Dragen modellen bij aan strategische capaciteit?: De uitkomsten van vijf experimenten

Marco te Brömmelstroet
Universiteit van Amsterdam, AISSR
brommelstroet@uva.nl

Bijdrage aan het Colloquium Vervoersplanologisch Speurwerk
20 en 21 november 2014, Eindhoven

Samenvatting

Een experimentele studie naar de meerwaarde van ondersteunende modellen voor planners

Planning Support Systemen (PSS) voorzien potentieel in belangrijke ondersteuning van strategische planprocessen in onze steden. Rondom een kern van computerinstrumenten brengen deze technologieën expliciete informatie in in de dagelijkse planningspraktijk. Toch zien we al decennia dat door een veelvoud aan barrières en bottlenecks het gebruik ervan sterk achterblijft bij deze potentie.

Dit paper rapporteert over een onderzoek naar de kernaanname van veel PSS ontwikkelingen: PSS hebben een intrinsieke toegevoegde waarde voor planprocessen. Het onderzoek behelst vijf afzonderlijke gecontroleerde experimenten, waaraan meer dan 250 studenten hebben deelgenomen. Zij werden gevraagd een typische planningstaak uit te voeren terwijl ervoor werd gezorgd dat ze verschillende vormen van PSS ondersteuning tot hun beschikking hadden (variërend van geen enkele ondersteuning, papieren kaarten tot complexe rekentools). In alle vijf experimenten is vervolgens aan de hand van een multidimensionaal kader gekeken naar de effecten hiervan op kwaliteiten van het planproces (reactie, inzicht, commitment, communicatie, gedeelde taal en effectiviteit) en de planningsuitkomst (vernieuwend, werkbaar, relevant en specifiek).

In slechte één van de vijf experimenten werden systematische positieve effecten van PSS op de kwaliteit van het planproces gemeten (bij reactie en consensus). De PSS hadden geen meetbaar effect op de kwaliteit van de planningsuitkomsten. In twee experimenten werden zelfs negatieve effecten op het planproces gemeten. De paper sluit af met een discussie over de betekenis van deze bevindingen voor toekomstig PSS onderzoek en de praktijk. Daarnaast worden mogelijke verklaringen en tekortkomingen van het onderzoeksontwerp besproken.

1.Introduction

Urban planning processes—especially their more strategic initial phases—have seen rapid and fundamental changes in the past decades. Stable hierarchical processes, marked by clear relations between financial po wer and problems/solutions, have been replaced by a complex and continuously shifting network, which involves many actors with disparate goals, interests, power and professional languages. In planning research and practice much attention has been given to ways of organizing this communicative turn (Allmendinger & Tewdwr-Jones, 2002; Healey, 1996). Marked differences in educational and professional backgrounds, institutional contexts and views of the urban system have resulted in a highly fragmented knowledge base. Each actor brings their unique—and often very specialized and fragmented—focus and knowledge to the table. Since the raision d'être of planning is to link knowledge to actions in the public domain (Friedmann, 1987), it is both important and challenging to combine all this knowledge into a meaningful and shared understanding of the relations between urban interventions, political goals and their effects on a wide range of important indicators (i.e. social, economic, spatial and environmental).

At the same time, and related to the abovementioned inclusiveness, 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 often uncertain, have complex interrelations, and sometimes are even unknown. The effectiveness of interventions is increasingly dependent on a myriad of reciprocal relations between multiple variables (Allen, 1997; Sterman, 2002).

This double complexity of process and object makes it crucial to not only structure the process of interaction between actors, but to also ensure that relevant knowledge about the urban system is included, contested, processed and shared among all relevant participants. Maintaining 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'). Similarly, a narrow *object* focus cannot lead to necessary agreements on strategies in the highly fragmented governance context. The financial implications of this are staggering. Hidden conflicts or superficial and naïve strategies have often resulted in legal and financial problems when they have to be revised or even abandoned altogether.

Planning Support Systems (PSS) aim to structure the exchange of different types of knowledge in such complex planning processes (Klosterman, 2001). Related to the views that strategic urban problems are 'wicked' (Rittel & Webber, 1984), do not have one optimal solution and are increasingly political and contested, PSS attempt to improve the strategic capacity and the ability of planning actors to go through a shared 'enlightenment' process and create 'negotiated knowledge' (Amara, Ouimet, & Landry, 2004; Gudmundsson, 2011; Healey, 2007). In contrast to computer models, PSS have the explicit aim to support and improve specified steps of the planning process (Geertman & Stillwell, 2003b). To do so, they actively feed explicit/codified information (often provided by these computer models) into planning processes. PSS, especially those that are designed to support the more strategic planning phases, are often designed as visually attractive platforms that aim to structure the mutual exchange of knowledge among many actors. This is usually organized in a setting of one or more

workshops, in which planning actors come together to learn about the planning issue at hand and to develop a shared understanding of the desired intervention.
Although planners 'can obviously use all the support they can get' (Couclelis, 2005), PSS use in planning practice still falls far behind expectations (Vonk, 2006). A persistent mismatch between the characteristics of PSS and those of strategy-making processes seems to stifle this long-anticipated progress. Planners keep seeing 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 (anonimized reference to self, 2010; Vonk, Geertman, & Schot, 2005). To break through this unfruitful dichotomy of hopeful PSS developers and antagonistic potential users, we need to develop more systematic insights into how PSS can address the needs of planners. This paper builds on the pragmatic school of 'realistic evaluation' (Pawson & Tilley, 1997) and aims to develop insights into the added value that PSS can provide on the quality of strategy-making processes. By testing the main underlying assumption of the PSS debate—that **PSS have systematic positive effects on the quality of planning**—under controlled conditions, it adds a systematic understanding of the relations between the mechanisms of PSS application and the expected outcomes.

2. Research design and methodological choice

2.1 Controlled experiments

As discussed elsewhere (anonimized reference to self), the academic PSS debate is heavily dominated by isolated case studies and context-rich field observations (Brail & Klosterman, 2001; Brail, 2008; Geertman, Toppen, & Stillwell, 2013; Geertman & Stillwell, 2003a; anonimized reference to self). By definition, these accounts provide a rich understanding of how PSS are developed and used in their wildly varying planning contexts (high ecological validity). Such studies are crucial for developing a realistic view of the relationship between planning contexts and PSS characteristics. However, this richness in dependent, independent and context variables makes it virtually impossible to generate generalizable claims or to test systematic relations (internal and external validity). The methodological argument is then, that such research needs to be complemented with other research designs that can counter this limitation (anonimized reference to self).

One such a research design is the 'controlled experiment'. In such experiments, the context is controlled as much as possible in order to isolate the effects of a specific factor. It follows the logic of consequential manipulation, which states that 'if a causal factor, X, is manipulated, then, given appropriate controls, a systematic effect is produced on the response variable, Y' (Goldthorpe, 2001, p. 5). If a systematic effect exists, it can be causally associated with this manipulation. Although it has its own methodological limitations, such a research design allows the PSS researcher to extract hypotheses from field observations and test whether there are systematic effects under controlled conditions. Such findings should then feed back into PPS development in order to reflect on their validity in real practices.

2.2 Manipulating the causal factor: PSS experiments

The five experiments in which this logic was followed were populated by different groups of students from urban planning or related studies. They were recruited at the University of Amsterdam (Urban Planning master's and bachelor's programme), the Technical University of Munich (Transport Engineering), the Windesheim University of Applied Science (Traffic Engineering) and the Saxion University of Applied Science (Planning, Environmental Engineering). In each of these experiments, students were randomly divided into groups and informed that they were taking part in a national design competition. The main characteristics of the five experiments are presented in table 1, and the general setup and PSS characteristics of each are shortly described below.

In experiment 1, all groups (5-6 persons from two international master's programmes) were invited to develop an integrated strategy for the location of new housing and work units in the metropolitan area of Munich. The control groups did not receive any support in terms of process or content: when they entered the room they were informed about the task at hand and the time for completing it. The treatment groups received a set of paper maps that were generated with the local accessibility instrument called 'Erreichbarheitsatlas'. These maps showed for each location in the region how many jobs and inhabitants could be reached within an acceptable travel time, indicating the location's development potential. In the framework of Vonk, this would be considered an 'Informing PSS' (Vonk, 2006, p. 79). All treatment groups worked simultaneously, and the PSS developer walked among the participants to give explanations when needed.

In the second experiment in Amsterdam, the small population of the urban planning master's programme necessitated smaller groups (three persons). The students were invited to redevelop an existing urban infill plan in the old harbour area of Rotterdam. Their degrees of freedom in this were limited to relocating the buildings, alter infrastructure and develop the spaces around them. The treatment groups were supported Urban Strategy; a PSS that allows quick calculations of the effects of urban interventions on a range of environmental, social and economic indicators ('Analysing PSS' from Vonk, 2006). Also, two chauffeurs were present to facilitate the exchange between the instrument and the participants.

The third experiment was done with a larger population of first-year urban planning students from Amsterdam. This allowed me to increase the group size to six. Again, all groups had the same assignment in Rotterdam, with 15 extra minutes compared to experiment 2. Also, the default plan was made more complex by adding more houses and office buildings. All these changes aimed to bring the conditions of the experiment closer to real-life planning practice. The treatment groups received similar support from Urban Strategy and two chauffeurs. Urban Strategy was supplemented with a Maptable, allowing improved visualisation and group interaction with the modelling output.

The population in experiment 4 was drawn from three different applied studies (group size increased to eight). In the setup, the differences between their backgrounds were accentuated to simulate the real-life differences in planning practice. Each participant received only role-specific information based on his or her study background. The planning students were divided into economists and urban designers, because their group was seen as too dominant in numbers. Again, the assignment was to redevelop the infill

plan in Rotterdam. The treatment groups were divided into two, based on the structure of the group process. All these groups were supported by Urban Strategy and the two chauffeurs. Now, also a mediator structured the session. He offered two different treatment structures: three groups followed a group process of brainstorming, designing and writing the strategy, while for the other three groups collective brainstorming was replaced with individual brainstorming and reflection.

In the final experiment, again with first-year Urban Planning students and based on the lessons from experiment 4, role playing elements were introduced to increase similarity with real-life practice. This time, the students all had the same background and were randomly assigned to a role (with role specific information and role specific prizes to win). Each session was extended to 90 minutes and the treatment groups were divided into two different PSS support treatments: (1) Urban Strategy, with two chauffeurs and one mediator, and (2) Phoenix, a Communicating PSS (Vonk, 2006) with two chauffeurs developed by GeoDan. Phoenix is a Maptable-based instrument that allows quick drawing and some basic computations. The two chauffeurs mainly used it to get different ideas on the table and to distinguish similarities and disagreements. Also, because of input data limitations, the assignment was changed into the redesign of an urban infill area in Utrecht.

As table 1 shows, each separate experiment strictly followed the logic of consequential manipulation by including control groups (no PSS support) and treatment groups (with PSS support). However, 'learning-by-doing' let us to progressively improve several other elements of the experimental setup as described above. As a result, both the structure of the experiment (the planning problem, group size, available time, role playing) and the context variables of the participating students changed. Therefore, the logic of consequential manipulation can only by used within, and not across, the five experiments.

2.3 Operationalizing the response variable: planning quality

PSS aim to improve the quality of planning, which is a broad and ambiguous goal. There are many different views on what good planning is, and all of these views lead to different indicators to be measured (Allmendinger, 2002; Healey, McDougall, & Thomas, 1982). However, all views share the abstract idea that the concept of planning quality can be broken down into quality of the planning process and quality of the planning outcome (anonimized reference to self). These two categories allow us to use more general literature in their operationalization, thus going beyond a single idea of planning quality towards a multidimensional framework that can accommodate different conceptualizations of planning quality.

PSS case studies distinguish between four main indicators for the quality of planning outcomes: novelty, workability, relevance and specificity (anonimized reference to self). This mirrors insights from the field of ideational output, where these four dimensions are further broken down into sub dimensions (Dean, Hender, Rodgers, & Santanen, 2006). For example, novelty is made up of originality and paradigm relatedness, while workability is operationalized into implementability and acceptability (see table 2).

Table 1 Characteristics of the five experiments

	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
Institute	TU München	UvA	UvA	Saxion Windesheim	UvA
Date	14-dec.-11	20-dec.-11	6-nov.-12	21-mei-13	29-okt.-13
Students	Master's Environmental Eng. Master's Transport Eng.	Master's urban Planning	2nd year Urban Planning	1st year Traffic Eng. 2nd year Planning 2nd year Environmental Eng.	2nd year Urban Planning
# Students	34	17	70	57	69
# groups	6	6	12	7	9
Conditions	3 control 3 PSS	3 control 3 PSS	6 control 6 PSS	1 control 3 group PSS 3 individual PSS	3 control 3 PSS A 3 PSS B
PSS	Erreichbarheitsatlas	Urban Strategy	Urban Strategy	Urban Strategy	A. Urban Strategy B. Phoenix
Type of PSS	Informing PSS	Analysing PSS	Analysing PSS	Analysing PSS	A. Analysing PSS B. Communicating PSS
Minutes/ session	60	45	60	60	90
Subject	New housing and jobs in Munich Metropole	Design of urban infill Waalhavens Rotterdam	Design of urban infill Waalhavens Rotterdam	Design of urban infill Waalhavens Rotterdam	Urban infill Cartesius Utecht
Role playing	no	no	Air quality Noise External safety Mobility Economist	Planners divided in Urban Design and Plan Economists	Urban designer Transport engineer Environmental advisor Citizen

The quality of the planning process can be further operationalized into eight distinct quality elements (the ninth element 'Behaviour' from the original framework is left out because it is not relevant for students). These dimensions are also found in recent studies on Group Model Building, which specifically focused on supporting group learning with instruments (Rouwette, Vennix, & Van Mullekom, 2002; Rouwette, 2003; Rouwette, Vennix, & Felling, 2009). The first four dimensions relate to personal learning, whereas the latter five relate to the quality of the group process. Again, some dimensions are further broken down into subdimensions (see table 2).

Table 2 Multi-dimensional framework for measuring quality of planning and performance of PSS (anonimized reference to self)

Planning outcomes	Planning process
Novelty	**Reaction**
Original	Enthusiasm
Paradigm relatedness	Satisfaction
Workability	Credibility
Implementability	**Insight**
Acceptability	Insight in problem
Relevance	Insight in assumptions
Applicability	**Commitment**
Effectiveness	**Communication**
Specificity	**Development of shared language**
Completeness	**Consensus**
Implicational explicitness	Consensus on problem
Clarity	Consensus on goals
	Consensus on strategies
	Cohesion
	Efficiency gains

2.4 Data gathering techniques

To measure outcome categories of table 2, two data gathering techniques were applied. First, all participating students were asked to rate a number of statements about the quality of the process, making use of a 7-point Liker scale. The averages of these responses were used to assess the perceived qualities of the processes with and without PSS support.

The second technique was used to rate the quality of the strategies that were developed by the groups. Again, a 7-point Likert scale was used to rate statements. These statements were rated for each strategy by two independent external raters, who were neither aware of the hypothesis nor could they trace the strategies to the control or treatment groups. The average score of both raters was used as a proxy for the qualities of the strategy.

Note that for both of these techniques the resulting scores can only be used in a relative sense. Although they indicate differences between groups, they cannot be used as an objective quality score.

3. Systematic effects on planning quality

3.1 Effects on quality of the planning process

Table 3 presents the outcomes of the five experiments in terms of planning quality, outlining for every dimension the average scores of the control and treatment groups. As already stated, although interesting, the score differences between the experiments cannot be considered a controlled effect because in addition to the difference in intervention also the context and the experiment setup changed.

One of the first noticeable trends is the relatively high score of most control groups on most process qualities. This positive evaluation is supported by the students' feedback (in the open-ended question section and in person) that they really enjoyed the session. In experiment 1, almost all process qualities (including the total score) seem to be negatively affected by the PSS treatment. In experiment 2 there are no significant effects, while the third experiment with the same PSS shows a significant positive effect on Reaction and Consensus. In experiment 4 there are no significant effects of the different treatments compared to the control group and also none between the two treatments. In experiment 5 we see again significant negative effects of one of the two PSS: on Commitment, Shared Language, Cohesion, Efficiency (and again also on Total Process). Also, there are significant differences between the two PSS, where Urban Strategy scores higher on Insight (0.60).

Table 3 Effects on qualities of the planning process

		n	Reac-tion	In-sight	commit-ment	commu-nication	shared langua ge	consen-sus	cohesion	Effi-ciency	total
1	Control	15	5.56	5.99	5.60	6.07	5.97	6.11	4.83	5.13	5.64
	Treatment	18	4.80	4.84	4.78	4.88	5.17	5.35	4.83	3.79	4.83
	Difference		-0.76*	-1.15**	-0.82	-1.18*	-0.80*	-0.75**	0.00	-1.34*	-0.81*
2	Control	9	5.45	4.97	5.78	4.89	4.94	5.96	5.47	3.78	5.04
	Treatment	8	5.27	4.73	5.50	5.00	5.00	5.60	4.94	4.75	5.02
	Difference		-0.18	-0.24	-0.28	0.11	0.06	-0.36	-0.53	0.97	-0.03
3	Control	31	5.38	4.98	5.84	5.39	4.76	5.73	5.47	5.48	5.32
	Treatment	36	5.82	5.29	6.25	5.39	5.15	6.17	5.32	5.74	5.61
	Difference		0.44*	0.31	0.41	0.00	0.39	0.44*	-0.15	0.25	0.29
4	Control	9	5.34	4.89	5.44	5.44	4.72	5.22	4.58	4.89	5.02
	Treatment A	32	4.89	4.74	5.44	5.06	4.27	5.20	4.43	5.03	4.79
	Treatme	2	5.25	5.04	5.67	5.29	4.79	5.40	4.73	4.92	5.09

	nt B	4								
	Difference A		-0.45	-0.16	-0.01	-0.38	-0.46	-0.02	-0.15	0.14	-0.22
	Difference B		-0.08	0.15	0.22	-0.15	0.07	0.18	0.15	0.03	0.07
5	Control	21	5.26	4.81	5.62	5.19	5.00	5.66	4.67	5.19	5.15
	PSS A	24	5.42	5.06	5.54	5.38	4.52	5.33	4.47	4.92	5.11
	PSS B	24	4.89	4.66	5.04	5.04	4.27	5.34	4.01	4.25	4.75
	Difference A		0.15	0.25	-0.08	0.18	-0.48	-0.34	-0.20	-0.27	-0.05
	Difference B		-0.37	-0.16	-0.58*	-0.15	-0.73*	-0.32	-0.66*	-0.94*	-0.41*

** Difference is significant at the 0.01 level
* Difference is significant at the 0.05 level

3.2 Effects on quality of the planning outcome

Table 4 presents the effects on the four qualities of the strategies for each of the five experiments (note that *N* here is much lower because it relates to groups instead of individuals). None of the five experiments resulted in significant differences in the quality of the developed strategies.

Table 4 Effects on quality of the planning outcome

		n	novelty	workability	relevance	clarity	total outcome
1	Control	5	3.41	4.65	3.73	3.95	3.92
	Treatment	7	2.96	4.21	3.71	4.14	3.85
	Difference		-0.45	-0.44	-0.02	0.19	-0.07
2	Control	3	4.44	4.88	5.17	4.75	4.52
	Treatment	3	4.17	4.71	4.39	4.08	4.08
	Difference		-0.28	-0.17	-0.78	-0.67	-0.44
3	Control	6	3.25	4.59	3.81	4.21	3.80
	Treatment	6	2.50	4.30	3.20	4.17	3.35
	Difference		-0.75	-0.29	-0.61	-0.04	-0.44
4	Control	1	3.17	4.00	3.67	3.25	3.60
	Treatment A	3	3.45	4.04	4.45	4.33	3.74
	Treatment B	3	3.31	4.38	4.39	3.67	3.91
	Difference A		0.28	0.04	0.78	1.08	0.14
	Difference B		0.14	0.38	0.72	0.42	0.31
5	Control	3	3.89	4.33	4.44	5.67	4.47
	Treatment US	3	4.28	4.50	4.50	5.83	4.70
	Treatment Ph	3	4.00	4.33	3.72	5.08	4.25

Difference US	0.39	0.17	0.06	0.17	0.23
Difference Ph	0.11	0.00	-0.72	-0.58	-0.22

4. Conclusion and reflection

The paper started with the observation that planning processes increasingly face the dual complexity of process and object. PSS offer a portfolio of instruments that aim to support planners in dealing with this complexity. By adding explicit knowledge and providing a structure for knowledge exchanges between different planning actors, these instruments offer crucial support. However, after decades of development, their use in practice is still rather limited. To explore why this is the case, the research presented here aimed to test the general underlying assumption of the PSS endeavor: that PSS have an added value for the quality of planning.

By segmenting the quality of planning into a multidimensional framework and assessing it under controlled conditions, I aimed to test this assumption as a hypothesis. Despite the limitations of this research design (see reflection below), it was selected because it provides an important contribution to a research domain dominated by context-rich case studies.

If PSS have an intrinsic added value for strategy-making processes, systematic effects should emerge (with everything else staying the same). The only consistent way to assess if such systematic effects occur is by working with a number of randomized groups that work simultaneously on a similar strategy-making task. By measuring the quality of the planning process and the quality of the planning outcomes I expected to find significant differences. The differences in context and research design only allow for comparison of the differences within each experiment not across experiments.

4.1 Conclusion

The overall conclusion is that the experiments could not substantiate the claim that PSS have an intrinsic added value for the quality of the developed strategies (i.e. planning outcomes). I found a significant positive effect on the quality of the process in only one of the five experiments (experiment 3: Reaction and Consensus). Interestingly, two other experiments resulted in significant *negative* effects (experiment 1 and experiment 5). Although not expected, this could be explained by differences in their 'fit for purpose' for this specific strategy-making assignment.

4.2 Reflection

That the hypothesis was not validated in the five experiments should not be interpreted as proof of the opposite; however, it does question the added-value assumption of many PSS studies. The different findings in the five experiments indicate that there is no intrinsic added value: the PSS impact depends on the type of PSS, the context and the way that the instrument is used. There are a number of fundamental reflections that can help put these findings into perspective.

The first relates to the logic of consequential manipulation, which prescribes that causal relations can be uncovered only when all other factors are held constant. This 'ceteris paribus' principle is maintained in this study by repeating each treatment-and control condition and ensuring a random assignment of students in groups. Nevertheless, the

numbers of participating students—and especially groups—is relatively low. This means that for instance a single brilliant student in a control group versus a wait-and-see passive treatment group can give distorted data. Although I expect that this effect is not very significant in this study, the possibility needs to be taken into account when interpreting the results. A second problem with the ceteris paribus principle is the learning that occurs between experiments and also within a single experiment: detailed findings of experiment 2 and 3 clearly indicate increasing scores on the process qualities in consecutive sessions.

A more fundamental problem is the ecological validity of the findings. It was knowingly sacrificed in this study, in order to improve the internal and external validity, and in particular two problematic issues should be highlighted. First, to what extent did the setup of the experimental sessions resemble planning practices? The sessions were designed together with the PSS developers, so that their experiences could inform the design, bringing it closer to real-life practice. Despite this effort, elements had to be simplified for pragmatic reasons; for example, a session normally takes much longer, allowing participants to get to know the PSS better and to have more opportunity to learn from it. The shorter duration of the sessions could have influenced the findings. But, and arguably more fundamentally important, the participants did not have a strong individual context, for example, years of good and bad experiences with this planning question, colleagues from other domains or with other PSS. This weak experience translates into high perceived qualities of the process under the control condition. They also did not bring crucial knowledge of the urban question to the table. One could argue that these real-life problems and potentials are actually what a PSS builds on. However, even if we follow this reasoning, this would still mean a much more nuanced version of the original assumption of general added value of PSS in strategy-making processes.

5. Discussion

One of the lessons learned in this research is that PSS could have an added value under the controlled conditions of the experiments. One of the bottlenecks that appears to stifle this potential is the limited attention paid to mediation and structuring of the process, which would require a sophisticated understanding and experience of knowing how to organize human interaction and interaction between PSS and planning actors. I observed (directly and through fly-on-the-wall recordings) that the chauffeurs and mediators were often surprised by the difficulties that the participants experienced in understanding the basic functions of the PSS or by the fact that some felt lost or even completely disengaged during the session. This view is clearly outlined by the outcome of the third workshop, which I will briefly address in closing.

In the first treatment session of the third experiment, the student group came in and was first given a short PowerPoint presentation on Urban Strategy by one of the chauffeurs. Since they were not yet familiar with this PSS and the assignment, the group seemed lost and started to question the detailed workings of some of the sub-models of Urban Strategy. This delay left only a very limited timespan to complete the entire strategy-making assignment. At the end of this first session, we decided to drop this first group and dramatically reshape the process for the next six groups. The main changes were to have the groups start the strategy-making assignment immediately upon arrival and then to introduce them to the relevant parts of Urban Strategy. In this way, the PSS could be

seen much more as an instrument instead of the focus of the experiment. As I mapped the quality dimensions for all groups, I could zoom in on the effects of this process change (figure 1 and 2). Most notably, the quality of the process and many of its sub-dimensions were dramatically improved. Although we should be careful to conclude anything based on this single occurrence, it supports my observations that by focusing on improving the process structure a lot can be gained in terms of added value.

Figure 1: Effect of disturbance in experiment 3 on process qualities

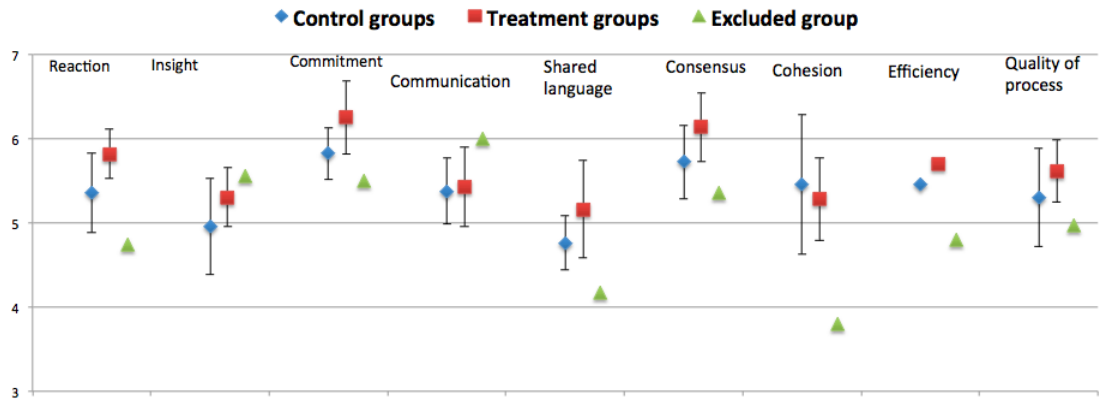
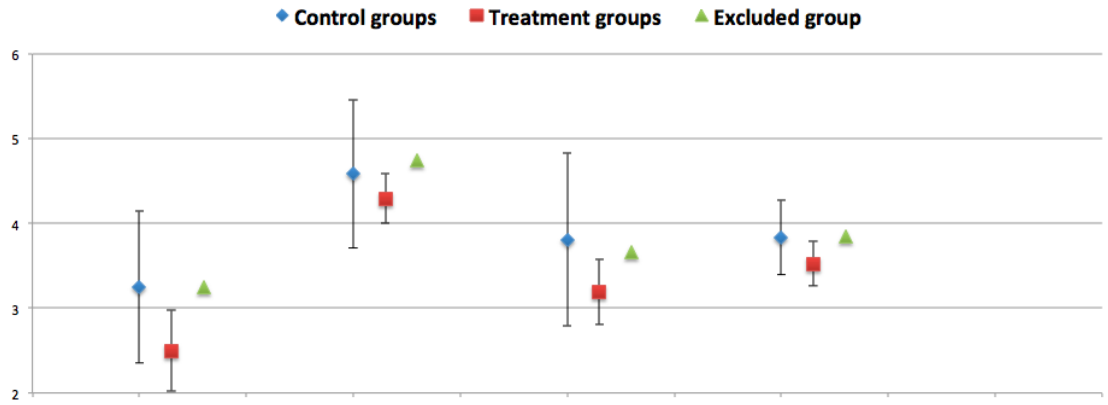


Figure 2: Effect of disturbance in experiment 3 on outcomes qualities



The general findings provide a great stepping stone for multiple research lines, of which several are already underway. First, it needs to be linked back again to context-rich observations. Do the findings improve our understanding regarding the use or lack of use of PSS in real-life planning practices? Second, the consequential manipulation needs to continue to zoom in on the essential assumption of the added value of PSS. Do systematic effects emerge under different conditions, such as different planning phases, different questions or different participants? As a third line, the research uncovered that we oversimplify some of the fundamental elements of the PSS implementation gap, which may obscure the path towards the important mechanisms to improve it. The participants bring a lot of relevant characteristics (i.e. worldviews, background domains, ways to deal with uncertainty and knowledge) to the table, which may go unnoticed. This also holds true for the dynamics of group sessions. In most PSS literature and in these experiments, such processes are considered in rather simplistic fashion.

References

Allen, P. M. (1997). *Cities and regions as self-organizing systems: Models of complexity*. Amsterdam: Gordon and Breach science publishers.

Allmendinger, P. (2002). Towards a post-positivist typology of planning theory. *Planning Theory, 1*(1), 77-99.

Allmendinger, P., & Tewdwr-Jones, M. (2002). The communicative turn in urban planning: Unravelling paradigmatic, imperialistic and moralistic dimensions. *Space and Policy, 6*(1), 5-24.

Amara, N., Ouimet, M., & Landry, R. (2004). New evidence on instrumental, conceptual, and symbolic utilization of university research in government agencies. *Science Communication, 26*(1), 75-106.

Brail, R. K., & Klosterman, R. E. (2001). *Planning support systems: Integrating geographical information systems, models and visualization tools*. Redlands, CA: ESRI Press.

Brail, R. K. (Ed.). (2008). *Planning support systems for cities and regions*. Cambridge, Massachusetts: Lincoln Institute of Land Policy.

Couclelis, H. (2005). "Where has the future gone?" rethinking the role of integrated land-use models in spatial planning. *Environment and Planning A, 37*, 1353-1371.

Dean, D. L., Hender, J. M., Rodgers, T. L., & Santanen, E. L. (2006). Identifying quality, novel, and creative ideas:Constructs and scales for idea evaluation. *Journal of the Association for Information Systems, 7*(10), 646-699.

Friedmann, J. (1987). *Planning in the public domain: From knowledge to action*. Princeton: Princeton University Press.

Geertman, S., Toppen, F., & Stillwell, J. (2013). Planning support systems for sustainable urban development.

Geertman, S., & Stillwell, J. (Eds.). (2003a). *Planning support systems in practice*. Berlin: Springer.

Geertman, S., & Stillwell, J. (2003b). Planning support systems: An introduction. In S. Geertman, & J. Stillwell (Eds.), *Planning support systems in practice* (). Berlin: Springer.

Goldthorpe, J. H. (2001). Causation, statistics, and sociology. *European Sociological Review, 17*(1), 1-20.

Gudmundsson, H. (2011). Analysing models as a knowledge technology in transport planning. *Transport Reviews, 31*(2), 145-159. doi:10.1080/01441647.2010.532884

Healey, P. (1996). The communicative turn in planning theory and its implications for spatial strategy formation. *Environment and Planning B: Planning and Design, 23*(217-234)

Healey, P. (2007). *Urban complexity and spatial strategies: Towards A relational planning for our times*. London: Routledge.

Healey, P., McDougall, G., & Thomas, M. (1982). Theoretical debates in planning: Towards a coherent dialogue. In P. Healey, G. McDougall & M. Thomas (Eds.), *Planning theory. prospects for the 1980s* (). Oxford: Pergamon Press.

Klosterman, R. E. (2001). Planning support systems: A new perspective on computer-aided planning. In R. K. Brail, & R. E. Klosterman (Eds.), *Planning support systems: Integrating geographical information systems, models and visualization tools* (pp. 1-23). New Brunswick: ESRI.

Pawson, R., & Tilley, N. (1997). *Realistic evaluation*. London: Sage.

Rittel, H., & Webber, M. (1984). Dilemmas in a general theory of planning. In N. Cross (Ed.), *Developments in design methodology* (pp. 135-144). Chicester: John Wiley and Sons.

Rouwette, E. A. J. A. (2003). *Group model building as mutual persuasion*. Nijmegen: Katholieke Universiteit Nijmegen (Ph.D. Dissertation).

Rouwette, E. A. J. A., Vennix, J. A. M., & Felling, A. J. A. (2009). On evaluating the performance of problem structuring methods: An attempt at formulating a conceptual model. *Group Decision and Negotiation, 18*, 567-587.

Rouwette, E. A. J. A., Vennix, J. A. M., & Van Mullekom, T. (2002). Group model building effectiveness: A review of assessment studies. *System Dynamics Review, 18*(1), 5-45.

Sterman, J. D. (2002). All models are wrong: Reflections on becoming a systems scientist. *System Dynamics Review, 18*(4), 501-531.

Vonk, G. (2006). *Improving planning support; the use of planning support systems for spatial planning*. Utrecht: Nederlandse Geografische Studies.

Vonk, G., Geertman, S., & Schot, P. (2005). Bottlenecks blocking widespread usage of planning support systems. *Environment and Planning A, 37*, 909-924.