



New communities, new relations: The impact of community organization on health outcomes

Robin Durie*, Katrina Wyatt

Peninsula Medical School Exeter, Devon, UK

Abstract

This paper addresses the debate concerning the ‘added value’ of complexity theory for health care research. In particular, it considers the way in which complexity theory can enable researchers to understand the relation between whole system processes and individual, and community, health outcomes. It presents a case study of a process of sustained regeneration which took place on a severely deprived estate in West Cornwall, UK. In so doing, it seeks to add to the stock of new empirical research, upon which debates about the value of complexity theory for health care research need to be founded. It also seeks to determine whether complexity theory can facilitate the transferability of successful regeneration processes from one place, or community, to another.

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Introduction

Place, health, and complexity theory

Our fundamental aim in this paper is to address the question of the most appropriate methodological approach for understanding the effects that place might have on health. The most significant challenge posed by this question is that of finding a means for determining the relation between those contextual processes which can be said to be operating at the level of whole places or communities, and both individual and community health outcomes. The force of this challenge stems from

the fact that the dominant means for understanding the relation between health outcomes and their causes work either at the level of the specificity of the individual, or at the statistical level of the population.

In order to address the question of the relation between place and health, we need to consider how to determine what the contextual processes are—if any—which are operating at the level of whole places or communities. While there has been much significant research done into the issues of communities and the power of community processes (e.g., Taylor, 2000), the key notion which is implicated by these questions is that of the relation between processes at the level of the individual, and processes at the level of the *whole*. At stake in this issue is the implication that processes at the level of the whole differ from those at the level of the

*Corresponding author. Tel.: +44 1392262859.

E-mail addresses: robin.durie@pms.ac.uk (R. Durie), k.m.wyatt@ex.ac.uk (K. Wyatt).

individual to such an extent that they cannot be reduced to, nor derived from, processes at the level of the individual. Whilst this claim does not offer to break radically new ground in the history of the social sciences, it does, however, indicate one of the most important areas where the methodologies of the natural sciences and those of the social sciences fail to find common ground.

One candidate for bridging this methodological gap is complexity theory. Complexity theory explicitly seeks to understand processes at the level of the whole, rather than at the level of parts in isolation, while emphasising, at the same time, that it is not possible to predict these processes at the level of the whole on the basis of an understanding of the processes pertaining to the level of individuals or parts in isolation (Durie, 2002; Goodwin, 1997). Second, it is a theory that appears to possess the potential to address, at one and the same time, both social and natural phenomena (Urry, 2003, pp. 12, 13, 17). Third, as Gattrell (2005) reported, it is a theory which is beginning to garner wide-spread interest amongst social scientists in general, and those undertaking research into health inequalities and health geography in particular. Gattrell (2005) concludes that 'more good empirical work' is needed to illuminate complexity theory, and by extension, its value for understanding the relation between processes occurring at the level of whole communities and health outcomes pertaining both to individuals and communities, and to the problem of health inequalities and their determination by place.

We concur with Gattrell's conclusion. For the most part, proponents of complexity theory have advanced arguments of three types: more or less theoretical arguments about the relevance of complexity to health care, based on a prevailing assumption regarding the need to move beyond the traditional 'positivist' or 'reductionist' paradigms of medicine (e.g., Plsek, 2001; Rosen, 1996); retrospective attempts to make sense of medical phenomena using complexity theory (e.g., Innes, Campion, & Griffiths, 2005); arguments urging those involved in seeking to bring about change in health care settings to adopt principles derived from complexity, rather than from traditional 'command and control' models of management (e.g., Morgan, 1997).

We present a case study examining the relation between contextual processes operating at the level of geographical place and the health (as well as

education and crime) outcomes that were shaped by these processes. The research was informed, from the outset, by complexity theory. To the extent, however, that primary data collection and analysis proceeded according to standard qualitative research methods, we would equally argue that the research was not overdetermined by complexity theory. Thus, we believe that this research provides an excellent opportunity to reflect on the way in which complexity theory can enable us to understand the relation between place or neighbourhood, community processes, and health related outcomes.

The more basic issue informing our research programme, from which the case study presented in this paper is derived, is the problem of designing interventions that may have a positive impact on health outcomes. 'Top-down' approaches tend to fail because of their lack of sensitivity to the specificity of the place of communities. 'Bottom-up' approaches, which are on the other hand entirely context specific, tend to fail to yield findings that can be effectively generalised. The issue of context specificity, and sensitivity to local initial conditions, constitutes one of the central concerns for complexity theory. Our proposal is that analysing the data from the case study we present (alongside the other findings from our research) from the perspective of complexity theory may yield evidence pertaining to the transferability of processes whereby interventions can lead to the development of enabling conditions for transformational change within communities resulting in the attainment of significantly improved health outcomes.

Health inequalities

In recent years health inequalities have become a major public health and policy issue within the UK (Davidson, Hunt, & Kitinger, 2003). The root of this Government focus probably dates from the Black Report, an independent enquiry into health inequalities chaired by Sir Douglas Black in 1977, and reported upon in 1980 (Department of Health and Social Security, 1980). In 1997, the then new Labour Government commissioned a further inquiry into inequalities in health; the Acheson report was published in 1998 and reviewed a similar range of evidence as that considered in the Black report (Acheson et al., 1998). Following the Acheson Report, tackling health inequalities became a priority for the NHS, establishing the principle that the 'NHS will help keep people healthy and work to

reduce health inequalities' as one of the 10 core principles in the *NHS Plan* (Department of Health, 2000). Although the Government has set targets at a local and national level to reduce health inequalities (Department of Health, 1999, 2003a, 2003b), to date the 'fully engaged' scenario set out in securing health for the whole nation (Wanless, 2004) appears to remain an aspiration rather than a reality (Department of Health, 2005).

Health inequalities, housing, and neighbourhoods

The importance of the physical and socio-economic environments in determining the health of communities and individuals is now recognised and globally there is an increasing interest in understanding the relationship between neighbourhood and health of the population (Department of Health, 1999; Wilkinson & Marmot, 2003). Current regeneration policy has shifted its focus, seemingly in recognition that previous policies whose emphasis was solely on the physical and economic infrastructure of communities failed to address issues of poverty and social exclusion (Sanderson, 2002; Taylor, 2000). The National Strategy for Neighbourhood Renewal (NSNR) emphasises the need to build cohesive and sustainable communities, and combined with notions of individual social responsibility, these are seen as the key aspects of this strategy (SEU, 2001). Residential environment is known to be an important determinant of quality of life and wellbeing. There is evidence linking the structure of housing, internal conditions and behaviour of the occupants with health (e.g., Williamson, Martin, MacGill, Monic, & Fennerty, 1997). However, while there is a recognition of the impact of individual neighbourhood effects (and social networks) on health and health inequalities, it is not clear what the causal pathways are through which these social processes and physical conditions affect health (Franzini, Caughy, Spears, & Esquer, 2005).

Evidence base for understanding the relation between place, health and health inequalities

Given the current emphasis on public health and health inequalities, researchers and policy makers are increasingly concerned about the nature of the evidence pertaining to the effects of interventions on health inequalities in general and on appropriate explanatory frameworks in particular (MacIntyre,

2003; Mackenbach, 2003). A recent paper looking at the methods and frameworks for interpreting and understanding health services research called for research in this area to be viewed 'in the context of the lives of the people most impacted by them (i.e., health inequalities)' (Forbes & Wainwright, 2001). By using complexity theory as the theoretical framework with which to understand a community regeneration process, we are drawing upon the principles of realistic evaluation (Pawson & Tilley, 1997; Weiss, 1995). Realistic evaluation proposes that, for any outcome, whether positive or negative, occurring as a result of an intervention, the context in which the intervention operates will determine the outcome. The advantage of adopting complexity theory is that it may provide a means for designing future interventions, to the extent that it can identify sets of dynamic interactions in a given context which may be susceptible to interventions and which bear the potential for initiating processes of change. The effect of such interventions would, therefore, be to facilitate these sets of dynamic interactions in becoming 'enabling conditions' for change. In our presentation of the case study which follows, therefore, we use complexity theory to identify the enabling conditions which allowed the regeneration process to occur, and the significant events and interactions which led to the formation of these enabling conditions.

Complexity theory

Below, we list some of features of complex systems (which, for the most part, concur with those features, derived from Cilliers (1998), that Gattrell (2005, p. 2662) lists), and offer brief explanations of each concept. This list does not constitute a definitive set of necessary or sufficient conditions for complex systems; indeed, at this stage in the development of complexity theory, no such generally agreed definitive set exists. We use the notion of 'system' in its widest sense, to denote any group of things, objects, entities or phenomena, amongst which there are certain relations or associations, or which display some form of arrangement or organisation. Such a system will be complex (as opposed to simple, or complicated), if:

- It is composed of many elements which interact dynamically, and *non-linearly*. The interactions between elements in a system are specified as

non-linear when these interactions are non-proportional.

- The behaviour of the system as a whole cannot be predicted from, or reduced to, the parts of the system in isolation, due to the constitutive role played by the relations between the parts in the system, and the non-linear nature of these relations.
- To the extent that they are unpredictable, properties of the system, such as its structure or organisation, which occur following processes of change within the system, are said to be *emergent*.
- The feedback loops affecting the system are both *negative* and *positive*. Negative feedback works to return a system to specified initial conditions, by reconfiguring the system in order to cancel out divergences from the initial conditions; positive feedback amplifies divergences from these initial conditions.
- It is *open*, and thus interacts dynamically with its environment; as a result, system and environment tend to *co-evolve* with one another. An evolutionary change in one organism within a biosphere will tend to impact on other organisms, meaning that they may have to evolve if they are to survive. Kauffman characterises evolution as movement over a 'fitness landscape', and captures the notion of co-evolution by arguing that fitness landscapes are neither static nor independent. (Kauffman, 1995, p. 208)
- It has a *history*, which influences the present behaviour of the system (in other words, the system demonstrates *path dependence*). The development of the QWERTY typewriter keyboard is an oft-cited example of path dependence (Waldrop, 1993, pp. 40ff).
- *Self-organisation* within the system tends to occur when the system is *far from equilibrium*, or at the *edge of chaos*. 'Edge of chaos' is the term used to describe the region where the phase transition occurs between the ordered state of a system and its chaotic state. The notion of self-organisation captures the tendency of the components in the system to behave in a way which neither dissolves into turbulence nor locks into ordered behaviour, and which can therefore begin to display emergent properties.
- It is able to explore *adjacent possibles*. Kauffman (2000, pp. 142ff) introduces the notion of adjacent possibles at the level of molecules. The set of all molecular species constitutes the

'actual', and the relations between the molecules constituting these molecular species represent the reactions among the species. 'The adjacent possible consists of all those molecular species that are not members of the actual, but are *one reaction step away from the actual*.' Once an adjacent possible has been actualised, it will in turn have its own set of adjacent possibles.)

Case study: Penwerris ward, Falmouth

In 1996, a Bristol University report (Gordon, Payne, & Henson, 1996) found that Penwerris, the electoral ward comprising the Beacon and Old Hill estates (having an overall population of 6000, living in 1500 homes), was the most deprived in Cornwall, UK. The houses were mostly built in the 1930s in response to the then thriving dockyard, which the houses overlook. In the 1930s the dockyards employed 3000 people, which had dropped to less than 300 employees by 1995. In 1995, eight out of 10 men living on the Beacon and Old Hill estates were out of work. A comparison with 132 other wards in the south-west showed that Penwerris had the highest number of poor households, the highest proportion of children in households with no wage earners and the second highest number of lone parents. More than 50% of homes lacked central heating and the illness rate was 18% above the national average.

However, by 2000, the overall crime rate had dropped by 50%. Affordable central heating and external cladding had been installed in over 60% of the properties. Child Protection Registrations had dropped by 42%. Post-natal depression was down by 70%. The educational attainment of 10–11-year-old boys, level 4, key stage 2, was up by 100%. The number of unwanted teenage pregnancies had been significantly reduced to the extent that in 1999 there were no unwanted teenage pregnancies. In addition, the unemployment rate was down 71% amongst both males and females. These achievements were recognised by central government when the Beacon Partnership (a community-led multi-agency partnership) was awarded the Nye Bevan Award for excellence. The sustainability of the regeneration process was further recognised in the form of the presentation of a Queen's Jubilee Award in June, 2003. In November 2003 the partnership won the first Deputy Prime Minister's Award for sustainable communities.

Methods

Aim

To use complexity theory to determine how the enabling conditions were created for transformational regeneration, with its attendant health outcomes, and how this process of regeneration followed from a whole community process.

Case study of Beacon—data collection

Case study research reflects well established and conventional qualitative research methods for describing, interpreting, and theorising about poorly understood areas (Creswell, 1998). Data were collected from open ended interviews and focus groups with the community and with the statutory agencies (health, police, education, welfare, housing, local government), which were supplemented with observational data from attending meetings and informal conversations with residents and service providers from the area.

We purposively sampled individuals who had been involved in the creation of the Beacon Partnership (residents and service providers) as well as people who had lived or worked in the area since 1995. A total of 18 interviews and two focus groups were conducted. Eight interviews and two focus groups were held with the community (two interviews and a focus group with people who had not been directly involved in the regeneration process) and 10 interviews with service providers (health, police, education, housing and welfare). All of the interviews and focus groups took place between December 2003 and September 2004, in community settings (Beacon Resource Centre, Youth Club, or in people's homes). Twelve meetings, including two exchange visits between the Beacon Partnership and other community initiatives, were observed, and over 120 hours of informal conversations were held with residents and service providers.

Ethical approval was obtained and anonymity was assured. The interviews and focus groups were guided by a schedule which addressed the participants' understanding of what it was like to live or work in the area in 1995, how they perceived the changes to happen and what they thought the facilitators and barriers to these changes were. Each interview lasted between 45 and 90 minutes. All interviews and focus groups were audio taped and fully transcribed.

Analysis

A thematic analysis of the data was conducted. Individual transcripts were read repeatedly and then coded to identify emergent themes. Transcripts were then re-read to identify recurrent themes, as such themes would represent a shared understanding of what it was like to live on the estate, and could provide initial clues as to how the changes came about. Respondent validation, in the form of negotiated feedback, was used to check whether the data analysis and interpretation represented the participants' views. The criteria of 'trustworthiness' laid down by Lincoln and Guba were used throughout the analysis as a verification of validity (Lincoln & Guba, 1985).

Following the thematic analysis, the themes were interrogated from the perspective of complexity. This interrogation sought to determine whether or not the main themes identified in the thematic analysis corresponded with the hypothesis that the regeneration which took place on the Beacon estate could be understood as the functioning of a complex system; if this proved to be the case, it further sought to determine whether the interpretation of the thematized data from the perspective of complexity yielded a richer understanding not only of *how* the regeneration process occurred, but *why* it occurred.

Throughout, the process of analysis itself, and specifically, the process of data interpretation from the perspective of complexity, was subjected to a rigorous, philosophical, reflexive analysis. The objectives of this dimension of the analysis were to ensure that the principles of complexity theory were not overdetermining the data analysis in advance, but were, rather, grounded properties of the data analysis itself; and to maintain a critical scrutiny with regard both to the coherence and the applicability of the complexity principles arising during the analysis.

Findings and discussion

In the four sub-sections of this discussion, we will present the findings from the qualitative analysis of the data set, and, in each case, reflect on these findings from the perspective of complexity theory. These four sub-sections correspond to four temporal phases in the recent history of the neighbourhood: the period of decline; the point of criticality at which decline turned to regeneration; the period of

regeneration; the ongoing sustainability of the outcomes of the period of regeneration.

Main themes

How and why decline occurred

It was generally agreed by the residents and service providers that, by 1995, the Beacon and Old Hill estate was in a state of severe decline. There was widespread unemployment in the area, as a result of the main employer dramatically reducing the size of its workforce.

Dock workers being laid off, taken on, a boat comes in and they are on again. So an on off employment cycle... no steady employment, and good employers weren't there. There was just turnover of the fag-end of the employment market [Housing Authority]

Increased unemployment coupled with feelings of 'hopelessness' would appear to have created an environment in which people began to feel *isolated*. Initially, the data suggests that people felt *abandoned* by the statutory agencies, a phenomenon mirrored by the fact that the estate had started to gain a reputation for being a 'no go' area for the police. Several people spoke about not being listened to and being fobbed off, a feeling that was recognised by some of the service providers:

They literally felt abandoned. They were really abandoned at the time. [Health]

So there was nobody for the people up here—no one to trust. I think that went on for a few years. There wasn't a lot of contact between us [i.e., the police] and the people on the estate. Nobody drove on the estate, and there was no residents' association to talk to and to discuss problems. [Police]

This sense of abandonment from the agencies also seemed to separate people from each other within the area. People talked about the lack of a sense of belonging to a community at that time, with people reflecting on the lack of concern they felt when seeing someone else's property being damaged:

The community spirit has always had a thing to it, Old Hill and the Penwerris area, but it seemed to be missing... the community had just given up on itself [Resident]

Because people didn't want to know... didn't bother if they weren't their kids. [Focus Group]

One group of people emotionally described the impact of trying to talk to the statutory agencies to get something done about the state of their homes, and the levels of vandalism and crime, and feeling that they were unable to get anything done about their issues:

You know it was like people were saying you're scum so live like scum and I think people just went along with that, didn't they? [Focus Group]

These themes of isolation and abandonment, characteristic of the decline of the neighbourhood, suggest a series of principles from complexity theory, which would account for why the process of decline proceeded in this way, and, equally significantly, would differentiate this phase of the history of the area from the point of criticality and the subsequent period of regeneration.

First and foremost, there is clear evidence of path dependency in the behaviour of both agency representatives and residents, and it is apparent that there had been a *locking in* of the behaviour patterns of both groups. (Waldrop, 1993, pp. 40ff). Behaviour becomes locked in when it seems that any potentially beneficial outcomes which might accrue from changing behaviour are outweighed by the investment that would be required to undertake the behavioural change in the first place. Typically, this is because of the effort that would be required to encourage everybody else to adopt this new form of behaviour. In the case of the Beacon and Old Hill estates, the telling evidence of locking in of behaviour was the reluctance of residents to report crimes to the police, especially acts of vandalism. The unsatisfactory nature of this situation was outweighed by the negative perception of the outcomes that would result from behaviour change, in this case, by the fear of potential reprisals which might follow the reporting of crimes. In a similar way, statutory agencies began to avoid the estates unless specifically called upon to intervene, subsequently citing the common assumption that actively visiting the estates would only lead to more trouble and to more work. Therefore, criminal activity, the silence of residents, and the perception of the estates as a 'no-go area', became locked in behaviour patterns. As one resident commented during a Focus Group: '*In my case I just felt everybody was going one way, so I thought I would just follow on.*'

Comparing this locking-in of behaviour with the fragmenting of the estates, expressed by interviewees in terms of their abandonment and isolation,

suggests, from the perspective of complex systems theory, a significant consequence of the nature of the relationality determining the behaviour of the system. Locked-in behaviour occurs typically when there is insufficient experience of different outcomes to persuade elements within the system to experiment with alternative behaviours; and when local experience reaffirms the expediency of current behaviour patterns. Current behaviour is thus exacerbated or strengthened through the effect of reinforcement by positive feedback loops. The fragmentation of the community would thus explain why the potential for experiencing different ways of behaving, and different potential outcomes, had been progressively removed from the community. Relations amongst members of the community, and between the community and service providers, had become significantly fewer in quantity, and less diverse in quality. Social network theory suggests that, for the most part, we maintain strong connections to those who are close to us, such as immediate family and neighbours, and that the effect of these relations is to reinforce current views and behaviours. The potential for difference being communicated within the system relies on 'weak connectors'. (Buchanan, 2002). In contrast to strong connections, weak connections link people who are mere acquaintances, and weak connectors are people who facilitate the formation of many such acquaintances, thereby binding the social network together (Granovetter, 1973).

Therefore, we hypothesise that during this cycle of decline within the community, the evidence of locked-in behaviour and the reports from the tenants and residents of feelings of isolation and abandonment, reflect the decline in weak connections within the community. Furthermore, without these weak connections, the system lacked the potential for any possible examples of innovative behaviour to influence other parts of the system, and therefore the impossibility of innovative behaviour spreading through the system. In complexity terms, we suggest that this entails that there was no potential for the system to explore adjacent possibles, and thus no potential for the system to change or evolve.

Point of criticality

The twin phenomena of *isolation* and *abandonment*, coupled with the physical state of people's homes, were recalled by one interviewee, who went on to suggest that the area had reached a pivotal

point where it could begin to spiral dramatically out of control. A key sign of this situation, in addition to the escalation in drug dealing and crimes of vandalism, was the spread of violence to acts of pet torture, a phenomenon which research has found to be associated with serious violent behaviour, especially amongst youth offenders (Ascione, 1999).

This escalating decline within the area was recognised by two local health visitors, to whose practice some two-thirds of the population of the estate were registered. Although this population group amounted to only a third of their overall caseload, they were devoting virtually all of their time to problems arising on the estate. There was an overwhelming sense that 'something had to be done' and that it could not be done by one agency alone—other statutory agencies as well as the community were needed to address these issues together.

Things couldn't go on like this because, it may be overstating it a bit to say that it was a tinderbox, but things couldn't really get much worse, without something horrendous happening, and I think something would have done eventually. I think the whole community would have collapsed really, if something hadn't happened. [Health]

During May–September 1995, the health visitors initiated a series of meetings with representatives from health, education, social services, local government and the police.

It was a combination of factors, and the feeling of abandonment, the lack of agencies talking to each other and engaging, so I think probably in those circumstances you needed to try and pull them in... We had the idea of getting as many agencies together as possible, just to see if they were experiencing the same sorts of problems. [Health]

It was certainly born by the fact that something had to give, something had to change, and, as I say, the only thing that I could think of initially was to try and get as many people together. I think we felt that we would be able to find some key people and some key residents because of our working relationship. I think that was the difference. Hopefully this trust, this respect that we had with people we had worked with, they trusted us even though they didn't know where it was going. [Health]

From the outset it was recognised that community involvement would be essential to the success in

tackling the issues. Twenty key tenants were identified by the health visitors as having the necessary skills to engage their peers and were invited to work in partnership with the statutory agencies. Of these 20, five agreed to participate. What has been recognised as key to people agreeing to take part was the trust that they had in the health visitors, people whom the residents felt understood their issues. In addition, the health visitors were people who came into their homes, and therefore had a different perspective on the plight of the residents from that of other statutory agents:

They [i.e., the health visitors] knew all about you, about the trouble with your homes... and they saw what happened to your kids because of your houses, full of mould.

So they didn't think you were scum?

No, I think if they'd thought we were scum they wouldn't have done what they did. [Focus Group]

They were the only public sector bodies on this estate who people trusted in the sense that they trusted them as individuals because they knew their children and had been in their homes, they were trusted people. [Housing Authority]

The residents who agreed to participate, and who went on to form a residents' association, expressed similar views to those of the health visitors, speaking of their realisation of the need to 'do something' to improve the area:

We [resident and health visitor] liaised quite a bit because my kids had ill health, and we were up there quite a bit, saying 'Can we do this?' 'What can we do about this?', and [name] thought that, well, something has to be done, and I thought something has to be done, and I was young and I thought, let's grab it and do it [Resident]

We [residents who initially got involved] wanted to improve the estate. Because we were all tenants, and at that time we weren't happy with the way the estate was. We didn't like the way that it was so rough, it wasn't safe for our kids to play, and there weren't enough playing facilities, even though you had the fields (they were just for football). You could never let your kid go down to the fields unattended. [Resident]

The abrupt change between the patterns of behaviour characterising the phase of decline in the community, and this new phase, can be characterised from the perspective of complexity

by the shift from the poverty of relations to the formation of a series of richly diverse *new* relations—instigated in the first instance by the health visitors—between both different statutory agencies, and between agencies and residents. Developing the point we made at the end of the previous subsection, we would argue that the formation of these new relations immediately introduced the potential for difference and innovation into the system, thereby allowing the system to explore new adjacent possibilities. Furthermore, the evidence suggests that the health visitors functioned as the weak connectors within the system which allowed the tenants and residents to enter into these new and diverse relations.

Why were the health visitors able to bring about this abrupt change, where before the system had been configured in such a way—due to the effects of locked in behaviour—as to make such an interruption in the cycle of decline nearly impossible? The most significant factor is that, whereas for the residents and other statutory agents, a calculation contrasting the outcomes resulting from ongoing behaviour and those which might follow from changed behaviour, a calculation which suggested that maintaining current behaviour would be preferable (however unpleasant the situation created by that behaviour), the health visitors were not in a position to make such a calculation. Literally, they could no longer carry on doing their jobs, because the work generated by the estate was overwhelming them. The perpetuation of locked in behaviour was simply not an option for them, although they could have chosen to alter their behaviour to bring it more in line with that of other statutory agents, and thereby withdraw from the estates.

This choice of options for the health visitors, the sense that the estates were on the brink of a dramatic escalation in the cycle of decline, and the fact that the intervention of the health visitors represented an abrupt change of behaviour within the system, all go together to suggest that this second phase in the systemic behaviour of the estates represents a point of criticality.

The concept of a critical point is helpful since it captures the notion of a threshold at which a system undergoes a phase transition, such as the abrupt transition of H₂O from liquid to gaseous state at 100 °C. At the critical point itself, the H₂O is present in both of the distinct liquid and gaseous forms (Bruce & Wallace, 1989). A key point to note is that

the molecules of H₂O do not themselves change during this phase transition—it is rather the organisation of their collective state which changes (Ball, 2005, pp. 99–120). Such phase transitions occur in equilibrium systems. In non-equilibrium systems, critical points take the form of *bifurcation points*, as the work of Ilya Prigogine has established. (Prigogine, 1980). The main difference between critical points in equilibrium systems and bifurcation points in non-equilibrium systems is that the latter are influenced by the history of the system. At any bifurcation point, according to Prigogine, the system is compelled to ‘choose’ between either of two alternatives. It is the history of the system that determines which of these alternatives is chosen. In the case of the Beacon and Old Hill estates, the alternatives for the system were either a rapid escalation in the cycle of decline, or an interruption of the cycle of decline.

What were the historical factors that determined the system to ‘choose’ the latter alternative? The evidence suggests that there were three key factors. First and foremost, the health visitors were trusted, both by the residents, and by the other statutory agents. This trust was based on the very same principle that provoked the crisis in the workloads of the health visitors, namely their commitment to the problems of the estate. Thus, the cause of the crisis already bore within it the potential for a positive, creative, response to the crisis. Second, the relations on which this trust was founded stemmed from the fact that the residents had children who were being visited by the health visitors. In turn, these children represented the future of the estate for the residents who became involved, and this future instilled in their parents a strong sense of wanting to make a difference. Third, a number of the residents who got involved had recently returned to the estate, or were new arrivals on to the estate, and thus had yet to become locked into the dominant behaviour of the system.

Features of the regeneration process

This small group of residents subsequently established a formal tenants and residents association. They went on to produce a hand delivered newsletter, and conducted a series of ‘one to one’ chats with all households, informing residents of the plans for the estate, and trying to find out what problems people were encountering on the estate.

Initially, these conversations met with some resistance from the other residents:

So we just knocked on people’s doors, getting what they felt about their estate and all that, and initially, all we got was ‘we are not interested.’ They thought we were five people just being nosy and trying, you know, to take over the estate. [Resident]

One of the initial roles that the residents associations assumed was to share knowledge of service providers who could be contacted, and then to talk with the residents to discover what their main issues were, to try and begin to connect these people to the appropriate agencies:

We met to talk through things, to go through who we could contact, and to get the contact names and numbers of people. We used to go around talking to people, and everything like that. [Resident]

A series of meetings were held for other residents, but initially few people turned up. What would appear to have changed the way that most people viewed the new residents association was a rapid response to an identified problem of traffic issues. People spoke of the severe traffic problems confronting the estate, and the newly formed residents association called a meeting to consider possible responses to this problem:

When you’ve got an issue like that, then you’ll fill the hall, and it was full and there was an uproar over it, yes, it’s got to be done. I do believe, as far as I can remember, that traffic calming is the first issue and they thought ‘yes, we could do something about it’ [Resident]

At one of the early meetings, a senior housing officer suggested that the residents should apply for an energy improvement grant for the area. The application was successful and led to the formation of the Beacon Partnership. Initially the partnership was one between the two residents associations (Penwerris and Old Hill) and the council, health, education and police. From the outset it was agreed that the partnership would be resident led and residents would constitute the majority of the partnership.

At that stage it was just us tenants, when we got the £1.2 million Capital Challenge, we had about 30 quid between us in the bank, we’d never run

anything like it before. But it was at this stage that we sat back and we looked at ourselves and said 'hold on we need help.' I think everyone got to think to that stage, and that's why we formed the partnership...[Name] came in from the school, and the police came in from the very start... [Resident]

Due to governance issues, it was decided that the funding would not go straight to the partnership, rather, the decision was taken that the residents would set the priorities and the council would agree the planning priorities. It was felt that this decision was not without risk, but was viewed very positively as openly demonstrating the belief the agencies had in the community:

You go in with your eyes open, and it's naivety, but you have to take risks on occasions, don't you, and hopefully we knew that, with the balance between the council, ourselves and education and the tenants, that you just have to have trust and faith sometimes, don't you? I think we had a large measure of trust in the people. [Local Authority]

The decision to hand the control over to the residents was seen as very significant by both the statutory agencies and the residents:

It was the tenants saying, we've decided how it's to be done. So that was quite big for the residents because they were in the majority. So that is why I think the funding was critical, it really gave them the confidence that they really could make big decisions and big decisions as to who would get the heating first. [Housing Authority]

We were making the decisions, not being asked what we would like and being advised, we made them. [Resident]

The most striking difference between the characteristics of the estate, considered as a system, before and after what we have called the 'point of criticality', is the development of series of rich, dynamic, relations during the phase of regeneration. During the cycle of decline, isolation and abandonment were, we suggested, indicative of the quantitative and qualitative poverty of relations which revealed the lack of weak connectors within the system, with the consequence that there was, on the one hand, no potential for the creation and exploration of adjacent possibles, and hence no potential for changing behaviour; while, on the

other hand, no means for any incidents of behaviour change to influence the rest of system. With the active creation of new relations between residents, resulting from the ongoing door-to-door conversations, and the various public meetings and consultations, as well as the new relations between residents and agencies, a rich reservoir for innovating with new behaviours was created. Just as significantly, however, these new relations ensured that the influence of these new behaviours could spread throughout the system.

The response to the traffic problems was particularly important, since it revealed that concrete solutions to problems could be achieved through these new ways of working with the statutory agencies. Where, during the cycle of decline, behaviour was locked in because people determined that the benefit of any possible outcomes from behaviour change was outweighed by the cost of undertaking the new behaviour, it now became apparent to residents, and to agencies, that new behaviours could yield strikingly beneficial outcomes. Just as positive feedback loops served to lock in behaviour in the cycle of decline, so positive feedback loops now served to lock in this new way of behaving.

A further important factor was the element of trust upon which these new behaviours were founded, a trust which was already significant in determining the alternative chosen by the system at the bifurcation point discussed in the previous subsection. This trust enabled a series of risks to be taken, both by the residents and by the agencies. Clearly, a degree of risk is attendant upon the adoption of any change in behaviour patterns. However, this element of trust, and the relations upon which it was founded, provided a degree of support and safety for those taking the risks, ensuring that should the new behaviour not prove successful, there would be no consequent isolation or abandonment of those risking the new behaviour. Rather, the new relations ensured that the risk was spread throughout the whole community (just as the influence of the outcomes following from the new behaviours spread through the community), which, of course, was much more resolute, as a whole system, than any part of the system in isolation (c.f., Buchanan, 2002, pp. 121–137).

Finally, the Beacon Partnership is a clear example of an *emergent structure* within the system. Most importantly, this new structure was the consequence of a process of *self-organisation*—at no point was

the idea of the partnership forced on to the community by any outside force.

Sustainability

Soon after its creation, the partnership began to be seen as more than an energy improvement partnership, since it provided an opportunity for the agencies to talk with each other and with the community, resulting in the formation of several other working groups, as well as bringing in new partners.

It brought them together, brought the parents together. They could share issues, share issues with us... They started to look beyond themselves and looked at their place in the community and their relationships with other people more. They could see beyond their own problems as well. I guess they could see that other people were experiencing similar problems. [Health]

The research clearly shows that the members of the partnership, as well as the wider community, saw the partnership as more than a means of improving the homes, and that it had begun to function in a wider context, a wider array of problems could be expressed and responded to:

It's a case of, they'll come along and say, 'Oh, you're in that Partnership thing, aren't you? Now, how would I go about getting...' [Resident]

The whole association itself—it's knowing that you've got someone to go to. If you want to moan, you know there is someone who will listen to you and do something about it. [Focus Group]

A striking example of the way in which the partnership functions in relation to the community, and of how the ongoing self-organisation of the community contributes to the emergent structure of the partnership, was offered by the partnership Co-ordinator (who is a resident from the estate). They commented on the length of time it takes to walk around the area:

It takes me roughly 3 hours to get round, because everybody wants to speak to you... You know, if I walk out of here, and I have to go down the other end of the estate for something, I'm gone 3 hours... I talk to people on the way, and they will, in half an hour, they will probably tell you nothing, but there's one sentence there, and that one sentence logs in and you hear it somewhere

else again, and you suddenly think, hold on, there is a need here. No one has actually said there is a need, but you just picked it out. Various people listen to what they say and what are they trying to tell you, and 10 different suggestions, but is there one thing which can almost answer those 10 things? Not completely address it, you never will but address the issue in one way... [Resident]

Several agencies (such as housing, and the police) regularly walk around the area, with the co-ordinator and another resident from the partnership. These walkabouts have a dual importance: they allow the statutory agencies to be seen, such that people can come up and talk with them; in addition, they allow any issues that have not been brought to the attention of the agencies to be witnessed. One person described them in the following way:

[It] takes about an hour, hour-and-a-half, depending on who stops you, who talks to you, whatever...so, you know, it's a way of finding things out, that perhaps people haven't reported to us, or I've not seen when I've been walking around, but it was something that I wasn't aware of, never knew it existed, 'til I came up here, never knew there was such a thing as a walk-about. [Police]

Once again, this analysis makes clear that the behaviour of the partnership, and the way in which it responds to the community, is not determined by any external principle. Rather, the self-organising nature of the behaviour of the community and of the partnership is revealed by the way in which problems and needs emerge. We believe that this is amongst the most significant of the findings from our research. It challenges our dominant understanding of how problems function, and, as a consequence, of how we should think about the process of solving problems.

For the most part, problems are assumed to be ready given, and as such, that a solution to such problems exists, but has yet to be found. The evidence from Beacon is that the process of discovering, and responding to, problems is itself a 'creative' process. In advance of the encounters and conversations, as a number of participants observed, both agencies and residents might be unaware that the problems or needs existed. Whereas in the cycle of decline, as a member of

the police had made clear, there was no opportunity to 'discuss problems' with the community, in the phase during which the regeneration has been sustained, the emergence of problems, and the development of potential responses to these problems, are an effect of the interactions between the various elements of the system. We would, therefore, like to suggest that such interactions constitute what are, in effect, events whereby adjacent possibles are created. In other words, the emergence of problems amounts to the creation of adjacent possibles. The various ways of responding to these problems, and the discussions and interactions upon which these responses are founded, would then represent the exploration of the adjacent possibles. It is this continual creation and exploration of adjacent possibles which enables the community to maintain its dynamic, non-equilibrium, nature, and, as a consequence, to continue to evolve. It is this continual creation and exploration of adjacent possibles which, we suggest, forms the grounds for the *sustainability* of the new configuration of the community, that is, of the whole system.

A further insight contained in this data is the suggestion that, just as the partnership is responding to the needs of the whole community, so also individuals within the community and amongst the agencies no longer perceive problems as affecting them in isolation, but rather conceive problems, whether their own or others', as affecting the community as a whole. In addition, the development of this new perspective, which, intriguingly, is shared by both residents and agency workers, reveals how a complex system can co-evolve with its environment. Just as the behaviour of the individuals in the community, and the community viewed as a whole, have evolved, so also has the behaviour of those statutory authorities who engage with the estate. Old Hill and Penwerris are no longer viewed as problem areas to be avoided—there is now active collaboration between the estates and the authorities.

Conclusion

We have explained how the regeneration process occurred on Beacon, and we have utilised a series of principles from complexity theory to explain why each of the four phases occurred in the way that they did. In particular, we have shown how complexity theory can account for the specific relation between the processes which occurred in

the neighbourhood, when this latter is conceived as a system, and the remarkable health, crime and educational outcomes which were achieved by individuals on the estate, and by the community as a whole. These outcomes were all attained as a result of the new relations which were formed in the wake of the bifurcation point, and the new behaviours which these new relations enabled. We have also shown how complexity theory can account for the sustainability of these extraordinary achievements.

What is the added value of complexity theory in relation to other social movement theories, on the one hand, and to other systems based theories on the other hand? With respect to the latter question, we would emphasise the themes of emergence, self-organisation, and the exploration of adjacent possibles, as being principles both distinctive to complexity theory as an explanatory framework, and principles which, as we have shown, serve to explain why a sustainable regeneration process has occurred on the Beacon estates. In particular, the emphasis on problem-solving in traditional systems theory is very much at odds with the way of understanding the emergence of, and response to, problems which we are developing here. With respect to the former question, we believe that it is here that complexity can make a distinctive contribution, specifically to developing an understanding of the relation between place and health. The effect of the 'fragmentation of pre-existing community structures', discussed by Rod and Deborah Wallace (Wallace & Wallace, 1997, p. 798), on the decline of a community can both be explained by complexity theory, and also thereby differentiated from the process of regeneration. More than this, complexity theory also reveals why traditional interventions tend not to be successful in restoring the health of communities. This is in part because the very authorities who are seeking to make the intervention are themselves a participatory cause of the process in the community which has led to the deterioration in the health of individuals and of the community.

Can complexity theory go further, and offer grounds for the potential transferability of learning gained from case studies such as that of Beacon to other areas suffering from the effects of health inequalities? We believe that the single most important point concerns the creation of the conditions to enable communities to develop their own processes of regeneration. Regeneration cannot

be imposed, from the outside, on communities, just as external public health interventions tend not to result in positive health outcomes for communities. In a similar way, partnerships, and partnership working cannot be imposed on communities. The alternative to imposing change has tended to be conceived in terms of 'empowering' local communities to bring about change themselves. Just as change cannot simply be imposed from the outside, so power is not a gift which can be bestowed upon a community. How then is it possible for such a process of empowerment to occur within a deprived, and apparently powerless, community? The answer that complexity theory can offer to this question is that empowerment can occur as a consequence of self-organisation within the community. Moreover, complexity theory enables us to understand the conditions which enable self-organisation to occur. We have suggested that the case of the Beacon exemplifies the role of bifurcation points as a condition for self-organisation. The effect of bifurcation points is to destabilise the system, thereby creating the conditions for the transformation of relations within the system. Clearly, however, bifurcation points also cannot be foisted on to systems. Nevertheless, it may well be possible to work to create conditions which may make such bifurcation points more likely to occur than not. This could, for example, take the form of creating the conditions to enable people to accept that things cannot carry on in the same way any longer. Equally, work can be done locally to facilitate the creation of new relations, and the emergence of new behaviours, in the wake of such bifurcation points. This would involve, we suggest, close collaboration with people, such as the health visitors on Beacon, who have both the local knowledge of the community, and the trust of the community, to work with both residents and agency workers to take the risk of forming new relations, and thereby exhibiting new behaviours.

The key lesson is that the success of the regeneration of one community cannot simply be transferred to, and replicated in, another community. Just as the specificity of a local area or place, the particular nature of a local community, determines the precise nature of the decline in the health of that area, so also the specificity of that place will determine how the process of regeneration of the area can and will occur. Complexity theory offers a potentially compelling way of enabling an understanding of, and a response to, the specificity of place.

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