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6 Complex Systems, Evolutionary Planning?

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Coping with uncertainty is a defining challenge for spatial planners. Accordingly, most spatial planning theories and methods are aimed at reducing uncertainty. However, the question is what should be done when this seems impossible? This chapter proposes an evolutionary interpretation of spatial planning as a way of exploring this challenge. It is based on the notion of spatial systems as complex systems and seeks further inspiration in fields where this thinking has been developed in more detail – most notably evolutionary economics. The main normative implications are the need to find a workable fit between planning innovations and local conditions – because of path-dependence – and the need to enhance the resilience and adaptability of the spatial system – because of unpredictability. An ongoing societal dialogue which covers different views on the means and goals of planning and an experimental attitude towards policies are required to identify appropriate interventions.

6.1 Introduction

There is a deep-seated tension between planning's constitutive orientation towards the future and the future's intrinsic uncertainty. Finding ways of dealing with this tension, or reducing uncertainty, is a central challenge for planners and a core objective of planning theories and methods. What should be done, however, when it appears impossible to reduce uncertainty, as in a seemingly increasing range of situations? This chapter explores how an evolutionary interpretation of planning, based on the recognition that social systems are complex systems, might help. The focus is on spatial planning as a combination of transportation and land use planning. Nevertheless, the essence of the argument could be extended to other planning fields. The chapter's first section deals in more detail with this key planning predicament. The second, core section discusses how an evolutionary interpretation of planning might help address it. In the third and final

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section the thus defined ‘evolutionary planning’ is compared with emerging planning interpretations and approaches, including those derived from applications of complexity theory to planning.

6.2 Planning and the future

Concern with the future is perhaps the characteristic that most distinguishes planning from other activities, professions and disciplines. Myers (2001, p. 366) remarks that, “The future is the only topic that other professions have ceded to planners as relatively uncontested turf”. However, the ground the future provides to planners is not, and cannot be a firm one, as the future is by definition uncertain. Myers (2001, p. 365) further articulates the problem by observing that, “Two difficulties constrain planners’ role in shaping the future. First, the future consequences of planning actions are not knowable with much certainty […] Second, […] decisions about the future require agreement among a great many stakeholders”. Finding ways of dealing with such fundamental uncertainty and disagreement about goals and means is a, if not *the*, central task facing planners.

The ideal, rational approach to this task is that of choosing desirable goals, identifying the most effective and efficient means to achieve these goals, and acting accordingly (Simon, 1957; March & Simon, 1958; Simon, 1969). It requires the ability to predict alternative possible future states of a spatial system, and to identify and control the variables that would lead to a preferred state. The practice of spatial planning rarely if ever conforms to this rational ideal. Endemic disagreement and uncertainty about goals and means impedes that. In the real world decisions rather resemble a process of mutual adjustment between different, competing views on goals and means, as conceptualized in the incremental approach to decision making (Lindblom, 1959; Lindblom, 1968; Braybrooke and Lindblom, 1970). The incremental approach has, however, also been criticized, most notably for it’s risk of aligning with the views of the most powerful and conserving the status quo at the expense of weaker interests and basic innovations. The mixed-scanning approach to decision-making (Etzioni, 1967) has attempted to overcome both these critiques by proposing a model of the decision making process that combines ‘fundamental’ decisions to set basic directions, and ‘incremental’ decisions to prepare and work out those fundamental decisions. Mixed-scanning seems to many a better characterization of how decision making processes in spatial planning are and should be. However, it also raises questions about the precise nature of and relationship between fundamental and incremental decisions, and about the mechanism through which they are generated and interact with each other and the context.

I believe that the conceptualization of spatial systems as complex systems, and of spatial planning as evolutionary can help in this latter respect. As more extensively argued in other parts of this book, complex systems are constituted by an indefinite (and indefinable) number of components and relationships. Because of this characteristic, future states of the system cannot be predicted (or just partially), and relevant variables cannot be identified and controlled (or insufficiently). Hence, improvements in complex systems cannot be just achieved in the ideal, rational way. Also a purely incremental approach is, however, at pains with complex systems, as it neglects another of their fundamental characteristics. This is path dependence, or the fact that the accumulation of incremental changes in the past fundamentally limits the scope of changes in the future, with a constant risk of suboptimal outcomes, and even to the point of system collapse. A mechanism of improvement that seems to better suit the characteristics of complex systems is evolution, or the process of variation in the features of the system and selection by its environment. Evolution does not require the previous identification of goals and means (other than those intrinsic to the system's environment), the prediction of future states, or the identification and control of relevant variables. At the same time, evolution seems to have been able to cope with many of the crisis that a combination of fundamental change in the environment which the path dependence of the system inevitably leads to. Evolution is, of course, an established way of describing and explaining change in natural systems. It is, however, being increasingly employed in other fields. In the social sciences it is especially evolutionary economics that has elaborated on these ideas. Following the reasoning so far, it seems thus interesting to explore how the conceptualizations of evolutionary economics, and of evolutionary thinking in general, can help shed light on the challenges of spatial planning. This is what the rest of this chapter attempts.

6.3 Looking for answers: complexity systems and evolutionary economics

Evolutionary thinking has its origins in the natural sciences but has been increasingly applied to social sciences and most explicitly to economics (Nelson and Winter, 1982; Dosi and Nelson, 1994; Van den Bergh and Fetchenhauer, 2001; Boschma et al., 2002), with a more recent but growing focus on policy implications (Metcalfe, 1994; Rammel and Van den Bergh, 2003; Witt, 2003). Underlying evolutionary thinking in social sciences is the recognition that social systems are complex systems. Because of this complexity, social actors cannot just behave rationally. A set of further assumptions characterizes the various streams of theoretical and empirical work. At a micro level, it is posited that different actors can react differently to similar system-wide perturbations, depending on the specificities of the local context and on their individual features (such as attitudes resulting from past experiences). Individual decisions and actions eventually cumulate into system developments that are (a) path-dependent – as earlier experiences largely determine the response to new stimuli – and (b) unpredictable – as even small, local differences can have major, global consequences due to self-reinforcing mechanisms. At macro level, and related to this, the assumption of (a single) equilibrium as the system's 'natural' state is questioned, and attention is directed instead towards far-from-equilibrium processes of change.

A focus on evolutionary economics can help further develop the argument. While different interpretations exist within the field, the basic principles are aptly captured by the notion of microevolution introduced by Nelson and Winter (1982; see also Nelson, 1995; Hall and Soskice, 2001). According to Nelson and Winter, irreducible uncertainty, the existence of transaction costs and the difficulty of change in the short-term mean that firms tend to follow proven ways of conducting business, rather than consider each time all the possible alternative courses of action. Nelson and Winter call these proven ways of doing business *organizational routines*. On the other hand, the evaluation of current routines can lead firms to implement adjustments and even substitutions. The results of such a *searching process* are also uncertain. Furthermore, because past experiences influence both existing routines and the search for new ones, different firms will have different routines and try different alternatives, resulting in a variety of economic behaviour. Eventually, the actual performance of a firm will be the major incentive for maintaining or changing a routine. Such performance is dependent on the characteristics of the environment in which the firm operates (most notably constituted by the market, but also by other institutions). Operational routines that fit the environment have more chance of surviving than those that don't. Because of this role in selecting successful behaviour Nelson and Winter call the firm's environment, in analogy with biological evolution, *selection environment*. The selection environment is not a static entity either, as it will also change as a result of the accumulation of firm-specific processes. In this sense, there is *co-evolution* between the market, other institutions, and individual firms.

The resulting economic reality is one characterized by continuous successions of disturbances and adaptations which preclude the attainment of a stable equilibrium. Relatively stable periods dominated by quantitative, incremental change are alternated by much more unstable periods dominated by qualitative, radical change – or *transition phases* – eventually leading to a new equilibrium. Continuous change means that previously successful organizational routines may become less efficient or effective, or even have unexpected consequences. There is no once-and-for-all, optimal routine. Furthermore, the nature of the process underlies the incremental nature of change, and the difficulty of more than marginally altering an existing routine. Because of such *path-dependence* the risk that firms become *locked-in* in a non-optimal routine is therefore always present (David, 1985; Arthur, 1989). The implication is that marginal change will not suffice beyond a certain threshold and that coordinated change will be required. However, because it is uncertain which new routines will be able to break the impasse, firms should be stimulated to explore a diversity of new routines. It is precisely such diversity that makes the economic system *resilient* and *adaptable*, that is capable of continuous performance in the face of changing, uncertain circumstances.

More recently, evolutionary economists have been trying to apply their insights to policy (Metcalfe, 1992; Rammel and Van den Bergh 2003; Witt, 2003). While this avenue of reflection is still relatively underdeveloped, some principles which deal with policy goals and means on one side and the policy process on the other side have been identified. With respect to policy goals and means, the core principle is that of the need to maintain and increase the *diversity* of organizational routines (Rammel and Van den Bergh, 2003). Since every successful organizational routine is only a temporary solution to changing selective conditions, developing and maintaining a diverse repertoire of alternative options increases the possibility that altered conditions can be successfully met. Diversity gives thus the system an evolutionary advantage, at least in the long term. In this respect, the problem with an excessively strong reliance on market selection mechanisms, as well as conventional narrow policy selection approaches such as those based on cost-benefit analysis, is that they tend to emphasize short-term efficiency at the expense of long-term viability. In the face of this, the aim of an evolutionary approach to policy making should, according to these authors, be to stimulate the generation of diversity through innovation and to ensure that the selection process does not impair diversity-generating mechanisms. There is however, they also observe, an inevitable trade off between maintaining a diversity of organizational routines and achieving short term, local optima, because the former would have to include organizational routines that are less efficient in the present context. A balance between short term efficiency and long term viability needs therefore to be found.

With respect to the policy making process, the distinctive contribution made by an evolutionary approach is the notion that the knowledge of all the actors involved changes during the course of the process (Witt, 2003). In other words, actors can and do *learn*. This is true for both positive knowledge (means-goals relationships) and normative knowledge (values, interests), and for both policy makers and actors affected by policies. Inter-subjective learning is necessary because some degree of shared positive and normative knowledge is a condition for collective action. Finding ways of enhancing and acknowledging learning processes of policy makers and those affected by policies is thus, in this view, a crucial condition for successful collective action.

6.4 Evolutionary planning?

How can the above conceptualization can be applied to the issue of how to cope with irreducible uncertainty in planning? With reference to spatial planning, existing transport and land use policies can be seen as *organizational routines*. The broader socio-demographic and economic context – as embodied by actors and institutions in the spatial political arena – can be seen as the *selection environment* in which existing policies must continuously prove their worth and the *searching process* for fitter policies takes place. As policies, in turn, also affect the selection environment, there is *co-evolution* between environment and policies. The analogy with evolutionary economics further suggests that there is no universally valid, optimal set of policies. While it is important to learn from practical experience elsewhere and from theoretical models, the value of a solution can only be appreciated in a specific, continuously evolving local situation. Understanding the unique set of opportunities and constraints determined by a given historical development and local configuration of factors – that is, *path-dependence* - is therefore essential. However, because of the limits to predictability, only actual engagement with the policy selection environment (the actors and institutions in the spatial political arena) can provide such understanding. This engagement, for-real or simulated, amounts to a 'policy experiment' of a sort (Szejnwald Brown et al., 2004).

Recognition of the unpredictability of the outcome – particularly in the long term – should also result in recognition of the need to look for ways of improving the ability of the spatial system to react and perform in the face of unforeseen (and unforeseeable) change. A transport and land use system capable of performing in the face of unpredictable change would, in the first place, be capable of continuing to function in the face of change. In other words, it must be a *resilient* system. Secondly, it would be a system capable of changing itself in response to change in the socio-economic environment. In other words, it must also be an *adaptable* system. As the requirements of resilience and adaptability might be contradictory, finding an optimal balance between them lies at the heart of the task (Holling, 1973; Walker et al., 2004). The identification of this optimal balance can, however, only partly be accomplished beforehand and will also require actual engagement with the selection environment (actual actors and institutions in the spatial political arena, or possibly some simulation thereof), or 'policy experiments'.

The interpretation of planning following from the above can be summarized in three core-principles:

- The first principle is that the spatial system changes in an evolutionary fashion. Defining, interrelated features are the occurrence of transition phases, the existence of path-dependence and the unpredictability of future states.
- The second, related principle is that land use and transportation policies need to find a fit with local conditions (because of path-dependence) and enhance the resilience and the adaptability of the system (because of unpredictability).
- The third and final principle is that 'policy experiments' (real or simulated) are essential for the identification of successful policies.

These three core principles will be examined in more detail in the next sections. Developments in the Amsterdam region in the post-war period will serve as an illustration (for a more in-depth discussion of this case see Bertolini, 2007).

6.5 The first principle: Features of evolutionary change

There are three defining features of evolutionary change identified by both the economics literature cited above and evolutionary work in other fields. The first is that it alternates periods of incremental, quantitative change and periods of radical, qualitative change, or system transition phases. The second defining feature is that change in the spatial system is path-dependent. In other words, existing system characteristics fundamentally limit the scope for change. The third and final defining feature is that change in the spatial system is, to a significant extent, unpredictable. As a consequence, interventions in the system will always also have significant unexpected effects.

All these three characteristics can be illustrated by means of developments of the Amsterdam spatial system in the second half of the past century. Next to more stable periods and incremental change, there were several instances of instability and more radical change. Massive migration by middle-class families from the city to the suburbs, their substitution by successive waves of foreign immigrants, and the emergence of new urban lifestyles in the city resulted in a major socio-demographic transition. Also the urban economy underwent radical change as traditional industrial activities were supplanted by business and financial services, leisure and tourism, and logistics, following a deep crisis in the '70s and '80s. Socio-demographic and economic change was accompanied by a fundamental reorganization of the transport and land use structure, as a strongly radial transportation system which was focused on a single centre transformed into a complex multi-modal network supporting multiple centralities (Fig. 6.1).

Figure 6.1 here

Both path dependence and unpredictability characterized the changes sketched above. Spatial path dependence, the second defining feature of evolutionary change, was most evident in the failure of repeated attempts to carry out a radical transformation of the physical fabric of the historic city centre. In the end, only policies which refrained from such radical morphological alterations were implemented. This is epitomized by the failure of a far-reaching, top-down approach to the transformation of the historic city centre, and the shift to a much more cautious, bottom-up approach as described in Box 6.1.

Many, if not all, of the transitions cited above went largely unanticipated, as did significant policy impacts, thus illustrating the third feature of evolutionary change: unpredictability. For instance, policies originally meant to preserve the existing fabric and uses in the city centre also unintentionally boosted its eventual gentrification and the explosion of tourism and leisure activities there. New transport infrastructure meant to improve access to the city centre also proved pivotal for the development of new, competing centres on the urban fringe.

Box 6.1 here

6.6 The second principle: Policy implications of path dependency and unpredictability

How did spatial planning cope with these developments? In which sense can successful transport and land use policies be characterized as evolutionary? The focus will first be on the policy implications of path-dependence and then on those of unpredictability.

The policy implication of path-dependence is that successful policies need to find a fit with the unique set of opportunities and constraints for change determined by a specific historical development path and local combination of factors. The issue of path-dependence is a wide-ranging one, cutting across multiple aspects and different layers of economic, social and cultural trends. This paragraph will have to limit itself to no more than a reference to morphological aspects. The fact that successful policies (that is, policies that have achieved their declared goals) have found a fit with the existing urban morphology, rather than ignoring it, is taken as evidence of the acknowledgment of path dependence. The failure of attempts to radically transform the city centre and the success of more morphologically (but not necessarily economically or socially) conservative land use and transport policies there, are the clearest illustrations of this in Amsterdam (see Box 6.1).

The second policy implication of evolutionary change is that, due to unpredictability, spatial policies need to increase the resilience of the spatial system, that is its ability to *keep functioning* in the face of unexpected change. In Amsterdam, the shape of the infrastructure networks seems to have had this characteristic. The combination of motorway and railway radials and tangents shown in Figure 6.1 was able to support a wide variety of developments across the whole period. These importantly included both developments before and development after transition phases, thus developments that could not be anticipated when the infrastructure was conceived and laid down. Examples of these developments are the sharply shifting foci of economic and social activity from one to multiple centres (Figure 6.1); changes in the transport systems (as in the shift from a freight to a passenger function, and from just a national to also a local scale: see Bertolini, 2007); or radical policy shifts as the one described in Box 6.1.

The third and last policy implication is that, due to unpredictability, there is also a need to increase the adaptability of the system, that is its ability to *react* to unexpected change. The fact that policies that were not resilient in the sense discussed above needed to be adapted in order to succeed can be seen as illustration of this point. The most poignant example seems, once again, to be the radical change of course of transport and land use policies in the 1970s (see Box 6.1). Such policy adaptation has been an essential condition for the development of the new, quite successful policy mix that – at least as far as the historic city of Amsterdam is concerned – has been considered viable up to the present day (whether this will also hold for the future is, of course, a different matter).

6.7 The third principle: Identifying policies through experiment

The central contention made above is that a spatial system capable of supporting change is also one capable of continuing to function in the face of change. In other words it must be a resilient system. Secondly, a spatial system capable of supporting change must be able to adapt itself in response to changes in the socio-economic environment. In other words, it must also be an adaptable system. The above characterization of the Amsterdam case illustrates both some of the workings of resilience and adaptability, and context specific ways (that is, ways that take account of path-dependence) of achieving them. But how have the policies behind these results been identified? In this respect, the Amsterdam case seems to suggests that there are limits to a purely 'rational choice' (in the sense of Simon, 1957) approach to achieving resilience and adaptability. The present, resilient transport network morphology is, for instance, the result of a very long chain of decisions and actions, which sometimes contributed unconsciously or unwillingly to the final result, rather than being the product of one piece of long-range planning (details in Bertolini, 2007). Also the ultimately successful land use and mobility management policy transition described in Box 6.1 emerged after a protracted period of conflicts and contradictions, rather than through a rational process of goal and means selection, and many effects were not anticipated. In both cases there seems, however, to be more at play than just incremental mutual adjustments between competing views. The outcomes were far form being just a confirmation of the status quo and the then powerful interests. How can these processes be then interpreted?

A possible answer lies in the third core principle of evolutionary planning, the idea the 'policy experiments' are essential for the identification of adequate policies. A reference to Christensen's (1985) characterization of how to cope with uncertainty in planning can help articulate this idea further. According to Christensen planning problems can be characterized in terms of the uncertainty about goals and the means of achieving them (what she terms 'technology')[2]. If there is agreement on goals and the technology is known 'programming' can take place. If no agreement can be reached on goals, 'bargaining' needs to take place. If not enough is known about the technology, 'experiments' should be carried out. The existence of both disagreement about goals and uncertainty about technology results in 'chaos', and 'order' must somehow 'be discovered'. This last, 'chaotic' situation is particularly relevant here. Situations of this type seem by no means atypical in planning. They are, arguably, even characteristic. But what is exactly 'chaos'? And, more importantly, what does exactly mean 'discovering order'? Figure 6.3 sketches a possible, evolutionary interpretation.

Figure 6.2 here

In the figure, the bottom right quadrant – disagreement about goals and uncertainty about technology, or 'chaos' - of Christensen's typology is blown up. The starting point is the observation that even when there is no agreement on the goals, a distinction can be made between goals that are not agreed but that are consistent with different future technological contexts and goals that are not. For instance, a goal as 'accommodating the growth of the urban economy' might not be shared by all actors but will remain meaningful irrespective of how the technological context will develop. On the contrary, a goal as 'accommodating the growth of a specific economic sector in a specific location' is not only a goal that not everybody will share but is also much more dependent on a specific technological context (for example, a location which is central in a railway dominated transport system will not necessarily be so in a car dominated system). By analogy, even when nothing is known about the technology, a distinction can be made between a technology that only has the potential to serve limited goals (as for instance a transportation system connecting a limited number of places in a limited number of ways) and a technology that has the potential to serve more goals (as a transportation system connecting more places in more ways).

If goals are not agreed *and* only relevant in a limited range of future technological contexts, and technologies are unknown *and* can only serve limited goals *options should be kept open*, thus preserving the adaptability of the system. With reference to the

[2] In the following, and as in Christensen (1985), the term 'technology' will be used in the broad sense of a 'means to achieve goals'. In this respect a transportation system is a technology, as is a zoning regime, or a marketing campaign. Furthermore, the term is inclusive of the economic, social and cultural institutions that identify the context in which a technology is developed and applied.

illustrations above, an irreversible choice for ‘accommodating the growth of a specific economic sector in a specific location’ should not be made, acknowledging that other sectors and other locations could later emerge. The same would apply, on the technology side, to ‘a transportation system connecting a limited number of places in a limited number of ways’ (as apparently was in Amsterdam the system being first proposed in the ‘60s; see Box 6.1). By contrast, when goals are not agreed *but* are consistent with more technological contexts, and when technologies are unknown *but* can serve many goals they are, at least potentially, *robust* goals and technologies and should be further explored. With reference to the illustrations above, even if not everybody agrees, a goal as ‘accommodating the growth of the urban economy’ should be acknowledged, as it is likely to continue to play a role in whatever technological future. The same applies to the technology ‘a transportation system connecting more places in more ways’, because it is likely to be able to serve more goals (as in Amsterdam apparently was the case with the much more articulated system that emerged at the end of the policy transition described in Box 6.1). However, because of the limits to predictability, only real-life (and possibly simulated) bargaining and experimentation – or ‘policy experiments’ – will tell how relevant this potential robustness is. If it is, policies should be developed further to allow implementation, as they are likely to improve the resilience of the system. If it is not, options will have to be reopened. In the course of this continuous, negotiated and experimental process, the opportunities for and constraints on policy intervention set by local conditions (or path-dependence) can be also appreciated and policies can be modified to take account of them (as happened in the policy transition sketched in Box 6.1).

6.8 Evolutionary planning and complexity

The 'evolutionary interpretation of planning sketched above – which in the following I will call for simplicity ‘evolutionary planning’ - is neither the only nor the first to try and address the challenges of irreducible uncertainty. In order to identify what the possibilities for cross-fertilization or even integration between different interpretations and approaches, some of them are compared below. While the overview is not exhaustive, the planning interpretations and approaches discussed share a fundamental feature. They focus on ways to cope with *irreducible* uncertainty. In that, they are different from more traditional planning interpretations and approaches that rather focus on ways of *reducing* uncertainty, that is on finding a consensus on *one* view of the future. They include more operational methods as Adaptive Management and Adaptive Governance (AM: Holling, 1978; Walters, 1986; AG: Dietz et al., 2003), the Strategic Choice Approach (SCA: Friend and Hickling, 2005), and Robust Decision Making methods for long-term policy analysis (RDM: Lempert et al., 2003). They also include the more conceptual, emerging applications of complexity theory to planning discussed elsewhere in this book and in other contributions (CT: Teisman, 1992; Portugali, 1999; De Roo, 2003; Alfasi and Portugali, 2004; Teisman, 2005; see also Innes and Booher, 1999; Byrne, 2003)[3]. These will serve as terms of reference for the rest of the discussion.

[3] For more examples of, and an ongoing discussion of, applications of complexity theory to planning, readers are advised to visit the site of the thematic group ‘Planning and

The central challenge of planning in the face of irreducible uncertainty is to "acknowledge deep uncertainty *and simultaneously* provide operational policy recommendations" (Lempert et al. 2003, p. 19, emphasis added). 'Evolutionary planning' as conceptualized in this chapter seeks a solution in the identification of robust measures – to enhance the resilience of the system – and options which can and should be left open – to enhance the adaptability of the system. The focus on the identification of robust measures (and conversely, on options to leave open) is shared with the SCA and RDM. The SCA has a robustness index for the purpose, "a 'robust' action being seen as one which is preferable to others in that it leaves open a wider range of acceptable paths for the future" (Friend and Hickling 2005, p. 60). RDM are methods to "frame arguments about near-term policy actions that hold true for the full range of plausible futures and that are acknowledged as useful and valid by all concerned parties" (Lempert et al. 2003, p. 44). It connects this search for robust actions to the need of enhancing the 'adaptivity' of the system, that is, of "identifying, assessing, and choosing among near-term actions that shape options available to future generations" (Lempert et al. 2003, p. 59). The other interpretations, methods and approaches cited above are implicit rather than explicit about the relationship between the acknowledgement of irreducible uncertainty and the need to identify robust policy measures.

A second feature of evolutionary planning is that, in line with Christensen (1985), it distinguishes between uncertainty about goals and uncertainty about means. A similar distinction is also made in RDM, SCA, and AG. The aim of RDM is to "seek robust … strategies that perform "well enough" by meeting or exceeding selected criteria across a broad range of plausible features *and* alternative ways of ranking the desirability of alternative scenarios" (Lempert et al. 2003, p. 45, emphasis added). The SCA distinguishes between "uncertainty about guiding values" (analogous to uncertainty about goals) and "uncertainty about the working environment" (analogous to uncertainty about means)[4]. AG "involves making tough decisions under uncertainty, complexity, and substantial biophysical constraints *as well as* conflicting human values and interests" (Dietz et al. 2003, p. 3 of download version, emphasis added). This distinction is less explicit in the other interpretations, methods and approaches. However, it is analytically important as it highlights two distinct planning challenges. The first is how to reach agreements about goals and the other is how to reach agreement about how to achieve goals? Each challenge points to a different sort of planning action, namely 'bargaining' and 'experimenting' respectively. However at the same time, evolutionary planning – as RDM, the SCA, and AG - recognizes that the two types of challenges and actions cannot be separated in practice. This is why it focuses on situations where both apply (the 'chaotic' quadrant in Christensen's typology). The concept of 'policy experiment' has been introduced to try and capture this idea of bargaining while experimenting,

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Complexity' of the Association of European Schools of Planning (AESOP) at www.aesop-planning.com.

[4] The SCA also identifies a third type of uncertainty, namely "uncertainty about related decisions" which accounts for organizational and institutional aspects. This is a dimension of uncertainty also explicitly recognized by De Roo (2003) and Teisman (1992, 2005), and implicitly rather than explicitly addressed in this chapter.

experimenting while bargaining. In this double emphasis, evolutionary planning, RDM, the SCA, and AG are distinct from collaborative planning (Healey, 1997) and similar 'communicative' interpretations of land use planning, where the emphasis tends to be on coping with uncertainty about goals, or bargaining. They are also distinct from emerging transportation planning approaches such as transition management (Kemp and Rotmans, 2004), where the emphasis is rather on coping with uncertainty about means, or experimenting.

In more abstract terms, evolutionary planning recognizes the need to distinguish between, and link, what Mannheim (1940; 1949) would call substantive and functional rationality, and what Faludi (1973; 1984) would call theories in planning and theories of planning, or the questions of "what to plan" and "how to plan" (see also De Roo, 2003). The identification of the overarching goal of planning as that of enhancing the resilience and adaptability of its object is about substantive rationality ("what to plan"), and it is shared with AM and AG. The characterization of the planning process as a continuous search for robust measures and options that need to be left open is related to functional rationality ("how to plan"), and it is shared with the SCA and RDM. The importance of distinguishing between the substantial and functional dimensions of planning is that arguments about "what to plan" (what are robust interventions?) and "how to plan" (how to identify them?) can be assessed and developed according to their own merits and internal logic. The importance of linking them is that different types of knowledge and rationality, both substantive and functional, can thus be tapped into, can meaningfully interact, and can potentially reinforce each other.

Evolutionary planning is conceptual rather than operational, it is an interpretation rather than an approach, or method. It shares this feature with Complexity Theory applications and in this way it is different from operational methods as the SCA and RDM, while AM and AG occupy a middle ground. This offers both advantages and disadvantages. The obvious disadvantage is that it cannot be readily or directly applied. An advantage is that it can serve as an interpretative and assessment framework of more diffuse, less formalized planning processes. The above discussion of the Amsterdam case is one illustration. It is a relevant characteristic: a lot of planning cannot be clearly defined with recognizable content borders, a beginning and an end, and a finite number of actors, issues and arenas, as for instance implied by SCA and RDM.. This is an argument that is also made forcefully by CT thinkers (e.g. Teisman, 1992; Portugali, 1999; De Roo, 2003; Alfasi and Portugali, 2004; Teisman, 2005; see also Healey, 1997).

Evolutionary planning draws inspiration from the natural sciences. This is a final feature, and one shared with AM, AG, and CT applications. All these are based on concepts which have been originally developed in order to understand natural phenomena, and consider them potentially relevant for understanding of social phenomena. Importantly however, this belief is grounded in more than vague associations between natural and social phenomena. The point of departure is rather the observation that, at a meta-systemic level, there are fundamental parallels between natural and social systems in that both are characterized by many components and relationships which are at least partly indefinite and of which full knowledge can never be acquired. Because of this, both are only partially predictable and controllable (uncertainty is to a significant extent irreducible). Order emerges from within rather than being imposed from the outside. Some understanding of how this happens is an essential precondition if attempts at influencing development of the system (that is, planning) are to succeed.

6.9 Conclusion

Dealing with the irreducible uncertainty (and welcome openness!) of the future is an essential task of planning. Both disagreement about goals and lack of knowledge concerning the means need to be addressed at the same time, as disagreement and lack of knowledge are irreducible to a considerable extent. Classic planning methods and theories have not yet dealt adequately with this fact. A number of emerging planning interpretations, methods and approaches seem to be deliberately building on it instead. This chapter has outlined one such possible interpretation. The point of departure was the conceptualization of spatial systems as complex systems. Further inspiration was sought in evolutionary theories and methods, as originated in the biological sciences and introduced and further developed in the social sciences and most notably economics. Evolutionary theories and methods have not entered yet the realm of planning theory, at least not explicitly. The case for planning practice might be a different one, because if the argument of this chapter is accepted, it follows that successful plans must have already had, *de facto* if not literally, an evolutionary dimension. Establishing whether this is the case, that is further exploring and testing the principles advanced here against past experiences, is therefore an obvious line of research which could follow on from this discussion. A second direction of work, and one which is also a form of research, is to try and apply these insights to current planning issues. Doing so might allow some of the more operational methods discussed in the last section to be integrated in the interpretation.

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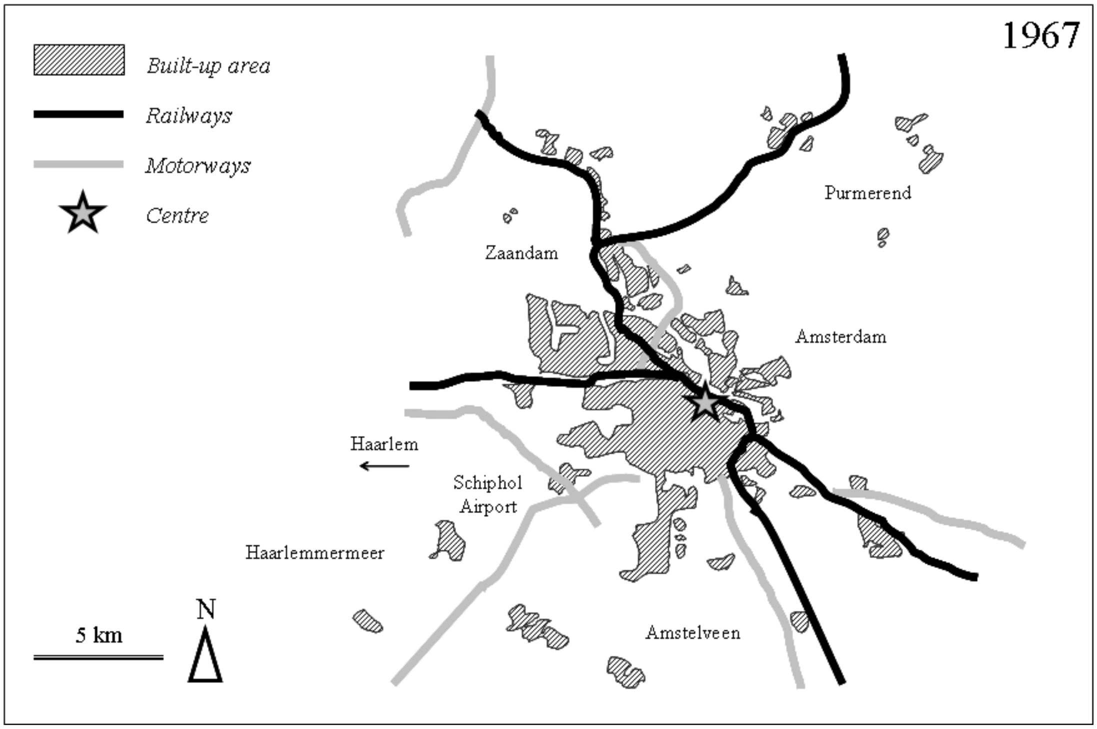
Figure 6.1 Changes in the built-up area and the infrastructure in the Amsterdam region, 1967-2001. *Source*: adapted from Jansen, 2003.



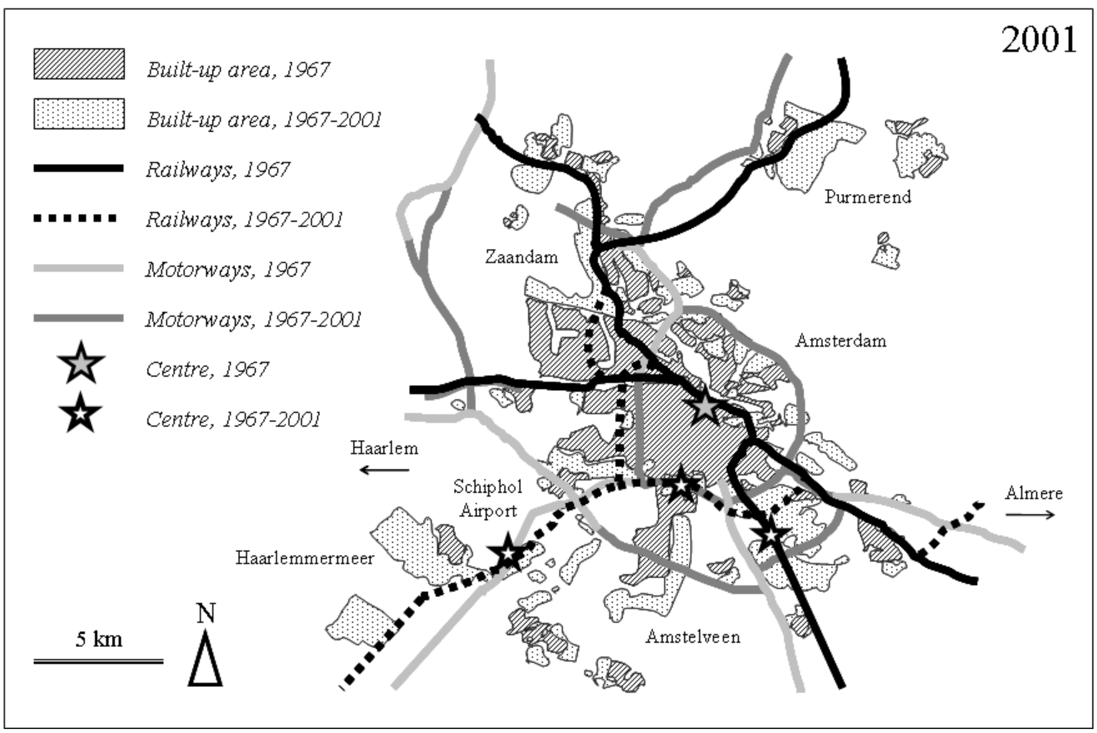
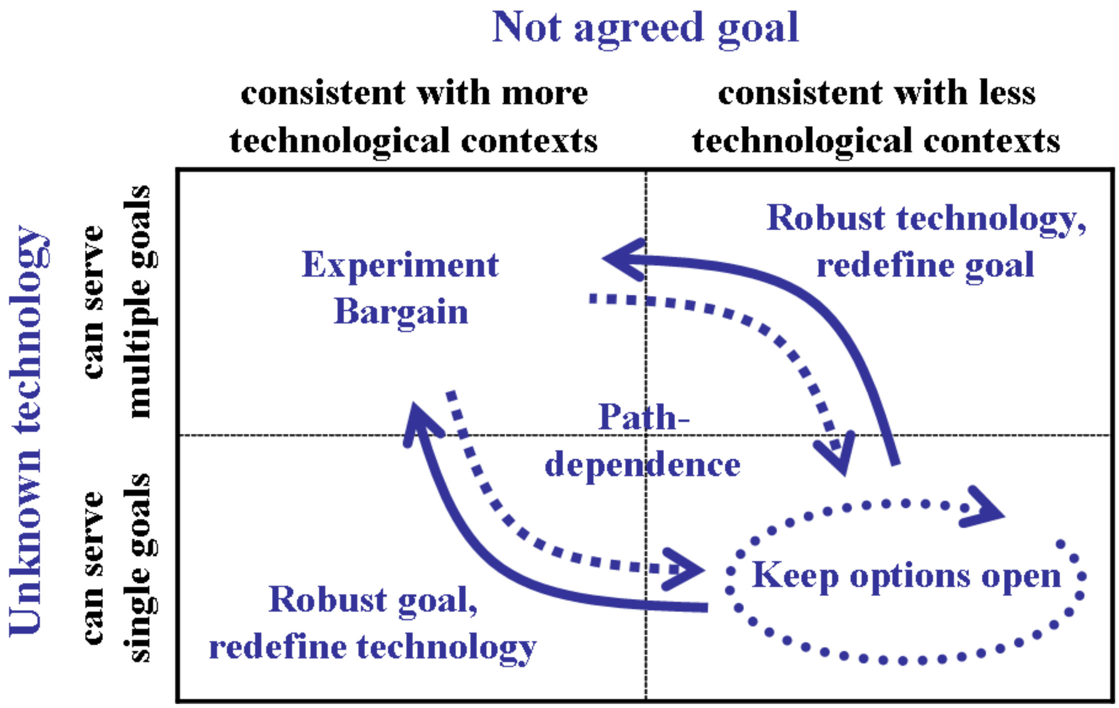


Figure 6.2 Coping with irreducible uncertainty in planning



Box 6.1 The late 1960s and early 1970s, a transport and land use policy transition dissected. *Sources*: Le Clercq, 2002; Dienst Ruimtelijke Ordening Amsterdam, 2003; Dijkstra et al., 1999; Honig, 1996; Poelstra, 2003.

In the 1960s far-reaching urban renewal and infrastructure plans for Amsterdam were proposed. Population growth was to be accommodated in new expansions on the urban periphery and in 'growth centres' in the region; service growth was to be concentrated in an enlarged and restructured city centre; and new road and underground railway infrastructure was to be developed to link the new concentrations of population, jobs and services. Both the city council and the city planners backed these plans, and implementation started. However, and unexpectedly, it was met with forceful public resistance, in particular to the envisaged radical transformation of the historic city. Years of political turmoil followed, until a new and fundamentally different policy course emerged. 'Urban renewal' was traded for 'building for the neighbourhood': incremental, housing-led adaptation of the historic city without displacement of the existing inhabitants. On the transport side, development of new, heavy infrastructure was traded for improvement of the existing tram system, introduction of more hierarchy in the existing road network, imposition of a restrictive parking policy, and creation of new cycling routes.