Explaining controversies over map visualizations in Impact Assessment

Linda Carton[a], Bert Enserink[a]
[a] Faculty Technology, Policy and Management
TU Delft, Netherlands

Abstract:

Spatial maps are among the most frequently used models in EIAs. However, there has been little research in the field of impact assessment on the use of this type of information.

Maps are powerful tools for communication, but the message they convey is hard to control; well-presented data are misread, misinterpreted or even strategically manipulated by the users. Professionals are often being unpleasantly surprised with the unintended reactions and follow up actions with 'their maps'. In this paper we address the question what causes the unforeseen controversies with maps.

We have analyzed the use of maps in several cases in the Netherlands. The case studies show many occurrences of strategic behavior and at times counter-effective map use. Apparently, maps serve different purposes simultaneously. Actions with maps vary, as actors have different individual goals and each actor interacts from his 'bounded rationality'. Different approaches with maps have been distinguished in the case studies:

- *An analytic approach, that primarily perceives maps as a scientific model. This approach is dominant within contexts where GIS is being used*
- *A 'creative' or design approach, where maps are conceived as 'art of thinking', as graphic language, especially among landscape designers and urban planners*
- *A negotiation approach, where maps are viewed as metaphors and as political consolidations.*

These approaches lead to a different 'framing of the problem', with different impacts on the discourse. During the process, maps gain importance as they state the gravity of the impairment and also demarcate the affected from the unaffected. These mechanisms will be explained and compared in practical examples. The paper ends with recommendations for different and mixed strategies in the design and use of maps in sensitive settings.

Key words: map use, interactive process, strategic behavior

Introduction

Maps are common tools in impact assessment; they are used to present alternatives or present in a graphical way the outcomes, effects and impacts of the various alternatives under study. The graphical visualization of the landscape in structured and abstract patterns (groups, borders, differentiations, etc) in a map depict the current state and the impacts of intended changes and policy options at one glance.

Most often maps are prepared by professional map makers based on information provided by content experts and analysts; the general public only sees these maps once they are ready and agreed upon by the specialists involved. (Tapio, 1996; Valve, 1999; Monnikhof & Bots, 2000) No wonder then that maps often are the catalysts of public dispute? Used in this way they merely fit a classical decide-announce-defend strategy,

which according to many public participation experts will lead instantaniously to opposition. (Fell & Sadler, 1999; Enserink & Monnikhof, 2003)

Spatial maps have been used since long times in policymaking and conflict resolution, next to written and spoken forms of language. The basic functions of a map are those of every representation: to communicate, both between people and between people-and-map. We do not consider maps to be a means to communicate end-results only. Maps form a model of reality, and thereby serve as language among participants during their explorations (Carton, 2002). Maps assist groups of participants in exploring spatial relations, in making trade-offs between spatial dilemma's and in explicating a common vocabulary across disciplines, scales, and professional backgrounds. But maps can, and often do, lead to polarized discussions on borders and locations. Professionals are often unpleasantly surprised with the unintended reactions and follow up actions with 'their maps'.

The latter is illustrated by the complete absence of policy maps in the European Spatial Development Perspective, which illustrates how controversial maps can become (Faludi and Waterhout, 2001; Ulied and Guevara, 1999). In this case the map accompanying the policy document showed the so-called "blue banana", the region considered to be the economic motor of Europe. All countries not in this blue banana fiercely objected to this picture. A special commision was established to explore and work out new ways of cartography, in order to overcome what Faludi and Waterhout (2001) called 'the problem of the maps'.

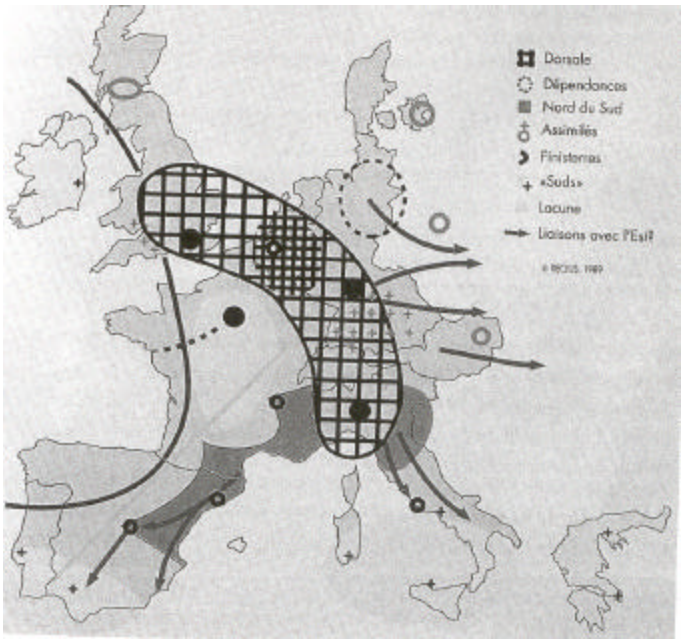

Figure 1. The 'Blue Banana' (Reprinted from Faludi and Waterhout, 2001)

Research Framework

In this paper we address the question what causes the unforeseen controversies with maps. Why do maps seem more sensitive to controversy than other types of information, such as models or texts? What mechanisms preceed the moments when conflicts over maps arise, and how do they influence the discussions and succeeding uses of the map? And if we can understand the sensitive nature of maps, how can we bend this to our advantage; preventing map controversies to end in deadlock situations, and exploiting the assets of cartograpghic visualizations?

This paper cannot answer all these questions in depth. Being part of an ongoing research project within a wider program on 'multi-actor systems', this paper will address the model of analysis and present a number of maps from case studies that illustrate different roles, effects and mechanisms with maps. We will end with a conclusion over roles of maps in decision-making, and recommendations to deal with potential map controversies.

We have used various case studies within the Netherlands where map use is part of design and assessment of potential policies. As many of the spatial challenges faced in the Netherlands are on a regional level, this scale is our main focus[1]. Examples of these challenges are: risk of flooding, noise disturbance around the main airport, new infrastructures through the countryside, urban sprawl 'eating' the rural spaces.
As we are primary interested in the role of maps in the *link* between expert usage and decision-makers, we have directed our study on the usage of maps in *interactions* among people, including the map making process. These interactions, aimed at reaching policy decisions and being situated between stakeholders, experts, impact assessors, process facilitators, and decision-makers, are denoted as discourses. Since we focus on what is being discussed and said, by verbal communication next to the map as well as by the map images themselves, we refer to our analysis as *map use in discourse analysis*. We do not focus on the entire scope of the policy discourse concentrated around a number of issues, but only concentrate on the discussions focused around maps. As the famous cartographer Bertin has insisted, maps are not " drawn once and for all, constructed and reconstructed until [they] reveal all the relationships constituted by the interplay of the data [...] A graphic is not only a drawing; it is a responsibility, sometimes a weighty one, in decision-making. (Bertin, 1981, p. 16).

We have used an observation framework that defines which factors have been considered to evaluate the roles of a map in it's situational context. This framework is based on two assumptions:

- Maps are being made and used for a purpose. This purpose may vary from concentration demanding observation purposes like 'visual assessment of spatial

[1] 'regional' still varies from almost national level to municipal –local– level

differentiations in impact estimations' to simple, practiced actions like 'making notes on an available piece of paper'.

- In deliberation processes, the role of a map is emergent; the formulation and selection of particular themes, scales and issues, is part of the scoping of the problem, which is both an analytical and political process. For instance, the decision which scenario's and criteria to incorporate in an EIA also defines the outline, scale, and themes of the maps.

The outline of this framework is presented in Figure 1, and explained underneath. The action of 'map use' in an environment of discourse, is the central object of study (M in figure 1). This is closely depending on the *context* (C) in which the map use takes place. Together, these evolve in interactions among participants and contribute to a particular perceived effect of the maps by it's users. We evaluate this effect (E) by reconstructing the evaluations of participants. From this, we try to reveal the 'underlying frames', that may explain the cause of a controversy as described by Rein and Schön (1993).

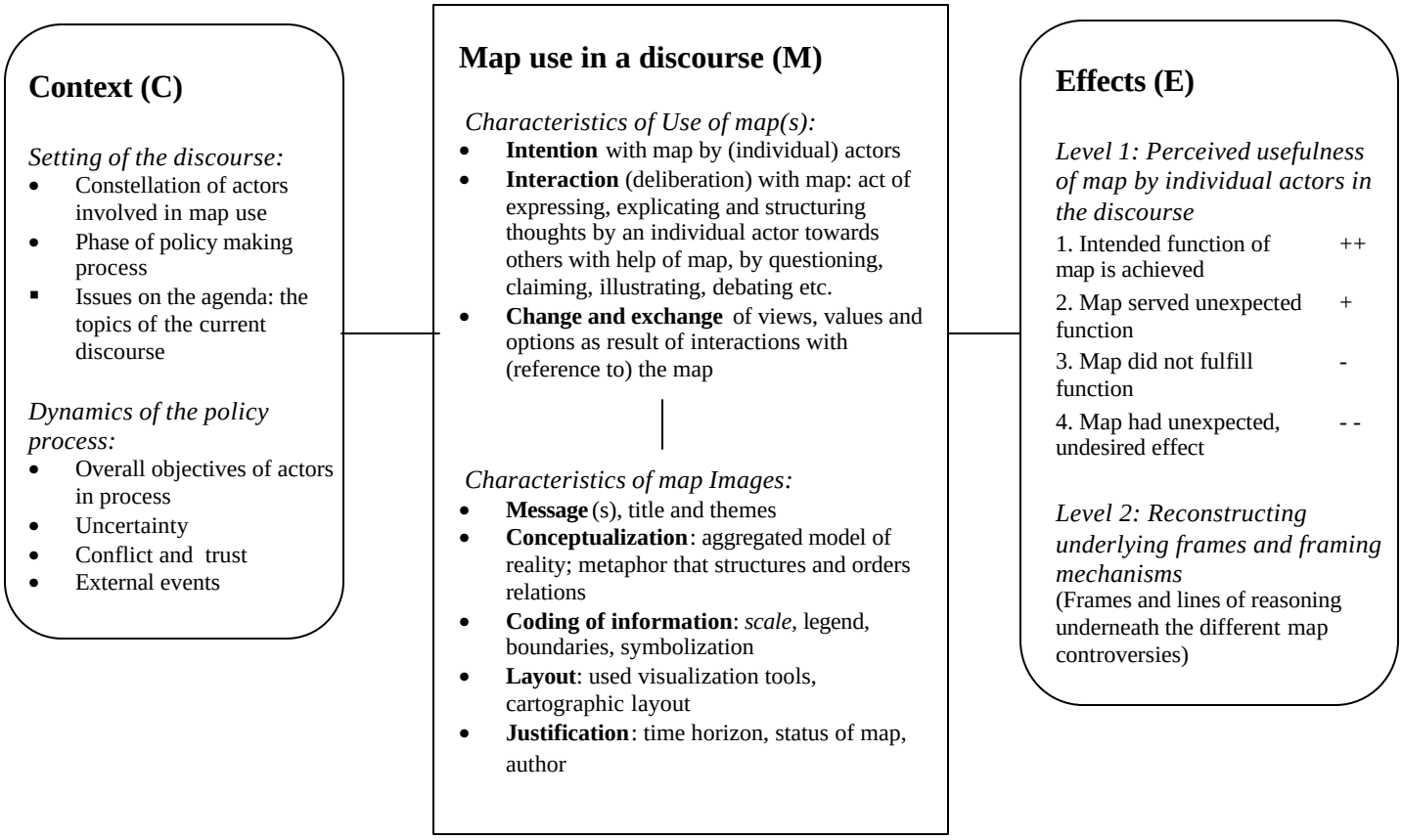

Figure 1. Outline of the observation framework; factors influencing the role of a map

1. Context

How a map is being used, and what it's use brings to bear, depends on the context in which the map use takes place. Since important policy decisions are usually not made at one instance, the process evolves over time. As new information may come up and new events may take place during these processes, the overall objectives of the decision-making process may shift (Bruijn et al. 2002). Contextual factors such as uncertainties, conflicts and trust are considered as influencing factors for the usage and effects of maps in the policy discourse.

2. Map use in discourse

The use of maps in decision-making is subject to ongoing change. Since the 1980's and 1990's, new concepts like public participation, collaborative/interactive planning and *social learning* have been introduced in the practice of decision-making (Healey, 1998; Salet and Faludi, 1999; Enserink, 2000; Bruijn et al, 2002). Social learning is called for when issues are at stake, which involve several stakeholders who are interdependent for realizing their goals. Participants not only learn about content and the best way to reach their goals (single-loop learning) but also reflect on their own and other's goals and justifications (double-loop learning) (Craps et al. 2003). In these modern settings of collective learning (Wenger, 2001:2; Soekijad et al.,2004) the map is not the private possession of the expert but the communication device of the participants; it has become a discussion tool and no longer an end-product of the blue print type.

In these renewed settings, the EIA is a process where exploration, assessment and communication with stakeholders are entangled and the assessment takes place on an integral basis. Maps are one of the devices where multiple aspects are related to each other; for instance, ecologic and economic impacts, small-scale and large scale issues, etc. The actors think, learn and negotiate through deliberation, expressing their ideas by adapting and re-adapting the map. This participative exploration takes place by using various modes of communication; the actors interact by listening, asking questions, providing statements, making arguments, and deciding on issues or procedures. In this process, maps are a means to 'grasp' the complexity of the real world. According to a professional process facilitator, "the map-maker gets a new role as the one who makes 'visualized briefings' of the various arguments, findings, views, options and decisions" (verbal statement in seminar "Image as Dialogue" in Amsterdam, November 2003).

Policymakers and participants use maps for a range of purposes. Amongst others to represent the problem of the real world, to assist the participants in their exploration and research, to visualize a new idea, or to communicate decisions. MacEachren and Kraak (1997) divided the functions of maps in two main types: to facilitate 'thinking' or *exploration*, and to facilitate communication. Carton (2003) classified these functions of map tools, in the context of policymaking, in line with the aim of social learning (see table).

Table 1. Functions of maps

Particular functions of maps for social learning	Example
1. to identify spatial phenomena	Collect knowledge and arguments on a map of ill-defined problems, f.e. local dryness, diffuse sources of water pollution
2. to articulate and specify spatial issues	Put issues on the agenda, f.e. local bottlenecks in drainage systems
3. to clarify spatial relations	Explain arguments and concerns by localizing and describing them with help of map images, f.e. link spatial patterns of water pollution to changes in local land-use
4. to synthesize (spatial aspects of) arguments and designs	Summarize a design, an analysis result or a viewpoint as an argument in the debate, f.e. argue for more space for water with a map of several flooding scenarios
5. to consolidate findings, views, options and decisions about spatial aspects	Location related decisions and visions get concrete when they are defined and described. Laid out on maps, this knowledge is being fixated and captured 'black on white'. For instance with the definition of regional river basins

3. Effect

Level 1: Perceived usefulness of map by individual actors in the discourse
We have analyzed the role of the maps using three questions, classified in two different levels. The first level is about the visible actions and interactions in policy processes; about what actually and obviously has been said and what has happened. On this level we analyze the –perceived– usefulness of the map by the participants using two simple criteria: 1) Was the usage and role of the map according to prior expectations by the individual map maker and map users in the group? 2) Was the effect of the map on the decision-making process perceived as positive or negative? The first question refers to *intended and expected functions of the map*, and the second question assesses the effectiveness of a map on that particular functions. Since one map is typically used by several people in several phases, for several functions simultaneously, this can lead to multiple classifications of usefulness, from various actor perspectives.

The answers on these questions are used to reconstruct the different perspectives or 'frames' underlying the interaction. This level is explained below.

Level 2: Reconstructing underlying frames and framing mechanisms
As main theory for explaining and analyzing the use of maps and the occurring controversies around maps, we refer to the theory on 'framing' of Rein and Schön (1993). They describe policy "frames" as 'taken-for-granted assumptional structures, held by participants in the forums of policy discourse and by actors in policy-making arenas'. In a more recent publication, Rein and Law (1999: 93) further specify frames as 'structures that give form to processes of social interaction and communication, as a particular way of representing knowledge, or as an interpretative scheme that bounds and orders a chaotic situation to facilitate interpretation'.

With the term 'underlying frames', the authors already emphasize the character of this type of study, being focused at issues that are not visible at the surface, issues that cannot directly be 'counted' in the world of direct observations. Rather, these issues concern the elicitation and interpretation of the 'taken-for-granted' assumptions, while the particular subjected persons themselves are often unaware of these. On this level, we analyze the

third question: What causes the differences between different actor perspectives on the same maps? In particular, we tried to reconstruct the underlying mechanism why a map is being considered as useful or controversial.

We will use the observation framework from Figure 1. for analyzing a number of case studies and hope to illustrate how setting, use and effect of maps in planning practices relate to different underlying frames and styles of map use like analysis, design and negotiation.

Case 1: The Green Heart map controversy

Van Eeten (1999, p. 91-111) described the controversy over maps in the story of the "Green Heart" planning concept in Dutch spatial planning. This public dispute on validity or fictionality of the Green Heart concept has been going on for years. Van Eeten (p. 109): "If a concept so clearly signals its main rationale is to capture the 'essence' of a map image, then one should not be surprised that all criticism is channeled into attempts to show that the concept doe not accurately represent the map." Van Eeten advises here to move beyond the fixation of "one area – one map – one concept – one identity". Illustrative in this respect is the Deltametopool initiative, in which the main cities surrounding the green hart united and presented themselves as the main economic "red" area. In their map, covering the same area of land as the Green Heart the emphasis is on the urban sprawl and the main infrastructure connecting the cities rather than on the empty green heart.

Figure 2. Map of the Green Heart. (Source: National Policy Document on Spatial Planning, Part 3, 2002)

Figure 3. Map of the Deltametropolis. (Source: National Policy Document on Spatial Planning, Part 3, 2002)

Lock-in effect of maps in social environments

The Green Heart map, according to stories, was first discovered in the 1930s by Albert Plesman, a legendary director of the Dutch royal airlines. He looked down from his cockpit, flying over the western part of the Netherlands, and saw a ring-like pattern of settlements, with an open space as its heart. From this time, the perception of the region as a city ring with an open, green, space in the middle entered the planning community until this day (Van Eeten, 1999).

Because of the conceptual power of a map, they have a high 'lock-in' effect on the group working with the maps (Carton, forthcoming). Harley (1989) has identified the existence of this mechanism. He spoke of "hidden messages", because people do not perceive it consciously but it is still inherent with all maps. A famous example is the world-map of Great Britain. Next to a view on the world's surface, this map also shows Britains' supremacy, with the Queen's home base London centered in the middle. Harley's message to the world is that every map 'shapes' reality according to a certain worldview. With the map as 'evidence', mapmakers keep their worldview alive and consolidate their position in the world.

Case 2: Water Exploration Maps to influence spatial planning

The next case illustrates the different roles of maps in the different phases of participative policymaking (Carton, 2002). During 2001-2002, the Dutch waterboard Delfland developed a water vision in close collaboration with municipalities in their region. Delfland used maps both as means and as end product, calling the resulting vision a 'water opportunity map'. This water board is situated in the western –lowest– part of the Netherlands. It comprises the cities of The Hague and Delft, and the largest greenhouse area called Westland. It is also situated along the coast and the mouth of the main trench of the Rhine, through the harbor of Rotterdam.

Figure 4. Location of the water board Delfland within the Netherlands.

At the start of the project, in the analytical phase, only mayor problems and scenarios were collected and sketched on a map, on a very broad scale. When 'zooming in' to a sub

region, first descriptive maps were made to clarify the current situation and to articulate the tacit knowledge of experts. Then followed maps (ten in number) with interpretations of specialists (expert judgements) of current problem situations and potential areas for measures. These maps led to a discussion on the underlying normative interpretations: "How should we differentiate target values for water quality (and quantity) here and there?" or "Where should we aim for a natural urban run-off and exclude rainwater from the drainage system?" Various options were designed in several versions, of each topic individually. In the next step, the maps were overlaid with help of a Geographic Information System (GIS) to explore conflicts and win-win situations. Finally, these were prioritised and integrated into an integral vision.

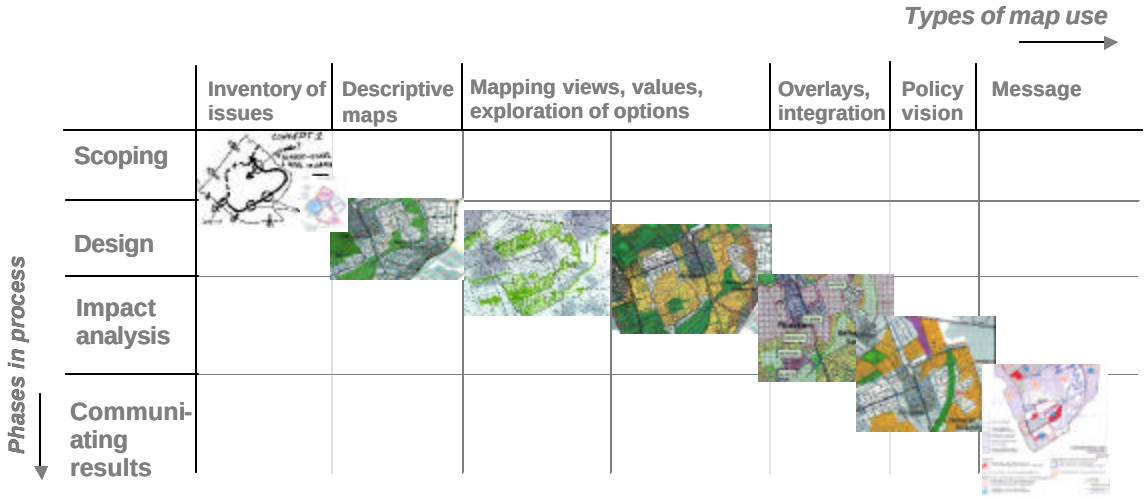

Figure 5. Illustration of the used maps and their shifted role in the collaborative process

These are all changing uses of maps. In Figure 5, a matrix is spanned by the phases in policymaking and the types of maps made in the case of Delfland's water opportunity map. The matrix illustrates the shifting role of mapping activities during the interactive and iterative policymaking process. The approach shifted from exploratory and analytical (as to make an inventory), via a creative or design phase in which new conceptual models were developed and normative viewpoints were made explicit, evolved into a *debating instrument* in the negotiations about priorities, trade-offs and combinations of water-and-land-use functions.

The first map in this project was drawn during the first policy round where the (internal) project members prepared for a Start Document. This document was to be used as starting point for vision-design in collaboration with (external) municipalities. A few meetings were planned in December and January 2000-2001 for this purpose. In the first meeting, the project members and board members had a long discussion on what should be understood by 'sustainable water management'. In order to clarify the discussion, the external facilitator made rough, abstract sketches of the area according to the information provided and the discussion of the experts. These sketches showed one of the first major policy choices to be made (see Figure 6): currently the water runs clockwise trough the area from the higher grounds to the lower polder areas. But this circulation implies that the water first runs through the heavily polluting glasshouse areas, then spreading the

polluted water all over the clean polder areas. From the perspective of water quality and ecology, this is the wrong order; according to the directive of the National Commission on Water Management in the 21st Century the water should run from the clean areas to the polluting ones. (WB21, 2000) The dilemma was born: following the directive would turn upside-down the existing water circulation. This would also mean that the water should be pumped counter clock-wise from lower to the higher areas, which is opposed to the ideas of sustainability. Much energy would be needed. The two sketches in Figure 6 show the two extreme alternatives for water circulation.

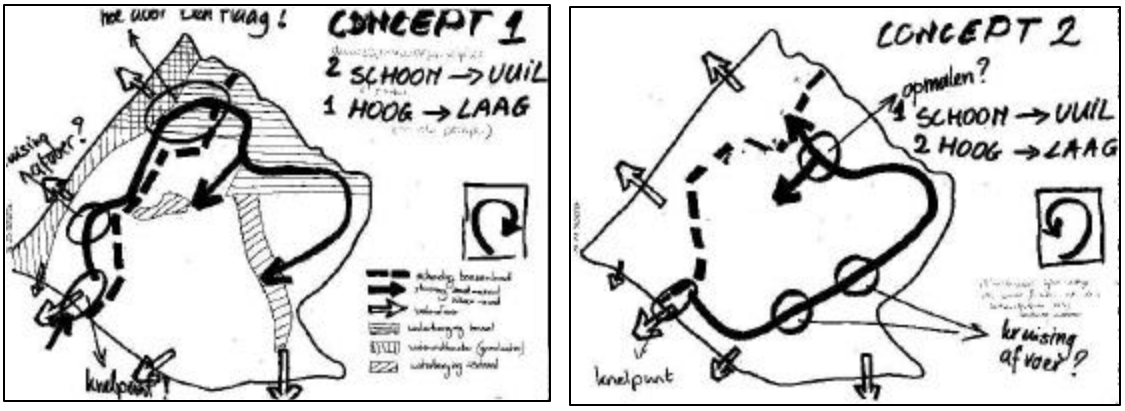

Figure 6. The two sketches of water circulation through the territory of Delfland. Left: from high to low. Right: from clean to dirty. Potential problem 'hotspots' are expressed with circle symbols and remarks.

The project group of the water board liked the underlying ecological idea of the anti-clockwise water circulation, and simultaneously acknowledged that at the moment, the actual hydrologic water flow resembles the clockwise alternative. They agreed to follow the new policy principle 'from clean to dirty' where possible, and to explore the consequences, although one of the project team members opposed against the qualitative approach used. Clearly the design principle prevailed at this stage.

Controversial overlapping spots

In a later phase, various spatial measures are worked out that need to ensure sustainability and self-sustained water control. These were worked out on a more detailed level in one of four sub-areas of Delfland, with help of GIS-analysis and consultation of municipality planners. (This pilot area was called Oostland). In this consultation, each potential policy measure on behalf of water management was printed on a map and spatial planners were invited to add comments on each map. The project team of the water board Delfland collected and overlayed all maps –about 60, some of which only with minor comments. In order to make sense of all this data, two main 'target images' were formulated;

- a target image for policy measures to deal with extreme rainy periods, 'water surplus situation'
- a target image for dealing with extreme dry periods, 'water shortage situation'.

All potential policy measures were divided long these lines and overlayed on maps. The two resulting map images showed many overlapping '*hotspots'*; areas with many issues and search locations concentrated around the same locations. The controversy

concentrated on the water shortage map. The potential transformation of grassland polders into permanent water storage basins was so controversial, that some argued to ‘take this legend item off the map’. Even a potential combination of such a water storage basin with functions as calamity polders (lands to inundate, e.g. let the land be flooded in controlled manner, in case of emergency due to heavy rainfalls) was highly disputed within the water board organization. The main argument to take the water storage basins from the map, were threefold:

- Water shortage is a long term problem, while water surplus (with threat of flooding) is very urgent. Mapping these issues on the same maps would indicate a similar relevance for both problems
- There are many uncertainties and other possible solutions open for the potential problem of water shortage, so this problem need not be emphasized in this phase, and mapping a possible measure would be premature
- the idea of water basins for shortage situations are ‘hard to sell’ to municipalities. For it would mean ‘their’ grasslands would be transformed into a lake permanently. This while calamity polders are usually grasslands, with only a minor change of being flooded once in hundred years.

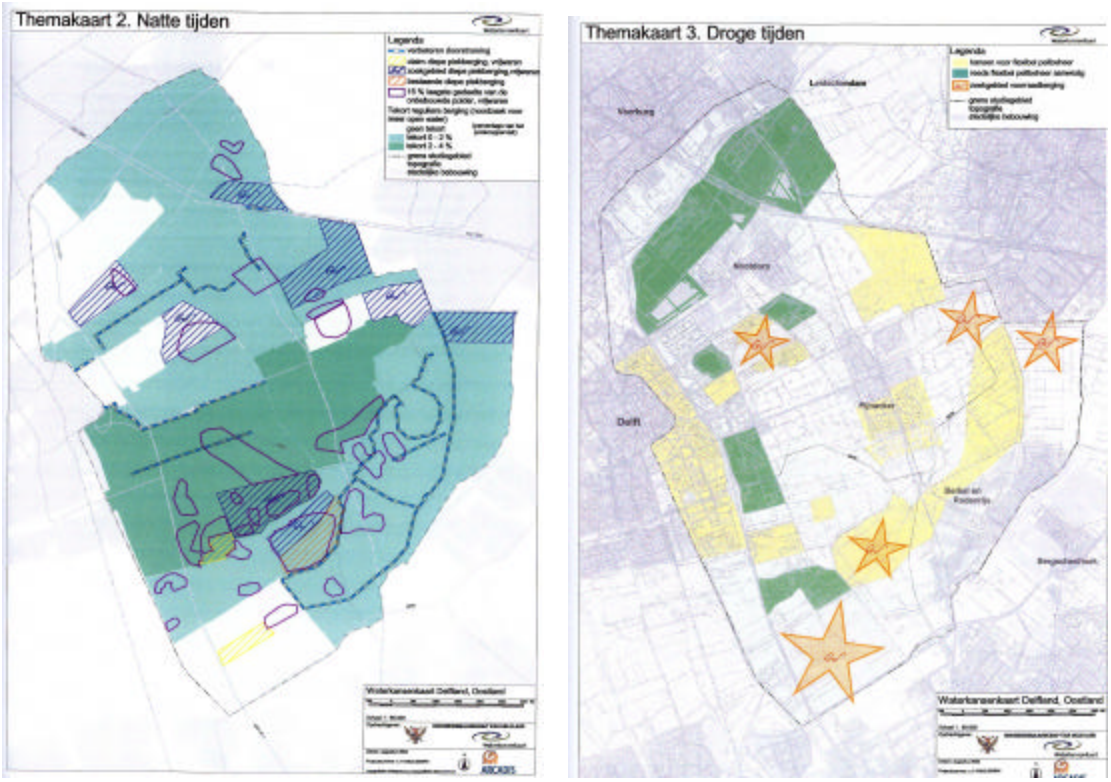

Figure 7. GIS-overlays of various policy measures in the area Oostland. Left: water surplus situation. Right: water shortage situation. Some search locations overlap.

Defenders of the water storage basins on the map, argued that this issue would require the largest amount of space and is the most difficult to reach. In the end, to settle the dispute, the director of the water board decided to give priority to calamity polders. The project leader, in the meantime, had the map-maker replace the bounded areas or the water

storage basins by indicative star symbols (Figure 7, right map), in order to keep them on the map, yet in another, 'lighter' form. On the final map (figure 9), they are still apparent as blue stars, labeled as 'search locations water conservation to be assessed on the level of Delfland'.

Final Water Opportunity Map

Delfland also wanted to make a 'synthesis map' of the most important issues. Here, the priority between policy measures was highly disputed. Not all measures would be included in this summarizing map, and some issues would visually lie 'on top of other spots' on the map. Finally, a new consultancy firm was hired to come out of the discussions and to finish the maps. Instead of copying the GIS-maps, these landscape designers listened to the various arguments why individual policy measures are more important than others. They re-shaped these arguments in three groups:

1. Water claims: options that are not negotiable according to Delfland
2. Water wishes: strong requests towards spatial planners to adopt zones or search locations in their plans for the sake of water management
3. Water opportunities: other ambitions, that deserve extra attention of water managers and planners.

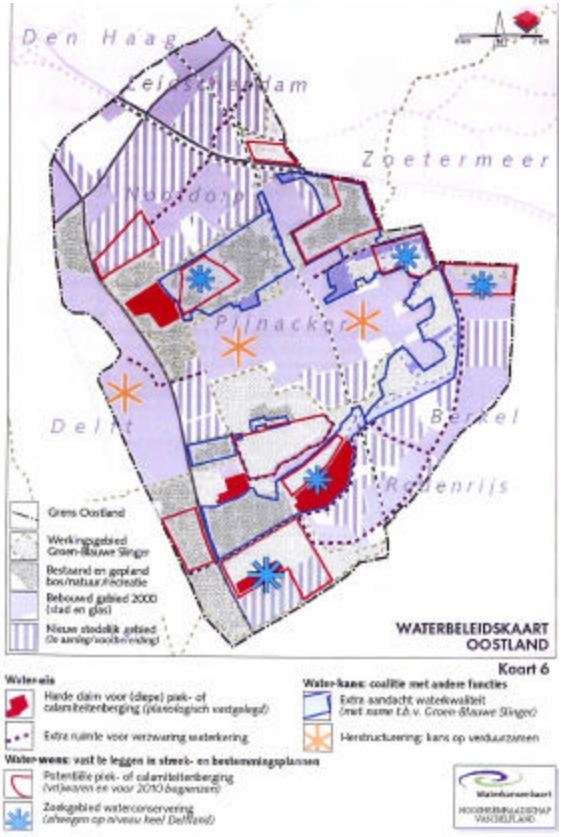

Figure 8. Resulting Water Opportunity Map of Oostland.

This way, the status of different spots and contours of the map where differentiated explicitely, as a settlement of the disputes. See figure 8 for the final Water Opportunity Map. The map-maker did not use GIS for the final layout, but redraw the picture, as the

GIS-package did not offer the options and *subtleties* that manual (computer-added) drawing offers. For instance, choosing specific patterns of texture, drawing a red line just next to a blue line instead of above it, giving a symbol a little 'shade', etc, is not possible with the standard layout-options of the current GIS-package used in this case[2].

The production of the final document also showed a striking difference between GIS-users, who use huge amounts of data stored in a (GIS-)database, and 'drawers that design by creating the lines themselves.' The same assignment was given to an engineering firm and a landscape designer, to make a map 'that explains the water system in a nutshell'. Figure 9 shows the two resulting images. Overlaying several layers of the GIS-database makes the left image. Every pump station is apparent on the map. The map exposes a high level of detail. However, the right picture tells us more about the coherence between relational parts of the water system: the canals are drawn with different thickness to differentiate importance; the height level of the area is divided in relatively 'high' and 'low' polder land (gray and white); and an extra vertical intersection is added underneath the map image, as to explain the regional height differences and the polder-and-canal system.

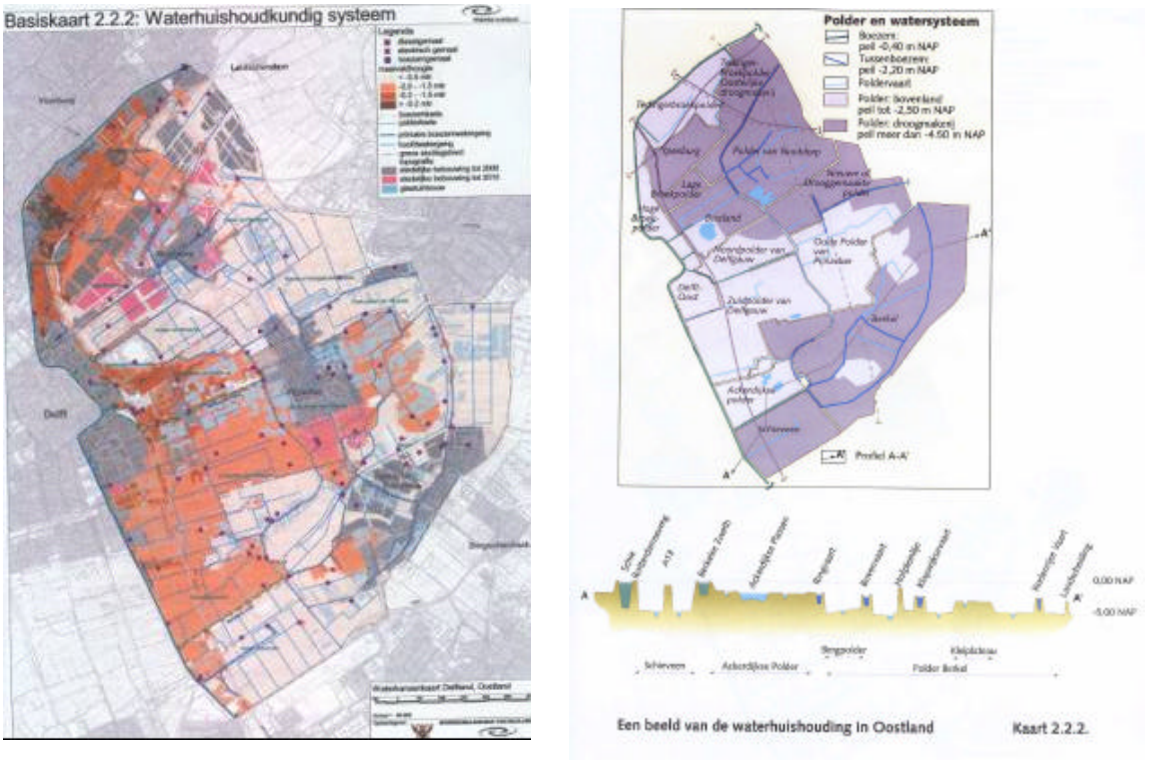

Figure 9. Explanation map that describes the water system by two different offices resulting from the same assignment. Left: map result from the GIS database. Right: map result drawn by landscape designer.

[2] The GIS used here is Arcview of ESRI.

Case 3: Noise contours of Schiphol Airport

The last example is about the noise disturbance of the Dutch main airport Schiphol. The Dutch Central Planning Office (CPB) was asked to execute a statistic Cost Benefit Analysis (CBA) for three 'limited' extension alternatives for the airport after 2010. The CBA has as primary objective 'to map out the societal effects of the extension alternatives, and in this way provide the government with relevant information for decision-making about nature and substance of succeeding phases in the extension of the airport on the long term' (CPB, 2002). The study focuses on three variants of extensions; an extra North-South runway (6P), an extra East-West runway (6PK) and both extra runways (7PK). The study concentrates on issues of noise and safety, along with prosperity effects, based on three scenarios for economic growth and noise calculations within a so-called 20 Ke contour.

The two-facetted objective for Schiphol is to provide way for expansion for the airport and boundaries to the environmental load. This objective ('dubbeldoelstelling') stems from 1991, when an integral EIA has been executed for the National Policy Decision (PKB) called 'Schiphol and the environment'. This PKB comprises an upper boundary for the number of houses inside the zones of the critical noise contour, but also a reduction is foreseen of the number of severly hindered and sleeps disturbed inhabitants outside this zone.

The results of the Cost Benefit Analysis are very positive on the assessment of noise. CPB (2002, p. 97, translated): "The noise capacity of all extension variants widely exceeds the physical capacity. On this basis, it can be concluded beforehand that the noise load with full utilization of the physical capacity will lie beneath the norm of 10.000 houses. *There seems to be raised an entanglement (dis-linking) between noise load and air traffic.*" In figure 10 (left), the 35 Ke contours of the 5P, 6P, and the 6PK system are visualized. This map image shows remarkably tight contours for something as intangible as noise.

Since the zone of the 35 Ke noise zone is determined by the government in 1996, it is followed by ongoing discussions about the zoning and noise hindrance (Berkhout, 2003). As commission in 't Veld recommended change of the existing noise zones, an EIA was set up for this zoning restructuring. But meanwhile, other plans were developed in another project. In 1999, the policy document TNL (Future of the National Airport) appeared, where a new norm system is defined to replace the old zoning system. In 2000, the Parliament doubts whether the proposed norm system will have the protective working as agreed upon for the new airport extension (Schiphol opened a new 5th runway in 2003). Therefore, the so-called commission Berkhout was founded, with independent experts.

Commission Berkhout criticized the new norm system. The new norm system uses a combination of issues to determine if Schiphol exceeds its levels of noise production. There is the 'Total Amount of Noise' (TAN), and a number of 'Points for Legal Maintenance', locations around the region of Schiphol where the noise production really is measured –and acted upon. The commission states explicitly that the full fixation on the location near the 35 Ke contour is not wise, neither for the Total Amount of Noise as

for the Points for Legal Maintenance. The commission reasoned from the perspective that, in the current agreements, also the noise disturbance in the area *outside* the 35 Ke contour would have to play an important role. Berkhout (2002/2003) explains this with the *metaphor of a hillside landscape* around Schiphol. The heights in the landscape represent the yearly noise load at those locations. If one aims to achieve the hindrance targets as maximal as possible, then the aviation sector needs to set up work procedures in such a way that the peaks are situated in the areas with fewer people and vice versa. Berkhout estimates that a minimum of 19 proposed extra points for legal maintenance is necessary, see figure 10 (right). This map is constituted on the logic that, no matter where noise disturbance is expected due to calculations and estimations, the real noise disturbance must be measured, on those locations where the people whose sleeping rest is at stake experience the disturbance.

The commission concluded that the new norm system was not considered to fulfill the criterion of equity with the old system. In the review advice, the Commision on EIA has also stated to see no argumentation for the statement that the old and the new norm system are equal. However, the government has accepted this new system anyway and dismissed the commission Berkhout, which evolved into an ongoing and almost personal conflict between mister Berkhout and the Dutch government. According to Berkhout, the implemented norm system and surrounding governmental decision-making process is a 'curtain of smoke', misleading Dutch citizens and failing as democratic process.

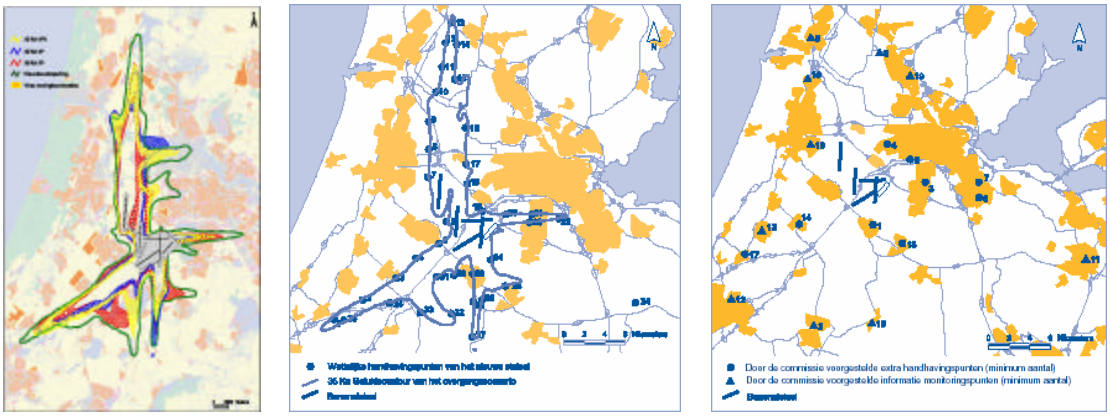

Figure 10. Maps on Schiphols noise disturbance. Left: Calculations with noise contours to assess impacts of new runways on noise load (source: CPB, 2002). Middle: Map of the current Points for Legal Maintenance, situated on the 35 Ke contour, belonging to the new norm system of the government. Right: Proposed locations for 'Points for Legal Maintenance' by commission Berkhout. (source: Berkhout, 2003).

Analysis - Interpretation of cases

Re-occurring underlying frames in map use
Apparently, maps serve different purposes or intentions simultaneously (see examples above). Actors have different individual intentions in the process, different frames or worldviews and different approaches to achieve their objectives. This influences how they use maps (and models in general), and how they perceive their role.

From the cases, we have distinguished different styles in map use that were frequently dominant in practical cases and at many times were underlying conflicting arguments. These styles reflect fundamental differences in the perspectives on the role of maps.
:

- An analytic style, that primarily perceives maps as a *scientific model*. This approach is dominant within contexts where GIS is being used
- A 'creative' or design style, where maps are conceived as *construct of art*, where craftsmen use the map as graphic language to express their ways of seeing and designing reality, especially among landscape designers and urban planners
- A negotiation style, where maps are viewed as *strategic representations*; as metaphors and as political consolidations of decisions made –or choices almost made.

The first, the *analytic approach*, reasons from the 'rational' perspective or: 'to measure is to know'. This style is characterized by large amounts of data that need to be collected, monitored, and mapped, before decisions can be made. But what data need to be collected is assumed to be 'given'. This approach is closely related to the widespread use of Geographic Information Systems (GIS). GIS allows the users to perform spatial analyses 'on the fly'. On-screen, 'dynamics maps' can be shown, with endless variation in visualizations of the large spatial data-set. Aggregation and validity are important issues in the building of such geo-databases. The maps are used as an interactive model. The structure of the map must be logical, each spot on the map should be properly defined and clearly bounded. The discourses with maps are perceived and reviewed from this point of view. The essence of the overall policy preparation process is seen primarily as a process for research and assessment.

The example of the GIS-map created on the request for a descriptive map by Delflands waterboard, is a typical example of an analytic approach (figure 9, left). Also the noise contour map of the Central Planning Bureau reflects this analytic approach (figure 10, left).

The second style, the *design approach*, is associated with creativity, with drawing and with intuition. The approach is related to the craft of urban design and landscape architecture. These professionals use maps to consolidate and express their thoughts. They design their ideas by drawing. Maps are used to present and express al kinds of variants and possibilities. The author designs something new in space, which did not exist before. Direct observations of landscapes and human reasoning serve as base techniques in the search for patterns. A combination of choices is composed, which then are reflected upon in how far these could meet given requirements. Searched for are coherent concepts. The concept or artifact itself, which is being created (at least in the mind) must be 'of good quality' in itself. The mapping process itself is being used to express oneself

and to stimulate creativity. Someone drawing sees how the designed reality emerges by the images created. This craft is taught with approaches for (free) associations, by using examples and by training in the craft of drawing. The map is used as a visual language. The whole discourse where maps are used is perceived and reviewed from this point of view. The essence of the overall policy preparation process is seen primarily as a process for creating and presenting options and alternatives.

The two sketches with alternative water circulations in the Delfland case are a typical example of a design approach. The Green Heart and Deltametropool have a design element too; they are wanted more or less esthetical visualizations, but even more so are intended to persuade as we will argue in the next paragraph.

The third style, the *negotiation approach*, is based on political reasoning. In spatial planning, well-known policy documents that contain maps are structure plans (or structure visions) and zoning plans. They have legal status once officially laid down. But also map images that have no official legal status are used as political devices in discourses of decision-making; they are used to communicate ideas and perceptions, and to clarify or advocate opinions. Maps are a logical instrument to consolidate decisions and agreements on space. As such, a map reflects a political agenda. In the political perspective, the whole discourse is perceived and reviewed from this negotiation point of view. The essence of the overall policy preparation process is seen primary as a process for argumentation, persuasion and advocacy in order to 'network' with other actors and to 'catch' opportunities as they come by.

As maps are simplified representations of the complex world, they can be considered as symbols: the information presented is not the world, but consists of symbols that make sense of the world. According to Stone (1988), metaphoric reasoning –seeing a likeness between two things– is essential to processes of classification and counting. To make a metaphor is also to make a political claim: [p. 108] The meaning of a symbol is not intrinsic to it, but is invested in it by the people who use it. In that sense, symbols are collectively created. Any good symbolic device, one that works to capture the imagination, also shapes our perceptions and suspends skepticism, at least temporarily….[p. 198]: "They [symbols] are a means of influence and control, even though it is often hard to tell with symbols exactly who is influencing whom."

The example of the Green Heart illustrates the framing influence of metaphors in map use. Van Eeten (1993, p. 92.): "When reading their plans, you cannot fail to notice the peculiar and *pictorial nature of the language* that planners use. Plans are the runways on which metaphors try to take off, including the current Dutch planning concepts of, amongst others, the compact city, buffer zones, transport axis, green wedges, blue chambers, and, of course, the Green Heart Metropolis". The maps of the Schilphol case shows how maps, even when used for analysis and estimation, are build upon and encompass political negotiations.

In each style, different preferences and lines of reasoning prevail to evaluate the role of a map. The overview of these three styles is presented in table 2.

Table 2. Overview of different styles in map use

	Analysis *Map use as science*	**Design** *Map use as art*	**Negotiation** *Map use as politics*
Context (C)			
Archetypical group or actor	Expert, skilled in research fields like geography, cartography, GIS, economy etc.	Expert, skilled in artistic fields like urban architecture, landscape design and facility of creativity.	Stakeholder, experienced in decision-making, acting on behalf of dependency (interests at stake).
Focus on policy analytic phase	Emphasis on research and assessment	Emphasis on creation and presentation of alternatives	Emphasis on interaction, problem framing, and arranging trade-offs
Limitations, perceived boundaries	Bounded possibilities by scope and available data	Bounded possibilities by objectives and conditions	Bounded possibilities by institutional constellation and timeframe
Map Use (M)			
Values in coding of information	Objective and valid information	Broad, holistic information	Comprehensible information
Values in presentation of information	Map layout 'correct' according to cartographic rules and heuristics	Visual impression of artistic quality	Map layout sufficient and opportune for the occasion[3]
Preferences in act of thinking	Use of technology; preferring rigid (unambiguous) definitions and specified (as possible quantified) information	Use of examples, associations, 'back talk'[4] and imagination to create innovative ideas	Strengthen arguments, map use according to pragmatic and strategic considerations[5]
Effects (E)			
Dominant functionalities of maps	…Clarify mechanisms in the morphology of space	…Visualize and articulate imaginative (sensational) planning concepts about the landscape	…Persuade actors with arguments.
	…Synthesize analytic results, providing accurate (detailed, precise and reliable) model information	…Identify, elicit patterns in the landscape (grouping or differentiation patterns)	…Move (inactive) tacit and implicit opinions towards an explicated, articulated agenda
	…Consolidate considerations as research model	…Consolidate considerations as design language	…Consolidate considerations as policy agenda

[3] For example: Hide sensitive issues from map. or: Reserve strategic assets; exagerate claims or options, for in later phases these might be used as a trade off.

[4] The designed map 'talks back from paper' to the creator. Schön described back talk using the example of designing an urban plan. A halfway designed plan has limited the degrees of freedom but it also thereby offers new insights on possibilities and problems (Schön, 1983).

[5] Prefering various different types of maps, depending on the position in the process, personal – negotiation– style and personal preference: either metaphors and abstract maps, or facts and figures on maps, or hiding (non-using) parts of map information in the process.

Conclusions and recommendations

Map controversies as frame conflicts

As long as participants share their approach towards the usage of a map, the role of the map is clear and unambiguous. Stakeholders may oppose against the decision made, but not against the status or role of the map. The map will either be used primarily to 'register' negotiated decisions (negotiation style), used as expressive tool to 'articulate, invent and construct' new emphasizes in landscape patterns (design style), or as mathematically based model to 'discover, quantify and diagnose' questions about land uses, such as number of houses within a noise contour (analytic style).

But in deliberation processes among participants, different approaches are often apparent. Deliberations focus on the problems at hand, such as noise contours and locations for water storage, but in fact the underlying frames 'clash'. The debate is sometimes about the cartographic 'lies of the maps', such as described by Monmonnier (1991)[6], but also about which frame is dominant. And with the question whose frame dominates, this question also is about who controls the approach and the attached rules of the decision-making process. Because the map is often a central document that comprises alternatives, reflects criteria, and 'suddenly' changes of status as it starts to represent the outcome of the decision, it is perceived as a strategic document.

What can be done to prevent such debates about maps to end in ineffective, endless deliberations, such as in the ESDP with the Blue Banana? In Schön's theory on the 'reflective practitioner' (Schön, 1983), he argues that many professionals are relying too heavily on scientific knowledge and technical rationality while giving little attention to "reflection-in-action". Analogues to his theory, we can differentiate the analytic and action-oriented usage of maps from its reflective role as communication medium between frames.

Reflection in participative settings requires a 'meta-dialogue' on the 'taken for granted assumptions' of which Rein and Schön are speaking. These assumptions should be recalled from the unconscious spaces of the participants' minds. The difficulty is to explicate what is 'evident' to the each individual. Maps serve as 'mirror' why choices are made the way they are. Some choices will be based on the negotiation between arguments; others will be made on the attractiveness of a designed option or the convincing evidence of analysis. We do not propose to fixate less on the usage of map images, such as Van Eeten does (1999). But we do plea for a more critical attitude when it comes to 'trying to persuade others' of one's own view with help of maps.
EIA practitioners, in the world of decision-makers, have a clear interest; to 'defend' the environment against otherwise often desirable or at least desired developments. Therefore, decision-makers will also perceive their maps in this context. When the introducer of the map does not build trust in his intentions and approach, his map will be evaluated in a 'context of justification' where all participants have been digging in the trenches of their individual views and interests.

Reflection and further research

[6] See Monmonniers examples of 'political propaganda', where the bandwith of 'ethic rules in mapping' are being touched upon by strategic manipulation of projections, borders, colors and legend classifications

We have presented a qualitative analysis of the role of maps in policy discourses, a topic that has got little attention in the variety of EIA literature.

This is not about EIA processes, one could say. To the extend of our case examples in this paper, there is a point. The Water Opportunity Map and the Schiphol noise measurement system are yet in the design phase, before an official EIA is taking place on the matter. But we feel these early phases are inseparably connected to the executed EIA once the policy options get a concrete form. We selected our examples that show most clearly the usage, roles and mechanisms with maps that we derived from a range of map use examples in practice. In four firms where practitioners working with maps daily are carrying out spatial designs and impact assessments, we presented the framework with different approaches towards maps. The differences between analytic, design and negotiation styles with maps were widely recognized and acknowledged.[7]

This is nothing new, one could say having read all this. Fair enough. Daily practitioners have internalized many habits and trained skills with maps. No need to explain what these practitioners intuitively know and do. However, we did not find this reaction from the people we would expect, namely the practitioners themselves. They did not think the workings and processes with maps are evident. The general reaction was that people indeed do use maps very often, as a trivial instrument, but never think consciously about the approach how to use it and why to use maps in that way. While the functionality of maps in a private setting is beyond any doubt, the frustration about unanticipated effects of 'their' maps is a generic feeling of 'unease' by map-makers in interactive settings.

This research should lead to recommendations for new methods and instruments in map tools, ranging from Public Particiaption GIS tools, to experimental design ateliers and to embedded map models in gaming and simulation settings. As said before, technological developments help out in making such interactive maps available. But with these high-tech tools available, many of the same pitfalls and hindrances with map use are expected as the ones happening in the 'classic' mode of paper maps. Therefore, this paper serves as moment of 'reflection-in-action' for researchers and practitioners experimenting with new and advanced possibilities of mapping tools for use in decision-making processes like EIA.

[7] Presentations at TNO, Delft (2003), Royal Haskoning, Rotterdam (2003), Bureau Nieuwe Gracht, Utrecht (2002), RDH landscape designers, Goes (2004).

References

Bertin, J. (1981) Graphics and graphic Information Processing. De Gruyter, Berlin.

Berkhout, A.J. (2003). Dossier Schiphol. Relaas van een falend democratisch proces. Value Report, Den Haag

Bruijn, H. de, E. ten Heuvelhof and R. in 't Veld (2002) Process Management. Why Project Management Fails in Complex Decision-Making Processes, Kluwer Academic Publishers, Boston/Dordrecht

Carton, L.J. (2002) Strengths and weaknesses of spatial language: Mapping activities as debating instrument. In: Conference Proceedings FIGXXII International Congress. (Washington, D.C., April 19-26 2002). International Federation of Surveying, Copenhagen.

Carton, L. (2003) Maps, in: Maurel Pierre (ed.) Role of Information and Communication Tools, WorkPackage 3 report of the HarmoniCOP project – Harmonising COllaborative Planning. Report prepared under contract from the European Commissiont no EVK1-CT-2002-00120, Deliverable Nr. 4

Carton, L.J. (2004, forthcoming) Map use in participative policymaking. (dissertation, title is tentative) Eburon, Delft.

Central Planning Bureau (CPB) (2002) Gevolgen van uitbreiding Schiphol: Een kengetallen kosten-baten analyse. www.cpb.nl/nl/pub/bijzonder/42

Craps, M., Van Rossen, E., Prins, S., Tailleu, T. Bouwen, R. & A. Dewulf (2003) Social learning and water management: Lessons from a case study on the Dijle catchment. Paper at Connections Conference, Leuven, September 2003.

Enserink, B. (2000) "A quick scan for infrastructure planning: screening alternatives through interactive stakeholder analysis." In: Impact Assessment and Project Appraisal, Vol. 18 no. 1, p.15-22.

Enserink, B & René A.H. Monnikhof (2003) Information Management for Public Participation in Co-design Processes: Evaluation of a Dutch Example. Journal of Environmental Planning and Management, 46(3), 315-344

Eeten, M. J.G. van, 1999, Dialogues of the deaf: defining new agendas for environmental deadlocks. (dissertation) Delft, Eburon.

Faludi and Waterhout (2002) The making of the European Spatial Development Perspective. No Masterplan. Routledge, London.

Fell, A & B. Sadler, (1999), Public involvement in environmental assessment and management – preview of IEA guidelines on good practice, Environmental Assessment, 7(2), pp 36-39

Fischer, F. and J. Forester (eds) (1993) The Argumentative Turn in Policy and Planning. Duke University Press and UCL Press Limited, London.

Harley, J.B. (1989) 'Maps, knowledge and power', in: Denis Cosgrove and Stephen Daniels (eds) The Iconography of Landscape. Cambridge University Press.

Healey, P. (1998) Building institutional capacity through collaborative approaches to urban planning. In: Environment and Planning A 1998, volume 30, pages 1531 - 1546

Jong, T. de and Van der Voort (eds) (2002) Ways to study and research urban, architectural and technical design (2002). DUP Science, Delft University Press.

Mayer, I., E. Daalen, P. Bots (2001) Perspectives on policy analyses; a framework for understanding and design. APPAM conference, Washington DC, 1-4 November, 2001.

Monnikhof, R.A.H. & P. Bots (2000) On the application of MCDA in interactive spatial planning processes: lessons learned from two stories from the swamp, Journal of Multi-criteria Decision Analysis 9(1-3) pp 28-44

Monmonnier, M., 1991, How to lie with maps. Chicago, University of Chicago press, second edition (1996).

Rein, M. and D. Schön, 1993. 'Reframing Policy Discourse' in Fischer, F and J.Forester (eds.), 1993. The Argumentative Turn in Policy Analysis and Planning.

Rein, M. and D. Laws (1999) "Controversy, Reframing and Reflexion." In: W. Salet and A. Faludi (eds) the Revival of Strategic Spatial Planning. Amsterdam, KNAW.

Salet, W. and A. Faludi (eds) (1999) the Revival of Strategic Spatial Planning. KNAW, Amsterdam.

Schön, D.A. (1983) The reflective practitioner; how professionals think in action. New York : Basic Books .

Soekijad, Maura, Mirjam A.A. Huis in't Veld and Bert Enserink, (2004) Learning and Knowledge Processes in Inter-Organizational Communities of Practice, Knowledge and Process Management, Volume 11, Number 1 pp 3-12

Stillwell, S.Geertman and S. Openshaw (eds) (1999) Geographical Information and Planning. Springer, Berlin.

Stone, D.A. (1988) Political Paradox and Political Reasoning. HarperCollins Publishers, USA.

Tapio, P. (1996) From technocracy to participation? Positivist, realist and pragmatist paradigms applied to traffic and environmental policy futures research in Finland, Futures, 28(5) pp 453-470

Ulied, A. and M. Guevara (1999). The Missing Dragon. Mapping European spatial policy in the 21st century. Mcrit, Barcelona.

Valve, H. (1999) Frame conflicts and the formulation of alternatives: environmental assessment of an infrastructure plan, Environmental Assessment Review, 19, pp. 125-142

WB21 (2000) Waterbeleid voor de 21e eeuw, advies van de Commissie Waterbeheer 21 eeuw, Nederland.

Wenger, E. 2001. Supporting communities of practice, a survey of community-oriented technologies. Shareware report on: http://www.ewenger.com/tech [May 2003]