Complexity, Probability and Causation: implications for homelessness research

Malcolm Williams

A recognition of complexity must lead us to re-think traditional approaches to explanation and prediction in the social world generally and in social policy in particular. In this paper I will examine the methodological implications that arise out of this recognition in one policy field, that of homelessness.

Homelessness has been long regarded as difficult to define and measure, yet with just a few exceptions researchers and analysts have persisted with the view that some kind of conceptual unity can be obtained. Here I argue that traditional approaches to understanding homelessness are likely to fail because it is a quintessentially complex phenomenon.

In this paper I suggest three things: that the range of symptoms we call homelessness is a manifestation of social complexity and that the emergent properties of that complexity are real. That this reality needs to be understood probabilistically, but at the level of the probability of the single case. That this implies a different methodology for explaining and predicting 'homelessness', based upon data built from single cases.

This paper is not about complexity as such, but instead is an appraisal of some methodological issues in one sub field of social policy, that of homelessness research. Here I will argue that a recognition of complexity must lead us to re-think traditional approaches to explanation and prediction in the social world generally and in social policy in particular. For my own part this re-think was not initially motivated by an interest in complexity, but a realisation that there is something wrong with how we explain and predict homelessness. It follows that if this is the case then any policy remedies to reduce or eliminate homelessness are themselves at risk of failure (and of course many have failed, see for example Vranken 1999).

I've led two projects in which a systematic count of homelessness, using capture recapture, was undertaken (Williams 1999a; Williams et al 1995; Gomez et al 1999), but the definitional basis of homelessness in an otherwise quite robust method was contested politically and methodologically. In each location, for example, the ruling political parties in the local authorities each proposed a different definition conducive to their political agenda. This is, of course, not surprising given the competing definitions that range from the narrow (and inconsistently applied) legislative definitions to the overtly sociological definition of Glen Bramley (Bramley 1988) could all be justifiably termed homelessness. The definitions were convenient to the policy stance of the councils and in one case at odds with that of the second major funder, a leading campaigning charity. Imagine chemists trying to work with three different definitions of potassium nitrate, or physicists using a range incommensurable properties of magnetism!

The problem is not so much the difficulty in trying to establish one agreed definition of homelessness, but the naïve and opportunist belief amongst politicians, policy makers and most social scientists that there is a 'thing' called homelessness. One might even say that there is no such thing as homelessness, but instead a range of heterogeneous characteristics that give rise to wide range of symptoms that we term 'homelessness'. Let me be clear about two things. Firstly this is not just a matter of taxonomy, I am neither suggesting a renaming or that taxonomy is impossible. However renaming leads to operationalism and a denial of any kind of taxonomy implies ontological relativism. Secondly this is not a denial of realism, but rather in what follows an argument for a complex and contingent realism.

Reality and Complexity in Homelessness

The initial symptoms of a range of diseases, particularly viral ones, can be the same - at the earliest stage the doctor cannot tell if the child has a mild flu, or meningitis. Conversely some diseases can begin with a range of quite different symptoms. In both cases complexity is present, but also origins and outcomes are real in the sense that they exist independently of anyone's beliefs about them. In this paper I want to propose something similar about 'homelessness', not in any specific sense identifying particular aetiologies, but in a more methodological sense. I want to suggest three things:

- That the range of symptoms we call homelessness is a manifestation of social complexity and that the emergent properties of that complexity are real.
- That this reality needs to be understood probabilistically, but at the level of the probability of the single case
- That this implies a different methodology for explaining and predicting 'homelessness'.

That the range of symptoms we call homelessness is a manifestation of social complexity [1] and that the emergent properties of that complexity are real.

Lets take three case study examples to illustrate this claim [2] . The personal names are, of course, pseudonyms:

Bethan: Bethan is 20 and is staying in a night shelter for young people in Plymouth. She ran away from home at 14 after witnessing here mother being physically abused by her stepfather. She was taken into care and has 'drifted' since leaving care at 16 and had been sleeping rough for three months up to two weeks prior to interview.

Jimmy. Jimmy is 63, an ex merchant seaman with a history of alcoholism. He lives in the Plymouth Salvation Army hostel and has done for the past 12 years. His inability to cope with life outside of the merchant navy led to the alcoholism, sleeping rough and unemployment, but now though technically homeless according to our study definition, is actually more settled than:

Mark and Ruth, both 21 and living in an HMO [3] in Torbay. They are on a shorthold (6 month) tenancy and Ruth is pregnant. Their flat is insecure both physically and in terms of tenancy. Both left home at 16, though both spent some time in care prior to this. Neither has ever been 'homeless' under most definitions.

Obviously the first thing one notices is a failure of taxonomy. Jimmy is relatively settled and will stay with the Salvation Army probably until he dies, or goes into care, whereas the housing situation of Mark and Ruth is precarious to say the least, yet on the pragmatic definitions we adopted in our research Jimmy is 'homeless' and Mark and Ruth are not.

The response to this kind of taxonomic problem has usually been to spread the definitional net (see for example Jacobs *et al* 1999), but quite apart from the measurement difficulties thereby created, the result is to created a taxonomy so broad as to be useless for conceptual purposes. The social policy equivalent to 'feeling poorly' in medicine. Now I'm not saying here that we should not, or cannot, define sub optimum housing situations that are occupied by social groups with similar characteristics, simply that if you start with trying to group the outcomes into a predefined universal definition (such as homelessness) and then try to find explanatory variables you will never explain the heterogeneity of the observations that make up the definition. For example in the cases above, as so many other analyses have done, we tested for 'time spent in an institution' and found that 62% of the Plymouth sample had spent time in an institution (Williams *et al* 1995: 34). There were two problems with this. First of all 38% had never been in an institution and secondly the 62% that had included a vast range of diverse institutions that respondents had entered at different points in their life cycle [4] .

If we look at the three examples above (and there are many more) we see a set of individual biographical circumstances and housing outcomes that are just those which we have chosen to group in a particular way. Indeed one of the striking things about doing depth interviews with homeless people is that usually only a minority privilege homelessness as a principle problem for them. Jimmy, for example, did not regard himself as homeless at all. Usually (unless they are actually sleeping rough) it is employment, health or addictions that they see as their difficulty. Being homeless, if they recognise their situation as such, is usually seen as a symptom of other problems.

The situation of Bethan, Jimmy, Mark and Ruth have a reality that is explained by them as a set of antecedents conditions, most of which they felt unable to determine or control and some of which they had no knowledge of until they had become effective. Some things might have been different for each of them and again interview data is replete with phrases such as 'if only I'd known', or 'it was really bad luck'.

The vignettes above demonstrate emergent properties from a set of nested probabilities of outcomes. The outcomes are real for those that experience them and at various points particular things that happen have a reality beyond the individual agent that will produce a local determinant of what will happen to him or her. Moreover these outcomes become the basis for future actions (or indeed in-actions), which in turn have outcomes equally real for other agents.

That this reality needs to be understood probabilistically, but at the level of the probability of the single case

Folk reconstructions of probability are often quite sophisticated. Donald Gillies (2000: 122-3) offers some good examples where people know the general odds of an occurrence (say of having a road accident), but reasons that their skills of driving etc. considerably lessen those odds. Reality is understood probabilistically, but likewise there is a folk understanding of its nested complexity. This insight has escaped the statisticians and their acolytes in social science. For instance:

Traditional analyses of the antecedents of homelessness might lead us to say that someone who currently resides in an institution has 2:10 chance (averaged across all types of institution) of becoming homeless. But if we took any given individual, how legitimate would it be to say that s/he has a 2:10 chance of becoming homeless (assuming for the moment such a definition is unproblematic)?

The standard (or frequency theory) of probability measures the relative frequency of an event A defined by conditions B. We might say that a person residing in an institution has a 2:10 chance of becoming 'homeless', but of course the probability of a given individual resident of an institution becoming homeless may not be 2:10 at all and may be greater or less depending upon individual circumstances (and of course importantly the nature of the institution). In a simple elaboration we may 'control' for other factors in the analysis in order to resolve the problem by seeking the narrowest reference class. However as Gillies (2000:121) points out there may not be a single narrowest reference class for which we have statistics. Indeed there will always be outliers and in the social world the narrowest reference class, if we have enough variables, will be those attaching to an individual.

Of course many move well beyond elaboration to try to find out why things happen. Yet when we strip away the rhetoric of even the most sophisticated multivariate analysis and its (often) attendant and specious causal claims we find something rather old fashioned, a Newtonian belief that variables occupy fixed co-ordinates in time and space and that they effect each other in a kind of push - pull way. The attempt to define the narrowest reference class is on one hand an acceptance that causal efficacy may not be achievable in practice, but a kind of faith that in a perfect world it would! In the case of homelessness what we are actually trying to do is to make sense of a plethora of antecedent conditions giving rise to a complex range of outcomes. But actually there is no *necessary* relationship between any given antecedents and any particular outcome, but the clustering of a particular set of antecedents in any individual will increase the probability of particular outcomes. Over time these probabilities might increase, or decrease until they reach zero (impossible) or one (necessary). However against any given outcome individuals who would have been given an equal

probability within a frequency distribution should really be assigned a range of different probabilities. These are what Karl Popper called single case probabilities.

Von Mises (1951) was quite aware of this problem back in the 1940s, but regarded as impossible the derivation of the probability of a single case. Popper (1957, 1959, 1982, 1995) believed that it was possible to derive the probability of a single case through determining the weight of the weighted possibilities. He maintained that experimental outcomes (rather similar to individual life situations in our scenario) are the result of the dispositional properties of the experiment. It is simply illustrated through the hypothesis that a tossed coin will show 50% heads in a sequence of throws. The frequentists would claim this would occur in the *long run*, but they don't say how long the run must be. A condition of our experiment might be that we allow only 49 tosses of the coin. The outcome cannot be 50 - 50, but whatever they are they have been determined by generating conditions, perhaps to do with the relative weight of the faces of the coin, differences in air pressure, temperature or surface over the throws. In theory these variables could be measured, so we knew their relative weights at each of the throws, leading to a probability estimate for each throw. Finally we could amend the probability estimate for the sequence of 49 throws.

There are a number of statistical objections to this strategy, but I will not discuss them here, but see my (1999b) and Gillies (2000:chapters 6 & 7). There is an interesting objection I do not raise in my 1999 paper, but one that actually turns out to be useful if we can counter it and it is simply, what counts as the single case? In the example of the 'coin' experiment is it the throw itself or the whole experiment? The response is that it could be either, depending on what question one is asking. The 'single case' is not rock bottom, but is simply a stratum in a series of nested probabilities. The single case might just be described as our intervention point in complex system.

The notion of nested probabilities has enormous implications for the way we think about reality and complexity. In the social sciences critical realists have perhaps come closer than anyone yet to developing an ontology that acknowledges the complex, yet implicit in much of critical realist thinking about complexity and emergence is (to use Cilliers' 1998: 3 distinction) is the use of the adjective complex, when what is really meant is complicated [5]. Their view might be characterised as, locked in every mechanism is a natural necessity, that simply requires the key of a particular event to be realised. It is the ghost in the machine, the first mover. In complexity there is no ghost in the machine and there is no first mover. The ghost in the machine for Bhaskar is natural necessity

> …if science is to be possible, there must be a relationship of natural necessity between what a thing is and what a thing can do and hence between what a thing is and what it tends to do, in appropriate conditions.
>
> (Bhaskar 1978: 202)

However it seems to me that only at the individual level can we talk of necessity and this is logical necessity. There is no necessity of eviction until the possessions are the street. A 'cause' can only be reconstructed retrospectively and in the individual case. The ontological reality of the social world is contingent and to speak of social causation is to imply an unjustified nomic necessity [6] . This is not a denial of realism but the claim that we must substitute a probabilistic ontology for one of nomic necessity [7] .

How can this help us to understand 'homelessness'?

I have suggested two things about homelessness so far, the second perhaps more implied than the first:

- That the thing we call homelessness is a heterogeneous set of phenomena, the outcomes of other processes.
- Those other processes are nested properties attaching to individuals.

In respect of the first of these I have suggested that there is no such thing as homelessness. Now there are two caveats to enter here; firstly that we may end up identifying something that is not just

outcomes, but it has the key properties of a complex system: that it is information rich and self organising. Secondly that this system may or may not be the outcome of the heterogeneous properties I spoke of earlier. There are three possible scenarios:

1. That homelessness is a bunch of non connected heterogeneous properties that are outcomes of other nested properties in systems. Homelessness does not exist other than a taxonomy.

2. That nested properties of antecedent systems can give rise to outcomes with the capacity for self-organisation. This may include a differential range of those outcomes we normally call homelessness.

3. That 1 may operate under some circumstances and 2 under other circumstances. The difference between 1 and 2 will be a difference, possibly slight, in the antecedent conditions.

What kind of circumstances might exist to produce each?

In the first case those things we have named homelessness, though the emergent properties of complex systems, do not have any logical relationship to each other after their emergence. Suppose that in a rural area homelessness was defined as sleeping rough, living in a hostel or other form of temporary accommodation. Each of these types of accommodation (or non-accommodation in case of rough sleeping) and sub types, may be occupied by people who have very different life histories. A new age traveller evicted from a cliff top site in Cornwall will likely have a totally different set of antecedent characteristics to a young couple given notice to quit on a shorthold tenancy. Their subsequent actions will quite likely be independent of each other and the probability of this independence is increased by the difficulty of interaction between types of 'homelessness' as a result of geographical dispersion.

In the second case the life histories of the 'homeless' group may or may not have similarities, but the emergent properties of their situation interact with other properties in the social or physical environment. These might be a set of local housing policies, very high levels of geographical concentration of emergent homelessness, or interaction characteristics of the people themselves (e.g. a large number belonging to a particular ethnic group). An excellent example of emergent properties that become such a self-organising system we could call homelessness was the 'Bull Ring' near Waterloo Station, in London in the late 1980s. Here (mainly) young people became a community of homeless people in a cardboard shantytown. The ways in which they got there were diverse, but the outcome was a self-organising system.

In the third case a self-organising system of homelessness may emerge, but alongside it there may be other characteristics that have no systemic properties, but were encompassed by the local definition. Small towns in Cornwall have miniature versions of young homeless communities (Buck *et al*: 1993), but the interactions between these and young local people in shorthold tenancies is fairly minimal .

Of course local systems of 'homelessness' may vary enormously in their characteristics and the taxonomic problem of whether they each should be called homelessness does not go away, but at least if the local systems can be identified in respect of their emergent and systemic characteristics then a basis of logical classification is possible.

This addresses whether or not we can talk of emergent homelessness, or at least it suggests some parameters within which we might do this, but the ensuing description would be anthropological or sociological and not especially helpful to the goal of explanation. To do this we have to identify the systemic properties (or their absence) in the antecedent conditions. In policy terms this is crucial, because the antecedents of Bethan's situation may have no logical or probabilistic connections with that of Jimmy. In terms of policy solutions 'one size fits all' may not be at all appropriate. Housing situation A and B may come under the same taxonomy, but their origins may have nothing to do with each other. Sharks and dolphins have similar characteristics, but taxonomy that included them both (other than that of animals) would be wrong. What then are we looking for when we look for such

systems? I think three things: the type of antecedent characteristic, the type of relationships (or absence of relationship) between them and its strength, expressed probabilistically.

That this implies a different methodology for explaining and predicting 'homelessness'

Variable analysis based on a frequency theory of probability is associational. The variables themselves arise from a theory and the associations are a function of the measurement of the operational definitions. This, for the reasons I suggested at the beginning of this paper, leads to particular problems in the social world of competing politically driven definitions.

There are two methodological problems. First, the epistemological one of correspondence between characteristics and characteristics as named. Second, the ontological one of the nesting of antecedent characteristics that manifest themselves slightly differently in each individual. The attempt to link variables to individuals will fail both on the impossibility of producing a reference class that can encompass more than one individual, and on the basis of identifying antecedent probabilities of the characteristics attaching to individuals.

Thus I suggest that any methodology must begin, not with the variable but with the case, where the case stands in for the experiment in Poppers' methodology (Popper 1959: 36-7). Ironically many homelessness researchers have long argued that survey approaches fail to capture what homelessness is (Watson 1984; Chamberlain and MacKenzie 1992) and instead advocate interpretive approaches. However a criticism of such approaches is that they are rarely generalisable and that they attach far too much emphasis on subjective meaning, rather than objective characteristics. However life history approaches, that utilise interpretive methods can be a useful starting point.

Nigel Fielding and Raymond Lee (1998) describe an approach proposed originally by Ragin (1987) and called Qualitative Comparative Analysis (QCA). Here qualitative data are analysed for patterns of causation. Unlike a data matrix in quantitative research, one begins with the cases (organised in rows) whereby the existence or non existence of characteristics can be represented by a 0 or 1 [8] . Analysis then proceeds through the use of logical operators (AND, OR, NOT) to indicate the combining of characteristics within the cases. Rather like neo analytic induction (fielding and lee 1998: 162) positive and negative outcomes of hypotheses can be examined. In the case studies examples given above, for example, a range of characteristics could be used in the formulation of some initial hypotheses: location, age, institutionalisation, etc. and the combination of these calculated in terms of probabilities for each case to produce the 'weight of the weighted possibilities' (Popper 1959: 37).

The possibilities of this kind of analysis are intriguing, not the least because they could potentially be used to build neural network models, and in multi stage cluster analysis (Byrne 2002 - forthcoming). However there are technical and methodological problems, some of which Fielding and Lee acknowledge: ‘the prospect of “proving” a hypothesis might tempt researchers into relaxing coding definitions or making rules so slack that they cannot fail to fire’ (1998: 63). Secondly QCA is designed for small scale research and to calculate the ‘weight of the weighted possibilities’ certainly more than a handful of cases would be needed, particularly as the hypothesised characteristics is all but boundless. This is what John Goldthorpe (1997: 5) (in a critique of Ragin) called the ‘small N problem’, that is the number of variables in an analysis exceed the cases. Thirdly, what I term ‘hypotheses’ here are the search terms the researcher proposes in the original qualitative analysis, but a presence in the ‘text’ does not imply a causal presence in the case and of course vice versa: the absence of an indication of a causal presence in the text, doesn’t mean its absent in the case.

Finally this tentative methodological programme maps well onto a substantive approach, recently suggested by Suzanne Fitzpatrick and David Clapham (1999) and overtly intended to avoid some of the definitional problems I have indicated. The approach was used by the latter to explain the housing situations of young people in Glasgow. The approach is a dynamic one that follows ‘housing pathways’ and looks back to housing histories, but also takes into account the future direction of a household. The approach is sensitive to life course events and recognises that some trajectories

may be downward, but others upward. Although in Glasgow the research did not move beyond qualitative accounts, the potential for QCA, cluster analysis or model building is apparent.

Conclusion

There is no such thing as homelessness if we mean this term to include a taxonomy of all sub optimum housing situations, or at least its use under these circumstances obscures deep, complex and heterogeneous systems and emergent properties. In this paper I have tried to show why this is the case and how variable based analyses depending on the frequency theory of probability will be operationalist and at the mercy of political power and caprice. I have secondly tried to show how a propensity interpretation of probability is not only conducive to a complexity approach, but also suggests a quite different methodological approach.

The status of the latter remains tentative, though the recent work of the aforementioned Fielding and Lee and that of Dave Byrne moves us on considerably toward developing robust methods based on case based approaches. There are many technical statistical problems to be overcome and unsurprisingly those trained in statistical methods dependent on the frequency theory will be sceptical, as will those researchers using variable based approaches. Though I hasten to add here that the foregoing does not rule out variable based analyses. The propensity theory may however have implications for how we interpret such results - but discussion of this is for another time.

Obviously homelessness is not the only phenomenon that is of interest to social policy that might be seen in the ways I describe. Bob Carter (2000) has begun to think of race in rather similar ways and likewise much of the current angst about gender might profit from such a re-thinking. Indeed an obvious and important point, left only implicit in this paper, is that the antecedent systems I refer to will not usually be housing based ones, but will for sure be systems in which social policy analysts will be concerned.

BIBLIOGRAPHY

Bhaskar, R. (1978) *A Realist Theory of Science*. 2nd edition. Hemel Hempstead: Harvester.

Bhaskar, R (1998) *The Possibility of Naturalism* 3rd edition. London: Routledge

Bramley, G. (1988) 'The Definition and Measurement of Homelessness' in Bramley, G (ed.) *Homelessness and the London Housing Market*. Bristol: SAUS.

Byrne, D (2002 - forthcoming) *Quantitative Interpretation*. London: Sage.

Buck, M; Williams, M and Bryant, L (1993) 'Housing the Cornish, Containing the Crisis', *Cornish Studies* (2) 1 pp97-108.

Chamberlain, C and MacKenzie, D (1992) 'Understanding Contemporary Homelessness: issues of definition and meaning', *Australian Journal of Social Issues*, 27 4.

Cilliers, P (1998) *Complexity and Postmodernism*. London: Routledge.

Fielding, N and Lee, R (1998) *Computer Analysis and Qualitative Research*. London: Sage.

Fitzpatrick, S and Clapham, D (1999) 'Homelessness and Young People' in Hutson, S and Clapham, D (eds.) *Homelessness: Public Policies and Private Troubles*. London: Cassell.

Goldthorpe, J (1997) ‘Current Issues in Comparative Macro Sociology: A Debate on Methodological Issues’ *Comparative Social Research* vol 16: pp1- 26.

Gomez, S; Cheal, B; Bunyard, T and Williams, M (1999) *Young People in Torbay with Severe Housing Need*. Plymouth: University of Plymouth, Department of Sociology.

Gillies, D (2000) *Philosophical Theories of Probability*. London: Routledge.

Hutson, S and Liddiard, M (1994) *Youth Homelessness: The Construction of a Social Issue*. London: Macmillan.

Jacobs, K., Kemeny,J., and Manzi, T. (1999), The struggle to define homelessness: a “Constructivist approach. in S. Hutson and D. Clapham (eds.) *Homelessness: Public Policies and Private Troubles*. London: Cassell.

Papineau, D. 1993. *Philosophical Naturalism*. Oxford: Blackwell.

Popper, K.R (1957) ‘The Propensity Interpretation of the Calculus of Probability, and the Quantum Theory’, in S. Körner (ed.) *Observation and Interpretation*, London: Butterworth Scientific

Popper, K. R. (1959) *The Propensity Interpretation of Probability*. British Journal for the Philosophy of Science 10 25-42.

Popper, K R (1982) *Quantum Theory and The Schism in Physics*. London: Routledge.

Popper, K R (1995) *A World of Propensities*. Bristol: Thoemmes.

Salmon, W (1979) 'Propensities: a Discussion Review of D H Mellor *The Matter of Chance*' Erkenntnis 14 pp183-216.

Von Mises, R (1951) *Probability, Statistics and Truth 2nd Edition*. London: George, Allen and Unwin.

Vranken, J (1999) 'Different Policy Approaches to Homelessness', in Aramov, D (Ed.) *Coping With Homelessness: Issues to be Tackled and Best Practices in Europe*. Aldershot: Ashgate.

Watson, S (1984) 'Definitions of Homelessness: a feminist perspective', *Critical Social Policy* 11 pp60-73.

Williams, M, Cheal, B and Gomez, S (1995) *Homelessness in Plymouth: Report of research - Stage Two.* Plymouth, University of Plymouth.

Williams, M (1998) ‘The Social World as Knowable’, in T. May and Williams, M (Eds) *Knowing the Social World*. Buckingham: Open University Press.

Williams, M (1999a) ‘Using Capture-Recapture’ to Estimate the size of the Homeless Population’ in Aramov, D (Ed.) *Coping With Homelessness: Issues to be Tackled and Best Practices in Europe*. Aldershot: Ashgate.

Williams, M (1999b) 'Single Case Probabilities and the Social World: The Application of Popper's Propensity Interpretation', *Journal for the Theory of Social Behaviour* 29 2 pp187-201.

Williams, M (2000) *Science and Social Science: an introduction*. London: Routledge.

About the author

Malcolm Williams is Principal Lecturer in Sociology at the University of Plymouth, UK. His interests cover the philosophy of social science, methodology and housing studies. He has written (with Tim May) Introduction to the Philosophy of Social Research (Routledge, 1996) and also edited Knowing the Social World (Open University Press, 1998). His recent works include Science and Social Science (Routledge, 2000).

Notes

[1] I rely here on Cilliers' very comprehensive definition of complexity (Cilliers 1998: 2-5). Important characteristics are that the system should consist of a large number of elements, that there is an exchange of information in a feedback loop, that the interactions are non linear and that there should be computational irreducibility (i.e. an algorithm to describe the system would be as complex as the system itself).

[2] The case studies are taken from data obtained in two multi method studies in Plymouth in 1995 and Torbay 1998/9. See Williams *et al* 1995 and Gomez *et al* 1999. Hutson and Liddiard (1994: chapter 6) discuss a number of similar kinds of individual homeless scenario.

[3] Housing in Multiple Occupation

[4] Institutions included children's homes, young offenders institutions, armed forces, prisons, but also foster homes. See Williams *et al* 1995: 34, for a full list.

[5] Complicated systems have a large number of components, but are complicated. Complex systems contain feedback loops and the whole system cannot be analysed at the same time. Cilliers (1998: 3) provides a nice analogy: a jumbo jet is complicated, but a mayonnaise is complex.!

[6] Nomic necessity is a metaphysical claim and one which it, or its denial, is not provable (Papineau 1993: 198*n*). Perhaps if we speak of fundamental physical laws of the kind which might be demonstrated in the laboratory, then nature would seem to side with Bhaskar in his claims of underlying necessity, but in any open system the evidence for contingency seems greater and none more so than in the social world. However the critical realists do try to have their cake and eat it here, placing stress on emergence and complexity. It is because the world is complex we can talk only of 'tendencies', powers' or 'liabilities' (Bhaskar 1978: 172; 1998: 97-101) in relation to necessity. Now whilst all of this is consistent with nomic necessity, that is that such regularity does not rule out counterfactuals (such as instances where (statistical) laws seem not to apply), it doesn't tell us how we can show how necessity is different to apparent contingency or separate out the necessary from the contingent should both exist. If nomic necessity admits of counterfactuals how could we separate out those things that must go together from those things which are merely contingent? Given this, does it provide any added value over probability and logical necessity, or indeed must it translate as these in any empirical investigation?

[7] The substitution of a probabilistic ontology for necessity (expressed through causation) is not without its problems. Following Popper I maintain that causation is simply a special case of propensity, where the case of propensity is equal to 1 (Popper 1995: 20). Probability has symmetry, where causes are asymmetrical. Thus for events A, B we can say that P(A/B) can be reversed and expressed as P(B/A) (Gillies 2000: 129). This leads to what is known as Humphreys' paradox. Wesley Salmon illustrates the problem with the following examples:

Suppose we are given a set of probabilities from which we can deduce the probability that a certain person died as a result of a certain person being shot through the head is .75. It would be strange, under these circumstances, to say that this corpse has a propensity of .75 to have had its skull perforated by a bullet. (Salmon 1979: 213-214)

[8] The analyses would be conducted using NUDIST or Nvivo, then transferring numeric data to SPSS.