7

Swarm Planning: A New Design Paradigm Dealing with Long-Term Problems Associated with Turbulence

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Introduction

In this chapter I discuss the role of spatial design in The Netherlands in its struggle with the consequences of climate change as an example of coping with turbulence.

The world is facing substantial and uncertain climate changes. The processes that influence these changes are contextual, diffuse and can only be understood over the longer term. It is a typical example of what Emery and Trist (1965) have called turbulence (see Chapter 2 in this volume). Coping with turbulence asks for a new planning strategy to anticipate future developments, while at the same time retaining a flexible stance to cope with irreducible uncertainty.

The urge for a new planning paradigm is nothing new. Spatial design methods tend to respond to the changing requirements of society. The requirements of today involve an environment of increasing contextual complexity, in which it has become difficult to define the interventions needed to achieve goals. With the traditional and often single-discipline design methods available, we are unable to give sufficient answers to challenges of longer time frames and higher complexity associated with turbulence. Climate change is an example of this. This chapter discusses the question of how to define or invent a new design approach able to meet these current needs. I will illustrate conclusions reached by referring to a case study of tackling the issue in the province of Groningen, The Netherlands.

A short history of spatial design paradigms

The history of spatial planning in The Netherlands shows a clear sequence of views emerging in response to the needs of the times (Emden, 1985). Over time, planning paradigms change, steered by trends and developments in society. This section explores the connection between spatial design and the dynamics of the 'environment', following Emery and Trist's (1965) categorization of causal texture and the issues involved in predicting future connections. The different eras described here are placed in the Dutch context of design. They do not represent eras in other countries and/or other times. For instance, one can imagine that developments in France or North America show the same sequence, but are, due to specific local situations and history, placed in different timeframes. The different eras are distinguished by their varying textures. And these textures create different contexts for designers, who wish to adopt the appropriate design paradigms to deal with the different textures.

Placid, randomized planning: End of the 19th to the beginning of the 20th century

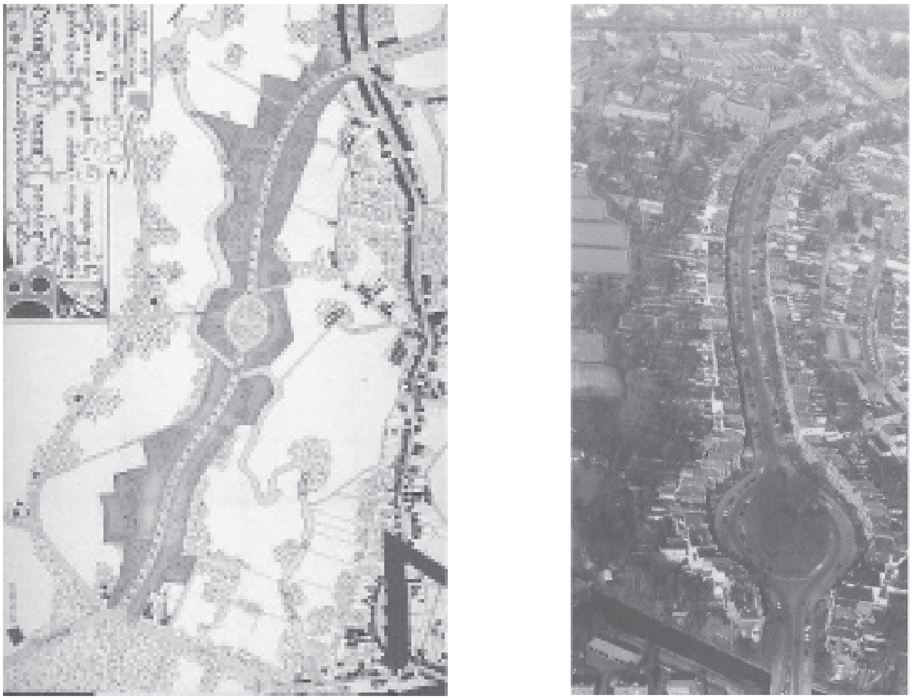
A placid, randomized environment is defined as follows (Emery and Trist, 1965): 'The simplest type of environmental texture is that in which goals and noxiants ("goods" and "bads") are relatively unchanging in themselves and randomly distributed' (see Chapter 2). At the end of the 19th century, spatial design tended to be a somewhat random affair, in which some centres of excellence could be distinguished, but where most of the time there was no design at all (Neuwirth, 2005). In order to tackle increasingly severe problems in cities (e.g. pollution and disease), the urge to make laws and regulations (1901 Housing Law; 1904 Education Law) increased. Society, on the whole, was prepared to accept that an elite made the decisions for the rest of the population.

By the end of the 19th century, modern comprehensive planning emerged for the first time in The Netherlands. Apart from comprehensive planning of trade and military cities such as Elburg (end 14th century) and Bourtange (late 16th century), centralized and comprehensive spatial design was uncommon.

The Baronielaan in Breda (see Figure 7.1) is an early example of modern comprehensive planning: the development of a whole street as one project (Duijghuisen, 1990; Sectie, 1997). The development of the Vondelpark in Amsterdam and its surroundings presents strong similarities with this development. During this period, the first urban designs for entire cities were initiated. The city of The Hague hired Berlage as its 'city architect'. He drew up a carefully designed urban pattern for the entire city. The design was equally and randomly spread over the area bounded by the city borders without specific clustering. It marks the end of an era and a transformation to the next phase in design.

Placid, clustered planning: 1920 to 1950

Chapter 2 gives the following definition of a placid, clustered environment (Emery and Trist, 1965): 'which can be characterized in terms of clustering: goals



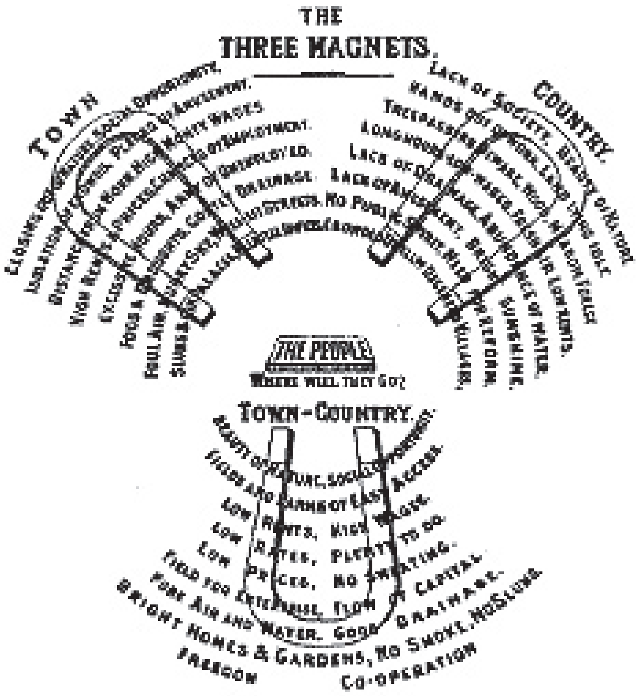
Source: Duijghuisen (1990)

Figure 7.1 Baronielaan, Breda, The Netherlands

and noxiants are not randomly distributed but hang together in certain ways'. This causal texture became relevant when planning and design started to gain importance. The Garden Cities Movement (Howard, 1902) initiated thinking about how and where people should live. Centrally planned villages were placed in concentrated, fully self-contained areas, where health and well-being played a major role (see Figure 7.2) in designs based on the best available techniques. The design principle adopted was to construct an end-state image of a harmonious and healthy society of the future. A placid causal texture ensured the best location for urban developments.

Disturbed–reactive planning: 1960 to 1970

A disturbed–reactive environment is defined as follows (Emery and Trist, 1965): 'it is an environment in which there is more than one organization of the same kind… The existence of a number of similar organizations now becomes the dominant characteristic.' At this stage of the history of spatial planning, an



Source: Howard (1902)

Figure 7.2 The three magnets: Ebenezer Howard's garden cities of tomorrow

increasing number of influential stakeholders (action groups, social housing corporations, etc.) comment critically on the centrally planned future. During the early stages of this period, a strong belief in technocratic end-state images of a wealthy future evolved in the form of high-rise building parks with separation of functions. The International Congress of Modern Architecture (CIAM) – an international city planners' movement, which dates back to the 1920s –became the leading voice in the world of urban designers and planners. Rebuilding Holland after World War II came to a climax in the development of the Bijlmer, an extension of Amsterdam, where extreme separation of functions is designed in (see Figure 7.3). But a new development saw people starting to react against these designs, which found less and less support in the community. In response to that, planners started to build scenarios to widen the bandwidth of future predictions. In the end, however, the planning system still comes up with a fixed design for

Source: R. Roggema

Figure 7.3 Bijlmer, Amsterdam

the future, not paying sufficient attention to future needs, aims and ambitions in society.

Turbulent planning: 1980 to 1990

A turbulent environment is defined as follows (Emery and Trist, 1965): 'The dynamic properties arise not simply from the interaction of the component organizations, but also from the ground itself. The "ground" is in motion.' During this period, everything was in a state of flux as a consequence of the democratization of the urban design process. Everyone with an interest, or even without, participated in deliberations about the future. Parties talked endlessly about details, down to the colour of the flowers in the nearest flowerpot. The aim of design was to shape an environment as close as possible to the wishes of the people. This led to what became known as the *Bloemkool* (cauliflower): neighbourhood designs with endlessly winding roads in which the streets are intended to be places in which to live and play instead of traffic conduits. This bottom-up process gives priority to making everyone happy over giving areas a distinct identity. Politics became a talking machine aimed at producing compromises. The design environment was characterized by a lot of uncertainty, based on contrasting opinions, which needed to be taken seriously, but could not always be united.

Vortical planning: 1990 to 2010

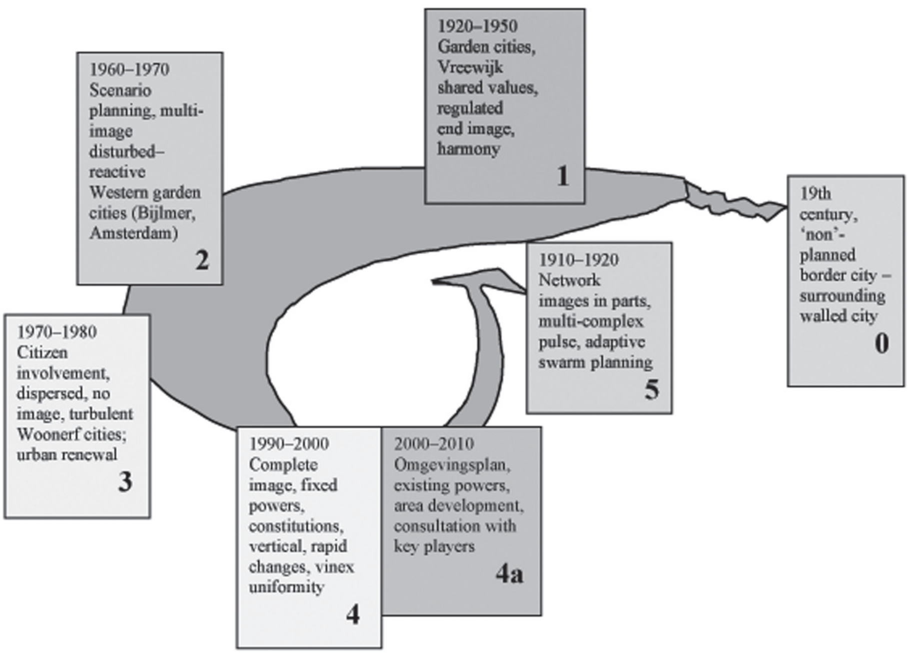
The vortical environment is defined as follows (Babüroğlu, 1988) 'the prevalence of stalemate, polarization and monothematic dogmatism … leads to a frozen or a clinched order of connectedness as well as that of unevenly dynamic turbulent conditions'. Nowadays, severe problems characterized by their unprecedented complex contextual nature, such as climate change, call for immediate action in order to solve problems occurring in the (far) future. However, existing political structures and decision-making systems find their origin in earlier, more placid, environments. The habit that systems have of reproducing themselves, the repetitive patterns of working methods, accepted political behaviour and power-based systems are ill prepared to respond to the needs of the new turbulent environment. It seems almost impossible to step out of this cluster of characteristics. It appears that everyone is sucked into a vortex of unwritten rules and role assumptions, unable to escape.

As predicted by Emery and Trist's (1965) causal texture theory, spatial planning in this period sees a more collaborative stance, agreements are made between developers, governments and other parties, and local governments start to work together – in content, process and realization – with key players, strategists or opinion leaders. The main concern is reaching a compromise about the content, responsibilities, investments and achievement of projects. These public–private partnerships give rise to what becomes known as 'area-oriented planning'. In this activity, certain unwritten values and rules guide the participants. The underlying agreement, which fixes the existing power balances, leads to repetitive processes, similar solutions and non-transparent decision-making. Participants are sucked into this vortex. This has serious consequences:

- Action is often taken too late due to slow decision-making. Therefore, anticipating expected situations is difficult (see Chapter 8 in this volume for a similar situation in southern Sweden).
- Existing and well-known political systems are the standard. People know how these systems work, so they continue to use them. These systems inevitably produce average solutions and proposals.
- People inside this arena become immune to signals from outside. The average opinion, resulting from trying to find compromises, tends to crowd out innovative and original solutions.
- These systems tend to reproduce themselves and become even stronger when threatened by external threats – for instance, climate change.

This way of solving problems, focused on reaching agreements, precludes tackling major problems and loses sight of the complete picture. As a result, the system becomes reactive instead of anticipatory or adaptive. And, even worse, because the whole picture is too complex for individual people to overview, they focus on only a segment of information as the basis for their decisions: the start of new problems (see Chapter 5 in this volume on how these tipping points come about).

At the same time, the new intractable and interconnected problems that the world faces have a long time horizon. Emery and Trist (1965) suggest that they are the result of a new set of indirect and unpredictable interactions in the contextual environment. The traditional set of political constellations does not have the power or the insight to anticipate the coming complex difficulties related to this. Consequently, attention tends to concentrate on single issues, such as income politics or specific conflicts and wars. As a result, taking the right measures now to adapt to the new issues such as climate change in the future is difficult. A new paradigm will, and has to, emerge in which the fixed constellations are broken. In this paradigm, a collaborative approach cannot be the whole story. Design within a vortical texture is also topical: coming up with the right impulse at the right moment (again, see Chapter 5).



Source: Roggema (2005b)

Figure 7.4 The spiral of planning

The 'spiral of planning' (see Figure 7.4) shows a clear parallel between the findings of Emery and Trist (1965) and the developments in society and spatial design. In response to the contextually complex problems that the world is facing, requiring focus on future actions, a new design paradigm – adapting to current developments in society – is likely to emerge. Extrapolation of the spiral into the future will give an insight into the characteristics of this future design paradigm. The traditional paradigm with its centrally controlled and fixed picture of the future will be left behind and will be replaced with one that contains more room for specific area-oriented developments, where the influence of people is able to give rise to a more flexible paradigm. The future complexity of society and its problems requires a planning paradigm of a higher order in which a spatial intervention is able to change the entire regional spatial system, which we have called the swarm paradigm (Jacobs and Roggema, 2005). Before we discuss this in more detail, we consider recent developments in spatial design methods in the Dutch province of Groningen, providing us with a real-world background against which the swarm paradigm may be explained and understood.

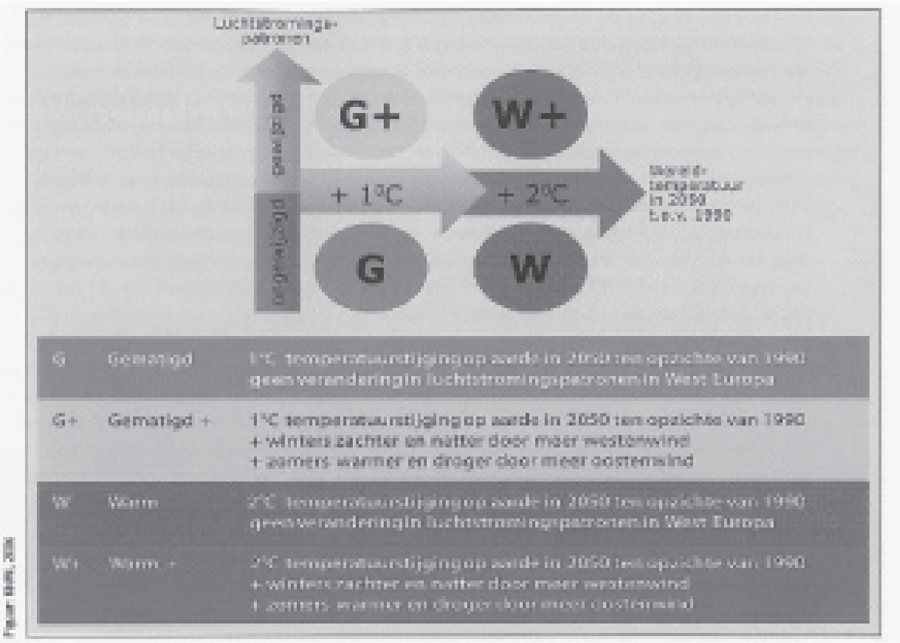
Climate Change scenarios: The Groningen case study

We now have a number of different types of climate change scenarios available to examine. On the one hand, scientific scenarios aim to predict the future within certain boundaries, and, on the other hand, more qualitative climate change scenarios are intended as a basis for policies and decisions on spatial measures. The Groningen example will illustrate how the latter can be used.

Scientific scenarios: KNMI

The Intergovernmental Panel on Climate Change (IPCC) collects recent scientific data every five to ten years and publishes it in a periodic assessment. The Fourth Assessment (IPCC, 2007) was finalized in 2007. The Netherlands are represented in the IPCC by the Royal Dutch Meteorological Institute (KNMI) and the Dutch Environment Assessment Agency (MNP). The IPCC scenarios are translated for The Netherlands by the KNMI into four climate scenarios for the year 2050 (KNMI, 2006). The scenarios – moderate, changed moderate, warm and changed warm – describe the changes in temperature (1°C to 2°C) and the possible fluctuations in air patterns, which might lead to wetter winter periods and dryer summer periods (see Figure 7.5). Corresponding with these scenarios are significant changes in sea level (between 15cm and 35cm 2050) (Dorland et al, 2006).

On the other hand, the future may be rather different. David Carlson, scientific director of the International Polar Year (IPY), considers such a different future plausible. In an interview with a national newspaper (Carlson, 2006) he



Source: KNMI (2006)

Figure 7.5 Four climate scenarios for The Netherlands

states that it might be possible that the upcoming century will see the sea level rise by 10m, caused by an accelerated melting of glaciers at Greenland and Western Antarctica.

Robustness scenarios: Groningen

To discuss future trends affecting the province of Groningen, climate change scenarios are used in a different way, focusing on the definition of an integrated spatial policy.

Starting point: Two scenarios

To start with, the KNMI scenarios were combined into one warm scenario with changed air patterns. A second scenario is based on the accelerated melting of the land ice in Greenland and Antarctica (Roggema, 2007). This scenario is found to be less realistic by the IPCC; but polar research scientists (Carlson 2006; Hacquebord, 2007) consider the latter scenario closer to reality than the KNMI scenarios. Both scenarios are defined for 2050. Table 7.1 summarizes the key indicators.

Table 7.1 *Scenarios for 2050*

	Royal Dutch Meteorological Institute (KNMI) scenario	Accelerated melting land ice scenario
Precipitation: spring and autumn	+20%	+30%
Precipitation: summer	–20%	–40%
Precipitation: winter	+15%	+30%
Temperature	+1.5˚C	+3.0˚C
Sea-level rise	+35cm	+150cm

Source: Roggema (2007)

Implications for Groningen

Climate change has been, until now, researched at the global and national level. At the regional scale, uncertainties are huge and research is just being started. For the province of Groningen, three key factors, crucial for spatial functions, are researched: precipitation, temperature and sea-level rise.

The summer will become much dryer. Peat habitats, in particular, will have to face water shortages. During these dry periods, it will be necessary to supply water to dried-out areas. Higher temperatures and an increase in evaporation will drive up water demand in summer even further. On the other hand, occasional rains will be much heavier. In autumn and spring, precipitation will increase. In the northern parts of the province, in and around the city of Groningen and in other urban areas, this will cause urban floods. The surplus of rainwater may be discharged towards storage areas. This requires space.

An important question will be whether agriculture and nature can withstand the dry summer period. Will potato production be able to reach the necessary level to supply the local starch industry, which is prominent in the area? The absence of water is a main factor; but the lengthening of the growing season – due to early higher temperatures – needs to be taken into account. Will nature be able to overcome the dry summer? The wet to dry gradients will especially create vulnerability at the edges of brooks and small and isolated ecological reserves. Rising temperatures, however, will offer opportunities for leisure and tourism.

The sea level is rising in both scenarios, and the extent to which this occurs will depend upon the speed of the melting processes of land ice. Potential impact upon the landscape if the sea enters the land undisturbed is shown in Figure 7.6.

In reality, the landscape contains several obstacles (e.g. roads and small dikes), which will reduce flooding of the land. On the other hand, the impact maps of Figure 7.6 do not take into account the circumstances under which a breech of the water defences would normally take place – combining spring tide with heavy rain and wind. In the highest parts of the province, the risk of flooding is minimal.

Source: Roggema (2007)

Figure 7.6 Potential impact of sea-level rise on the landscape in Groningen (left: 35cm; right: 155cm)

Only if sea level rises more than 3m will these areas be in danger. The northern parts of the province can withstand sea level rises of 1.5m. The industrial areas of Eemshaven and Delfzijl are (even in the more extreme scenarios) relatively safe due to their (artificial) higher altitudes. The lower and wetter parts of the province show a spatial connection between Lauwers Lake and Dollard. This connection might be crucial for ecological zoning because nature has the best chance to survive in these robust and wet areas.

Another effect of sea-level rise could be the disappearance of parts of the Wadden Sea sandbanks to the north. Rapid sea-level rise leads to the inability of the sedimentation process to supply sandbanks, which quickly become submerged (Stive, 2004). It is estimated that 40 per cent of sandbanks could disappear 40 years from now.

Idea map of climate-adapted Groningen

Climate analysis leads to an idea map of a more adaptive Groningen. In Figure 7.7, the adaptation is spatially translated (Roggema, 2007). The map is a spatial image of climate design principles. The realization of functions that are valuable to the economy, such as housing industry and infrastructure, at the safest locations (i.e. higher altitudes) is an important underlying principle. If housing or other functions are to be located in lower areas, the newest innovative techniques (floodable houses, floating houses, new artificial hills, or *wierden*, or living on super dikes) will have to be used. On the other hand, the province will profit from warmer and dry summers by creating housing and recreation near nature reserves, on islands and along the coast. To cope with increased rainfall during autumn

Source: Roggema (2007)

Figure 7.7 Idea map of climate-adapted Groningen, The Netherlands

and spring, water storage needs to be organized. A system that provides nature and agriculture with water during the dry summer will have to be implemented. Finally, space is required for various other functions, such as aquaculture along the saltier coast, inundation and robust ecological zones.

In autumn, winter and spring, existing beaches will discharge the surplus of rainwater into the storage reservoirs in the central lower area. Here, a robust

Source: Roggema et al (2006)

Figure 7.8 New Wadden islands in front of the northern coast

ecological network offers space for species that are pushed away from other climate zones in order to survive. The reservoirs provide agriculture with enough water in summer, making use of the existing canal system.

The coastal zone will become saltier, which makes this area suitable for aquaculture. Near Lauwers Lake, Dollard and around Delfzijl, space is created where seawater is allowed to inundate and can be periodically stored. A brackish environment emerges.

Accelerating sea-level rise places the ecosystem of the Wadden Sea at risk. To prevent the natural environment from disappearing, an offensive coastal defence system is introduced. As part of this future, new islands are created in the North Sea (Alders, 2006; Roggema et al, 2006a) to protect the hinterland against heavier storms and to allow the landscape to develop by downgrading the intensity of the waves. At the same time, the islands offer an excellent opportunity to achieve luxurious living space in recreational and tourist areas. The new islands will create a lagoon, where sand easily moves through a sedimentation process and the existing sandbanks are able to catch up with the speed of sea-level rise. The sandbanks will continue to fall dry and the Wadden Sea will retain its semi-natural environment.

The introduction of new islands is an example of the new planning paradigm. It is an answer to long-term and complex problems. The islands function as an intervention that might change the whole ecosystem of the coast and the sea, affecting life in water and on land, as it makes use of the natural processes of water, wind and sea.

This is an example of swarm planning, a new paradigm that differs fundamentally from the current paradigm, in which solutions are one dimensional, such as the heightening of dikes.

Swarm planning

Developments in society

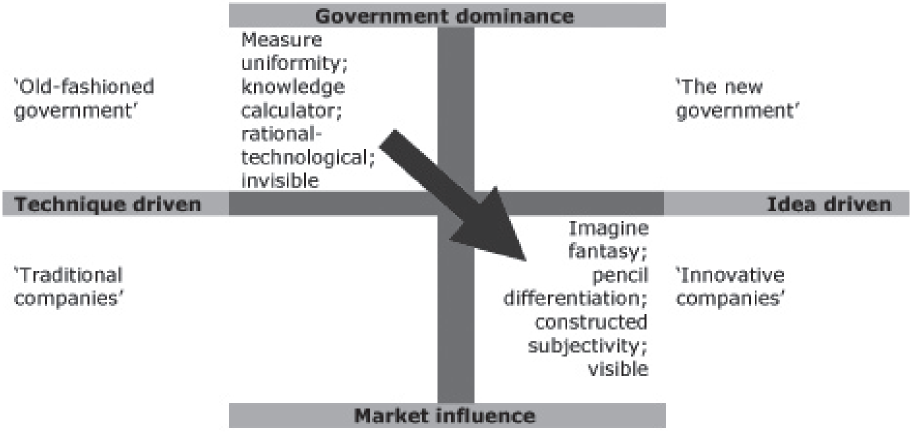
Today a broad range of information is continuously available to everyone. An increasing number of interactions is possible and continuously occurs. These interactions determine the direction that society is taking, although it is difficult to predict how things will evolve. Issues such as climate change, which will have a major impact upon people's lives, are an illustration of how an increasing series of complex interactions, which influence each other, lead to high-impact problems: floods, drought, bushfires, deserts, melting permafrost, etc. The exact relation and effects of these interactions cannot be assessed by any single individual. People are gradually beginning to understand how a single intervention can affect the entire system, requiring multilayered thinking.

Design approach

A combination of continuous and ongoing interactions, multilayered thinking and knowledge of invisible connections will be required to deal with climate change because the indirect consequences of any intervention need to be foreseen such that the total system is able to adapt in time. The creation of new islands exemplifies this: they change the existing system, creating emerging circumstances for spectacular living, high-quality nature and coastal protection. By influencing a crucial part in the system at a carefully selected high-leverage point, the entire area changes and future effects of climate change can benefit spatial quality. Extraordinary creativity of a specialist nature (Ridderstråle and Nordström, 2004) is required to find these crucial interventions. These bright and above average ideas will be able to help us change the way in which we live in order to adapt to climate change. If we do not anticipate long-term developments and stick to the way we usually act, finding compromises and devising substandard solutions, unsolvable problems will appear.

Innovation shift

Because society evolves, it is reasonable to assume that the planning paradigm will adjust as well. The shift that is taking place can be described as an innovation



Source: Roggema (2005b)

Figure 7.9 Innovation shift

shift (see Figure 7.9). A government with strong established procedures and rules will become inert. In these circumstances, it is hardly possible for creativity and new solutions to emerge. We need to consider what can be done technologically as traditional solutions reach their limits. An innovation shift (Roggema, 2005b) brings a new arena, where exceptional talents and imaginary creativity are the main values. The role of the government is still important but has lessened – essentially in order to stimulate the emergence of ideas and to guide a network-based organization in which the idea-creating processes are embedded. Small innovative companies – able to operate flexibly, and reacting directly to fuzzy questions while distinguishing themselves with brilliant skills in solving such problems creatively – will become crucial for progress (Florida, 2005).

Swarm planning

In order to prepare society, with its endless interactions, for the future, it is necessary to bring the regional spatial design system to a higher level of complexity so that it is able to adapt better to future and unforeseen changes. In the long term, a region of higher complexity is better capable of adjusting itself to new circumstances than an inert one. In order to reach this higher level of complexity, new crucial interventions must be discovered that can change the entire regional spatial system and make it more robust. A new design paradigm, which focuses on these interventions, is therefore required. This new design paradigm can be called swarm planning (an analogy of a swarm of birds).

A swarm is transforming constantly, influenced by external impulses and directed by only a few, very simple, rules. The swarm is changing its pattern suddenly by apparent impulse: it alters its form and direction. The question is which interventions bring the swarm to a higher lever of complexity, which can be characterized as above average and which as 'multilayered thinking'. In order to consider this it is helpful to look at complex systems, especially those that are 'close to chaos' (see Chapter 5 in this volume).

Typology of complex systems

Which kind of systems are the 'playground' for new ideas on the edge between chaos and effective interventions? Systems in general can be subdivided into four categories (Wolfram, 2002):

1 closed system;
2 linear feedback systems;
3 systems randomly open to assimilation; and
4 non-linear adaptive systems.

De Roo (2006) describes class IV systems as able to behave in order to maximize benefits of stability while retaining a capacity to change (Mitchell Waldrop, 1994). The question is how to interpret design projects in terms of complex systems. De Roo (2006) suggests that the following aspects are relevant to create class IV systems:

- They contain a large number of interactions.
- Simple rules underpin complexity.
- Adaptation, self-organization and co-evolution are apparent.
- The design transforms and retains the project.
- Design principles are characterized by robustness, emergence and fitness for purpose.

In addition, experience shows that the subject of design is often sensitive to impulses and tipping points.

The question at this stage is which planning approaches would be most effective if the future consists of class IV system behaviour manifest in a large number of interactions. The insights of organization dynamics can be useful here. Homan (2005) suggests that improving the overall fitness of an organization requires the following conditions:

- Large groups of individual elements lead to the emergence of collective patterns under certain conditions (e.g. the amount of connections, quality of relations and network).

- There is enough diversity, but not too much to start autocatalytic processes.
- Idea interaction (Homan calls it idea sex) between different elements may lead to creative jumps where new structures and information are created.
- Co-evolution of local systems leads to the emergence of collective patterns, enhancing the overall fitness of the system.
- Complex systems manifest several co-existing patterns (patches), rather than one overall pattern or a large variety of local systems.
- Local ideas function as nuclei, eventually influencing and patronizing large parts of a complex system.

The common characteristic in the conditions described are large numbers and many interactions. There needs to be a substantial pool of elements. The chance that elements will interact is then more probable and new processes emerge increasing the overall fitness of the system.

What is missing so far is a trigger setting these processes in motion, such as a focal point that enforces the pool of interactive elements and starting the process of changing the system. These points, where 'dovecotes flutter', ultimately make things happen. Every element in the system orientates itself to these points, and by doing so the system as a whole changes. The result is an innovation coming out of a bunch of ideas. An impulse needs to be added in order to reach a tipping point.

Tipping points

The tipping point is that magic moment when an idea, trend or social behaviour crosses a threshold, tips and spreads like wildfire. The possibility of sudden change is at the centre of the idea of the tipping point. Big changes occur as a result of small events. The situation is similar to the phenomenon of an epidemic.

Epidemics follow three rules (Gladwell, 2000):

1. the law of the few: a small part of the whole does all the work (80/20);
2. the stickiness factor: the message makes an impact – it is impossible to forget;
3. the power of context: sensitivity to the environment; influence of the surroundings.

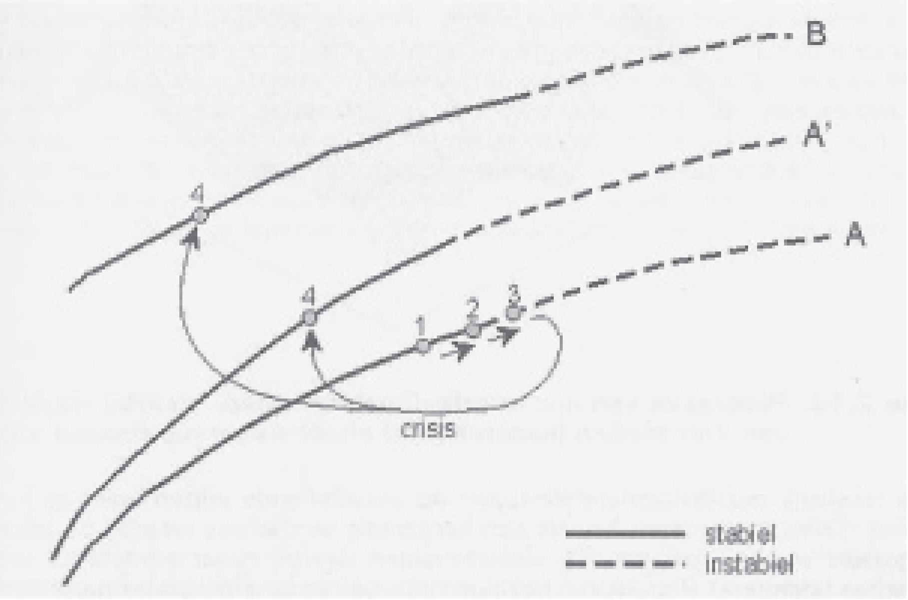
By applying these rules to planning and design, the question of when a design becomes a success, reinforcing the required changes, can be understood. First of all, the law of the few tells us that a successful design will originate from a small group of individuals. The design is not what the majority expects. In order to change things, the design will be above average (Ridderstråle and Nordström, 2004; Roggema, 2005b).

Second, the stickiness factor suggests that a successful design sticks in one's head. Once having seen the image of the design, it is not forgotten. Roberts (2005) calls it a visible love mark. A good example of this is the design for the wall in Almere Poort (see Figure 7.10) (MVRDV et al, 2001).

Finally, the power of context in relation to design processes tells us that a design with high impact provides the solution to a commonly felt problem. If a fundamental change is required, such as climate change necessitates, a widely shared context of deep trouble improves the chances of change. A sense of real urgency is required for fundamental change, and a crisis will provide the energy to jump to the new situation (Timmermans, 2004). If the existing system is inadequate, a crisis is required to jump to the next level of complexity required to upgrade the system (see Figure 7.11) (Geldof 2002). These crises can be seen as the tipping points in design processes.

Source: MVRDV et al (2001)

Figure 7.10 The wall in Almere Poort, The Netherlands



Source: Geldof (2002)

Figure 7.11 Crisis enforces the jump to a higher level

A new design paradigm

Translated in planning design terms, the effective spatial intervention creates a tipping point, orientating all spatial, societal and political elements in such a way that the entire region changes. Contemporary planning approaches do not provide this and, therefore, in the light of the problems posed by climate change, a new way of design is required. As we suggested earlier, the new spatial design paradigm is called swarm planning (Roggema, 2005b). In this paradigm, the role of spatial design is seen as introducing essential impulses to influence the whole system, like a swarm of birds reshapes itself constantly under external influences. Spatial design will no longer be concerned with the whole picture, but will focus on those essential design interventions that enforce the region to reshape itself. The metaphor is not any longer the blueprint, but acupuncture.

Thus, for a swarm planning approach (Roggema et al, 2006) to be successful, two aspects are essential: the (spatial) characteristics of the region and the availability of extraordinary ideas. Complex systems theory suggests that the swarm paradigm will work where the following conditions are met:

- a large group of individual elements (people, buildings);
- many connections (virtual, roads, rail, water);

- high-quality relations (fast, intense);
- high-quality network (flexibility, intensity);
- enough, but not too much, diversity (neighbourhoods, groups);
- several co-existing patterns (patches).

If these circumstances entail idea mergers between different elements, this will lead to creative jumps, and new structures and information will evolve. A small group of extravagant and creative people will enforce this and transform it into a catchy idea, which influences and shapes large parts of the region. If a sense of urgency exists (e.g. regarding climate change), a suitable trigger brings the idea to a tipping point and collective patterns emerge out of the co-evolution of local systems, leading to an increased overall fitness of the system, which is able to adapt more easily to the new world of climate change.

This paradigm is not yet common; but the first examples in spatial design are there. The way in which interventions are planned in the 'Blauwe Stad' in the remote parts of Groningen Province (van der Meer, 2003), the projection of new islands along the northern coast of The Netherlands, the impact that the Öresund Bridge has on accessibility, economic welfare and images of Malmö and Copenhagen, or the way in which Mendini (Poletti, 1994) changed the entire inner city in Groningen through the Groninger Museum project are early examples of swarm planning.

'Blauwe Stad'

The eastern part of the province of Groningen has traditionally been the poorest region in The Netherlands, with pervasive high unemployment, low levels of education and poverty. People, who could, left the area. This provides a good example of swarm planning. In this case, the swarm consists of the people living in the area. They were dissatisfied with their situation – or, in swarm language, with the shape of their swarm. It was commonly felt that something needed to be changed. This change was created through an impulse provided by one deputy of the regional government. The project concerned establishing a completely new village –Blauwe Stad – around a new lake, which had been shown to attract well-educated and wealthy people from outside the area. The project acts as an impulse as the new village makes itself felt across the entire area, with new amenities, restructured villages and new transportation developing around the Blauwe Stad.

The Groninger Museum

The 'Verbindingskanaal' is a waterway at the edge of the city centre of Groningen, located between the central station and the inner city. The fastest way to reach

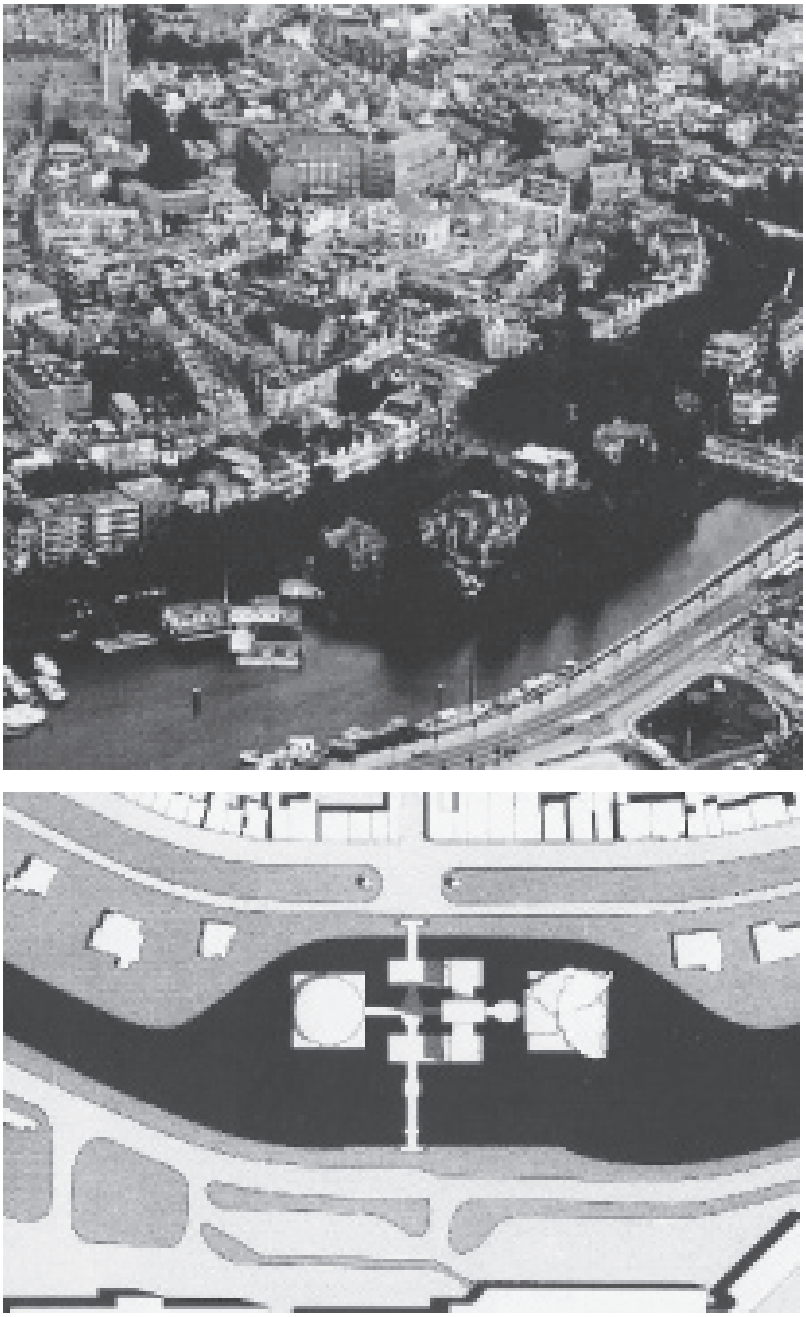
Source: R. Roggema

Figure 7.12 The village of Blauwe Stad established in the landscape of eastern Groningen, The Netherlands

the inner city was traditionally to go around the canal. As a result, the area at the city side of the Verbindingskanaal became neglected, attracting hooligans and criminals. In this case, the swarm consists of the buildings, functions and routes in this part of the inner city. Most of the elements in the area were neglected, malfunctioning and of low quality. The shape of the swarm dissatisfied large groups of people, users, policy-makers and politicians. Once again, one deputy of the municipality provided the important impulse. He enforced the building of the museum right in the middle of the Verbindingskanaal. A new and much shorter connection was introduced between the station and the inner city. Many people began to use this connection and in few years' time the neglected area was transformed into a very popular neighbourhood, where lots of high-quality shops emerged. In this way, the museum transformed the entire inner city.

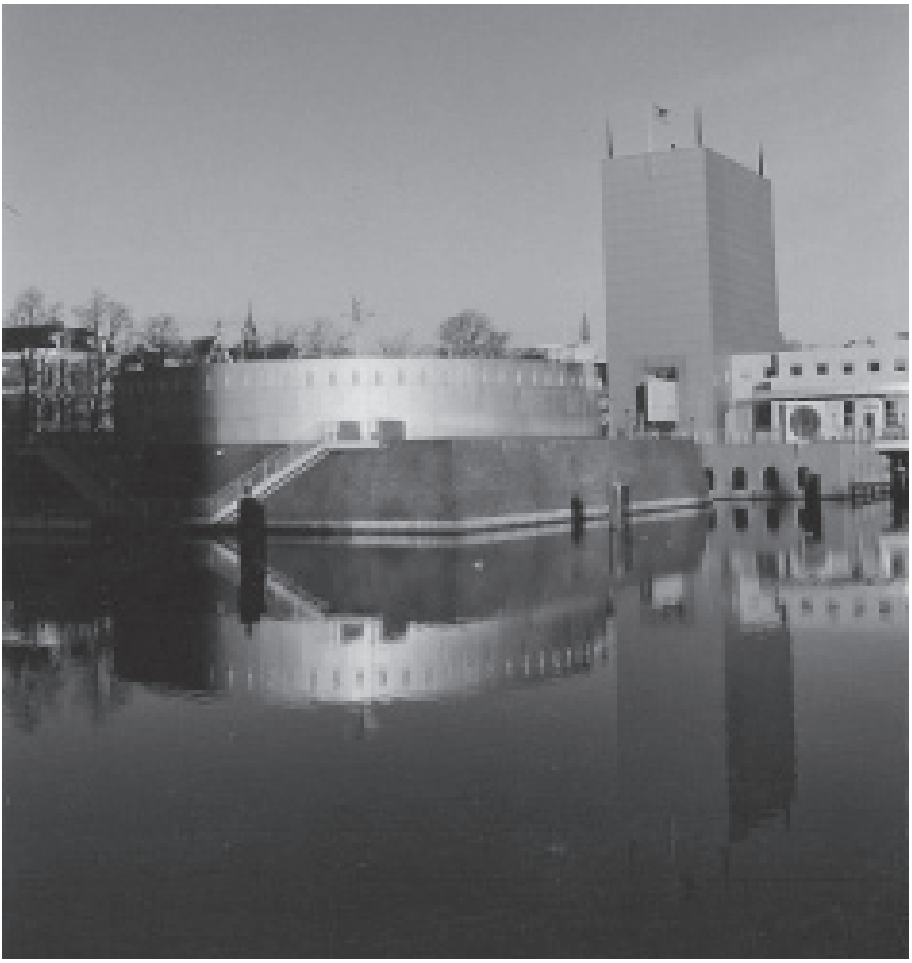
The solar polder

The Dutch supply of natural gas is produced in Groningen Province. The gas network and knowledge about gas in Groningen is exceptional. Even so, by 2040, most gas reserves will be depleted. In this case, the swarm consists of the current energy constellation – energy companies, existing network and market policies – which does not want to change its way of acting. This network is strong and tends to be repetitive in its behaviour. This will eventually be problematic as fossil fuel reserves diminish. In order to prevent the province from becoming dependent



Source: Poletti (1994)

Figure 7.13 The Groninger Museum positioned in the Verbindingskanaalzone: Before (left) and after (right)



Source: R. Roggema

Figure 7.14 The Groninger Museum in the Verbindingskanaal

upon the import of energy, plans have been developed to create a so-called 500ha 'solar polder' in the eastern part of Groningen – once again, an initiative of one deputy of the regional authority. By making use of current knowledge and the existing gas network, this will enable energy to be supplied to most people and industries within the province. The introduction of solar energy will change the entire energy supply. First, it will cut through the existing industry structure of gas and oil companies, without changing the distribution network. Second, it will attract specialized research companies to the province. The introduction of the solar polder will stimulate the technological development of solar power, resulting in a decisive advance compared to other sources. Once the tipping point has been reached, solar power may well become the most important energy source in the future, at least in this part of the world.

Steer the swarm

Because of the inability of traditional spatial planning to create and reinforce effective interventions that are capable of changing the regional system, a new steering principle needs to be developed. This issue is explored in some depth in the environmental spatial plan of Groningen Province (Roggema and Huyink, 2007), leading to the decision to develop a range of approaches in order to influence the spatial system. In doing so, it is hoped that the best regime with the most satisfactory outcome will emerge. The aim is to end up with a regime that is able to change the direction of the 'swarm' towards a high standard of spatial

Source: Roggema and Huyink (2007)

Figure 7.15 The Dutch painter Mondrian, combining regimes and identities quality. The most appropriate approaches may differ from area to area, depending upon their identity, and the availability of a number of approaches to choose from in combination with the unique characteristics of the area will make it possible to help the area adapt to uncertain future developments, such as climate change, as illustrated colourfully by the well-known Dutch painter Mondrian.

Conclusion: The benefits of swarm planning

The world has firmly entered the era of global turbulence. This has serious consequences for how people and organizations need to conduct their affairs. Countries and regions must expect significant and unforeseen structural change in the future. In order to cope with this, they need to develop a degree of adaptability that is of a different order of magnitude than is manifest today. This is particularly true for spatial design, which anticipates the uncertainties of the (far) future.

Over time, designers have shown themselves able to change their paradigm in response to the needs of the moment. Such a change is necessary today. Swarm planning will be able to help regions in this task. The application of swarm planning in Groningen, The Netherlands, has shown how it is capable of making vulnerable regions more robust and flexible, allowing them to manage turbulent and unexpected changes in a spatial manner as energy and climate change.

Swarm planning rises above the spatial design idea of prescribing, in detail, what should be done every inch of the area. Instead, it provides an opportunity for finding those special interventions that change the region and creates space for surprises to be dealt with in time. This allows designers to continue connecting with the profoundest desires of citizens: the search for beauty, safety, comfort and the absence of worry about their children's future (Roggema, 2005a).

I have found it interesting to compare the idea of adaptability through swarm planning with Emery and Trist's (1965) ideas of coping with turbulence. They emphasize the need for common values and collaboration in order to build institutions that cope with the new uncertain environment. Yet, experience in spatial design has shown that common values and collaboration cannot provide the full answer. The lesson of swarm planning is that there is a crucial role to be played by invention, creativity and original ideas, which require the active contribution of single individuals and/or small groups with divergent, even maverick, views at the right place and at the right time. As demonstrated in this chapter, the most spectacular examples of spatial planning in coping with new and unanticipated change all arise as a result of the initiatives of single individuals who did not subscribe to the common view.

I see a strong analogy with Prigogine's idea of 'dissipative structures' (see Chapter 5 in this volume). At the point of bifurcation where structure is created, one single small fluctuation causes the whole field to transform in one direction or another. Swarms act in a similar way. At the point where things really matter – at the point of bifurcation – the future is made by individuals, not collaborators.

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