Complexity Science and Transformations in Social Policy

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This paper argues for the general value of the complexity frame of reference in understanding social policy issues. It does so both by proposing a complex understanding as the foundation of an inter-disciplinary method in examining social policy issues - by following the arguments proposed by the Gulbenkian Commission on the Future of the Social Sciences - and by using specific examples to illustrate how a complexity frame of reference can be applied to real issues. The essential vocabulary of complexity is outlined as the basis for a description of how we can generally construct models of complex social processes. The argument is then developed at the macro level by a complexity fix on discussions about the processes of transformation of welfare regimes and at the micro level of specific policies through an examination of the transformation of the UK mental health system. Both of these examples are developed in qualitative terms but the third example, that of the examination and explanation of urban social change, is used to illustrate how we can use quantitative procedures in exploring change in complex systems.

Introduction

Social Policy is usually considered to be at least a field in Social Science. We sometimes argue about whether it is a discipline with its own distinctive methodological programme or a field constituted by the interdisciplinary consideration of a set of issues, but the social scientific nature of the enterprise is taken for granted. Fine - but that begs the question of what we mean by social science. Social Policy is actually often determinedly unmethodological - it uses a ragbag of methods of investigation and leaves the arguments about the appropriateness of those methods to the foundational disciplines. I am here to say that that will not do, and it won't do not least because the whole modernist project of disciplinary knowledge is disintegrating - see the report of the Gulbenkian Commission (1996) *Open the Social Sciences*. Moreover a major source of that disintegration is the actual experience of interdisciplinary work in fields exactly like social policy. There are two routes from this. One is that of developed postmodernism - which logically implies a solipsist relativism which might be politely rendered as total fundamental self-insertion. The other takes up a perspective which, as Katherine Hayles (1990) puts it, is emerging (a key word in itself) everywhere in the episteme - across the whole field of knowledge. That perspective is complexity science.

Let us work through antonyms - complex is the opposite of simple. Complexity science involves a rejection of the programme of simplification which has dominated scientific understanding since Newton, especially scientific understanding represented in mathematical form. It is essentially an ontological programme with epistemological consequences. That is to say it has a view about what the world is like - the ontological programme - and from that view it derives a programme of ways of understanding the world - the epistemological consequences. The essence of the idea is that what matters in the world are complex open systems which have evolutionary potential. These systems cannot be understood through analysis - through reduction to their component parts. Neither does the reductionist principle of causation apply. Complex things have properties and causal liabilities which do not reduce in a hierarchical sense - things at different levels can recursively interact. Emergence is crucial which is another way of saying the whole is greater than the sum of its parts. Changes are non-linear - systems change through phase shifts - radical transformations of kind rather than incremental development. It is really important to grasp that complexity science is a revolutionary shift in science as a whole and that one of the implications is that the boundaries between natural and social are broken, not in the positivist direction of methodological and causal subordination of the social to the natural but rather in terms of an opening to mutual interchange. The

social sciences and the natural sciences have much to say to each other and the traffic has to run both ways.

Complexity theory leads us to understand social systems as evolutionary. This means that they have histories and the histories are uni-directional. This may seem painfully obvious but the notion of an arrow of time is important. This means that social systems are path dependent - becoming is a function of what is and what has been. For those with a mathematical frame of reference this is something like, although not the same as, a Markov chain.[1] However, there is more to the word evolutionary than simply the notion of path dependent history. Evolution implies change and moreover change which is not incremental but fundamental - changes not of degree but of kind. Let me illustrate this by using terms from chaos theory which will at least serve us as analogies here - we have to be careful about equating chaos and complexity - we can get to complexity without chaos (see Cilliers 1998) - but the terms are useful at least heuristically.

Social systems are not fixed and unchanging, even when they are relatively stable. However, much of the time the changes are bounded - things change over time but the system's essential character is not changed. The chaos notion of the torus as an attractor state for systems gives us a good image here. It is necessary to introduce the idea of state space in order to explain the use of the idea of attractor. Although I have grave reservations about the notion of variables as real entities which exist, to use a good Scots word, outwith real systems, (that is to say have any existence separate from the systems), we can properly describe a system through measuring variate traces which represent properties of that system. If we think that each measurement can be regarded as a coordinate on a dimension which is the range of possible values of that variate trace, then we have a multi-dimensional state space with the location of the system being describable as a set of coordinates in that multi-dimensional system. The trajectory of the system is the trace through successive time points of its location.

Figure One - The Torus Attractor
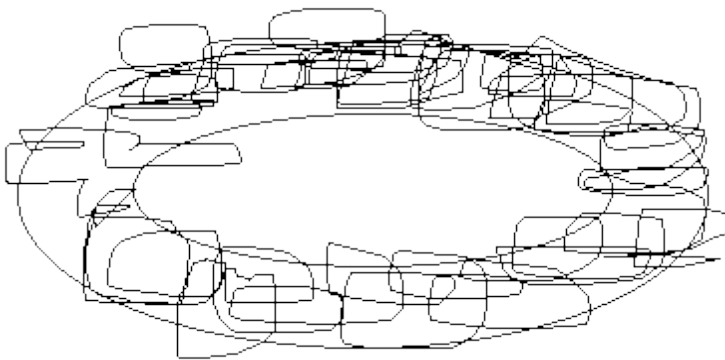
In this frame of reference a system which changes in detailed characteristics over time but does not change its form will have a trajectory which will produce a path looking like the doughnut shape of a torus. The important thing here is the icon - the image. An example of a Torus attractor could be the set of results from a school over a period of time in which there are changes in the numbers of children getting five A to Cs at GCSE, truany rates etc. so that the figures for every year are somewhat different, but not to the degree that we would think the character of the school had changed in some radical way. Changes in the character of such a system which are non-linear and transformational will result in the establishment of a new trajectory occupying a different domain in the state space. Suppose a 'failing school' is made a target school with a changed administration and goes from being way below average and unattractive to parents who have any choice to being above average and attractive.   At a much larger scale we might regard the shift from a Keynesian to postfordist welfare state as having this character. We can use the image of Lorenz or butterfly attractor to describe this[2] - see Figure 2.

We have already had a basic description of the essential characteristics of complex systems. It is now necessary to consider some of the implications of these. There are three which are of particular importance in social science in general but particularly in relation to social policy. The first is that complex systems can be 'nested'. There should be a better term here because nested gives an image of something like Russian dolls with the smaller contained discretely within each larger layer. In 'nested systems' boundaries are not discrete. Rather there is interpentration of systems.

Figure 2 - A Lorenz Attractor
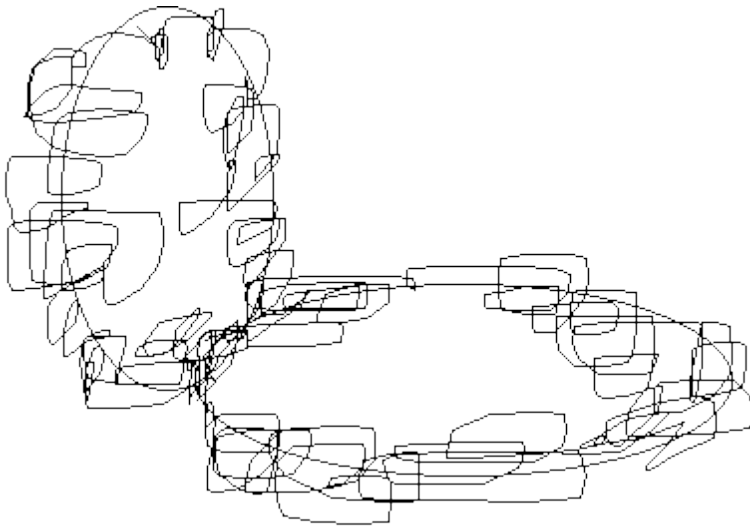
The idea of interpentration means that systems at all levels intersect and interact although I do think it is useful to consider interpenetration as having different densities so that systems at adjacent levels interpenetrate to a considerable degree, whilst those at more removed levels have less interpenetration. It is very important to note that this idea of nested inter-penetrating systems is non-hierarchical. That means that influences can flow in all possible directions. Certainly spatial levels can be conceptualized as inter-penetrating complex systems and the implication of the rejection of hierarchy is that the local can influence the global rather than the global determining the local.

The second implication is that agency matters in determining systemic form and that moreover agency can be recursive. In other words in social systems, and indeed where social and natural systems intersect in ecologies, human actions can change things and moreover those human actions can be based on a understanding of the nature of the systems and the potential impact of particular actions. This is a realist position - it argues that we can have understanding - understanding which is complex, local and socially constructed but which nevertheless lets us know how things work, and that that very understanding can contribute to our actions in shaping our world. It is important not to privilege 'academic understanding' here. I am all for dialogical and participatory research and am a great fan of Freire (see particularly *Pedagogy of Hope* 1998) but systematic academic understanding is absolutely part of the story.

Finally we have to realize that whilst complexity gets rid of absolute determination one of its great potentials lies in the way in which complex modelling - a phrase to which I will return in a moment - allows us to explore the range of future possibilities understood as discrete, different and multiple but not limitless. Prigogine puts this well when he remarks:

> ' ... we see that there is, as in physics, no universal optimization principle for complex
> systems, that many futures are possible. and they differ from each other qualitatively,

so that any useful strategic policy exploration needs to be able to view these possible futures. This is the purpose of the methods that are set out here.' (1997 xi)

This is a remarkably optimistic statement when you think about it. It means that policies can make a difference in forming our futures. Note, however, that it, taken with the general description of complex systems offered in this introduction, is also restrictive. Some social forms are just not possible - I devoted a considerable part of *Social Exclusion* (1999) to arguing that a flexible and non-exclusionary postindustrial capitalism is not an achievable attractor state for contemporary social orders. In other words we can have a flexible capitalism based on reducing the capacity of workers to control their conditions of work and a minimalist welfare state or we can have a non-exclusionary social system in which workers can organize effectively and in which there is universal welfare but we cannot have flexibility without people being excluded. We can see what is possible and what is not possible. Ever the optimist I think that complex modelling can help us in seeing how to get there from here.

Complex Modelling

A model is a representation - something we work with which is considered to work in the same way as real system which is of interest to us. Jeffrey et al put it like this:

> ' ... the characteristic of models that causes difficulties with regard to deriving an acceptable definition, is precisely the attribute that marks them out as useful tools both in conceptual and practical terms. They are a representation of the real world and not the real thing. It is important, however, to remember that while models are devices to help us understand the real world more clearly, they are also part of that world both through their physical - or cognitive presence and   more significantly through the impacts which arise from their development and use.' (Jeffrey et al 1999 76)

Traditionally, modelling in social science has been understood as the process of describing some process in terms of mathematical formalisms, either through specific equation sets or through the use of 'ready made' statistical models. Simulation approaches which use rule systems describing the potential range of action of agents go beyond this and specifically allow for emergent behaviour and characteristics which derive from rule systems, but such agent based simulation remains intrinsically atomistic. It seems to me that insisting on mathematics or game theory as the foundation of modelling is at least over restrictive and may be utterly misconcevied. In engineering physical models are used to deal with turbulence, an emergent and non-linear phenomenon which is still not amenable to representation through mathematical formalisms. In other words things can be models and are made as models specifically because mathematics fails.

I would argue very strongly for measurement as a means for the exploration and description of complex social systems but absolutely as part of an integrative method (see Lemon,1998) which includes qualitative approaches and which is organized in interpretive mode. In other words textual description and interpretation should form part of the modelling process. This is not so much a matter of the specification of wholly new procedures as looking at current procedures in a different way. The difference lies in understanding our research as always generating a representation and in recognizing that a crucial purpose, indeed for policy the crucial purpose, is extrapolation of potential futures. Models describe and project - a better word than predict because the whole point is that there is no adequate systems of linear prediction. This way of thinking has many implications, not least for the current fashion for experimental method as the basis of policy development. In summary it trashes that strange regression absolutely on ontological grounds - in complex systems experiment cannot yield prediction, but that is the subject of another paper. Here I now want to turn to some examples to illustrate what a complexity frame of reference implies. Essentially the examples involve looking at topics in social policy and thinking them through with a complexity frame of reference. For me that process is the essence of complexity science as practice.

Complexity at the macro, meso, and micro levels: the global system, the welfare regime, and the specific policy

The scaling frame of global as macro, levels below that but which describe more than a single area of policy generation and implementation as meso, and specific policy domains as micro is convenient although by no means the only one possible. Indeed we might use the scaling terms in a different way with micro specified as a particular locale of implementation or, and this would be conventional in Sociology, to describe the domain of interpersonal communication and other interaction. Here I want to focus on the meso and micro levels. It is certainly possible to conceptualize the shift from fordist to postfordist, industrial to postindustrial, democratic to postdemocratic capitalism as a global phase shift at the macro level (see Byrne 1999, 2001) but I don't want to dwell on that level. Instead I want to consider the meso and micro levels treating the first in the form of welfare regimes and the second in terms of policies for dealing with mental illness.

The idea of 'welfare regime' is a staple of contemporary academic social policy and Esping-Andersen's (1990) original formulation of the idea of distinctive types of welfare systems with path dependent histories has been most useful. However, we should note that this original formulation and most of the variants derived from it have placed the emphasis almost entirely on institutional form in relation to socio-political context. There has been surprisingly little discussion of implementation and although issues of political ideology have not been entirely neglected, the role of political belief systems does seem underplayed - particularly in relation to the significance of order-liberalism in the post second world war German social market economy. We can use welfare regimes to illustrate the idea of attractor states and to consider how general policy frameworks predicate the form of actual welfare systems.

The idea of welfare-regime is inherently typological. That is to say welfare regimes fall into broad categories. However, at least in original formulation, the concept is not particularly dynamic or rather has only been explicitly dynamic in terms of retroduction - it has looked backwards and considered the past from the point of view of what exists now. Discussions of welfare regimes have usually been founded around historical accounts of their development to current state with futures understood certainly in terms of path dependency from current state, but without much elaboration of this idea. Typologies are always intrinsically qualitative - they specify differences of kind rather than of degree. The interesting question is can a welfare regime be moved by policy interventions from one form to another and if so by what policy interventions? This is not an easy question because welfare systems are embedded in and inter-penetrate (the latter is extremely important) general socio-economic systems, and the national level, the meso-descriptive level of welfare regime, is embedded in and inter-penetrates the global level.

Globalization theses on welfare regimes have an easy answer here. They assert that post-industrial / fordist / democratic capitalism has a determinant influence on welfare regime form which means that all regimes will converge on a residualist / privatized anglo-american norm. There is no alternative. We are at the 'end of history' when liberal market capitalism is the only game in town. In reality this is not the product of anonymous and inevitable forces in social systems. Instead we can identify institutional agencies through which real people are making this happen - the immensely important GATS process which may force the privatiziation of European health and education systems for example.

We can see how the political systems of the UK and US (and until recently other English speaking countries but note the remarkable shift in New Zealand in recent years) can accommodate the residualization and privatization of welfare. However, I want to ask the question if any nation state with a functioning Christian Democratic (Germany but not Italy) or 'National Conservative' (Ireland - Fianna Fail, France - the Gaullists) can actually accomodate such a neo-liberal transition. Crouch's recent Fabian (!) pamphlet (2000) is extremely good on the nature of postdemocratic politics here. It is not that massive changes cannot be engendered. The destruction of British Labourism which derives from the Thatcherite elimination of grass roots trade unionism and its syndicalist tradition shows that this is possible, but in Britain there was really only labourism. When you have both labourist and Christian democratic political traditions such transitions are much harder. In much of

Europe there has been a real centre politics which was quite distinctive from free market capitalism. 'One nation conservatism' was like this in Britain but it was embedded within a Conservative Party which could be changed into something else. It really is much harder to change a European Social Democratic or Christian Democratic Party, perhaps harder for the Christian than the Social Democratic Party because the principles of that party remain intact to a greater degree.

Interestingly if we have fragmentation, as asserted by New Labour and associated think tanks, we might think that there should be a political system which allows for multiple representations of positions. If the big battalions of labour and capital don't matter so much then we should see other political positions being expressed. Within Germany viable political parties representing the ex-communist left, the Greens, social democrats, christian democrats, conservative christians (Bavaria), and on the right fringe nationalists. In much of Europe this is the case. We might not approve of any given one of these elements - particularly the right fringe nationalists, but a reasonable number of real parties allows for a wide range of interests to be represented in the political process,[3] provided the electoral system permits this to happen.

In two party systems there are two parties of capitalist elites - both parties look primarily to business for legitimacy and for funds and uphold free markets - and the political process of welfare transformation is much more easily achieved. This actually makes sense in relation to the present situation in Scotland. The existence of the Scottish Nationalists as a party with much in common with, say, Fianna Fail, means that a Labour led administration in Edinburgh must work in a welfarist direction. The attractor state of radical free market endorsement is not open to it. The emergence of a viable party to the left of Labour in New Zealand seems to have transformed the political possibilities in that social order. Without a challenger on the Left New Zealand Labour could be the party to dismantle the welfare state. With a challenger in place it can't be any more. In effect the nature of the political system is a control parameter for the form of welfare regime. Note that in Italy it is the collapse of Christian Democracy and its replacement by the business led Forza Italiana which has moved that society in an anti-welfarist direction, even under a former communist dominated Olive Tree administration. The ex-stalinists in the remaining communist opposition cannot articulate an alternative post-industrial politics rather in the same way, albeit on a much larger scale of significance, that socialist labour and socialist alliance in England and Wales have failed to articulate an alternative position. There has to be somebody credible to vote for if the traditional left is not to be dragged along with, or even as with New Labour to initiate, the dismantling of the welfare state.

It is important to note that welfare regimes are not ranked on a continuum and efforts to do so, even in an ordinal fashion, are unconvincing. They are different and transformation from one form to another is a non-linear transformation. It is generally conventional to regard welfare systems as derivative products of socio-political and socio-economic forces but a complexity viewpoint regards social systems as inherently inter-linked and mutually determinant. In other words we have to consider the constitutive role of welfare systems in establishing post-industrial social orders.

Micro-level phase shifts

If we turn to the micro level, understood in terms of specific policies, then the transformation in the UK mental health system usually identified under the rubric 'community care' provides a good illustrative example. Prior (1993) reviewed the various 'generative' accounts of this transformation and, to my mind entirely convincingly, identified changes in professional perspectives about the nature of mental illnesses and consequent appropriate therapies as the major factor in change. In complexity terms this was an internal perturbation. However, as Prior recognizes, other factors also were in operation. I have never been much convinced by the crude fiscal arguments advanced by Skull but at the end of the process the value of the realizable assets of the institutional system - the hospital sites - certainly speeded up the abandonment of asylum care. Likewise the social critique of total institutions, and indeed the potency of that very phrase played a part.

All these factors can be considered to have interacted in forcing forward radical change. We might argue that none would have been enough on its own. Some - for example the social critique of total institutions and dominance of a bio-mechanical organic model of mental illness in psychiatry are

even, on the face of it, completely contradictory, but they worked together to produce a fundamental change.

Here we can note something which recent policy developments seem to have begun to realize is the impossible - to maintain a drug therapy based programme for managing the lives of the mentally ill in a system which combines residence in the community with acute ward clinical management of voluntary patients. This is not a possible attractor state. Patients cannot be medicalized with their consent so long as they are free to live an ordinary life. Hence, the move towards compulsory treatment - not in the community but by regular and enforced removal from it. However, this is a classic instance of trying to control an unstable situation by negative feedback. It is very likely that we will have a continuing round of scandals - both of failure to control and of excessive control - mentally ill murderers and mentally ill victims of medical management. The asylum system was a stable attractor until things changed around it.

To say something is not a possible attractor state is to say that the components of the system when it is in that state will not work together to generate a relatively stable situation. Things cannot stay as they are. That extremely important and useful word 'crisis' with its origins in Greek medicine where it was used to describe the turning point in a confrontation between acute disease and the body - the patient either died or got better but could not stay as 'ill' - is exactly a description of a complex system in an unstable state. The UK's mental health system is unstable. Policy is turning to negative feedback in an effort to stabilize it - to the introduction of community treatment orders which will enforce drug and related therapies on resisting patients who are normally not resident in institutions. Note by the way that this approach does not seem to involve any social notion of mental illness since there is no specification, at least explicit specification, of 'therapeutic institutional care' as part of the compulsory treatment programme. For me the absence of a therapeutic programme based on a social aetiology is the destabilizing factor in the mental health system. Here we might interpret the move towards cognitive therapies as positive feedback - something with a transformational potential which might move the whole system towards what could be a stable state.

Measurement, classification and dynamic trajectories

The two examples given above were deliberately non-quantitative although the welfare regimes model could be quantified or at least computer qualified. It is actually a tailor made example for the use of 'Qualitative Comparative Analysis' (see Fielding and Lee 1998). However, it would be silly to discuss complexity approaches in social science without considering the implications for quantitative work, particularly in relation to the very important 'dynamic turn' represented by the contributions to Leisering and Walker's edited collection (1998). The issue I want to identify in this section is the uni-dimensionality, and hence artificiality, of social policy's use of measures. 'Poverty' defined simply in income terms is the classic example but there is a general tendency, represented for example by UNDP in its index of social development, for the generation of single measures to describe states. In the case of indices this is typically achieved by using regression analysis to construct a single measure summarizing the common variation in a range of measures. This certainly reifies variables as entities separate from real complex systems, although it does generate a crude summary description of the state of the system. When such continuous indicators (i.e. measured at a ratio scale level) are employed, then the notion of phase state transition has to be represented by movement beyond what can be more or less arbitrary cut off points on the scale.[4]

Compare this with the use of multi-dimensional approaches involving say clustering procedures in which the condition of a system at any given timepoint is represented by the ensemble attractor represented by the cluster to which it belongs at that timepoint. The idea of ensemble attractor is important. This is an area of the state space occupied by a number of systems moving in the same general domain. These systems can be considered to belong to the same classification. The members of the category are not identical in terms of scores on all the variate traces. Indeed they may differ on all of them, but they are in the same domain - this is more like prototypical than aristotelian classification - it means that we have some general idea of what a typical member of a class looks like rather than classifying things by possession of specific attributes.

Whelan and Whelan (1995) asked: 'In what sense is poverty multidimensional?' and suggested that: ' Paradoxically, however, an insistence on multidimensionality at the level of measurement of poverty could have the effect of obscuring the dynamics processes involved, leaving us incapable of distinguishing between the consequences of poverty, social class and a variety of specific forms of discrimination and social exclusion.' (1995 29) Given that the multi-dimensional methods they are criticizing are derivatives of the general linear model, and in particular involve that offence against the reality of nature, factor analysis and the reification of latent variables, they are quite right. However, the classification through time approach suggested above allows not for multi-dimensionality with the variate elements of social exclusion considered as discrete and real, but for an appreciation of the complex character of social exclusion and of the causal processes which drive the dynamics of social exclusion.

We can do this with data about places rather easily. I have used small area census data for 1971 and 1991 supplemented by household level data from an annual local survey to chart the shifting position of social areas in Teesside (see Byrne 1995). In 1971 East Middlesbrough was an area of traditional social housing occupied by an employed working class population which, whilst somewhat less affluent than residents of owner occupied new estates, was not radically different. Indeed speculative builders were directing their advertising at prosperous council tenants. By 1991 East Middlesbrough was occupied by a residualized working class with unstable employment which was much more different from the residents of owner occupied new estates. Here we can see changes in the classification system and in the position of places within it.   In North Tyneside, in central North Shields, we can see a reverse process in which relatively poor inner working class areas have gentrified, sometimes but not always in the same housing stock.

Conclusion

The purpose of this paper has been to introduce the vocabulary of complexity theory to students of social policy by using it in discussing examples of interest to us. These ideas are being used, particularly in relation to explorations of the dynamics of urban systems, but they have enormous potential for wider application. Note that I wrote ideas, not methods. Complexity is essentially a frame of reference - a way of understanding what things are like, how they work, and how they might be made to work. The approach has as much relevance in qualitative and historical work as it has in quantitative modelling, although one of the things it pushes us towards is the collapsing of the false boundaries between quantitative and qualitative work. For me the great advantage of thinking about things in a complexity mode is that it opens up for us the exploration of what futures we might make come to pass. That is what social policies are about - or at least what the best sort of social policy has attempted to do. We might have some confidence in going back to this, not as social engineers, but as dialogical participants in positive social change.

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Notes

[1]Markov Chains are mathematical models which work on the principle that what happens next depends only on what has just happened. The next state of the system is a function of its present state and nothing else.

[2] With the caveat that Lorenz was describing weather systems which can move rapidly from one domain to the state space to another. We are dealing with something more like climate regimes where such transitions do occur but not with much regularity.

[3]In accord with the principles of chaos theory we should note that you can have too much of a good thing and Poland illustrates this. There are so many parties that there isn't a viable basis for support for the key political positions of postindustrial capitalism.

[4] If the cut off points are based on clustering on the scale itself, this is not so arbitrary because there is an exploratory basis for the designation of the transition values.