From integrative to interdisciplinary: PSS to support frame reflection among disciplines.

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Abstract

It is generally acknowledged that one of the central aims of urban planning is to strive for sustainable urban development. One of the crucial prerequisites to achieve sustainability in urban development lies in an integrative approach, in which different disciplines are attributing to the final result. We postulate that Planning Support Systems (PSS) can support such an interdisciplinary approach by assisting distinctive participants in a spatial planning process in their 'frame reflection' . The latter can be defined as 'the ability to act from one perspective while in the back of our minds we hold onto an awareness of other possible perspectives, in a sort of double vision'(Innes and Booher 1999, p.13). Next, we illustrate the different frames of five disciplines involved in planning in the Netherlands. It is found that both the usage and perception of tools varies significantly among disciplines. The paper concludes that specific added value of PSS lies in supporting the development of a 'spatial language', which connects to the frames of different disciplines. We recommend that this hypothesis should be tested and refined in experimental workshops and planning practice.

1. Introduction

At present, it is generally acknowledged that one of the central aims of urban planning is to strive for sustainable urban development. Although the concept of sustainability is widely debated, it is acknowledged that one of the crucial prerequisites lies in an integral approach, in which different disciplines are working together to achieve sustainability in urban development. Moreover, it is generally acknowledged that communication in planning among different disciplines is a well-known problem. Frictions arise for instance in the communication between transport planners and land use planners (te Brömmelstroet 2010), between environmental analysts and land use planners (De Roo et al. 2012), and between urban designers and environmental analysts (Pelzer et al. 2013).

From the field of (urban) design, a plead is made for more 'tranddisciplinarity' (Doucet and Janssens 2011). In short, this paradigm echoes Donald Schön's (1983) view of policymaking as a reflective practice in which 'frame reflection' plays a central role. Hence, planning becomes a learning process, in which solutions evolve creatively and unpredictably (Bertolini 2010).

The question arises how these rather theoretical recommendations can be translated into concrete actions, approaches and solutions for spatial planning practice. This paper argues that an important answer lies in the usage of dedicated geo-information tools, often captured under the header of Planning Support Systems (PSS) (e.g. Brail 2008, Geertman and Stillwell 2009), which can be defined as 'geoinformation technology-based instruments that incorporate a suite of components that collectively support some specific parts of a unique professional planning task' (Geertman 2008, p.217).

One group of PSS recently receiving increasing attention is becoming well-known under the heading of Geodesign[1] (Flaxman 2010, McElvaney 2012, Zwick 2010). Geodesign currently has momentum, financial and institional support (ESRI's founder Jack Dangermond strongly supports Geodesign), and – last but not least – a catchy term. However, the lessons learned in last decade in the debates around Planning Support Systems (PSS) should not be forgotten. In particular, the call for much more attention for the user instead of solely for the instrument, should not be forgotten (e.g. Geertman and Stillwell 2009, Geertman 2006, Moore 2008, te Brömmelstroet 2010, Vonk et al. 2005, 2007a, 2007b)

[1] This paper does deliberately not discusses the similarities and differences between Geodesign and Planning Support Systems. We do believe this comparison deserves separate conceptual and empirical attention.

However in most of the literature the concept of the 'user' is defined rather generically, whereas in planning and policy practice *the* user does not exist. In practice, a range of different users with very different disciplinary backgrounds, working habits and knowledge demands can be found due to the interdisciplinarity of most policy issues. Therefore, in this paper we take a user-perspective as a starting point and consequently we will pay explicit attention to each ones distinctive characteristics, foremost linked to their disciplinary background. In that we will argue that each PSS user in planning practice will have a specific *role* to play, which will influence the way in which he/she conceives planning support and his/hers way of usage made of PSS. In that, combining a user perspective of PSS with a focus on interdisciplinarity seems to be a fruitful approach.

This paper is structured as follows. In the next section the importance of an interdisciplinary approach for urban planning will be outlined. Moreover, it will be argued that 'frame reflection' is critical for a smoother working together of different disciplines. Section three will illustrate the distinguishable frames of discipline ('roles') which are based on an empirical study of professionals involved in urban planning in the Netherlands. The paper will conclude with the finding that the foremost added value of PSS in supporting frame reflection lies in the development of a shared spatial language among the involved actors and outline some implications for future research.

2. PSS and Interdisciplinarity

2.1. Urban Planning: an interdisciplinary discipline

The praxis of urban planning is inherently interdisciplinary. Developing a plan for a new neighborhood or the design of a citywide vision asks for inclusion of a range of dimensions: the environment, aesthetics, zoning, finance. Moreover, with the emergence of the notion of 'sustainability' in urban planning it seems that the amount and diversity of disciplines to include is just growing exponential. A further complexity is the interrelationship of these dimensions. In short, Campbell's (1996) triangle reveals that aiming for sustainable urban development will result in frictions between economic growth, environmental protection and social equity. Besides difficulty in interrelating different dimensions also the inherent cooperation of different disciplines with different languages will result in difficulties in communication. These different 'languages' can be considered as 'frames',

which are ‘schemata of interpretation’ (Goffman 1974) which steer the way in which planning actors perceive problems and solutions and fulfill their tasks. This paper argues that a better understanding of these different ‘frames’ of planning actors is crucial to arrive at interdisciplinarity and multi-dimensional solutions

2.2. Planning and Frame Reflection

In this paper, interdisciplinarity is conceived as the fruitful interaction among different disciplines. Relevant in this respect is the work of Donald Schön (Schön 1983, Schön and Rein 1994, cf. Doucet and Janssens 2011). Schön addresses policymaking as a process of continuous ‘reflection-in-action’. In particular in coping with ‘wicked planning problems’ (see Rittel and Webber 1973), it is critical for the involved actors to reflect continuously on their own actions and frames through which they conceive the planning problem, so called ‘frame reflection’. Innes and Booher (1999, p.13) define frame reflection as: ‘the ability to act from one perspective while in the back of our minds we hold onto an awareness of other possible perspectives, in a sort of double vision’. Put differently, frame reflection is a learning process that occurs during the process of policymaking, potentially leading to a better understanding of other actors’ perspectives and, consequently, more integral and broadly supported solutions.

2.3. PSS and social interaction

Schön’s work about frames in policymaking is related to the ‘interactive’ approach to planning (Salet and Faludi 2000), in which collaboration and consensus-seeking are the central elements (e.g. Innes and Booher 1999, 2010). In the interactive approach to planning, the process of communication among stakeholders has become a crucial part of the planning process. Hence, it is not surprising that communication between stakeholders has recently gained more attention in the literature about planning support. For a PSS to be able to facilitate the communication between stakeholders specific attention should be paid to the enthusiasm it generates, to the insights it provides in the problem at hand, to the perspectives of other stakeholders and to the extent in which it facilitates consensus-seeking (Te Brommelstroet 2012). In short, not the instrumental characteristics are crucial, but rather the way in which tools are conceived by its users. In the words of Campbell (1995, p.104): ‘technologies do not function independently of their environments, rather, they gain meaning only as individual

staff members in a particular cultural and organizational context interact with them'.

This opinion has implications for the role of tools in planning practice. . Hence, a PSS should be addressed both from an instrumental perspective (what can the instrument do?) and a user perspective '(how is the instrument conceived and actually used, in short, the PSS methodology?) (Geertman 2008). For an example, te Brömmelstroet (2010) argues for 'Mediated Planning Support' in the case of the collaboration between the disciplines of land use and transport planning.

2.4. Disciplines and Frames

In a study of the framing of maps by planning actors, Carton (2007) makes a distinction between three frames that are held by planning actors:

- A *design* frame, which addresses problems and tools from a perspective of aesthetics, visualization and creativity. Note that this is a more restricted view of design than the notion of 'design-as-process', outlined in paragraph 2. Design is addressed here foremost as a *product*, not so much as a process.
- An *analytic* frame, which focuses on understanding and solving the problem. This frame resonates strongly with the scientific-analytical approach to planning (Salet and Faludi 2000). Tools help to understand the problem, in particular quantitative models and empirical-scientific information are important support tools.
- A *negotiation* frame, finally, sees planning problems and tools through a strategic and tactical lens. The focus here is not so much on the aesthetics or the content, but on the political and power-laden process in which it is embedded (e.g. Flyvbjerg 1998, Gudmundsson 2011, Naess 2011). The literature about PSS tends to have little attention for this perspective (Pelzer 2012).

The study by Carton (2007) is of relevance over here in two respects . First, to each of the frames distinctive disciplines can be associated. . It could, for instance be hypothesized that urban designers foremost have a design frame and that transport analysts have in general an analytic frame. Second, to each of the frames different tools can be associated. For in-

stance, traffic models are traditionally used for analytic purposes, although recent studies point at its tactical use as well. Tools captured under the header of Geodesign, on the other hand seem to combine a design and an analytic frame.

3. Disciplines, Tools and Frames

3.1. Purpose and Methodology

To gain a more in-depth insight into the way and role of framing with the help of PSS in the interdisciplinary practice of spatial planning we conducted a series of twenty single interviews and three group interviews with planning actors in the Netherlands. With the help of these interviews a more detailed insight was gained into the different 'roles' in spatial planning processes. 'Roles' are defined over here as an uniform disciplinary group of actors which fulfill a distinctive function within a spatial planning process (e.g. urban designer) In total five roles were distinguished: urban designer, environmental specialist, transport planner, and plan economist, and spatial planner. The aim of the interviews was to better understand the frame(s) that the different roles possess and the way in which they envision the usage of support tools like PSS. To be able to distinguish these roles, we focused in the interviews on four different dimensions: content of the planning issue, frame, information demands and the usage of tools.

3.2. Five roles

Based on the interviews five distinctive roles in spatial planning interventions can be identified: urban designer, spatial planner, environmental specialist, transport planner and plan economist. The outcomes of the interviews show the distinctive features of each of these roles.

Urban designer

'*Drawing is not just a question of design, that something is finished and just needs to get a nice form*[2]*.' (urban designer)*

[2] All the quotes from the interviews are translated from Dutch.

In the Dutch spatial planning practice the role of urban designers is positioned in between the micro-scale of the architect and the meso-/macro-scale of the spatial planner. Tools that are used by the urban designers are for instance design software like Autocad, Indesign and Illustrator or sometimes even GIS-software, besides – still – pen and paper. In fact, urban designers use a range of (visual) tools to capture the desired future for a certain locale. Or, as expressed by an urban designer in an interview:

> I'm trying to get the direction clear and also trying to come to solutions. This is not done in one drawing, but a number of variants which show the solutions and possibilities. This is then discussed with other parties.

This process of design often is seen as a creative process in which sometimes multiple stakeholders interact. However, an urban designer who had worked in a session with an integral focus and an interactive geo-information based support instrument expressed his worries about the fact that the focus on integrality can hamper the creativity.

Besides the role of urban designers is not always clear distinguishable from that of spatial planners. In a group interview with spatial planners and designers, a spatial planner puts the distinction as follows:

> I think it is the classical story of site and situation. I believe urban designers have a lot of knowledge about a site, since they focus on a design for a specific moment in time. Spatial planners are mainly situation-oriented. Things have to be in the right place and that requires an analysis of the function of that place or city. (…)

Spatial Planner

'I am a kind of an 'interpreter' (...) looking for the red line. I am searching for the coherent chunk I have to tell an alderman, who has to form an opinion at a certain point in time. It is about preparing, making things ready.' (spatial planner)

The latter quote points at an important focus of spatial planners: the *strategic process*. Urban planning is populated by a range of stakeholders: politicians, residents, private parties etc. Hence tools have to facilitate these different roles. Using maps for instance generated in a GIS has the role and power to facilitate communication and to convince other stakeholders. Or as stated by a spatial planner: 'I can show tables, but you (pointing at an urban designer) are not comfortable with tables, neither do I. We are convinced at the moment we see a map.'

As noted, another characteristic of spatial planners is that they are focused on the meso-/macro scale in both time and space of a plan area. The 'situation' as mentioned by the interviewee before refers to the broader context in which a plan is embedded. Conversely, the role of tools is to aid

in this. During the interviews it was mentioned that the diversity of available GIS functionalities well support this kind of analyses (e.g. long term trends of housing prices). Hereby it should be noted that from the interviews it appears that most spatial planners do not perform these GIS-analyses themselves, but are facilitated in that by GIS-specialists.

Environmental Specialist

'Environmental Specialists tend to focus on checking whether a plan meets the law and numbers, they do not think spatially (consultant specialized in environmental aspects in spatial planning).

In the Dutch context, the environment ('milieu') is addressed as the effect of (spatial) interventions on (natural) indicators related to the health of the population or indicators related to the preservation of nature areas or of natural conditions. Important subfields include noise, air quality, water and safety (e.g. the chance a factory will explode). An interviewee who had given advise to governmental organizations for years concerning the integration of spatial planning and environmental aspects **re**pointed out that those environmental specialists can fulfill two distinguishable roles. First, they can be analysts on a specific subfield, such as air quality. These are specialists with detailed knowledge about a specific subfield and mostly are familiar with the quantitative models that are used to predict or control the natural conditions of that subfield. Their main role is to test whether spatial plans met the legal requirements concerning the environment. Second, another group of environmental specialists act as environmental advisors who focus more on the communication of findings, thinking along with other actors and playing their role in negotiation processes. In general, theey possess a more generic knowledge about environmental topics and associated models.

In general, from the interviews it can be concluded that the information demands of environmental specialists focus foremost on quantitative information, mostly captured in widely accepted models and/or indicators. Moreover, it appears that an important input for a range of environmental models are the outcomes of models used by transport planners.

Transport Planner

In my world of transport planners we now that there is a certain extent of uncertainty [to models]. But it is not very practical to mention all the disclaimers […] Then you would completely undermine your own position.' (transport planner)

Transport planners have a strong tradition in the application of quantitative models to simulate, predict and assess the impact of traffic. Traditionally, transport planners are very much focused on quantitative analysis of traffic flows, foremost of automobiles. The transport planners in the interviews were reflective about the way in which they used models. One interviewee remarked for instance about the communication of model results: 'Sometimes you just have to phrase things a bit more convincingly to provide a counterweight. I do have a standard: I will never lie.' From the interviews it can be concluded that the limitations of models were also acknowledged: 'If you just go there and have a look, you have a much better understanding of what's going on.' The role of transport planners depends very much of the type of planning issues they are involved in. In the case of the construction of a new highway or bridge, they will likely have a dominant and leading role, whereas in the development of a spatial vision for a region, there role limits itself to show the traffic impact of spatial interventions.

Plan Economist

'A plan economist calculates the financial effects of spatial developments' (plan economist)

As a rule of thumb, the more worked out a plan gets, the more important becomes the financial feasibility of the plan. In this more finished phase the plan economist will become part of the planning process. In government-led spatial planning, plan economists are often civil servants who evaluate the costs and revenues of proposed plans. However, since the private sector becomes more and more important in financing area development, plan economists from private parties also play an important role. In particular since the financial crisis of 2008, the plan economist has gained a more dominant role. One of the first questions that is now asked is: what does it cost? To answer this questions plan economists make use of quantitative models (e.g. so-called 'exploitation models') which calculate the costs and benefits of proposed spatial plans. The communication of these models with other tools, like for instance environmental or traffic models, or a GIS is mainly absent.

3.3. Synthesis

In table 1, the main findings from the interviews concerning the different roles are presented. Not surprisingly, the five roles differ with regard to *the content of the planning issue.* Besides the fact that disciplinary roles are

socially constructed (through education, interaction, congresses, etc.), they are also a reflection of the (spatial) phenomena they represent.

Table 1 Five roles identified in Dutch urban planning and their associated characteristics

Role	**Content of Planning Issue**	**Frame**	**Information Demands**	**Tools**
Urban Designer	Focus on the characteristics of site, spatial form and aesthetics.	Design, some negotiation	Qualitative, quantitative for requirements	Maps with pencils, 3D software (e.g. AutoCAD, InDesign)
Spatial planner	Focus on the situation and process related to a planning problem.	Analytic, negotiation and design	Qualitative and Quantitative	Limited role of GIS, maps (e.g. ArcGIS, MapInfo)
Transport Planner	Transportation infrastructure and traffic flows	Analytic, some negotiation	Quantitative	Quantitative models (e.g. OmniTrans)
Environmental	Environmental regula	Analytic some	Quantitative	Quantitative models (e.g.
Plan Ec	Financial Feasibilit	Analytic, som	Quantitative	Quantitative mo

For instance, the fact that environmental specialists make use of mathematical models extensively can to a certain extent be explained by the issues they are dealing with and which are possible to model like air and sound polution. Urban designers, on the other hand, cope with issues that are more fuzzy, for instance the question how will a user experience the newly designed space. Because of its inherent subjectivity these kind of issues are much more difficult or impossible to put into a quantitative model. The drawings and sketches used by urban designers often capture a broad range of meanings and interpretations.

With regards to the different *frames* identified before, none of the distinctive roles possess an explicit negotiation frame. This is not surprisingly because this frame would be expected for politicians and others with a clear stake (private parties, residents). Nonetheless, from the interviews it appears each role acknowledge the relevance of a negotiation frame. To a certain extent 'frame reflection' already occurs, because the negotiation frame is 'in the back of their mind' (Innes and Booher 1999). Transport planners, environmental specialists and plan economists mainly have an analytic frame, which is related to their usage of quantitative models. Urban designers mainly have a design frame; relate to more 'intuitive' and visually appealing support tools. And spatial planners try to combine the different frames. Hence, it is not surprising that many interviewees could not clearly demarcate the role of spatial planners.

Related to the *information demands* which have a clear link to the frames, the urban designers mainly are in need for qualitative information , the transport planners, environmental specialists and plan economists mostly are in need for quantitative information and – again –the spatial planners are in need for a combination of both. The information demands are related to the tools that are currently used. Plan economists, environmental analysts, and transport planners all use quantitative models, in dedicated software and standard packages (e.g. Microfsoft Excel). Urban Designers use design software (such as Autocad), but also hang on to paper and pens for drawing. Spatial planners such a multitude of tools, whereby the importance of GIS is acknowledged, but its importance is not comparable to for instance the critical role models play in the work of transport planners and plan economists.

4. Conclusions and Recommendations

In the previous section five roles and their related characteristics are described. Understanding the characteristics of different roles in planning situations is a first step in order to improve the communication between disciplines. Since these are based on the Dutch context, other contexts will likely result in a different set of roles with different characteristics. Nonetheless, the distinction between actors with a *design* and an *analytic* frame is more widely applicable. Transport planners, environmental analysts and plan economists, primarily have an analytic frame, which is reflected in their usage of tools which use quantitative data. Better communication between these roles through PSS requires careful organization of workshops and data and model management, but does not involve fundamental differences in terms of *how* the problem is conceived. Communication between roles with a *design* frame (in this case urban designers) and an *analytic* frame, requires an innovative way of merging different ways of problem conception and tools.

Hence, both the instrumental characteristics of a PSS and the way in which it is applied should relate to all roles that are involved (cf. MacEachren 2000). The added value of applying a PSS likely lies in supporting the development of a 'spatial language' which connects to all the involved stakeholders. A spatial representation (i.e. a map) helps an urban designer to understand the way of thinking of a transport planner, and vice versa. Put differently, a PSS can help to make ideas, insights, claims and assumptions spatially explicit in their facilitation of a spatial language. It becomes a 'boundary object' relating to different disciplines (Harvey and Chrisman 1998). The focus on concrete, spatial representation relates to an insight by Innes and Booher (1999, p.13) about the condition for frame reflection.

> Crucial to the usefulness of such double vision and, more generally, to reflective policy inquiry, in Schön and Rein's view, is the link to concrete practice. Dialogue that is grounded in practice, at least in part, helps participants to avoid being trapped in their own thought and failing to see assumptions and possibilities.

At the time of writing, we are researching what the demands of a PSS are, both in terms of the instrument and the process, to support this development of a spatial language. Earlier research reports that the usage of a map-based touch table has great potential to improve the communication between stakeholders (Arciniegas 2012). Preliminary findings with users of a map-based touch table conducted for this study underline the idea that this is an effective instrument in developing a shared spatial language between planning actors. As several interviewees indicate a map-based touch

table helps to foster discussion (because people stand around a table) and a focus on content (because of the *geographic* information that is depicted).

Future research should further specify whether this claim about a map-based touch table is also relevant for other contexts, and what kind of additional characteristics of a PSS are needed. These empirical studies should likely be a combination of experiments (e.g. Arciniegas 2012, te Brömmelstroet et al. 2013) and in-depth study of urban planning practice (e.g. Moore 2008). This kind of research is also very relevant for the field of Geodesign. Results from this paper indicate that some urban designers are hesitant to use more advanced geo-information technology. Understanding how to also connect to them through a PSS is a key to bring the field of Geodesign forward.

This paper has focused on the role of PSS for improving communication among disciplines. While this is a very important added value of applying a PSS, this is certainly not the only one. Other added values include: increased efficiency, more and better participation, and preventing 'negotiated nonsense'. All of these are necessary elements for sustainable urban development.

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