exponent is a global property of the system in question. We might therefore expect that the interaction effects revealed by Goldthorpe's u_{ij} parameters might also be 'of a piece': and in an important sense this is the case. True, the values of those parameters vary markedly across his matrix of intergenerational cross-tabulations (Erikson and Goldthorpe, 1993: Table 4.4). Nevertheless, when it comes to comparing national deviations, it is possible for Goldthorpe to speak globally of how rugged or muted this topography is. It seems that in general, countries do not reveal relative ruggedness here, greater gentleness there, as compared with the broader range of countries: their endogenous mobility regime is, rather, woven to a uniform pattern.

7 CONCLUSION

The foregoing account in terms of self-organised criticality makes reference, as we have seen, to critical thresholds in terms of working class intrusion, by reference to which more advantaged groups bestir themselves in outflanking strategies. It similarly makes reference to critical thresholds in terms of such efforts by the more advantaged to block or at least constrain working class access routes, by reference to which the State bestirs itself in countervailing efforts. We argued further that the cross-national contrasts in the ruggedness of the endogenous mobility regime might be construed in terms of variations in these thresholds.

In principle this should be open to empirical investigation: both the model of action by reference to thresholds that signal the case for action and the significance of cross-national variations in such thresholds. In regards to the advantaged, we have suggested additional survey questions that might be included in social mobility enquiries and that would be relevant to the mapping of such thresholds. This is however no less necessary in regards to State action and modelling of the policy process. That is however beyond the scope of the present paper.

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