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Evaluating Complex Social Interventions in a Complex World

David Byrne

School of Applied Social Sciences: Durham University.

The social world is complex and emergent. Nomothetic inquiry, directed towards establishing universal empirical regularities, cannot establish causality. We can never assign a causal effect to any intervention without assessing the whole context of that intervention. However, we can develop generalizable knowledge if we adopt research approaches which recognize both the implications of assigning causal powers to context – the essence of the realist take on evaluation, and the significance of human agency in relation to ‘the social type of causal nexus’. Useful literatures which can contribute to developing such knowledge include macro-political science’s concern with the importance of temporal ordering in relation to outcomes, Ragin’s set theoretic understanding of causal relations and his development of systematic comparison as a basis for explicating those relations, and the presentation of causal narratives as foundation for process tracing. Every complex social intervention has to be considered as a case. Systematic comparison across cases allows us to generalize within limits but this still means we can transfer knowledge beyond the unique ideographically described instance. Whilst we can never establish universal / nomothetic accounts of causality, we can, through careful comparison and exploration of complex contingent causation, begin to get a handle on what works *where (in what context), when (in what temporal context), and in what order.*

Introduction

The view that the social world is composed of complex systems is now almost conventional. So for example the recent University College London / Lancet Commission investigating *Shaping Cities for Health: complexity and the planning of the urban environment in the 21st Century* (Rydin et al. 2012) laid out its frame of reference unequivocally and identified the implications with equal force:

‘The Commission began from the premise that cities are complex systems, with urban health outcomes dependent upon many interactions and feedback loops, so that prediction within the planning process is fraught with difficulties and unintended consequences are common.’ (Rydin et al. 2012 2079)

The key characteristic of complex systems is emergence and there are few better definitions of the implications of emergence than the earliest use of the word in this context:

‘Every resultant is either a sum or a difference of the co-operant forces; their sum when their directions are the same – their difference when the directions are contrary. Further, every resultant is clearly traceable in its components, because these are homogeneous and commensurable. It is otherwise with emergent, when, instead of adding measurable motion to measurable motion, or things of one kind to other individuals of their kind, there is a co-operation of things of unlike kinds. The emergent is unlike its components insofar as these are incommensurable and it cannot be reduced to their sum or their differences.’ (G.H. Lewes 1875 412)

The whole is greater than the sum of its parts but emergence implies more than simple holism: that we must understand things taken as a totality and only as a totality. And plainly a recognition of emergence means that we cannot understand things in terms of their components, the essence of the reductionist approach which underpins positivist science. Instead we have to think about parts and wholes and we must recognize that causality does not run in any one direction. So parts have causal implications for the whole, interactions among parts have causal implications for the whole, parts have causal implications for each other, and the whole has causal implications for parts.¹ What does this mean for evaluation research, a process defined by the Oxford English Dictionary as among other things: evaluations of social programmes aimed at discovering whether these programmes have worked or not? Evaluation can be a matter of accounting for the unique – did this single programme work? – but generally it has the wider intention not just of seeing if something worked but of seeing why it worked – establishing causality – as a basis for transferring effective knowledge beyond that specific instance. Evaluation attempts to develop knowledge which is in some way generalizable. In simple systems we do this by identifying causal relationships in terms of laws – statements which can tell us what will happen if something is done in relation to a system given the original state of that system. The classic form of such laws is expressed in Newton’s laws of motion. The assumption is that we can establish causality in terms which hold everywhere and always – the nomothetic programme.

Note that laws in the Newtonian sense are inherently deterministic. If that then this, which is radically different from the establishment of a probabilistic relationship which says if this then that in a proportion of possible instances of that. Laws of a Newtonian form are applicable to all systems of a given kind. Probabilistic science establishes what will happen in proportionate terms across a large number of systems but can never tell us what will happen in a unique single system drawn from that large numbers of systems. So a meta-analysis of well conducted Randomized Controlled Trials of a drug in relation to a clinical condition will tell a physician about the proportion of cases with that condition for which the drug is effective BUT cannot tell the physician whether the drug will work on the patient sitting in a given consultation in relation to the condition. This is the dilemma identified by Griffiths et al. (2010) in a piece entitle: *How to tailor medical interventions for the individual patient*. It was precisely this distinction between regularities of relationship established by controlled experiment on single cases but repeated consistently across other single cases – bench science, and probabilistic relationships established statistically across multiple cases which led Znaniecki (1931) to turn towards qualitative analytic induction as the mode for establishing causation in the social world.

Emergence makes things even more difficult. We should in fact recognize incomplete probabilistic causal explanations as indicative of emergence. The cases which do not fit the incomplete causal account have something else going on – the drug which works for one patient does not work for another because the complex systems represented by the patients differ in some important respect. The Bayesian programme of incremental improvement in probabilistic predictive power by the attachment of additional conditional probabilities represents a kind of acknowledgement of this, as does the setting of interaction terms in linear

modelling processes. So we cannot assert that we can find out what works for changing complex systems. Instead we have to ask:

- What has worked?
- How has it worked?
 - ❖ Which is to ask: What causal mechanisms have operated?
- Where has it worked?
- When has it worked?
- Can it work elsewhere?
- Can it work elsewhen?

What is about specification of the nature of intervention. Where and when are about context. Elsewhere and elsewhen are about transferability. Answers to all those questions depend on answering *how* – on the establishment of causal mechanism. Note that in complex systems the cause will seldom be the intervention – something done to the system – taken alone. What matters is how the intervention works in relation to all existing components of the system and to other systems and their sub-systems which intersect with the system of interest. The mechanism will be complex. Indeed we should stop talking about the mechanism, mechanisms in the singular. The notion of a single way in which outcomes can be generated has to be abandoned because we must recognize as the rather strange English expression puts it, there is more than one way to skin a cat.² When we intervene in multiple complex systems then we have to recognize that the same outcome may be generated in more than one way. So we have to find methods of identifying causal mechanisms, methods that can cope not only with complex causation, but also with multiple causation.

There is another crucial characteristic of complex systems which matters in relation to evaluation. Complex systems have a history and that history has a direction towards their current state and reaching forward into the future. For complex systems time has an arrow. The best way to develop an understanding of the implications of this is by using the idea of a state space to describe all possible states of the complex system. The state space is the multi-dimensional mathematical space where the number of dimensions is the number of quantitative descriptors of the condition of the system and the location of a given system in that state space is indicated by the values of those descriptors. In a two dimensional state space this would be at a point, in a three dimensional one across a plane, and so on for higher dimensions where the number of descriptors is greater than three. We can think of the state space as being a possibility space in the sense that it contains all possible conditions of the system given the possible values of the descriptors. However, complex systems do not have access to all these possible conditions. Instead they have access only to a more limited set of possible future states and one key determinant of the character of that set is their history. This is the essence of the idea of path dependency. Note that the set of possible future states for the system given its current state is not one but multiple and that set of course includes staying much the same, that is undergoing no qualitative change of kind. The objective of

interventions is to change the state of the system, to modify its trajectory through time so that in the future it is different from what it is now. However, the set of futures is path dependent limited, note not determined in the sense of single but determined in the other sense of the word which means bounded within a range.

The implications of complexity for evaluation have been explored rather well by Sanderson (2000), Barnes et al. (2003) and Callaghan (2008). All write in a way which is congruent with the tradition of complex realism developed by Reed and Harvey (1992). So there is a substantial degree of overlap between the issues which emerge from a complexity take on evaluation and both the programme of realist evaluation which began with Pawson and Tilley (1997) and the approach of 'Theories of Change' (see Mason and Barnes 2007).³ Here we find an explicit concern with the key themes of social theory, that is the significance of social structure and the potential of human agency.

Pawson puts it like this:

'... a critical feature of all programmes is that, as they are delivered, they are embedded in social systems. It is through the workings of entire systems of social relationships that any changes in behaviours, events and social conditions are effected.' (2006 30)

Another way to express this is to say that social structure matters. Callaghan develops this idea very fruitfully in relation to the idea of 'negotiated order':

'The notion of negotiated order is premised in understanding of how systems are not only structural entities, but are also fundamentally shaped in the context of the forces and conditions pertaining at the 'bottom' of the hierarchy, being created and recreated by the actors located there. Straus et al. (1933) developed the concept from fieldwork in organizations in response to the clash between the perspectives of Parsons (primacy of order) and Dewey (primacy of change). Strauss argued that within organizations order is negotiated and that this is an ongoing production of the actors involved. Organizational relations, therefore, although having a structural quality, are the product of this continued process of making and remaking. The existence of structure is important in setting the positions from which individuals negotiate and, in turn, which gives these negotiations their patterned quality, but these products are historical and temporally shaped, always open to review and revision. The order that is produced is best described as negotiated because it relies on the daily decisions of actors within this context. ... In negotiated order we can understand the structures as created but also as creating the context for action.' (2008 45)

We can extend this, as Callaghan herself does, beyond the level of the organization to that of the social order as a whole. Note however that Callaghan brings agency to the fore, agency in the context of structure but also agency as constitutive of structure.

Let us return to the issue of evaluation. We can evaluate simple interventions simply by RCTs, although note that the failure of any but the most dramatically effective pharmaceutical interventions to achieve full coverage in effectiveness raises very important

issues even here. However, when it comes to complex social interventions things are very different. This should be glaringly obvious when we deal with interventions which develop over time, involve lots of actors negotiating not only the contextual social order but also as Pawson reminds us the very process of evaluation itself. (2006 10), and are designed to achieve change at some systemic level. Action research, and especially participatory action research, is not only about investigation of effectiveness. It is also about constitution of social orders anew. Even when dealing with the evaluation of interventions intended to achieve effects at the level of the individual or at most the household, we have to consider the implications of emergence. Often these are constructed in the form of RCTs but in reality there is very little useful evidence generated from them when considered in that mode precisely because the actual trajectory of the individuals in treatment and control groups is so profoundly affected by past history, present context, and the inter-relationship of the individuals considered as complex systems with other complex systems, which systems exist at every level up to and including the nature of the global economy.

And, we have to consider agency. Cicourel annotating McIver put it like this:

‘ ... the social structure is for the most part created Unlike the physical nexus [the social type of causal nexus] does not exist apart from the motives of social beings [and requires a methodological strategy that fits the distinctiveness of social events.’ (Cicourel 1964 1 quoting and annotating McIver 1942).

Here we find Callaghan’s (2008) insistence on agency translated into a methodological specification for the exploration of cause. McIver asserts a distinctive ontology for the social, an ontology which has underpinned all assertions of the distinctiveness of the human sciences since Vico. It is important to recognize that the endorsement of what amounts to an ontology which takes account of agency did not lead McIver to abandon the notion of cause. In contrast to Dilthey and Wildelband he did not confine the role of social science to the ideographic establishment of meaning through interpretation – the exposition of systems of meaning in the unique and specific case. Max Weber notoriously asserted that for social explanations to be satisfactory they had to be satisfactory at the levels of both cause and meaning. In answering how questions we have to address causality but in so doing we have to recognize that human agency informed by meaning is absolutely part of our causal nexus. However, once we recognize that, then we are faced with the problem that methods devised for systems which are both simple and not permeated by purposeful human agency do not work for understanding complex social cause.

Is there a way out of this dilemma? Yes, if we start to think about what we mean when describe social entities as cases and explore the potential of styles of social research which are case based and congruent with the complexity frame of reference.

Cases considered as complex systems

Let us establish what we mean by cases, that is present a summary of answers to the question posed by the title of Ragin and Becker's book *What is a Case?* (1992) Abbott's answer in that book works well for our purposes:

'The move from population/analytic approach to case/narrative approach is thus a move first to a new way of regarding cases – as fuzzy realities with autonomously defined complex properties – and a move second to seeing cases as engaged in perpetual dialogue with their environment, a dialogue of action and constraint that we call plot.' (1992 65)

How can we answer our how question when we are dealing with cases? We need to begin with difference. McIver pointed us towards a fundamental when he asserted:

'the search for causes is directed to the differences between things... Underneath all our questioning lies the implicit acceptance of the axiom that no difference exists without a cause'. (1942 27-28)

Cilliers makes the same point in relation to understanding complex systems more generally.

'The point to be emphasized is that an abundance of difference is not a convenience, it is a necessity. Complex systems cannot be what they are without it, and we cannot understand them without the making of profuse distinctions. Since the interactions in such systems are non-linear their complexity cannot be reduced. The removal of relationships, i.e. the reduction of difference in the system will distort our understanding of such systems. A failure to acknowledge this leads to error, an error which is not only technical, but also ethical.' (2010 8)

To establish difference we need to compare and to compare in a systematic fashion. There is a method designed to do exactly that, Ragin's Qualitative Comparative Analysis (1987) and that is one of the approaches which will be asserted as appropriate here. Implicit in Ragin's approach is the idea that the end states, the 'effects' of complex causation in complex systems (see Byrne 2012), are the results of processes which have led to the systems being in a given state. This notion corresponds well to the general objectives of complex social interventions.

'... policy researchers, especially those concerned with social as opposed to economic policy, are often more interested in different kinds of cases and their different fates than they are in the extent of the net causal effect of a variable across a large encompassing population of observations. After all, a common goal of social policy is to make decisive interventions, not to move average levels or rates up or down by some miniscule fraction.' (Rihoux and Ragin 2004 18)

Ragin's original interest was in macro-social historical development, in dealing with questions of the order of why did some nations in the first half of the twentieth century become dictatorships rather than democracies or why advanced industrial societies developed welfare states of different forms. We can see the outcome here being a state and the foundation of the attempt to establish causation in relation to a state being systematic

qualitative – hence qualitative – across cases - hence comparative – with a view to identifying causal complexes – hence analysis although the usual reductionist logic of that terms is only partially pursued in Ragin’s approach.

We need to return to the idea of process. Castellani and Hafferty (2009) have correctly asserted that given the dynamic natures of complex systems we must pay attention to processes as ongoing whilst recognizing that complex systems have relatively stable states for long periods. Such states are not static but rather describe periods in the trajectories of the system where they move in state space but move only within a relatively restricted area of the state space and do not move to a degree where quantity becomes transformed into quality and they therefore change kind. There is a method which systematizes exploration of process across time – process tracing as proposed by George and Bennett precisely to address the relationship between case studies and theory building in the social sciences:

‘... it was necessary to devise a case study methodology to analyze past instances of each of these generic problems to identify conditions and procedures that were associated with successful or failed outcomes. The challenge was to find ways of doing comparative analysis of a number of instances of each generic problem in ways that would draw analytical explanations of each case into a broader more complex theory, one that would discourage reliance on a single historical analogy. For this purpose, George adapted methods of historical explanation to convert descriptive explanations of case outcomes into analytic explanations comprised of variables. This procedure made use of an inductive approach for theory-building, but it was analytic induction not raw empiricism. ... In Harry Eckstein’s terminology, an ideographic atheoretical explanation was converted into a “disciplined configurative” study.’ (2005 x-xi)

We will not accept ‘analytic explanations comprised of variables’ but the underlying logic of this approach in terms of analytic induction fits our needs.

There is three further ingredients to add to the mix here. First, there is Byrne’s identification of cases as complex systems (2011) drawing on a synthesis of complexity and case based reasoning and explicitly endorsed by Ragin (2011). This amounts to a fuller development of the position expressed by Abbott (1992 65 see above) drawing on the language of complexity science and discussion of the nature of complex systems. Second, there is attention to what Ragin (1992) identified as the problem of casing in terms essentially synonymous with Cillier’s discussion of the specification for purposes of science of the boundaries of complex systems (2001). Third there is the value of explicit categorization both of cases as wholes and of subsystems of cases using available data describing subsets of what Byrne (2002) calls quantitative traces of the trajectories of complex systems. The purpose of this latter is to identify sub-systems of complex systems, which is both important in itself and facilitates the use of the quantitative element in QCA, the establishment of truth tables of configurations in relation to outcomes.

The term configuration in this sense is Ragin's (1987) and it is revolutionary in its content. Ragin was explicitly rejecting variable based accounts of social relation in favour of what he calls 'set theoretic' understanding:

'... case oriented research is not a primitive form of variable-oriented research that can be improved through stricter adherence to variable oriented standards. Rather, the case-oriented approach is better understood as a different mode of inquiry with different operating assumptions.' (2004 12)

'For causation, the main contrast is between the conventional view of causation as a contest between individual variables to explain variation in an outcome and the diversity-oriented view that causation is both conjunctural and multiple. In the conventional view, each single causal condition, conceived as an analytically distinct variable, has an independent impact on the outcome. In the diversity-oriented view, causes combine in different and sometimes contradictory ways to produce the same outcome, revealing different paths.' (2000 15)

Configurations, represented by lines in a truth table in the simplest form of QCA where attributes are assigned to cases as binaries i.e. present or absent, can be understood as assemblages. These are complexes, not variables, and there is an explicit rejection of the notion that it is meaningful to assign partial causal powers to any element in the configuration. The following refers explicitly to the use of QCA in exploring organizations but has general applicability.

'What emerges, then, is a picture of configurations as embedded in space and time and involving varying levels of complexity, dynamism and analysis. Simple configurations may involve only a few and linear interdependencies. In contrast, complex configurations may involve multiple interdependencies that are furthermore characterized by interactions such as complementarity or substitution effects leading to synergies and trade-offs between the different elements. Furthermore, configurations need not be static, but may be dynamically changing, suggesting that organizations follow dynamic constellations that change over their life cycles. ... Finally, configurations may be cutting across several levels of analysis. For example, organizational configurations may involve elements at the organizational, intra-organizational, and supra-organizational level.' (Fiss 2009 429-30)

Configurations represent difference both in relation to cause and in relation to effects, understood here as outcome states. If we take the simplest and commonest form of QCA it establishes configurations which show patterns of sets of binary attributes of cases in relation to outcomes also defined in binary terms as present or absent. In this form the truth table is a slice through a multi-dimensional contingency table with each configuration being a set of cells arranged against an outcome.⁴ The truth table is simply a two dimensional representation of this table with the number of cases recorded as it would be in the outcome set of cells in the table. So the truth table allows us to see all the configurations possible given the set of attributes deployed, those configurations which have cases with that set of attributes, the number of such cases, and the proportion of those cases which have the

outcome condition state specified. QCA allows for a reduction in configuration elements using De Morgan's law and Boolean logic but it is not necessary to proceed to that stage. We can use the method in an exploratory rather than explanatory mode. This is particularly useful when we have 'contradictory' configurations i.e. configurations without 100% of the cases having the same outcome state. We can then return to the cases in such instances and seek for the additional differentiating characteristics of their previous trajectories and contexts which might help us to resolve the contradiction i.e. generate an explanation of the difference in observed outcome state.⁵

This discussion of the nature of truth tables identifies another radical distinction between the kind of methods which are compatible with an understanding of the social and interventions in the social which are complexity compatible. Traditional quantitative approaches have overwhelmingly preferred measurements which are scalar i.e. possess the full arithmetical properties of real numbers. In terms of levels of measurement they are continuous. However, QCA's set theoretic approach deals primarily with measurement at the nominal level, that is with measurement simply used to specify difference in terms of set membership. There is a scalar component to fuzzy set QCA although in practice only at an ordinal level. Fuzzy set approaches are first nominal. That is they specify set membership. Then in QCA they become ordinal by specifying ranked degree of membership of the set between total non membership indicated by 0 and total membership indicated by 1. This can be useful but it is the nominal specification which matters. A complexity take on attribute specification in a QCA truth table regards each attribute as a specification of a sub-system with causal potential, that is as an element in the system which in interaction with other elements has causal powers. This raises a practical issue. Conventional statistical techniques can cope with large numbers of variate entities although they do, particularly in relation to data sets derived from samples, have to address issues of multicollinearity in terms of assigning causal power to individual predictors in a model. QCA in its simplest form, that is when it works with bivariate attributes, generates 2^n configurations when we have n attributes. Many of the configurations thus generated will have no cases associated with them. This is not a problem because such configurations can in complexity terms be considered as describing empty attractor states in the possibility space. The probability of such empty attractor states is high and their existence is inherent in a complexity framed understanding of the nature of reality. However, we still are likely to have very large numbers of occupied attractor states –configurations - when we use large numbers of attributes in the generation of truth tables.

The practical way to resolve this is to use some data reduction device to reduce the number of attributes we deploy in generating the truth table. Two approaches are possible here. One is to use some variant of factor analysis and use the generated factors instead of the attributes although factor analysis is a continuous data technique and produces continuous scores rather than nominal specification of attribute value as an indicator of set membership. Another which is both much more straightforward in practice and conceptually more in tune with a complex systems understanding is to use cluster analysis across sub-sets of the measurements for the cases used in the analysis. This allows for the incorporation into the analysis of variates measured at any level. The key issue is careful specification of the sub-set of variates

used to construct clusters. This must be justified on grounds which specify those variates as traces of a sub-system in the overall causal process. See Blackman et al.(2011) for an example of this approach. Sorting things into kinds, the outcome of any numerical typology method, can also be used in relation to outcomes. This approach can be particularly useful when in addition to attributes generated by careful historical process tracing, we have available attribute data of a conventional statistical kind which is particularly the case when we have large geographical data sets or data sets describing sets of institutions – schools, hospitals, public health systems and so on.

If we set configurations into complexity terms then we can see cases with the same ‘causal attribute set’ (configuration) as being in the same location in the multi-dimensional possibility (space) state. The cases can be thought of as ensembles i.e. sets of systems rather than single systems and those with the same causal configuration can be thought of as near neighbours. This term is extremely valuable since it allows us to bring in similarity, including similarity derived from path dependencies, in exploring possible futures. This matters since when asking what works when and where we need to find answers which work for cases of particular kinds. Consider success in achieving good cohort outcomes measured by examination success for secondary schools. Selective schools do well because they select. Schools with children who are affluent and do not have special needs⁶ mostly do well. Schools with more deprived intakes of children and with more children with special needs mostly do not so well. When we find a factor differentiating such schools so that some do well, then that is of value to other schools of the same kind. They cannot make their children affluent. They can introduce what was identified here, a specialist intensive mentoring system. It might work for them. So in general in this logic of inquiry we proceed by systematic consideration of the relationships of differences to outcomes.

The emphasis on process should remind us of the significance of temporal order in complex causation: ‘When things happen within a sequence affects how they happen.’ Charles Tilly (1984 14) Whilst much of the work influenced by Tilly’s dictat has turned to conventional statistical methods which incorporate attention to time and order, those approaches do not adequately address the issues of complex and multiple causation. Establishment of temporal order is a necessary part of process tracing and there has been an extensive discussion in the QCA literature of the possibility of including a temporal dimension in the framing of configurations: see Caren and Panofsky (2005) and Ragin and Strand (2008). The key point is that set theoretic approaches can take account of temporal ordering.

One final practical tip is in order. Often in evaluation we work with sets of texts, usually literal texts in the form of documents, transcripts of interviews / focus groups, field notes etc. although increasingly we might use other documentary forms including images, sound recordings pre transcription and so on. The widely used qualitative data management package NVIVO has a facility which allows specification of case as well as thematic nodes. Thematic nodes are conceptually associated with a grounded theory approach to interpretation. Case nodes contain all material associated with the case. NVIVO allows entry of attribute values for cases and the construction of a data spread sheet with the values of these attributes for every case. Although the guidance material for the package and literature discussing its use

generally indicates that attributes of cases will primarily be existing measurements on the cases, we can actually identify new attributes during the qualitative interpretative phase of the work and then specify values for these attributes for each case as a case node. The attribute table spread sheet can then be exported and used as input into QCA. In other word NVIVO provides a useful platform for the development of the comparative phase of qualitative comparative analysis. This development is necessarily a development towards specification of attributes and thereby moves towards quantitative work. It can be used in conjunction with a QCA which begins with a data set describing a large number of cases when that QCA is deployed in exploratory mode. So when we have contradictory configurations we can assemble qualitative information about the cases associated with that configuration and construct new attributes to try to arrive at a causal account of distinction in that configuration. This can often be done for formal institutions on the basis of inspection reports.

Conclusion

Let us be clear about the position advanced in this piece. If we understand the social world as composed of intersecting complex systems with causal powers running in all directions across and within those systems, not only does this have implications for the methods which can establish causality in useful ways (see Byrne and Uprichard 2012) but it also disallows other approaches. In particular it denies the value of Randomized Controlled Trials, particularly in relation to complex social interventions. The RCT is premised on the notion that a single intervention of a particular kind can yield useful information on the basis of comparisons between sets of cases randomly allocated to treatment and control groups with interventions and outcomes being very clearly defined from the outset. Complex social interventions which involve complex actions over time by humans with agency can never accord with this protocol. Nor should they! Let along the practical difficulties – the numbers of cases are too small for valid statistical inference, it is impossible to control the actions of human agents in the context, designs cannot cope with any but the most straightforward of first order statistical interactions and can only do so with very tight experimental controls - once we understand the social world as complex then we must recognize that methods organized around simplicity have very limited – not none but very limited – value and then only in very special circumstances. We have to recognize that even in contexts where the RCT, or rather the meta-analysis of large numbers of RCTs, has been promoted as the gold standard, this approach is now being challenged. The move towards data mining of health records in order to develop personalized medical interventions (see Castellani and Castellani 2003) is a recognition of the significance of trajectories and path dependency even at the level of the complex system which is a single human being. For complex and chronic conditions, the major sources of human morbidity and of much human mortality, this approach works when RCTs are effectively useless.

Most of the studies which have been conducted in accordance with the complexity frame of reference have been conducted in advanced developed societies but they have been conducted primarily in relation to health and other interventions in the poorest areas of those societies, in the territories which are sometimes described as ‘the fourth world’. The practices and techniques which have been developed in such interventions are immediately transferable to

what have been traditionally thought of as the development context. Indeed since many of these interventions have relied explicitly on participatory methods and co-production of knowledge, they have drawn themselves on development research experience as it is conventionally understood. And that is perhaps the most important thing to say about complexity informed research in relation to development of any kind. The complexity frame of reference deployed through process tracing and systematic comparison across cases poses no problems for the evaluation of action research and other forms of participatory research. It can accommodate history and agency and that is just what is needed for the development of transferable knowledge from social interventions in a complex social world.

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¹ For an elaborated discussion of this point see Byrne and Uprichard (2012)

² I have never skinned a cat but have skinned rabbits and know only one way to do it!

³ See the useful counter posing of these two positions by Blamey and Mackenzie (2007)

⁴ A conventional variable approach would be logistic regression although models could be fitted in a less deterministic way using log-linear methods. However, both fit 'the model' as opposed to allowing for multiple causation and can only admit complex causation through rather clumsy fitting of interaction terms.

⁵ There are variants of QCA which allow for multiple values of attributes or for partial (fuzzy) assignation of cases to attribute sets. These are more complicated to run and interpret but the underlying logic is the same.

⁶ The data suggests that there is a threshold effect (tipping point) for proportion of children with special needs in an English secondary school. Below this threshold the proportion does not contribute to outcome. Above it there is an increasing negative effect.