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Towards a pragmatic research agenda for the PSS domain

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ABSTRACT

The tenuous link between knowledge and processes of urban strategy-making leads to sub-optimal plans, time delays and financial costs. The planning professional is ill-equipped to deal with fundamental urban challenges that threaten the quality and competiveness of cities and regions. For decades, Planning Support Systems (PSS) are being developed to address this challenge. The PSS research domain grew accordingly. Only recently did researchers start to focus more directly on how PSS are used (or not used) by planning practitioners. Understanding the real-life application of PSS is fundamental for addressing the challenges of knowledge use. This commentary argues that we need to go beyond the current simplistic understanding of several key concepts. It identifies academic pathways that further mature the conceptualization of PSS, of planning processes, of the participants and the relationship between them. The argument builds on ten years of full-time research in this domain and combines this with recent insights from other academic fields, such as group performance and behavior psychology. This provides us pathways towards a more realistic evaluation of how knowledge can regain its important role in urban planning.

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1. Introduction

Urban planning processes—especially their more strategic initial phases—have seen rapid and fundamental changes in the past decades. Complex and continuously shifting networks have replaced the stable hierarchical processes marked by clear relations between financial power, problems and solutions. These networks include many actors with widely varying goals, interests, power and professional languages. Planning research and practice pays much attention to how this communicative turn is organized (Allmendinger and Tewdwr-Jones, 2002; Healey, 1996). Strong differences in educational and professional backgrounds, combined with institutional contexts and views of the urban system, resulted in a highly fragmented knowledge base. Each actor brings their unique—and often highly specialized and fragmented—focus and language to the table. Since planning is about linking knowledge to actions in the public domain (Friedmann, 1987), it is both important and challenging to combine and transform these diverse contributions into a meaningful and shared understanding of the complex relations between urban interventions, political goals and their effects on a wide range of important indicators (i.e. social, economic, spatial and environmental).

Next to this process complexity, we have become increasingly aware of the complex relations between the components of the urban system itself. The causes of many unsustainable urban trends are largely unknown, uncertain and complex. But also the effectiveness of interventions increasingly depends on a myriad of reciprocal relations between numerous variables.

Because of this double complexity of process and object, it is crucial to structure the interaction between planning actors as well as to ensure that relevant knowledge about the urban system is properly included, contested, processed and shared

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among them. A narrow *process* focus runs the risk of being superficial and leading to unrealistic, ineffective or even counterproductive strategies for urban interventions (i.e. 'negotiated nonsense' (Van de Riet, 2003)). A narrow *object* focus cannot yield the necessary agreements on strategies in the highly fragmented governance context. The financial implications and potential time delays are staggering. Hidden conflicts or superficial and naïve strategies have often resulted in dire legal and financial problems. Previous research identified these knowledge gaps and their consequences on socio-economic costs and benefits (Beukers et al., 2011), mobility impacts (Te Brömmelstroet and Bertolini, 2011), and environmental impacts and constraints (Fischer, 2003).

Planning Support Systems (PSS) aim to structure the exchange of different types of knowledge in planning processes (Klosterman, 2001). Seeing strategic urban problems as 'wicked' (Rittel and Webber, 1984), without a one optimal solution, and increasingly political and contested, they attempt to improve the strategic capacity and the ability of planning actors to go through a shared 'enlightenment' process and create 'negotiated knowledge' (Amara et al., 2004; Gudmundsson, 2011). In contrast to computer models, PSS have the explicit aim to support and improve specific steps of the planning process (Geertman and Stillwell, 2003b). To do so, explicit and codified information (often provided by these computer models) is systematically fed and shared into planning processes. Many PSS offer a visually attractive platform that structures the mutual exchange of knowledge among many actors. Typically organized in a setting of one or more workshops, a group of planning actors comes together to learn about the planning issue at hand and to develop shared ideas.

Although planners 'can obviously use all the support they can get' (Couclelis, 2005), and large private and public funds are used to further develop the suite of tools, PSS use in planning practice still lags far behind expectations (Te Brömmelstroet, 2012; Vonk, 2006). There seems to be a persistent mismatch between characteristics of the PSS and those of strategy-making processes. Planners see PSS as overly detailed and precise, mathematically complex, rigid, slow, unintelligible and not transparent enough to be compatible with the unpredictable and dynamic nature of strategy-making processes (Te Brömmelstroet, 2010a; Vonk et al., 2005). The recent literature proposes three main mechanisms for improving this perceived mismatch: simplifying underlying models, increasing transparency, and increasing flexibility (Brail, 2008; Geertman et al., 2013).

2. State of the debate

Most PSS studies are case-based reports of pilot applications, authored by the PSS developers themselves (Brail and Klosterman, 2001; mostly in edited volumes such as: Brail, 2008; Geertman and Stillwell, 2003a, 2009; Geertman et al., 2013). While they do offer valuable insights into the technical details and context specifics, they fail to develop a generalizable body of knowledge on the effectiveness of the mechanisms for bridging the implementation gap (Te Brömmelstroet, 2013). The limited studies that did aim to provide an overview were mainly geared towards identifying implementation problems and hardly explored potential solutions (Vonk, 2006).

Recently, several researchers have been testing claims about the added value of PSS for strategy-making and with some significant progress (see Goodspeed, 2016, 2013; Pelzer, 2015). In my own research I first focused on testing the effectiveness of participative design mechanisms. Through three experiential cases a structured dialogue between PSS developers and intended users was developed, tested and refined (Te Brömmelstroet, 2010b). A follow-up study was designed to test hypotheses about PSS usability and their expected added value for multi-actor strategy-making. One project focused on context-rich observations in workshops (Pelzer et al., 2014, 2015; Pelzer and Geertman, 2013). In close relation, a control-rich experimental research environment was setup to test the added value of PSS under controlled conditions. Urban planning students, working in small roleplaying groups, were asked to design urban strategies, with the level of PSS support varying between the groups. We found only limited positive effects on the quality of the group process and the outcome (Te Brömmelstroet, 2015, 2017). Also, Goodspeed (2013, 2016) followed a context-rich approach to develop valuable insights into how PSS knowledge and technologies influenced group learning.

An overview of the seminal academic publications (most notably edited books such as: Harris, 1989; Geertman and Stillwell, 2003a; Brail, 2008; Geertman et al., 2013) reveals that there has been a shift away from the pure technical considerations of PSS design towards a focus on the impacts that PSS might have on planning practices. Increasingly, studies focus on possible reasons for a lack of such impacts to actually occur. The study of Vonk (2006) explored these 'bottlenecks' and propelled the academic PSS community into mapping the 'implementation gap'. The most recent advances go one step further and start to re-examine the key premise: Even when PSS are used, do they actually have a significant impact on the quality of planning? These studies translate the conceptual work of scholars like Couclelis (2005) and Innes (1998) into specific PSS test cases. Examples of this are Pelzer's field observations and the controlled experiments conducted by our own research team.

This commentary identifies four academic pathways to further mature the PSS debate. Fig. 1 presents an epistemic map that builds on a large body of academic research on the general performance of groups (Nijstad, 2009). It describes group processes such as urban strategy-making as an exchange among individuals with a shared purpose. It follows Healey's collaborative perspective (Healey, 1997, 2007) and indirectly builds on the wider conceptual work on planning as a social process (e.g. Forester, 1999; Friedmann, 1987; Innes and Gruber, 2005). There are those who are 'in' and those who are 'out' of the group. The output that the group produces is used to communicate with those outside. The group itself essentially engages in a process of exchange of knowledge and skills, which leads to learning at the individual level and the creation

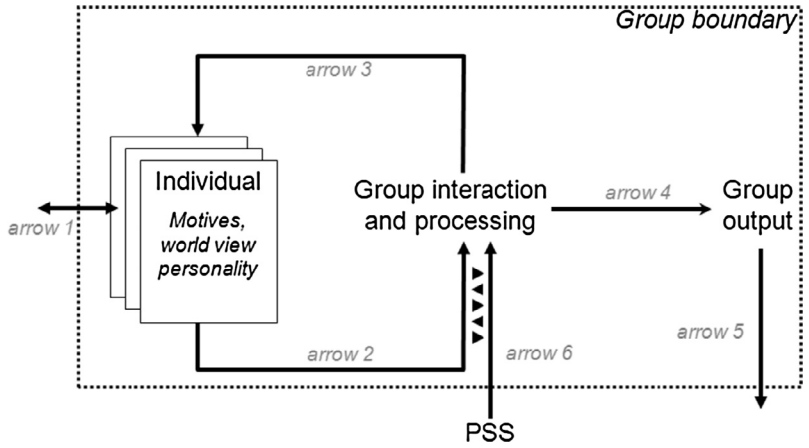

Fig. 1. Conceptual framework for PSS in strategy-making processes (adapted from Nijstad, 2009, p. 4).

of new and shared knowledge at the group level. In this conceptual framework a PSS adds explicit knowledge from outside the group and offers support to improve the knowledge exchange between the group members.

As an analytical tool it distinguishes between individuals, group interaction, group output, group boundary, and their relations (represented as arrows in Fig. 1). In planning, the group boundary is not carved in stone, but fluid: Planning actors explicitly represent groups that are outside of a session but still exercise influence. Also, planning actors can influence things outside of this boundary, for instance, through their choice of PSS. These relations are represented by arrow 1. The planners who are 'in' contribute their motives, worldview and personality to the group (arrow 2) and can also alter these personal characteristics as a result of the interaction (3). The group interaction leads to the product (4), which is then used to communicate with the external world (5). In all this, PSS aim to connect their knowledge with that of each individual and contribute to the quality of group interaction (6). Below, I will use the relations of Fig. 1 as guidance for the development of the research agenda.

2.1. PATHWAY 1: explore relations between user-friendliness and planning qualities

The first pathway is to expand the insights on how PSS relate to the quality of planning, by including ideas about user-friendliness mechanisms as independent variables: How does the improvement of the interaction between planners and PSS (arrow 6, arrow 2) impact the other processes and results (group interaction, personal learning, output)? A growing body of literature suggests that improving the user-friendliness of PSS should realize the promised added value for planning quality (Brail, 2008; Geertman et al., 2013; Klosterman, 1997).

These studies point to three important avenues of action. The first is simplifying the underlying models (Klosterman, 2012; Lee, 1973). In many cases, PSS are built on sophisticated computer models developed over many years, covering ever more variables. This makes it hard for planning actors to relate their inputs (i.e. urban interventions) with the outcomes (i.e. environmental effects) that the PSS generates. In some cases, most notably in sophisticated transportation models, simplifying the modelling rules and accepting lower explanatory power potentially strengthens this relation and enables shared learning. The second focuses on increasing the transparency of the PSS. In contrast to the first approach, it emphasizes the explanation of the underlying model and allows participants to develop a shared understanding (i.e. take a peek under the hood) before using the PSS (Sterman, 2002). A third proposed approach is increasing the flexibility of how the PSS is used and what kinds of effects it shows. This relates to observations that the dynamic characteristics of strategy-making call for instruments that can be quickly adapted and contextualized (Te Brömmelstroet, 2010b). By offering choices to the planning actors and mediating the process of contextualizing a PSS, it allows the actors to develop a sense of ownership and adapt the PSS to their specific demands.

Although these three mechanisms offer a convincing logic, they remain largely untested. We do not know *if* they improve PSS user-friendliness; where their optimums lie (as in, a PSS should be 'as simple as possible, but not simpler than necessary'); how the mechanisms interact with each other; or if they eventually lead to improved planning quality. The conceptual framework in Fig. 1 offers a valuable framework to assess most of these questions (further detailed in Te Brömmelstroet, 2013).

2.2. PATHWAY 2: adding realism to group dynamics

A second academic pathway fills the urgent need to abandon the naïve and simplistic view of the characteristics of group processes. In PSS studies, strategy-making processes are implicitly characterized as an objective, power-neutral and shared

process in which all actors have a similar interest: to learn about the abovementioned double complexity. This is far removed from reality, as extensive research on group performance shows (Nijstad, 2009). A conceptual paper by Geertman (2006), for instance, maps a number of important context characteristics of planning processes that influence the potential added value of a PSS (i.e. dominant planning style, political context and dominant policy model). Also, there is a need to acknowledge the distorting effect of power on the use of knowledge in strategy-making processes.

Pioneering research from the related field of Group Model Building finds that power, politics and personal agendas of different actors severely influences how they relate to each other and to the external knowledge that is brought in (Nistelrooij et al., 2012; Poole and DeSanctis, 1990). The level of trust that exists or can be created in strategy-making processes is another aspect that is widely ignored in PSS studies (Edelenbos and Klijn, 2007). We need to increase our awareness of how such dynamics might drive the usability and the added value of PSS in order to have (a) more realistic expectations, (b) more realistic simulations, and (c) a better understanding how to cope with their effects.

2.3. PATHWAY 3: diverse learning and cognitive styles

The third research frontier is the necessity to improve our understanding of the variety of individual planning actors at the table. PSS studies tend to either neglect or simplify the actors, i.e. all actors are similar or are differentiated only by their professional background. However, as the dynamic field of behavioral psychology shows, there is a lot of relevant information about how an individual thinks and interacts with knowledge that might have strong implications on how a PSS is or is not used, and ultimately on the quality of planning. An important element is the participants' motivation and orientation towards acquiring knowledge: Are they open for learning; do they approach it cautiously and strategically, or are they even completely disinterested (Mouter et al., 2013)? Instead of taking the user for granted, we need to engage with them on a deeper level (interesting insights in this direction in: Goodspeed, 2013). This is possible through more qualitative research methods that allow us to understand more of this individual complexity or though large-N studies that map attitudes among larger populations of relevant planning actors. Other relevant aspects in these studies are the cognitive styles of individuals, such as the Need for Structure or the Fear of Uncertainty. A cognitive style largely determines how a person seeks and processes information and which learning strategy fits best (Kahneman, 2011; Riding and Rayner, 1998; Thompson et al., 2001).

2.4. PATHWAY 4: combining research designs towards a pragmatic approach

PSS researchers often take a position outside of the object they study. But in fact, they often aim to have a direct or indirect effect on how PSS are further developed or used in planning practices. In that sense, they are more like artists than classical scientists (Sennett, 2008). The three pathways above hold the potential to mature the general view of the PSS 'guild' and increase its realism with the underlying mechanisms of knowledge production. This last pathway focuses more on the research design and the selected logic. Currently, PSS research is built around two different strands of research designs. On the one hand, many single-case studies discuss prototyping of PSS, and on the other general conceptual studies examine the bottlenecks for PSS use or theoretical frameworks. But to propel the domain forward, conceptual and practical studies need to be connected in reciprocal loops.

A pragmatic research program holds the potential to link and strengthen both of these separate endeavors (building on Schön, 1983; Straatemeier et al., 2010; Van Aken, 2005; Weber, 1947). Two important elements of such a pragmatic program are the experiential spiral, which ties practice and theory together (Fig. 2), and the combination of context-rich and control-rich research environments (Fig. 3).

The experiential spiral builds on Kolb's famous, and contested, learning cycle (Kolb, 1984). Four distinct forms of learning are linked together in one loop. When applied to research, it shows that observation and reflection (O&R) of challenges in practice is often the starting point, followed by forming abstract concepts (FAC) about problems and potential solutions by researchers. This is where current PSS conceptual research often stops. But, testing in new situations (TNS) offers the potential to link up with practical situations. This leads in time to new concrete experiences (CE). Through this step, and in contrast to most single-case studies, a new research cycle can start. In such a spiral, researchers develop rigorous academic knowledge, and at the same time ensure their relevance in practice (Pawson and Tilley, 1997). Also, PSS and planning practitioners can directly tap into this knowledge, and apply and test it.

The second element of a pragmatic research approach is the combination of control-rich and context-rich designs (Fig. 3). Putting two extreme research designs together offers synergetic advantages by combining their strengths (Abbott, 2004; McGrath, 1981). In the pragmatic approach it leads to different ways to create and study abstract concepts in practical situations under different conditions. Academics aim to ensure internal validity of their findings through tight control over relevant variables (*Y*-axis) and external validity though a high level of context (*X*-axis). Fundamental trade-offs between these two aims make their union impossible in real-life practice; however, by combining different designs we can approach the ideal in a research setting. As already stated, the PSS domain is rich in classical case study designs that offer deep insights in context, but have very limited control over what is actually happening in real-life application settings. There are some positive and negative experiences in using the experimental design in PSS research (Arciniegas et al., 2013; Jankowski and Nyerges, 2001; Te Brömmelstroet, 2015), and several research groups are currently working on this approach. Experiential case studies offer settings in which next-to-real planning practices (e.g. serious games, workshops) are used to test the relevance of abstract ideas (see examples in: Beukers, 2015; Hoetjes, 2010; Straatemeier, 2008; Te Brömmelstroet

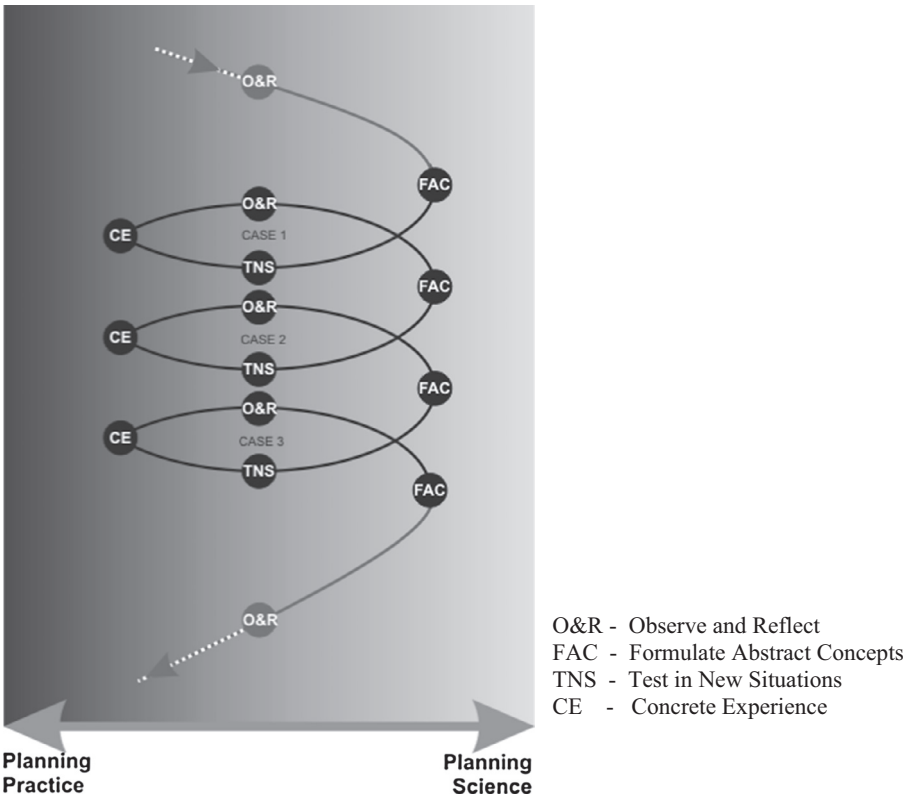

Fig. 2. Pragmatic, experiential spiral between theory and practice (further explored in: Straatemeier et al., 2010).

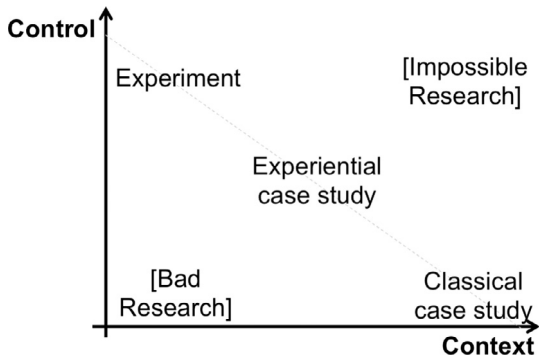

Fig. 3. Family of pragmatic research designs in control–context diagram.

and Schrijnen, 2010). These do not provide as much context as a classical case study, but still more than an experiment. Likewise, the researcher has less control than in experiments, but more than classical case studies. The notion expressed in Fig. 3 is that all three research designs provide a trade-offs between control and context. Linking them into one coherent programme can optimize the explanatory potential of each. By testing similar research questions in different designs internal and external validity can be strengthened.

We should acknowledge that there are many obstacles to achieving this deep synthesis of practice and scholarship. Underneath the design science literature lie long and sometimes bitter debates about the types of valid research, and on how technical and social contributions relate to one another. Aside from the epistemological challenges, there are many practical ones. Academics by their nature often become alienated from practice, or skeptical of assumptions made by practitioners. Similarly, practitioners do not always understand or see the relevance of intricate academic theory. This might for a large part explain the current state of the PSS research domain.

3. Conclusions

The PSS research domain studies an important element of the pertinent challenges in city and regional planning. More insight into how knowledge can play a role in transport planning is vital for improving both the content of integrated plans and strategies as well as the organization of shared learning processes (strategy capacity, as defined in Healey, 2007). Seeing PSS researchers and developers more like 'craftsmen' than scientists, I identified four pathways that help to further mature the field of study. Three of them are related to adding realism to central concepts of PSS (user-friendliness/usefulness, group dynamics and individual learning) and one to the research methodology (pragmatic linkage of theory and practice).

The PSS research guild is well equipped to find answers to the relevant questions. Most parts of the cycle are well covered; some scholars are working on developing abstract concepts on both PSS technologies and on their use in practice, while others are developing experimental studies, large numbers of single case studies and even programmes that link these. The main challenge is to add structural links between these parts. Another important direction for quality improvement is for more scholars to research PSS from a *planning perspective*, i.e. to focus on practical applications instead of the technologies themselves. And ideally, this research is done by scholars that do not have an interest in the PSS itself.

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