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Coping with the irreducible uncertainties of planning: an evolutionary approach

Luca Bertolini

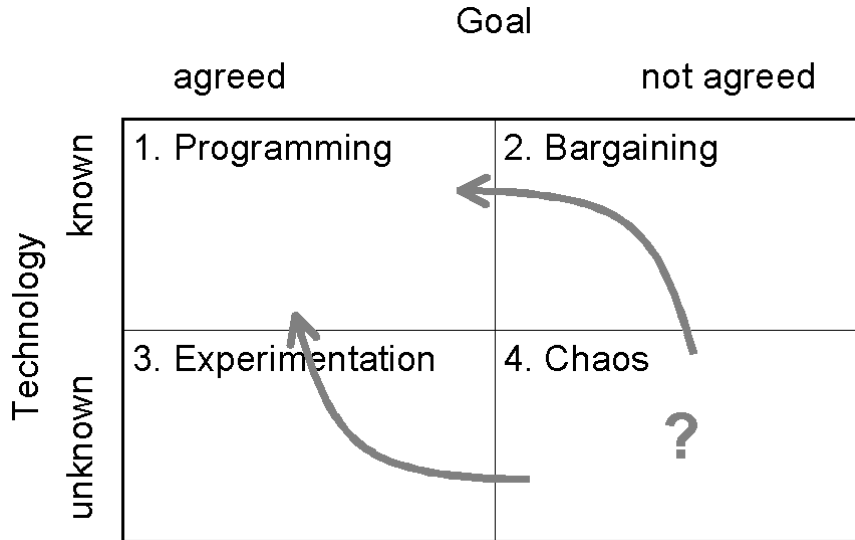
The challenges of irreducible uncertainty

The question of how to shape the future is perhaps the one that most distinguishes planning as an activity. Myers (2001, p. 366) remarks for instance that, “[t]he future is the only topic that other professions have ceded to planners as relatively uncontested turf”. However, the ground of identification which the future provides to planners is not, and cannot be a firm one, as the future is by definition uncertain. Myers (2001, p. 365) also observes that, “[t]wo difficulties constrain planners’ role in shaping the future. First, the future consequences of planning actions are not knowable with much certainty [...] Second, [...] decisions about the future require agreement among a great many stakeholders”. Finding ways of dealing with such fundamental uncertainty and disagreement is a, if not *the*, central task facing planners.

In a classic contribution to planning theory Christensen (1985) characterized the challenge as that of coping with disagreement on planning goals (what?) and means, or what she terms ‘technologies¹’ (how?). When we agree on both goals and means planning is essentially a matter of ‘programming’. When we agree on the means but not the goals, it is a matter of ‘bargaining’; when we agree on the goals but not the means, one of ‘experimentation’. When we disagree on both means and goals there is ‘chaos’, and we need to find ways of somehow structuring the problem in order to move towards or into one of the other, more tractable situations (see Figure 1).

¹ The term ‘technology’ is used here in the broad sense of ‘means to achieve goals’. In this respect a transportation system is a technology, as are also a parking regime, or a marketing campaign. In the rest of the chapter I will use the two terms interchangeably.

Figure 1. Coping with uncertainty in planning. *Source:* Christensen, 1985.



This last case is especially intriguing. Such ‘chaos’ seems increasingly common in contemporary, deeply contested governance settings [see chapter]. At the same time, it seems increasingly less clear how, if at all, we could ‘move out’ of chaos. For example - all sustainable urban development rhetoric notwithstanding - will ‘bargaining’ ever make us finally agree on whether the environment, society or the economy should take priority in urban development? Will ‘experimentation’ ever make us finally agree on how to best preserve the environment, strengthen society or enhance the economy in a city? And if agreement is possible, should we also pursue it, or should we rather cultivate a pluralistic variety of views on what goals to pursue and what means to employ? How then to cope with the all too common situations, where uncertainty and disagreement about planning goals and means appear irreducible, or even desirable?

In another, earlier, classic contribution to planning theory Rittel and Webber (1973) had already made their point in this respect. For them all but the most trivial planning problems were ‘wicked’ (Christensen would say ‘chaotic’), “for they defy efforts to delineate their boundaries and to identify their causes, and thus to expose their problematic nature” (p. 167). While most of their paper is devoted to discussing why uncertainty and disagreement about planning goals and means are irreducible, Rittel and Webber also suggest a possible approach for coping with this. Such an approach “should be based on a model of planning as an argumentative process in the course of which an image of the problem and of the solutions emerges gradually among participants, as a product of incessant judgment, subjected to critical argument” (p. 162).

The idea of planning as a participatory, argumentative process has since, of course, become a dominant paradigm in at least planning theory [see chapter]. In Rittel and Webber’s suggestion there is, however, more than just a plea for more participation (as in advocacy planning) or a more communicative rationality (as in collaborative planning). They also indicate what the *purpose* of participation and communication should be

(‘letting an image of the problem and of the solutions gradually emerge among participants’), and *how* this could be achieved (‘through incessant judgment, subjected to critical argument’). Rittel and Weber did not go much further than evocative statements. However, I believe that further exploring such thoughts could help us better understand how we could cope with the ever more ‘chaotic’ and ‘wicked’ nature of contemporary planning problems, and provide more articulation to the notion that planning should be participatory and communicative. In order to do this, in this chapter I will identify the approach sketched by Rittel and Webber as evolutionary and akin to emerging characterizations of design processes. I will then articulate this idea by means of a reformulation of Christensen’s typology of planning challenges, and illustrate its workings through one concrete example. Finally, I will point at some implications of the argument for future efforts in planning theory development.

The planning process as a design process, the design process as an evolutionary process

While Rittel and Webber evoke, rather than fully articulate, their model of planning, their views strongly resonate with emerging insights into how designers go about with their work (Cross, 2007). Designers of new products are, by definition, confronted with elusive problems and solutions. While there might be agreement about what are less or more successful design products, at least in term of their appreciation by users, it is much less clear how designers achieve such results. To address this issue detailed empirical studies of real-world design processes have been carried out in recent years and some of the defining features of these processes have been pinpointed. Crucially, and similarly to what Rittel and Webber (1973) hypothesized, design problems and solutions are identified *jointly* rather than *sequentially* in the design process. Design processes are aimed at finding internally and context consistent *problem-solution combinations*, *not* solutions for previously defined problems. The definition of problems and solutions is kept fluid until such combinations have been found. ‘Creative leaps’ are all about finding ‘bridges’ between problems and solutions that allow such combinations. In the words of Cross (2007, p. 78):

“During the design process, partial models of the problem and solution are constructed side-by-side, as it were. But the crucial factor, the ‘creative leap’, is the bridging of these two partial models by the articulation of a concept ... which enables the partial models to be mapped onto each other”

Valkenburg and Dorst (1998) have studied this dynamics in the work of industrial design teams. Their framework of analysis is inspired by Schön’s (1983) characterization of design as reflection-in-action and applied to detailed visual and audio records of design processes. According to Valkenburg and Dorst designer teams appear to be engaged in a ‘reflective conversation with the situation’, which iteratively entails “*naming* the relevant factors in the situation, *framing* a problem in a certain way, *making moves* toward a solution and [*reflecting* on] these moves” (1998, p. 251, emphasis added). Different rounds and levels of feedback spurred by continuous reflection are at the essence of the process. Reflection can lead to new moves towards a solution, but also to new framing of

the problem or naming. In particular, Valkenburg and Dorst find evidence that breakthroughs in the design process tend to occur when design teams change frames, that is, when problems are defined in new ways (analogous to the ‘bridges’ mentioned by Cross).

The above characterization of design seems also a fruitful characterization of planning. There is however, an important difference between the two. Problems in industrial design, but also in architecture or engineering, tend to be more limited in terms of the numbers and diversity of those involved, the magnitude of potential repercussions on society, and their spatial and temporal horizons. In planning, ‘reflection in action’, needs to engage many more and more diverse actors, and address many more levels of impacts and scales. However, and this is the essence of the argument here, in order to successfully tackle its ‘chaotic’ and ‘wicked’ problems planning should also be a process of ‘reflection in action’, and thus one iteratively linking naming situations, framing problems, moving towards solutions and reflecting on each of these, in order to identify consistent problem-solutions combinations amenable to collective action. However, even implementing these will not lead the process to a termination, as the repercussions of action in a changing societal context will inevitably and continuously generate the need for new rounds of naming, framing, moving and reflecting.

The design process, as described by Valkenburg and Dorst, closely resembles an evolutionary process of *variation* (of moves, frames and names) and *selection* (through reflection). The crucial difference with biological evolution is that the process engages not so much, and certainly not only, material entities, but rather immaterial concepts and ideas. It is as much an evolution in the understanding of the situation as it is an evolution in the situation itself, both generating the other (it is thus *co-evolution*). The development pattern is reminiscent of that of autopoiesis, an essential characteristic of living organisms: “autopoiesis, or self-making’, is a network pattern in which the function of each component is to participate in the production or transformation of other components in the network. In this way, the network continually makes itself. It is produced by its components and in turn produces those components” (Capra, 1996, 158; see also 163-164).

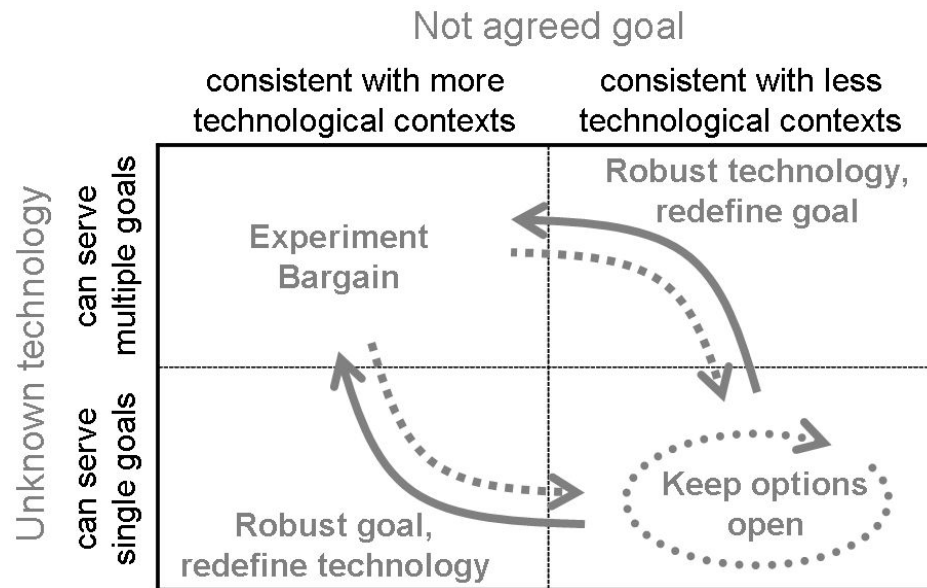
How to further articulate this evolutionary process in a way that accounts for the more unbounded nature of planning activities relative to design activities? An attempt is made in the following section, by means of a reformulation of Christensen’s (1985) characterization of how to cope with uncertainty in planning discussed in the introduction.

Coping with irreducible uncertainty in planning

According to Christensen planning problems can be characterized in terms of the uncertainty about goals and the means of achieving them. The existence of both disagreement about goals and uncertainty about means results in ‘chaos’, and ‘order’ must somehow ‘be discovered’. This last, ‘chaotic’ situation is particularly relevant here. Situations of this type seem by no means atypical in planning. They are, on the contrary,

characteristic, as contended above. But what is ‘chaos’ exactly? And, more importantly, what does ‘discovering order’ mean exactly? Figure 2 sketches a possible, evolutionary interpretation.

Figure 2. Coping with irreducible uncertainty in planning



In the figure, the bottom right quadrant – disagreement about goals and uncertainty about means, or ‘chaos’ - of Christensen’s typology is highlighted: goals are *always* not agreed, technologies are *always* unknown. The starting point is the observation that even when there is no agreement on the goals, a distinction can be made between goals that are not agreed but that are consistent with different future technological contexts² and goals that are not. For instance, a goal as ‘accommodating change in the urban economy’ might not be shared by all participants but will remain meaningful irrespective of how the technological context will develop. On the contrary, a goal as ‘accommodating the growth of a specific economic sector in a specific location’ is not only a goal that not everybody might share but is also one that is much more dependent on a specific technological context (for example, a location which is central in a railway dominated urban transportation context will not necessarily be so in a car dominated urban transportation context). By analogy, even when not enough is known about the effectiveness of technologies, a distinction can be made between technologies that only have the potential to serve limited goals (as for instance an urban transportation system connecting a limited number of places in a limited number of ways) and technologies that have the potential to serve more goals (as a more articulated urban transportation network connecting more places in more ways).

² The term ‘technological context’ is used here to synthetically identify aspects of the context (technical, economic, social, and cultural) that together determine the effectiveness of certain means in achieving certain goals. They might include such things as the availability of previously unknown intervention options, improved knowledge on the effects of interventions, but also broader changes in the economic, social and cultural sphere affecting the desirability or feasibility of interventions.

If goals are not agreed *and* only relevant in a limited range of future technological contexts, and technologies are unknown *and* can only serve limited goals, *options should be kept open*. With reference to the illustrations above, an irreversible choice for ‘accommodating the growth of a specific economic sector in a specific location’ should not be made, acknowledging the fact that other sectors and other locations could later emerge. The same would apply, on the technologies side, to ‘a transportation system connecting a limited number of places in a limited number of ways’: other goals could later emerge, requiring a system connecting other places in other ways. By contrast, when goals are not agreed *but* are consistent with more technological contexts, and when technologies are unknown *but* can serve many goals they are, at least potentially, *robust* goals and technologies and should be further ‘bargained’ and ‘experimented’ with. With reference to the illustrations above, even if not everybody agrees, a goal as ‘accommodating change in the urban economy’ should be acknowledged, as it is likely to continue to play a role in whatever future technological context. The same applies to the technology ‘a transportation network connecting more places in more ways’, because it is likely to be able to serve more goals (including emerging, yet unknown, ones). In both cases, if the test of bargaining and experimenting is passed, decisions should be taken and actions implemented. If not, options should be re-opened³.

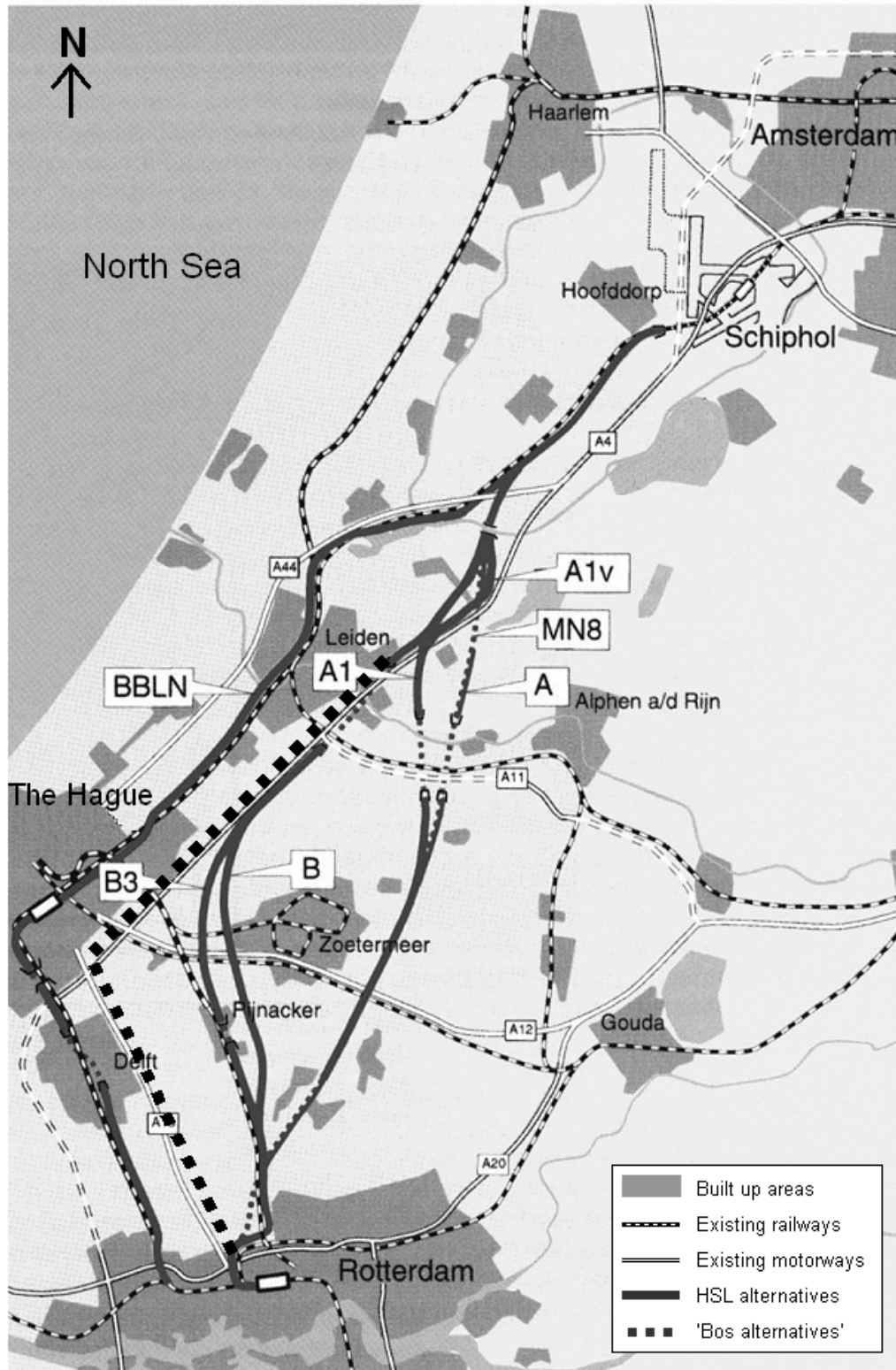
Paraphrasing Rittel and Webber (1973), the purpose of the process is thus letting an image of goals and means gradually emerge among participants, as a product of incessant judgment, subjected to critical argument. Paraphrasing Cross (2007), it entails constructing side-by-side partial models of goals and means. The crucial factor, the ‘creative leap’, is the bridging of these two partial models by the articulation of a concept which enables the partial models to be mapped onto each other; that is, to identify combinations of goals and means that acknowledge and reflect the participants’ knowledge (or ignorance) and agreement (or disagreement) and which in that sense are ‘robust’. Paraphrasing Valkenburg and Dorst (1998), such combinations can be identified by an iterative process of naming the relevant factors in the situation, framing a problem in a certain way (identifying potential goals and means), making moves toward a provisional synthesis (a potential combination of goals and means) and reflecting on these moves. The process can be characterized as an evolutionary process of variation (of names, frames, and moves) and selection (through reflection). Planning is about setting up and governing the process. In the following section, an example will be used to illustrate these notions.

³ The term ‘robust’ is used here in the sense of ‘compatible with different goals and means’. It thus identifies decisions and actions that shape conditions for a *variety* of futures to unfold, as opposed to decisions and actions that are only aimed at one particular future. The term is complementary to the notion of ‘leaving options open’. The latter are decisions and actions that, because they are compatible with a too limited range of goals and means, should not be implemented (or not yet). This interpretation of robustness is close to that suggested in policy and decision analysis approaches exploring ways of dealing with irreducible or ‘deep’ uncertainty (Lempert et al. 2003). It is also related to the notion of ‘resilience’ ecologists are beginning to use in order to identify the ability of natural, social or economic systems to respond and adapt to shocks and external changes (Capra, 1996; ICSU, 2002).

An illustration: planning the HSL in the Randstad

Fundamentally different and constantly changing views on the project goals and means characterized the planning of the High Speed Line (HSL) South in the Netherlands, linking Amsterdam to Rotterdam, Antwerp and Brussels. The case is extreme in its complexity, and as such helps show the sort of planning approach that coping with irreducible uncertainties might require. It also documents the possibilities of, but also the limits to, such an approach in the present institutional context. I will focus on just one representative phase and aspect of this still unfolding development: the selection of the HSL route in the Randstad, the highly urbanized West of the Netherlands, between the cities of Rotterdam and Amsterdam. My main source of information is the extensive reconstruction of the case made by the commission installed by the Dutch parliament to enquire into mega transport projects decision making (Tweede Kamer der Staten-Generaal, 2004b; see also Priemus, 2007)

Figure 3. Alternative routes for the HSL-South in the Randstad. *Source:* adapted from Tweede Kamer der Staten-Generaal, 2004b



Alternative routes between Rotterdam and Amsterdam have been at the centre of the political and technical debate around the HSL South in the 1990s. Figure 3 shows some of these alternative routes. Different interpretations of the project goals and means emerged during the debate. Three main ones can be distinguished. A first interpretation centered on the development of a competitive transport product for the international traveler. A second interpretation focused, alternately, on mitigating local impacts in general and on the preservation of the landscape of the Green Heart (the central open area in the Randstad) in particular. A third interpretation aimed predominantly at reinforcing the urban structure of the Randstad, improving connections both among the main cities and also between the main cities and metropolitan areas outside of the Netherlands.

This multiplicity of interpretations of goals and means translated in a number of irreducible uncertainties and practical dilemmas. From within the transport development interpretation achieving the shortest travel times between the main traffic generators seemed crucial. This led to a preference for routes directly linking Amsterdam, Schiphol airport and Rotterdam right across the Green Heart (such as the A routes in Figure 3). The local impact mitigation and landscape preservation interpretation argued instead for routes staying out of the Green Heart and using already existing infrastructure corridors (the BBLN route in Figure 3). From within the interpretation aiming at reinforcing the structure and position of the Randstad, most important was the connection of all the main urban centers to the HSL South; thus not just Amsterdam, Schiphol and Rotterdam, but importantly also The Hague, the seat of the national government and of many international institutions. This interpretation preferred the BBLN route too.

Not all interpretations were equally strong. The first, transport interpretation was for long the only interpretation, and the one to which central government always gave priority. The second, environmental interpretation, acquired strength during the consultation phase to become an effective counterpart. These two interpretations eventually dominated the debate around alternative routes in the Randstad. They each had a clear champion in the national government: the Ministry of Transport and Public Works (V&W) and the Ministry of Housing, Spatial Planning and the Environment (VROM) respectively. VROM was also supportive of the third interpretation (the Randstad and the Green Heart are after all the main pillars of the Dutch spatial planning doctrine). However, in the debate this interpretation tended to be associated with a local lobby (most notably, the municipality of The Hague) rather than with a national interest. The different interpretations of the goals and means of the project seemed irreconcilable: the most desirable route for the one was the least desirable for the other two, and the other way round. More than once a total stalemate loomed. After a long and turbulent process, compromise between the first two interpretations was reached. The HSL would cut straight across the Green Heart, but a tunnel would be dug under its most valuable section. The only concession to the third interpretation was a High Speed Train (HST) 'shuttle' to The Hague: a HST service on conventional tracks branching out from the main line in Rotterdam a few times a day.

The process leading to this compromise, which I lack space to describe in more detail, provides fascinating insights into how relatively robust combinations of goals and means

emerge through incessant re-naming, re-framing, and re-moving, fuelled by reflection. However, it also, and crucially, shows how opportunities for identifying *more* robust combinations are missed, because the ‘re-‘ does not go far enough. The final solution was, as we have seen, above all a combination (Cross would say ‘bridge’) between the first two interpretations, transport and the environment, and which largely frustrated the third, the Randstad. It was thus only partially robust. However, during the debate also combinations of goals and means emerged that held the promise of bridging *all* three interpretations. The most apparent of these ultimately unfulfilled ‘creative leaps’ were the so-called ‘Bos alternatives’, named after a civil servant that developed the initial idea on his own initiative. The common denominator of the ‘Bos-alternatives’ was the aligning of the HSL with the A4 and A13 existing motorways (running South of Leiden and The Hague and East of Delft in Figure 3), thus achieving *both* competitive travel times, avoidance of the Green Heart, *and* a fully-fledged station in The Hague.

As a governmental commission recognized, the ‘Bos alternatives’ were a good second best option in *all* the three interpretations (Tweede Kamer der Staten-Generaal, 2004b, p. 82). Because they were new ideas, developed as a reaction to previously unrecognized dilemmas, they had not been included in the official route selection procedures thus far. Their evident potential, and the very large societal support they enjoyed almost instantly (at one point a majority of parliament members was in their favor), forced their later inclusion in the procedure. However, this inclusion was not in a way that allowed full exploration of their potential. It was not so much substance matters, but rather the fear of delays in the decision-making process, that was the decisive argument for discarding them. The same procedural argument would later also be evoked ‘not to learn’ from other crucial, emerging insights. For instance, the international travel market would show as much less important than initially thought, to the advantage of a burgeoning demand for fast travel within the Netherlands, thus further questioning the choice not to stop in The Hague. Furthermore, a substantial, unexpected lengthening of the travel time in the Belgian section of around 20 minutes – due to decisions beyond the control of the Dutch government – would put the couple of extra minutes that the ‘Bos-alternatives’ would have cost in even greater perspective. Finally, the tunnel under the Green Heart would demonstrate a much more symbolic, than an effective, solution to the landscape preservation issues there; certainly if related to the very high costs involved. All these new insights were not accounted for. In retrospect, the initial route choice (and ‘frame’) does not seem to have ever been seriously questioned. Mitigation measures have been accepted as a necessary price to pay on the way to its implementation, but re-consideration of the original choice (‘re-framing’) has never been a real option, whatever its potential: it was always ‘too late’. As a consequence, variation in naming, framing and moving was limited, and even when present, reflection was not fully allowed to select among the different options.

Altogether, the compromise route appears a sub-optimal choice in many respects, and one that could not adapt to emerging insights, whatever the breadth of consensus. Was it also an inevitable choice? Or could perhaps a planning approach be adopted that was more receptive to the multiple *and* emergent interpretations of the project’s goals and means? There is no easy answer. It is intrinsic for mega infrastructure projects (as for other

planning issues) to be, to a large degree, irreversible, and this characteristic necessarily affects the planning process. During the Dutch parliamentary enquiry the dilemma was poignantly summarized by W. Korf, project director of the HSL: “The apparently logic sequence: first demonstrate the usefulness and necessity [of a project] and then articulate and implement the decision, does not hold. The usefulness and necessity of a project continue to remain a matter of discussion. But at some point a decision must be taken whether to sign the contracts or stop altogether” (Tweede Kamer der Staten-Generaal, 2004a, p. 140).

While there are no easy answers, posing the question may still provide a focus for the analysis of the planning process and help direct the search for improvements. As far as mega infrastructure projects are concerned, the Dutch parliamentary enquiry advocates a more thorough, divergent, and transparent exploration of alternatives in the initial phases of the process (Tweede Kamer der Staten-Generaal, 2004a). This amounts to providing for *more variation* in interpretations in a phase of the process where *selection by reflection* can be allowed to work more freely and thoroughly and would thus guarantee that more informed choices are made in the first place. Also, Flyvbjerg et al. (2003) complement their appraisal of dismal past experiences in the planning of mega infrastructure projects by pointing at a possible, and - in some instances - even emerging better approach. This would be, above all, directed at increasing stakeholder accountability and public awareness of the risks. It would seek that risks are distributed more evenly and that more effective ways of managing them are adopted. These are also suggestions that point in the direction of *increasing sources of variation* and *improving mechanisms of selection*. All this is important, but it should be also acknowledged that it will not eliminate uncertainty. Accordingly, both the exploration of alternatives and the assessment of risks cannot be carried out once and for all, because views on goals and means will keep changing, soliciting new definitions of problems and solutions and putting existing ones in a different light. A complementary direction of improvement would thus have to assess the scope for allowing evolutionary mechanisms to operate throughout the planning process (not just at the beginning), thus increasing opportunities to translate lessons in actions as they are learned. It would, however, also have to acknowledge the fact of the inevitable irreversibility of certain decisions and actions (not all options can be indefinitely kept open). The crucial question is: which planning institutions and strategies can foster this?

5. Speculations

In this chapter, recognition of the ever-more-irreducible uncertainties surrounding planning issues has been the point of departure in a search for a conceptualization of planning that is rooted in such recognition. Inspiration has been found in suggestions of how to tackle ‘wicked’ problems made by Rittel and Webber and Schön in the past and their more recent articulations in analyses of design processes. The core notion they together provide is that the planning process is one where situations, problems and solutions are defined jointly and interactively, in the course of what Schön would call a ‘reflective conversation with the situation’. This ‘conversation’ is a quintessentially evolutionary process, where variation concerns both the situation and its interpretations,

both problems and solutions, and selection operates through multiple reflections. Building upon these ideas, a reformulation of Christensen's characterization of how to cope with uncertainty in planning has been proposed. It moved from the contention that uncertainty on both planning goals and means is irreducible, and that planning processes should be geared at identifying 'robust' combinations of goals and means. Robust combinations are also uncertain, but, crucially allow *more* futures to coexist (and what could be a better ambition for planning in a diverse society?). In order to identify these combinations planners need to engage stakeholders in processes of variation in interpretations and selection by reflection, analogous to those recorded in design processes. The case of planning the HSL in the Randstad illustrated these concepts, but also showed some of the formidable challenges that gearing the planning process towards a 'reflective conversation with the situation' poses. I believe that a main focus of future efforts in planning theory should be on better understanding and defining these challenges, as well as on promising ways of addressing them. The task is urgent, because increasing diversification *within* societies and increasing linkages *between* societies all mean that the irreducibility of the uncertainties surrounding planning goals and means is bound to grow.

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