THE PERSPECTIVES METHOD
Towards socially robust river management

Astrid Offermans

Propositions belonging to the thesis:

The Perspectives method; towards socially robust river management

By Astrid Offermans

1. The Perspectives Method acknowledges the *non-stereotypical* and *dynamic* nature of perspectives and offers a method to *operationalize* and *measure* perspectives on water. (this thesis)

2. The Perspectives Method provides more knowledge on *future perspective changes* and *socially robust* water management strategies. (this thesis)

3. Identification of disagreement may be a first step towards a dialogue, possibly leading to more synergistic and robust solutions. (this thesis)

4. The role of social science is not to predict future developments, but to explore the effects of perspective changes on support for water management strategies. (this thesis)

5. Stability without change is like trying to balance oneself on a bicycle without turning the pedals. (Michael Thompson et al.)

6. Perception is organized via anticipatory schemata whereby the individual anticipates new incoming information while simultaneously mentally digesting old. (Anthony Giddens)

7. Pause to recall a scene from a favorite past experience, then read the rest of this note. Did you see yourself in the scene? If so, your memory must be a reconstruction, for in reality you did not see yourself.

8. (Sustainability) science can not predict future climate with certainty, it can however explore effects of actions in different climate scenarios. Therefore it is hard to see people only debating in order to find the truth instead of taking action.

9. If you want to make peace with your enemy, you have to work with your enemy. Then he becomes your partner. (Nelson Mandela)

10. My thesis is like water; those of the great geniuses are wine. (Fortunately) everybody drinks water. (adapted from Mark Twain)

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Chapter 1

INTRODUCTION

1 THE SOCIAL ASPECTS OF RIVER MANAGEMENT

A random Google search for figures with the text "river management" offers pictures of river stretches, channels and (artificial) lakes in their natural context. Although channels, bridges, sluices and hydropower dams are direct signs of human interventions, people are hardly found on these figures. The same focus can be found in river research. River research has traditionally been associated with geomorphologic and hydrological characteristics of rivers, the way run-offs and water scarcity could be managed properly and with the question how rivers can be understood in a more detailed way (also see Pahl-Wost *et al*., 2008). Climate science has brought a fairly detailed understanding of possible changes in climate (precipitation and temperature) and their effects on the river state. Nonetheless, considering the river system as a whole, social aspects are probably most decisive for the river's appearance and the way it will be managed, as the pictures resulting from our Google exercise also show. Any sustainability problem (of which river management is one) can only be defined in relation to people's perceptions, needs, desires and goals. A well-chosen sentence of J. David Tàbara as quoted by Valkering (2009) says: "*Rivers don't have problems. Only people may have problems with rivers*". People's beliefs, norms and values determine whether something is perceived as a problem or not. Further, people are the one's influencing the river system through water consumption, navigation, recreation, irrigation, pollution, land use and the implementation of various water management strategies. However, these social aspects are probably least understood in current river management research (Valkering, 2009). In this thesis the focus will be on providing more insights in the social aspects of river management. Water management can easily become controversial. The traditional approach is that we need more scientific facts and knowledge to solve controversies. However, most of these controversies are not grounded in any lack of knowledge, but rooted in different values and interests (Sarewitz, 2004). Identification of different views on river management, insight in the dynamic character of these views and the effects on social support for different water management strategies will be explored. This thesis will therefore focus on the social robustness of water management strategies.

1.1 Sustainable water management

It is hard to identify the source wherein the concept of sustainable water management was mentioned for the first time, but it is likely that its first appearance took place around the early eighties of the last century. During this period the concept of sustainable development arose and has since then become the stated aspiration of governments and societies all over the world (Martens, 2006). Sustainable development is a complex notion, which has appeared notoriously hard to define. Out of many possible definitions, the Brundtland definition is the most cited: "Sustainable development is a development that meets the needs of the present generations

without compromising the ability of future generations to meet their own needs" (WCED, 1987). The interpretation of this definition depends -again- on a subjective range of values and perceptions as concepts like 'needs' and 'meets' are inherently subjective, ambiguous, and therefore multi-interpretable. Nonetheless, this definition may be useful to apply to long-term water management, as it provides space to take multiple (and even changing) interpretations of both 'needs' and 'meets' into account. Depending on your perspective, 'needs' may refer to a multitude of aspects including consumptive water, navigation, nature, discharge, cooling water, agriculture, recreation, arts or any combination between the aforementioned aspects. Although it is not even an easy task to delineate each need and to define which needs can be considered more important than others, an additional difficulty is that these interpretations are dynamic and therefore changeable. The challenge is thus to find a water management strategy, or a way to deal with water that takes different present and future interpretations of 'needs' and priorities within those 'needs' into account.

Following from this, we consider a water management strategy to be sustainable if it: 1. *is socially robust*, meaning that the strategy and its consequences on the fulfillment of needs is considered acceptable from different present and future points of view (perspectives). However, as it is questionable whether such a strategy truly exists, a sustainable strategy is also 2. *flexible*, meaning relatively easy to adapt to changing situations and points of view. The concept of 'social robustness' plays an important role throughout this thesis. It is an evaluative screen to assess the extent to which a strategy and its consequences are considered acceptable from different points of view and in different (climatic) futures. A socially robust strategy is a strategy or measure that is *acceptable* under a range of future conditions (see also Lempert *et al*., 2003). Future conditions include a broad range of developments in climate, land use and social perspectives (perceptions), but also includes stochastic events that may indirectly change people's perceptions on how the river should be managed (for example a flood). The acceptability of a strategy can be expressed in years, for example: "if we won't change anything in our water system anymore, the situation may become unacceptable within x-years". In this case, the current water management strategy may have a *tenability* of x-years. Theoretically, a socially robust strategy thus has an unlimited tenability and remains acceptable under a diversity of climatic and social futures. Social robustness says something about the present situation; do people with different perspectives consider a strategy or measure and its effects acceptable? But social robustness also says something about the future. What if people change their ideas on how water should be managed, would they still consider a strategy to be acceptable? And what if climate change differs from what has been expected: do we still think that the effects of a strategy are acceptable? A socially robust strategy can count on social support in the present and future. We assume that if a majority of people (citizens and stakeholders) agrees that a strategy is not (anymore) acceptable, *social support* to continue the strategy may be lost (see chapter 5 for examples).

Different points of view, or perspectives, play an important role in the type of strategies that are accepted and preferred. What is acceptable for one person, may be totally unacceptable for another. Following Van Asselt (2000) we define a perspective as 'a perceptual screen through which people interpret the world and which guides in action'. It refers to different perceptions and value interpretations people can have. Following Cultural Theory (Douglas, 1996; Thompson *et al.,* 1990) we assume that all people on earth may have a slightly different perspective, but their main assumptions on how the world functions are reducible to only four stereotypical perspectives or a combination between these four: the Hierarchist, Egalitarian, Individualist and Fatalist. In reality these perspectives tend to be non-stereotypical and -due to events and developments that prove the reality to be different than expected- also dynamic. If the dominant perspective (the perspective shared by the majority) changes, this may effect support for water management strategies and may pose new objectives and demands regarding the way water should be managed. Perspective *change* thus also effects the acceptability of a strategy and should be taken into account when analyzing a strategy's social robustness. The challenge is thus to identify a (relatively) robust water management strategy, which can be any policy-driven initiative to change, adapt or modify the environmental system, the way people perceive the system, or people's ability to deal with (changes in) the environment. Usually a strategy consists of a combination of measures. These include visible interventions like 'Dike raising', providing 'Room for the river' and 'Amphibian houses', but also invisible interventions like 'Education' and the possibility to 'Insure against flood damage'.

1.2   Context of the research

It is important to note that this thesis only encompasses one ingredient for sustainable water management, namely the part on perspectives (change) and social robustness. Other crucial aspects include a proper understanding of the effects of different water management measures on the environment under various futures. Knowledge on hydrological and environmental processes is crucial as it provides thresholds where in between the future may evolve. Our goal is subsequently to analyze how society would respond to and evaluate these future developments. The thesis lying in front of you is produced in close collaboration with Marjolijn Haasnoot who is writing a thesis on transient scenario developments and adaptation pathways in the water system. Both theses offer useful information on their own, but the power and policy relevance lies in combining and connecting insights from both disciplines offering a complete overview on how to explore the sustainability of water management strategies under an uncertain future. Both theses are part of the Deltares project 'Perspectives in Integrated water Resources Management in River Deltas'. The overall project aim is to integrate insights from the social and water sciences to develop a method to explore the sustainability of different water management strategies under an uncertain future. In 2011, this project was strengthened by two post-doctoral researchers working on

the NWO project 'Exploring adaptation pathways for sustainable river management into the uncertain future'.

1.2.1   Cultural Theory perspectives and its application to water

At the start of this research, the integrated assessment community already had broad experience in using, applying and translating Cultural theory perspectives to several research fields and topics. Accurate use, concretization and development of the methodology have always been considered essential. In 1997 the TARGETS approach (Tool to Assess Regional and Global Environmental and Health Targets for Sustainability) was developed in order to identify a selective number of future directions to assess global implications for health, energy, land- and water-use and biochemical cycles (Rotmans and de Vries, 1997; Hoekstra, 1998b; Hoekstra, 1998a). Besides TARGETS, the Perspectives of Cultural Theory were applied to the topic of risk and uncertainty (van Asselt et al., 1995; van Asselt, Beusen and Hilderink, 1996; van Asselt, 2000) and used to develop integrated scenarios for water management under the umbrella of the European IRMA-SPONGE and NOP program (IRMA-SPONGE program, 1999; van Asselt et al., 2001; Middelkoop et al., 2004). Within the EU-MATISSE project (April 2005-March 2008) cultural values were integrated in a participatory agent based gaming approach for integrated sustainability assessments (Valkering et al., 2009). As a follow up of the IRMA-SPONGE program, the Dutch BSIK project 'Perspectieven in Integraal waterbeheer' (Dutch for 'Perspectives in Integrated Water management') started in 2006. The aim of this project was to develop sustainable water management strategies involving social uncertainties. The three active perspectives of Cultural Theory were used to explore these social uncertainties and social support for different future water management strategies. This project offered first insights on how to operationalize and measure perspectives on water and how these perspectives may change over time (for more information on the use of Cultural Theory see chapter two and four; Offermans et al, 2012; Valkering et al., 2008c).

1.2.2   The Perspectives Method

In 2008 the Deltares project 'Perspectives in Integrated Water Resources Management in River Deltas' started. The project is complementary to the earlier mentioned projects that focused on perspective-based scenarios and has three main objectives: 1. to assess the vulnerability of river deltas for global change, 2 to develop a method to identify effective, robust and flexible adaptation strategies in river deltas under uncertainty, taking into account different possible and integrated scenarios for the physical, socio-economic and social system; and 3 to provide recommendations on how to use this method to define robust and flexible strategies for the river deltas. This thesis will contribute to the second and third project goal by elaborating on '*The Perspectives Method to measure and monitor non-stereotypical and dynamic perspectives on water in order to gain more insight in perspective change and socially*

robust river management' (or in brief: *The Perspectives Method*). This method *applies* Cultural Theory perspectives to water management, while acknowledging the *non-stereotypical* and *dynamic* nature of perspectives and simultaneously offering a method to *operationalize* and *measure* perspectives on water in order to gain more knowledge on *future perspective changes* and *socially robust* water management strategies

1.3   Research objectives and research questions

The main and generic objective of this study is to further develop a method including different (Cultural Theory) perspectives to explore the acceptability of water management strategies under an uncertain future. Based on this, the central research question of this thesis is:

To what extent is it possible to explore the social robustness of different water management strategies, taking uncertain developments in our social and physical environment into account?

Sub-questions that will be answered in this thesis include:
1. How do Cultural Theory perspectives relate to other, comparable segments or typologies?
2. How can Cultural Theory be applied to water management and what fundamental starting points underlie this translation?
3. How can we operationalize and measure perspectives on water and how can we monitor change?
4. What can we learn about the methodology and social robustness when applying the Perspectives Method to Dutch water management history?
5. What is the present Dutch dominant perspective on water and what does this mean for the robustness of current policies?
6. To what extent can we gain insight in future perspective changes and the way future developments may be evaluated under different perspectives?

1.4   Key methodologies

Integrated Assessment may help to increase insight in the interaction between society and the water system. Integrated Assessment is a holistic research approach to frame and analyze complex societal issues by combining knowledge from various scientific disciplines (Rotmans, 1998; de Ridder *et al.*, 2007; Valkering, 2009; Moreno Sanchez, 2010). Where traditional research approaches tended to focus on a limited number of connections between system components, Integrated Assessment tries to adopt a Birdseye view that includes all components and that allows problems to be tackled at their root(s). Societal problems oftentimes have several causes that sometimes even correlate. Traditional approaches may be very effective in tackling one or two of the

causes, but oftentimes neglect relations between components and rarely manage to take away all causes, leading to preservation of the problem at stake. Integrated Assessment studies typically aim to derive a systems view capturing causes and effects, feedback loops, and interactions across multiple domains. Understanding long term developments, treatment of uncertainty, choosing appropriate scale levels for analysis, including stakeholders in the process, and blending qualitative and quantitative knowledge are just some of the common challenges in Integrated Assessment (Rotmans, 1998; Valkering, 2009). As Moreno Sanchez (2010) pointed out, the nature of current complex problems require the use of inter- and trans-disciplinary approaches. The intertwined character of sustainability problems necessitates the joint contribution of several disciplines including sociology, psychology, ecology, physics, hydrology and climate science. This integration of knowledge sources and disciplines goes hand in hand with an integration of actors that have different perspectives on a particular issue. The integration of different perceptions and social actors has the added advantage of increasing the credibility and legitimacy of the policies emerging from the process. In this sense, Integrated Assessment is also meant to support decision and policy-making and building societal learning. The Integrated Assessment Society (TIAS, 2011b) -that was created to promote a community of developers and users of the Integrated Assessment approach- defines Integrated Assessment as:

"*The scientific "meta-discipline" that integrates knowledge about a problem domain and makes it available for societal learning and decision making processes. Public policy issues involving long-range and long-term environmental management are where the roots of integrated assessment can be found*" (TIAS, 2011a p. 1).

As Integrated Assessment ideally focuses on the use and combination of different tools and research methods, something such as '*the* Integrated Assessment' methodology does simply not exist. Narrowing down Integrated Assessment into one specified and worked out method would severely undo the approach's main strength that lies in adaptation to specific problems and all facets connected to the problem. Different problems require different research approaches that cannot be pinned down into a single methodological blueprint. However, there are some methods that are particularly suitable for Integrated Assessment projects, like Integrated Assessment modeling (Valkering, 2009), scenario development (van Notten, 2005), and participatory methods (Van Asselt and Rijkens-Klomp, 2002). For a more detailed discussion on Integrated Assessment methods, see Rotmans (1998), de Ridder *et al*. (2007), Harris (2002), and Van Asselt & Rijkens-Klomp (2002). Next to the aforementioned methods, the Perspectives Method as described in this thesis is considered to be a promising method within the Integrated Assessment approach as it explicitly focuses on the interaction and interconnectedness between the environmental and social system and multi-dimensional ways to define problems and solutions. In chapter six we further used an online questionnaire to measure the present dominant perspective on water under Dutch water professionals (see paragraph 6.2.2). We further applied statistical analysis to calculate sum totals (how

often was every answer chosen), averages, clusters (Two-step clustering) and differences in perspectives based on a respondent's background or socio-demographic characteristics. Such differences were calculated by using the Anova test (for questions with a nominal character) or a T-test (for questions with a scale-character) and an exceedance probability (P-value) of no more than 5% ($P \leq 0.05$). In chapter seven we analyze storylines resulting from playing our model based participatory simulation game. We also analyzed these storylines with help from SPSS, as we assigned quantitative codes to every event, development and choice that occurred in the simulation game.

1.5   Outline of the thesis

The perspectives Method and the way it may be helpful in analyzing the social robustness of water management strategies lies at the core of this thesis. A deep understanding of the method, its relation to other frameworks and the way it can be applied to water issues is necessary before future social robustness can be explored. Figure 1 presents a simplified thesis outline.
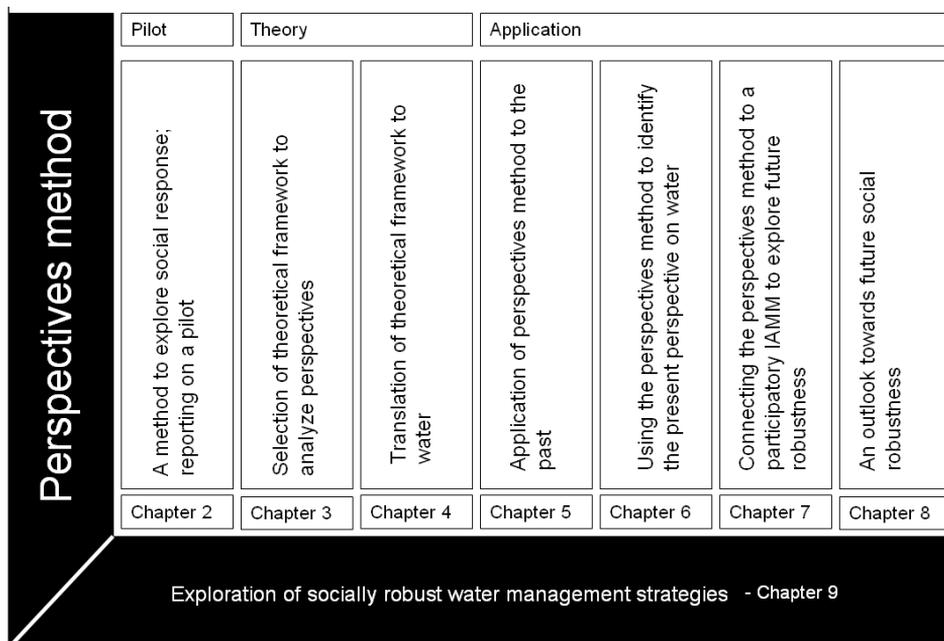
Figure 1: A simplified overview on the structure of this thesis.

In chapter 2, our line of thinking will be presented and we will touch upon several aspects that will be studied more in depth in the following parts of the thesis. The

chapter will also touch upon lessons we have learnt from our perspectives-study of the Meuse Valley in the Dutch province of Limburg. This study was part of the Dutch BSIK project 'Perspectieven in Integraal Waterbeheer" (Dutch for 'Perspectives in Integrated Water management') and can be regarded as the direct precursor and/or pilot study for this PhD research.

As cultural theory has been applied to multiple domains, including water, the use of Cultural Theory as a typology to analyze perspectives on water could have been a logical one. However, we have not found convincing motivations or thorough research underlying the choice for Cultural theory to analyze perspectives on water. Therefore, chapter 3 focuses on the position of Cultural theory in relation to other typologies. We will analyze the extent to which Cultural Theory can be considered complete and recognizable in other typologies. Weaknesses, lessons and attention points for research will be identified regarding the use of Cultural Theory.

As chapter three provides enough reasons to justify the use of Cultural Theory to identify (changing) perspectives on water, chapter 4 explains the basic principles of the theory and its application to water. The Perspectives Method will be explained in detail in this chapter as well. In chapter 5, the Perspectives Method will be applied to Dutch water management history as from 1900. We will analyze why and how the dominant perspective on water and support for strategies changed. At the end we focus on lessons regarding perspective change and the additional value of the Perspectives Method for science and policy.

Chapter 6 focuses on the present. We developed a questionnaire as part of the Perspectives Method to analyze the present perspective on water among Dutch water professionals. Besides providing an overview on dominant interpretations of beliefs, we will also focus on the so called 'undercurrent' that encompasses a group of people that share a non-dominant but coherent view on water and the way water should be managed. In the next step we compare the professional dominant perspective to the policy perspective inherent to the Dutch policy document of the 'Delta report (Deltacommissie, 2008; DeltaCommittee, 2008)'. This comparison provides useful information on the extent to which current, but also future support for the measures proposed in the policy document can be expected, hence providing insight into the social robustness of the policy document.

Chapter 7 reports on our perspective based simulation game that was developed in the project 'Perspectives in Integrated Water Resources Management in River Deltas'. The game integrates a hydrological simulation model (Haasnoot, accepted; Haasnoot, 2011) with the Perspectives Method to be used in an interactive way to explore the sustainability of different water management strategies in an uncertain future. As the model is still under development, the focus will be on the methodology and the kind of results that can be extracted from it. Chapter 8 reflects on the Simulation game and Perspectives Method to explore future support for strategies. It elaborates on a concept to assess different gradations in social robustness of water management

strategies in different climatic and perspectivistic futures (see Table 1 for a short summary on the chapters' content and scope).

In chapter 9 we will answer the sub questions (see paragraph 1.3) and reflect upon the main question (see also paragraph 1.3). We conclude with a reflection on the use of the Perspectives Method and an outlook for future research.

Table 1: A brief overview on the chapters, their content and their scope.

Chapter	Content	Type of lessons	Methods	Temporal scale	Spatial scale
1	General introduction	Content of the thesis	n.a.	n.a.	n.a.
2	Lessons from a pilot study	Methodological	Workshop results	Past, Present & Future	Meuse valley in the Dutch province of Limburg
3	Selection of a classification system	Methodological	Literature review and empirical comparison	Past, Present & Future	Global
4	Application of classification system to water	Methodological and content wise	Literature review	Past, Present & Future	Netherlands
5	Application of the Perspectives Method to the past	Methodological	Interpretative content analysis	Past	Netherlands
6	Application of the Perspectives Method to the present	Methodological and content wise	Questionnaire and interpretative content analyses	Present	Netherlands
7	Development of a tool to explore future perspective changes and social robustness	Methodological	Participatory Integrated Assessment Meta Model	Future	Hypothetical case study of the Waas area
8	Exploration of tenability and different gradations of robustness	Methodological	Combining computer scores on indicators with perspectivistic thresholds of acceptability	Future	Netherlands
9	Answering research questions and reflection	Recapitulation	n.a.	Past, Present & Future	Netherlands

Chapter 2

A METHOD TO EXPLORE SOCIAL RESPONSE FOR SUSTAINABLE WATER MANAGEMENT STRATEGIES

2   INTRODUCTION

Water management has always been adapting to changing conditions. Although mostly successful in the end, adaptation processes are often costly and accompanied by disturbances in society (for example after a flood). For the next 100 years water management may be challenged more through expected climate change and socio-economic developments. More techniques and knowledge may be available but increasing population and urbanisation may also result in limited space and increasing exposure to flood risk. The challenge is to cope sustainably with future uncertainties in both the water system and the social system (also see Haasnoot *et al.*, 2011). Uncertainties in the water system relate to (changes in) drivers and pressures and their effects on the state, like the effects of climate change on discharges. Uncertainties in the social system involve changing perceptions, goals and beliefs on water and the way water should ideally being managed. Sustainable water management strategies are able to cope with future uncertainties or can easily adapt to changing situations. To explore the sustainability of different water management strategies under an uncertain future we need to take into account a wide range of uncertainties in both the *water* and *social* system.

Recent water management studies (for an overview see Haasnoot *et al.*, 2011) analyze the robustness of a strategy by calculating its performance in terms of effects on floods and droughts in different futures and from our present point of view. This present point of view includes its own, unique evaluation of indicators and criteria, hence ignoring social change and change of those criteria to assess a strategies' performance. Further, most studies only included developments in climate and a few included linear socio-economic developments (see also Haasnoot *et al.*, 2011). However, in reality the success (or failure) of a strategy depends not only on its performance in terms of floods and droughts, but also on discontinuous developments in the socio-economic context and changing societal perceptions. Dike raising could for example be very effective in terms of flood prevention, even in the case of climate change. However, if society does not support this strategy (for example because higher dikes block the view on the river or are seen as unnecessary or unnatural) it may get impossible to implement the chosen strategy. In other words, the dominant societal perspective and our present criteria to evaluate a strategies' performance are dynamic and crucial for the success or failure of a water management strategy.

This observation generally holds for issues regarding sustainable development. The nature of this concept is highly contested, complex, and multi-interpretable. Further, it has been proven that the perception of sustainable development changes as it can be

interpreted through different and changeable perspectives (Williams and Millington, 2004). These perspectives differ -amongst others- in the value attached to people, planet and profit, possibly resulting in disagreement on the roots of sustainability problems, and ways to solve them. Williams and Millington (2004) use the distinction between weak and strong sustainability to illustrate an example of such disagreement. Weak sustainability approaches the inefficient use of resources as one of the major sustainability problems and thinks that solutions have to be found in the use of innovative technologies to increase resource supply (a technological fix approach). Strong sustainability on the other hand, focuses on the demand side of resource use as humans are considered to consume more than the carrying capacity of the earth can handle. Therefore, solutions to sustainability problems lie in behavioral change and decreasing human demands (Williams and Millington, 2004). Changing interpretations of sustainable development may thus have significant implications for the appropriateness of management options.

Previous research (Hoekstra, 1998b; van Asselt et al., 2001) has already indicated the necessity to include social uncertainties and different perspectivistic evaluation screens into an exploration of long term water management strategies. This chapter reports on a pilot study on the possibility of applying Cultural Theory to water management and follows the same structure of the thesis, namely from the past to the present to the future. Its main objective is to analyze if our approach to include social uncertainties into an exploration of the sustainability of water management strategies is possible and makes sense. More in detail, this chapter will report on the development of a method for sustainability assessment, focusing on exploring the social response for water management strategies under changing conditions (Haasnoot et al., 2011). First we will shortly focus on the interaction between society and the water system along the framework of Pressure - State - Impact - Response. Second, we describe the Perspectives Method by elaborating on our approach to operationalize perspective diversity and perspective change. Subsequently we show how water system and society can be conceptualized and integrated within a tool (technological framework) to assess the sustainability of different water management strategies under future uncertainties. Third, a historical example of perspective change in the Dutch Meuse valley and its effects on water management policy is given. Finally, we describe how this method can be used by scientists and policymakers to explore future acceptance of water management strategies.

2.1   The interaction of water systems with social systems

Water management generally aims at providing protection against floods and the provision of adequate amounts of water of proper quality for various water-related services. It involves finding a balance between water demand and water availability. The water demand is determined by water-related services and individual behavior,

which are part of the social system. The water availability is determined by climatic and geomorphologic characteristics (in other words the water system, which on its turn may be influenced by policies and measures resulting from the social system and vice versa). Flood and drought events may result in an impact on different water functions, such as drinking water supply, agricultural practices or habitat development. These events may also have an effect on our perception of the water system. It may confirm, amplify or change our expectations about future climate, the extent to which water can be controlled etcetera. Development of water management strategies is often based on past water events and average conditions, expectations of the future state and present objectives and values of society. In other words, the water and social system interact and a simultaneous consideration of both contributes to the identification of sustainable water management strategies.

The PSIR concept, or Pressure - State - Impact - Response concept (OECD, 1993; Rotmans and de Vries, 1997; Hoekstra, 1998b; Valkering et al., 2009; Valkering et al., accepted) provides an understandable but simplified overview on the interactions within and between society and the water system in the form of an effect chain (Figure 2). Environmental pressures (P) such as climate change and land use changes influence the water availability. Socio-economic pressures (P) determine the water demand and spatial claims. These factors influence the system state (S), including water quantity and water quality. The state has an impact (I) on social, economic and ecological services, such as drinking water supply, agriculture and habitats. The responses (R), finally, are divided in water policy and autonomous responses. Water policy refers to practices, measures and implementations resulting from actions taken by policy institutions (local, regional, national or international). The autonomous responses include agricultural practices by farmers, the recreational use of water, lifestyle issues and patterns by the general public. Water policy may change the water system directly (for example through the implementation of dikes) or indirectly through individual stakeholders (for example through education or the provision of insurances against flood damage). Individual stakeholders may effect the water system directly and indirectly as well: directly through their water use and indirectly through the support given to specific groups within the policy arena[1]. Policy makers may have excellent ideas on how to shape our water system, but without support from stakeholders and citizens it becomes very difficult to implement those ideas. After effecting the water system in a direct or indirect way, stakeholders and policy makers will be confronted with the effects of measures and behavior on the water system and related water functions. These effects may either confirm or reject their expectations on how the

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[1] This discussion is strongly related to dynamics between dominant perspectives and undercurrents, see section 2.3

water system functions. Strategies may subsequently be intensified, continued or changed according to new insights. The nature of the response (what do people actually do?) as well as the perception of problems is highly influenced by one's perspective.
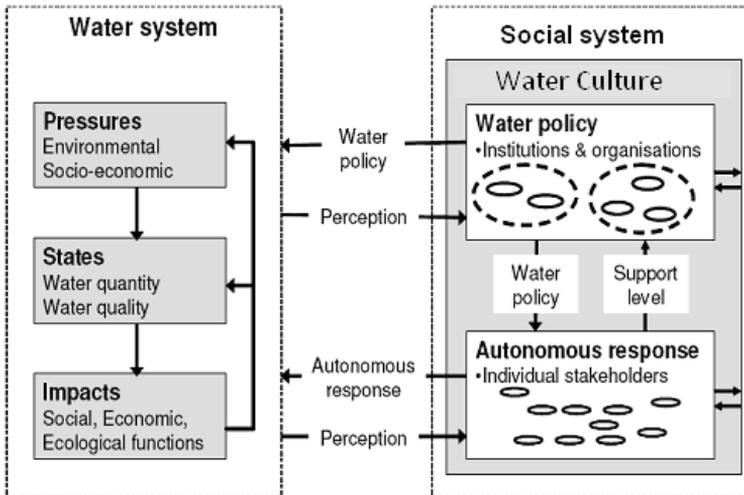
Figure 2: The PSIR framework which provides a simplified overview on the interactions between the water system and the social system (Valkering *et al.*, 2009). For the original PSIR diagram applied to water management see Hoekstra (1998b).

2.2   A method to explore social response and acceptance under changing conditions

2.2.1   Perspectives

Although it is not an easy task, the PSI-chain is relatively well understood; the main challenge however, lies in understanding the response part of the PSIR chain. To that end, we use the Perspectives Method. Perspectives can be defined as: perceptual screens through which people interpret the world (the worldview) and which guides them in acting (the management style) (van Asselt, 2000). They are steering for the content of the response. The Perspectives Method is derived from Cultural Theory (Douglas, 1970; Thompson, Ellis and Wildavsky, 1990) and has been used to analyze different views on religion (Douglas, 1970), nature and resources (Thompson et al., 1990), uncertainty (Rayner, 1992; Renn, 1992; Rotmans and de Vries, 1997; van Asselt, 2000), climate change (Janssen and de Vries, 1998; Pendergraft, 1998; O'Riordan and Jordan, 1999; Verweij *et al.*, 2006), biodiversity (Beumer and Martens, 2010), car use (Steg and Sievers, 2000), and transport risks (Oltedal and Rundmo, 2006). Further, it

has been used to interpret and classify perspectives on water (Hoekstra, 1998b; Middelkoop *et al.*, 2004; Valkering *et al.*, 2008b). Within Cultural Theory three active, stereotypical perspectives can be distinguished: the Hierarchist, Egalitarian and Individualist. Applied to water (Figure 3) (Hoekstra, 1998b; van Asselt *et al.*, 2001; Middelkoop *et al.*, 2004; Valkering *et al.*, 2008b), the *Hierarchist* believes in controlling water and nature, high government responsibilities, and decisions should be based on research and expert knowledge. Water is mainly seen as a threat to human safety. A sustainable water system highlights safety and flood prevention and leaves space for some economic and natural development. As a consequence, preferred water policy options are 'Building dikes', 'Leveling up or broadening dikes', and 'Channeling'. *Egalitarians* on the other hand, prioritize ecological recovery, natural development and the creation of more space for nature and water. Decisions should be based on participatory decision making processes with a more equal voice for everyone. Also the needs of animals and plants should be seriously considered. As a consequence, preferred water policy options are 'Room for the river', 'Decreasing human demands', 'Relocation' at higher areas, and precautionary actions. A sustainable water system focuses on strong sustainability with space for natural and ecological processes and reconsideration of human demands. *Individualists* adhere to a more opportunistic point of view. They do not regard water as a threat to human safety but as something that offers opportunities in terms of economy, creativity, self development and recreation. They follow an adaptation approach, have great trust in technology and the liberal market. Their preferred water management policies focus on innovative projects, like 'Amphibian living'[2], 'Living on water', and 'Building off shore islands'. A sustainable water system is inspired by weak sustainability (Williams and Millington, 2004) with a focus on economic opportunities and innovative, technological solutions to unsustainable situations. In Cultural Theory a fourth perspective, the Fatalist, is distinguished (Douglas, 1970; Thompson *et al.*, 1990). A stereotypical Fatalist is not concerned about the future and sees live as a lottery. Everything is determined by destiny which cannot be influenced by humans. One has to enjoy every day and make the most of the present. Policy does not change the course of life and sustainable development is not worth to discuss about: fate is unchangeable. Because our research is directed towards policy understanding and the formulation of strategies we decided to exclude the Fatalist in our first pilot analysis.

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[2] Amphibian living: buildings or infrastructures are (partially) built on the water surface and follow the dynamics of the water surface. They are suited both to float on the water surface as well as to be on solid ground.
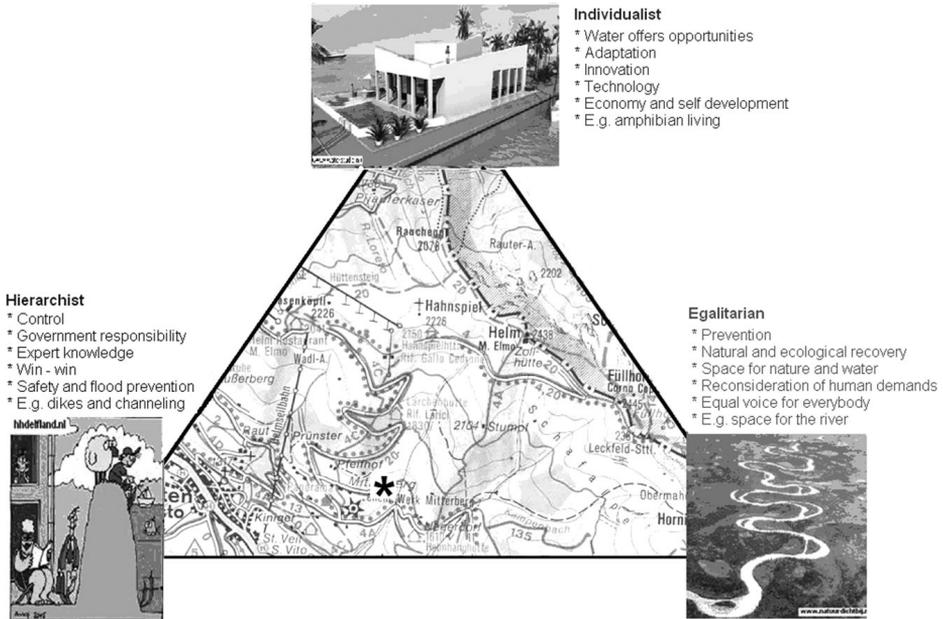
Figure 3: The perspective triangle with a short description of every perspective (Valkering et al., 2008b). The asterisk (*) refers to the present, average perspective of Dutch water professionals given our first inventory (see paragraph 2.6).

2.3   Towards an operationalisation of perspectives: perspectives mapping and dynamics

Although there are some examples of operationalisation of perspectives (see for example Dake, 1991; Rippl, 2002) there are only a few examples of the operationalisation (Hoekstra, 1998b) or measurement of perspectives on water. In order to use Cultural Theory to explore the social robustness of water management strategies, the above presented descriptions have been further elaborated for different core beliefs and characteristics related to water management (see Table 2 at page 26). For each belief (left column in Table 2), the stereotypical interpretation of the three perspectives is given (second-fifth column). To measure perspectives the corresponding interpretations per belief need to be marked. As real life perspectives tend to exist of a mix between stereotypical perspectives, per belief zero, one, two and even three interpretations can be marked. Each marked interpretation equals a score of one. The interpretations of all beliefs together form a perspective and offer a score for each perspective (vertical sum wherein every marked cell represents a score of one). We normalize this score to three and calculate a x- and y- value that can be plotted on a standardized triangle to indicate the similarities with the three archetypes (Figure 4). To plot the normalized numbers in the perspectives triangle, we first calculated the x-score by multiplying the Hierarchical score by xa (= 0 as hierarchism is

located at the bottom left of the triangle). Subsequently we added the Egalitarian score (bottom right) multiplied by xb (=1) and the Individualistic score multiplied by xc (=0.5). The y-value is calculated by multiplying the Hierarchical score by ya (=0) plus the Egalitarian score multiplied by yb (=0), plus the Individualistic score multiplied by yc (=0.866025). These x- and y-values can be plotted on a standard triangle with x and y-axes varying from 0-3. When all features of a group correspond with one of the stereotypical Perspectives, e.g. the Egalitarian, this group can be classified as an Egalitarian stereotype and mapped at the right corner of the triangle. If a perspective exists of interpretations of different stereotypes, it will be located somewhere in the middle of the triangle, depending on the exact completion of the map. If perspectives of the same people or group of people are measured in different time frames, we can also indicate perspective change following the same procedure as described above and comparing the positions of dots in different time frames.

The three different perspectives are theoretically well distinguishable, however, in reality they are not. Real life perspectives are heterogeneous (Douglas, 1970; Pendergraft, 1998; Caulkins, 1999; Verweij *et al.*, 2006; Valkering *et al.*, 2008b; Valkering *et al.*, 2009) and therefore existing of a combination of different perspectivistic interpretations (also see Oltedal and Rundmo, 2006). While previous empirical studies focused on classifying individuals or groups in one of the stereotypical (and thus extreme) positions in the triangle of Figure 4, we allow Perspectives to be heterogeneous (Valkering *et al.*, 2008b). Preliminary results in this pilot study confirmed the heterogeneous character of perspectives (Table 2). This implies that it is possible to have characteristics of more than one stereotypical perspective (e.g. to adopt a Hierarchical interpretation of the belief 'water problems versus manageability' and an Egalitarian interpretation of the belief 'water system organization'). Besides, it is also possible to adhere to more than only one perspective for one belief (e.g. I believe both in water as a source of rest and well being, as well as a reliable source to fulfill different functions).

Within the broad spectrum of perspectives existing within a society, a dominant perspective and (one or more) undercurrents can be distinguished (Loorbach, 2007). A dominant perspective consists of interpretations of beliefs upon which the majority of people in a group (society, institute etcetera) explicitly or implicitly agree. This could be a Hierarchical idea of control and regulation, resulting in a desire to reinforce dikes. Undercurrents refer to non-dominant but significant interpretations of beliefs according to a minority of people in a group, for example an Individualistic perspective with focus on opportunities and innovation resulting in a preference for 'Amphibian living'. Because of the dynamic nature of perspectives, the interpretation of beliefs, as well as the distribution between dominant perspectives and undercurrent(s) may change over time. Eventually, an undercurrent could become dominant at costs of the previous dominant perspective. In our example, this would imply a loss of support for dike reinforcements and growing popularity and attention for amphibian infrastructures. Perspectives change due to surprises (Thompson *et al.*, 1990; Verweij

et al., 2006; Valkering *et al.*, 2008b). Surprises are events, developments and occurrences (possibly catalyzed by people or the media) that indicate a mismatch between expectation and reality. For a Hierarchist, with great trust in dikes, it would be a surprise to face a dike breach. However, perspectives also offer resistance against surprises. When confronted with a surprise, people will try to ignore its occurrence, or try to explain it in such a way that it still fits within the former expectations (Thompson *et al.*, 1990). This ignorance however, is only tenable up to a certain tipping point. At this tipping point, reality cannot be denied any longer, and the perspective (interpretation of beliefs) will change. Perspectives change if at least one interpretation of one belief in Table 2 changes according to new insights. With a changing dominant perspective, the social support for a given water management strategy may also change. To avoid protests, indefensible situations and any other difficulties concerning the implementation of a strategy, the robustness of a strategy for changing perspectives, in other words the social robustness, has to be tested in advance. A sustainable strategy is able to cope with developments in the water system as well as developments in the social system (perspective change). This contributes to make the water system sustainable and future proof (in stead of only climate proof).

2.4   IAMM tool to analyze to interaction between social and water system

To analyze and reflect the interaction between society and the water system in a more realistic way we developed an Integrated Assessment Meta Model (IAMM) based on simple cause-effect relations (Haasnoot et al., 2011). With this participatory simulation model (see chapter 7) it is possible to analyze the PSIR chain for many transient scenarios without a large calculation time. Transient scenarios comprise time-series of climate, including flood and drought events, socio-economic trends, social events, surprises and interactions between the water system and society. At any moment in time it is possible to evaluate a water management strategy and adapt if necessary. As described by Haasnoot et al. (2011) this evaluation is guided by scores on a variety of indicators, including the number of flooded dike rings, (agricultural) damage, shipping suitability and nature diversity. The way these indicators are interpreted depends on one's perspective. For example, for an Egalitarian who values nature and ecological development over economic issues, high shipping suitability[3] is less important than for Individualists who highly value economic prosperity. The acceptability threshold for shipping suitability will be lower for individualists than for Egalitarians (see chapter 8). The result of playing the simulation game many times, is a set of storylines, together making up an ensemble of transient runs including dynamics due to natural and social variability and interaction between the water system and social system. Each storyline will be evaluated on events, management style, impacts (damage, costs, and effects on nature) and perspective changes. Threats and opportunities for different strategies

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[3] Expressed in the percentage of time wherein ships could navigate unhindered.

may become clear, which can then be used to improve the strategies. We could for example identify no-regret or regret measures, analyze the risk of doing nothing or waiting and then analyze the range of possible futures.

2.5   From theory to practice: historical perspective changes in the Meuse valley

To gain more insight in perspectives and perspective change, we organized four stakeholder workshops for the case study of the Meuse valley in the province of Limburg, the Netherlands. In the first workshop we explored historic perspectives and drivers (surprises) for change. To this end, a number of water management experts were invited, including representatives of government (regional and national scale), NGOs, drinking water sector and researchers. In a facilitated discussion, they were asked to reflect on historic perspective changes and drivers for change concerning the Meuse, resulting in a historical timeline linking events, developments, influential people and perspective change. Summarized four periods could be distinguished according to the participants (Valkering et al., 2007; Valkering et al., 2008b)[4]:

1. 1800 till 1960 could be characterized by referring to a combination between Hierarchism and Individualism. In a context of economic growth, technological innovations, industrialization and mining activities (and the related increased demand for fast and large scale shipping of coal to the port of Rotterdam), this period caught on manipulability, which resulted in regulation of the Meuse for large scale coal transportation throughout the whole year.
2. Starting as from the 1960s, the dominant perspective moved towards Egalitarism (although the first undercurrents date back to the early 1920s). Main driver was a growing environmental awareness, catalyzed by some major, visible calamities (like the Endosulfan poisoning of the river Rhine, and the explosion in Chernobyl's nuclear power plant) and environmentally focused initiatives (like 'plan Ooievaar', which asked for more space for water and nature, see footnote 33 for more information). The accumulation of calamities empathetically served as surprise for the Hierarchical-Individualistic perspective with trust in technology, control and the belief that nature is robust for external disturbances. Reality could not be denied any longer which made the perspective change towards Egalitarism.
3. In 1993 and 1995, the Meuse area was hit by floods, which caused the dominant perspective to become more Hierarchical again. An increased awareness of unsafety, the expected effects of future climate change on discharges and an increased spatial pressure on the Meuse valley led to a more Hierarchical perspective. Within this perspective more attention was paid to flood protection,

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[4] For more information on perspective changes on a national scale and the lessons for science and policy, see chapter 5

the combination of different water functions, and strong government responsibilities. Here we see that events may also function as a reproduction mechanism. A reproduction mechanism is an event or development which reflects expectations about reality to be right, and therefore strengthens a given perspective. After the 1960s an undercurrent kept believing in the controlling capacity of dikes and their importance for human safety. The 1993 and 1995 floods reproduced their perspective and the undercurrent eventually won popularity again.

4. Around 2006 the dominant perspective consisted of a combination of the three stereotypes (see Figure 3). Hierarchical elements include flood protection as leading principle, government responsibilities, and controlling/regulating measures (like off-shore sand suppletion and raising the levels of the IJsselmeer Lake). Egalitarian characteristics include participatory decision making processes, citizen involvement and reservation of natural area (as preventive measure against the possible consequences of climate change). Individualistic elements were financing measures to pay the costs for natural development or conservation with profits from recreation, catering or education. In addition, the increased attention for the innovative use of water and space (like 'Amphibian living') suits perfectly in the Individualist perspective.

This short summary shows the dynamic nature of perspectives and changing preferences for water policy options (both content wise, e.g. dike reinforcement as well as process wise, e.g. expert knowledge or participatory decision making). Mostly, perspectives changed due to external events or developments, occurring outside the area of the Meuse and often external to the water system (like the Chernobyl disaster). Further it states that the role of undercurrents should not be underestimated. The minorities at this moment could possibly be the dominant ones in the next decades. In chapter 5 we further elaborate on historical lessons for perspective change and its relation to societal support for strategies.
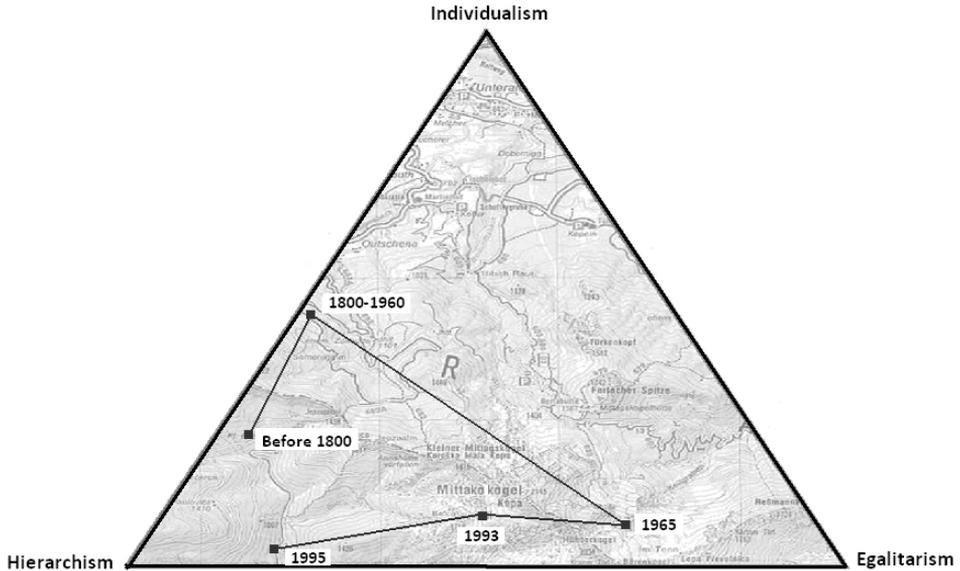
Figure 4: Visualization of the historical transition path for perspective change in the Dutch Meuse valley from 1800 till 1995 (Valkering et al., 2008b). In Figure 3 the location of the present (2007) perspective on water can be found. See paragraph 2.3 for an explanation on how the dots in the figure have been calculated.

2.6   From theory to practice: the Dutch dominant perspective on water

In our pilot, we used the perspectives map to measure the Dutch dominant perspective on water. This inventory[5] was meant as a first test case to measure the Dutch dominant perspective on water (see chapter 6 for more information). Resulting from this test inventory, the present Dutch perspective on water consists of a combination between Hierarchism and Egalitarism, with some Individualistic characteristics (see underscored cells in Table 2). In general, expectations about the future, as well as responsibility issues are dominantly approached in a Hierarchical way. However, the Hierarchical idea of water as being a threat against we have to fight is less popular at the moment. Instead, professionals are searching for ways to combine natural developments, room for water and nature with innovative, technological opportunities. Water is believed to offer opportunities, the input from various stakeholders should be considered in decision making, but the government remains responsible for water management. In Figure 3 we see the location of this dominant Dutch perspective on water in the perspective triangle (represented by an asterisk).

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[5] (N=90, Cronbachs' Alpha= 0.78)

Table 2. A first operationalisation of perspectives on water (Valkering et al., 2008b). The underlined text refers to the present dominant perspective on water among Dutch water professionals (n=90). For every belief (left column) respondents have to choose which interpretation fits best to their personal impression. For every belief, one, two or even three interpretations can be selected.

	Hierarchist	Egalitarian	Individualist
Value of water	<u>Reliable source for fulfillment of functions</u>	Source for rest and well-being	Source of prosperity and self development
Water problems vs manageability	<u>Serious problem, but manageable</u>	Serious problem, and not manageable	No problem
Expectation about climate change	<u>Average trend as forecasted by experts</u>	<u>High trend (worst case)</u>	Low trend
Trust in technology	<u>Moderate positive, reserved trust</u>	Negative, low trust	Positive, great trust
Expectation socio-economic context	<u>Average trends</u>	Low trends (e.g. small population growth)	High trends (e.g. high population growth)
Water priorities	Preservation of current function; win-win	<u>Compensation and ecology</u>	<u>Innovation and economy</u>
Managing safety	Flood prevention	Avoidance of areas sensitive to floods	<u>Adaptation and utilizing opportunities</u>
Water supply in dry times	Demand driven	<u>Supply driven</u>	Market driven
Water system organization	Damming and regulation	<u>Naturally</u>	Opportunistically
Spatial planning & water	Water follows	Water steers	<u>Water offers opportunities</u>
Responsibility	<u>National and European governments</u>	Regional governments and NGOs	Private companies and individuals
Process design	Norms and expert knowledge	<u>Participatory decision making</u>	Free market - Privatization
Identity & knowledge	<u>Dutch water authorities</u>	<u>River catchment - local</u>	International companies
Level of integrality	Sectoral	<u>Integral</u>	Competition

2.7   Sustainable water management paths that are robust and flexible

The process of perspective change can metaphorically be described as paths and roads on hiking maps (therefore the background in Figure 3 and Figure 4 represents a map). On a map, it is possible to identify where you came from, what your current position is, where you would like to go to and what expectable obstacles are (like rivers and gorges). However, it is not illusory that if the journey goes along, unexpected circumstances, (like washed away trails, broken bridges or bulls in a pasture) come

across. The same is true for perspectives: we are able to identify the road being followed by historic perspective changes, the position we are right now, and which directions we may want follow in the near by future. However, depending on social, technological and natural uncertainties the future may look different than expected: one could be confronted with different unexpected developments (the surprises), like a flood or failure of technology and one can choose to turn into a different pathway (choose different measures). Besides, in reality there are a lot of unofficial roads, which are not stated on the map, but are used by some walkers as an alternative pathway; which is comparable with an undercurrent. At the moment these unofficial paths gain popularity and are being walked on by more and more people, they become more visible and eventually develop into an official road, indicated on a map and possibly resulting in a very good alternative. Given our objective to explore the sustainability of water management strategies and following the map metaphor the next question arises: What is a good way to explore the most promising pathway to achieve a sustainable water system in a changing world? Partially, this is a matter of robustness as the path needs to be able to cope with different possible futures in terms of different circumstances and developments. For example, the trail should still be accessible in case of heavy rainfalls or droughts. Besides, it should be suited for a multitude of personal situations; a flat trail is better able to cope with such personal circumstances (like injuries, fatigue, broken shoes) than a hilly trail. The same should be true for a water management strategy: it should be able to cope with natural developments, such as climate change, as well as societal developments (changing perceptions, goals and demands from society). In addition, a sustainable strategy is a matter of flexibility. If a pathway turns out to be washed away, it should be easy and fast to find another trail, leading to the same destination as the initial road. If 'Room for the river' turns out to be ineffective in terms of climate change or societal response, it should be relatively easy to transform: the strategy needs to be flexible. An attentive reader will realize that the extent to which a strategy is flexible also depends on the perspective at hand. Theoretically, every strategy can be undone. The extent to which we consider adapting a strategy to be reasonable depends on our evaluation of involved costs, natural damage, societal upheaval etcetera.

A first step in exploring the sustainability of water management strategies thus consists of a social robustness analysis. This analysis explicitly draws from the added value of the diversity of perspectives that exist at any point in time. This diversity of perspectives can be illustrated by analyzing water management measures that are currently debated from a perspectivistic point of view (Valkering et al., 2008b) (Figure 5). Some measures mentioned in Figure 5 may seem unbridgeable as they are based upon fundamental different assumptions about how the world functions and how the water system should ideally be managed. However, this diversity does not automatically result in ignorance and solitary situations. According to Douglas (1973) and Thompson et al. (1990) each perspective needs each of its rivals, either to make up for deficiencies, to exploit, or to define itself against. The Hierarchist, for example, is

decisive but innovation fails due to a web of governmental rules. The Individualist is a source of innovative ideas, however lacking attention for environment and solidarity. The Egalitarian focuses on environmental issues and harmony, while missing decisiveness (Douglas, 1970; Verweij et al., 2006; Valkering et al., 2008a). However, that no perspective can exist alone does not mean that every perspective has to be represented equally within a group (Thompson et al., 1990). The perspective map could be used to identify similarities and differences underlying different preferences for strategies and can hence function as a basis for dialogue, eventually leading to synergetic solutions that are relatively robust under different climatic and social futures.
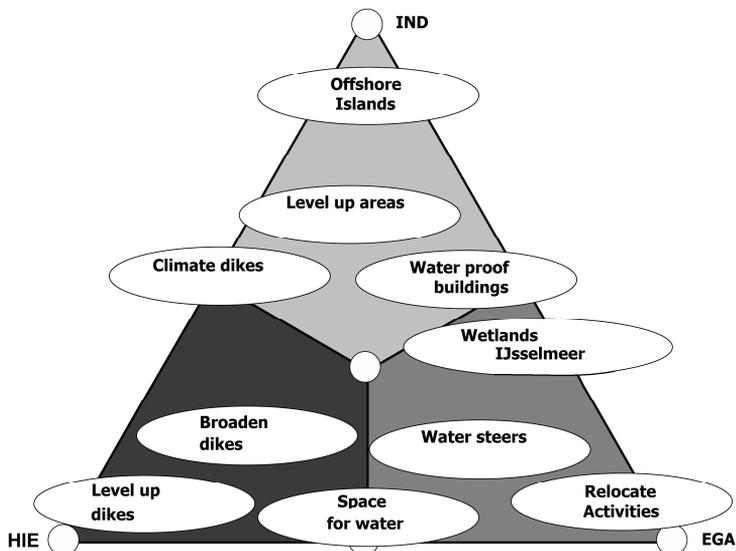
Figure 5: The perspectives triangle and possible measures categorized by perspective (Valkering et al., 2008a)

A social robustness analysis to assess the performance of a strategy under different social perspectives may start with a dialogue between representatives with different perspectives. Every perspective comments on the preferred measures of others based upon their own worldview (Table 3). In this way risks and vulnerabilities of a strategy become visible. The completed perspectives map visualizes the beliefs upon which stakeholders disagree which may explain why a given strategy may be rejected by one or more parties. It offers opportunities to direct the dialogue towards laying the finger on the sore spot and try to achieve agreement by making certain adjustments to the initial idea (e.g. to ensure enough attention for human safety and natural developments for animal and plant species within the 'living on water idea' to comply better to respectively the Hierarchist and Egalitarian). If it is impossible to find

adjustments to make a strategy at least acceptable for other perspectives, the strategy lacks social robustness.

Table 3: Three examples of measures and possible reactions and critiques on these measures from the other perspectives (Valkering et al., 2008a).

	Hierarchist	Egalitarian	Individualist
Relocate activities	Renounces the rich Dutch history of water management. Besides it is unnecessary because we have the capacity to control the water.	*Relocate infrastructure and buildings to higher areas which are not vulnerable to floods. Gives more space to the river.*	Too expensive and we are in need for more space for building areas, especially if populations continue to grow. Would be a missed change to profile the Dutch capacity to govern water.
Offshore islands	There is not enough scientific proof for its consequences. Might harm sea water quality for swimming due to changing sea streams	Disturbs and harms ecological dynamics, birds and other organisms. Not natural.	*Building innovative islands to protect the coast from erosion and flooding. Preferably the shape of these islands should be innovative too (e.g. the shape of a tulip) to boost innovative image.*
Level up dikes	*Leveling up existing dikes in order to better cope with increased discharges. The vulnerability of the dike goes down, the safety for people as a consequence goes up.*	Unnatural and only a short term solution with regards to climate change. Besides it is clumsy for people and prevents development of natural river banks.	Too soft, not innovative enough. Besides it's a bit old-fashioned, blocks peoples' view on the river. Same space could be used more efficiently and for a better living enjoyment.

A second step in the robustness analysis is analyzing the effects of surprises on perspectivistic evaluations and social support for strategies. To this end, the IAMM was used to confront management strategies with a number of possible scenario developments and events. In the IAMM tool, users are confronted with surprises and reproduction mechanisms (see paragraph 4.2.7) by means of news paper headlines (see Figure 6 for examples), and with the effects of a strategy on indicators. Although history provides some insight in the effects of surprises and reproduction mechanisms (e.g. change or enforcement of perspectives), little is known about the direction of change (e.g. if a Hierarchist gets confronted with surprises, will he or she change into the direction of Egalitarism or Individualism?). To gain more knowledge about drivers and thresholds for change, the direction of change and the role of undercurrents herein we continue to develop the IAMM tool in a participatory setting, see chapter 7 or Valkering et al. (2009).
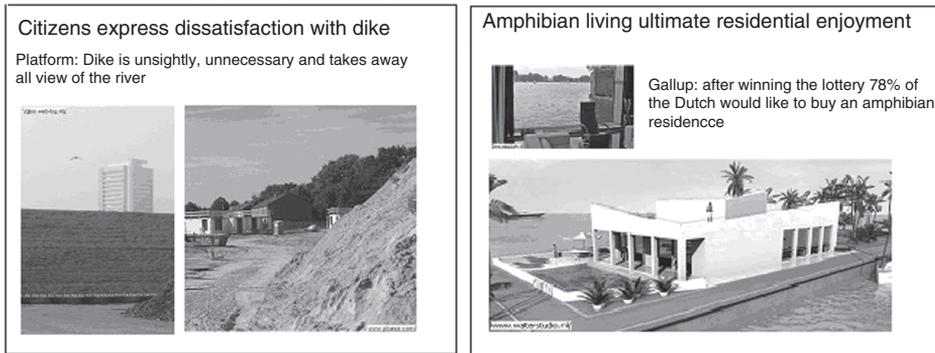
Figure 6: Examples of headlines in the IAMM tool. The left one is a surprise for the Hierarchist (and a reproduction mechanism for the Individualist and Egalitarian). The right one is a reproduction mechanism for the Individualist and a surprise for the Hierarchist and –to a lesser extent because of the space given to the water- the Egalitarian

2.8   Reflection

Sustainable water management involves analyzing the interaction between society and the water system. A sustainable water management strategy is robust and flexible. Robust means being able to cope with different future events and developments in the social and water system (like changing social perspectives, floods, droughts, and increased discharges). Flexible means that a strategy can be adapted to changing social and physical circumstances if it is not able to cope with them. In other words; a sustainable strategy has to be acceptable under different futures or it should be easy to adapt it in order to become acceptable again. To assess the sustainability of river management strategies, one thus needs to test the success of those strategies under a variety of non-linear developments of the coupled water - social system.

There are different perspectives on promising ways for sustainable water management strategies. The Perspectives Method can be used to classify, interpret and analyze these different perspectives. Next, the perspectives map, which forms a fundamental part of the Perspectives Method, may play an important role in a negotiation process, as it provides insight in differences and similarities between various stakeholders and may hence be used to identify the reasons behind disagreement. The Perspectives Method may also highlight positive aspects of each individual perspective and visualizes risks and vulnerabilities inherent to measures. The combination of facilitating dialogue and performing a risk- and vulnerability assessment may lead to a more satisfying situation for stakeholders involved, since the strategy becomes a bit more acceptable under all different perspectives and futures. This contributes to make strategies more socially robust and may save costs as a loss of social support may be prevented. The Perspectives Method will be further integrated into the IAMM tool (see chapter 7) resulting in storylines that will be evaluated for their robustness and

capacity to adapt to changing conditions. First results of this type of analysis show that surprises are important ingredients for perspective change and social support. Also, the performance of strategies for the nearby future is mainly determined by climate *variability*, while for the longer term (> 50 years) climate *change* is important to take into account. A sustainable strategy could then be a strategy which is robust for climate variability (fluctuations within the climate) and social change in the near future, and flexible enough to adapt to climate change (fluctuations between different climates) and social change on the long term.

As the pilot project had to be performed within the time constraint of one year, some assumptions had to be made. The most important among them, was the choice for Cultural Theory as reference typology to assess and analyze dynamic perspectives on water. In the next chapter we will reflect on the position of Cultural Theory within other typologies and the role of the fourth, so called passive perspective of the Fatalist. This relative unknown perspective is oftentimes ignored in policy relevant research. For simplicity reasons and a first impression that this perspective does not play an important role in changing perspectives on water we excluded the Fatalist in the pilot. The next chapter that reports on a follow up of the pilot concludes however that convincing proofs ask for an inclusion of the Fatalistic perspective. Also, a reflection on the content of the perspective map is needed. Especially the beliefs on developments in the socio-economic context, identity issues and the level of integrality were oftentimes not well understood and their interpretation did not vary substantially between the stakeholders as other beliefs did. Further, we had the feeling that beliefs on drought issues and water supply were missing in the map, but may possibly play an important role in assessing perspectives on water.

Chapter 3

IN SEARCH OF A CLASSIFICATION SYSTEM; CULTURAL THEORY IN COMPARISON WITH OTHER TYPOLOGIES

3   INTRODUCTION

Understanding the social system has proven to be a challenge, but since we depend on others, the need to communicate, collaborate and at least understand some basic behavioral features has always been essential (Thompson et al., 1990; Offermans, 2010b). Nevertheless, with billions of people on earth, there is a multitude of different personalities; almost everybody has different preferences and people react differently to the same stimuli. However, still it is desirable to classify groups of people in segments in order to better understand their actions, and explore regularities in their (non) support for strategies. Typologies distinguish groups consisting of comparable persons allowing to find patterns that help explaining and even predicting (or retrodicting) the human construction of meaning (Thompson et al., 1990; Offermans, 2010b). Cultural Theory is such a typology and has initially been developed to classify, analyze and interpret communities' behavior according to their (religious) rituals (Douglas 1970), and has also been used to analyze different views on nature and resources (Thompson et al., 1990), uncertainty (Rayner, 1992; Renn, 1992; Rotmans and de Vries, 1997; van Asselt, 2000), climate change (Janssen and de Vries, 1998; Pendergraft, 1998; O'Riordan and Jordan, 1999; Verweij et al., 2006), car use (Steg and Sievers, 2000), problem framing (Hoppe, 2011), water management (Hoekstra, 1998b; Hoekstra, 1998a; Middelkoop et al., 2004; Valkering et al., 2008b; Offermans et al., 2011a), biodiversity (Beumer and Martens, 2010) and transport risks (Oltedal and Rundmo, 2006). In these studies however, the choice for Cultural Theory is not convincing. More typologies (see below) exist and it is not evident why Cultural Theory in these studies was chosen in favor of others. Some argue that Cultural theory can be used to gain more insight into group and individual responses (for example Renn, 1992; Pendergraft, 1998), others reject that claim (for example Meader, Uzzell and Gatersleben, 2006; Oltedal and Rundmo, 2006).

Our research goal is to gain more insight in (changing) perspectives on water and river management in the Netherlands. We are thus in need of a classification system that describes different, but coherent perspectives people may hold on river management in the Netherlands. Ultimately, differences in preferences, support for water management strategies and choices for measures can be explained by differences in perspective. In this chapter we explore the relative usefulness (or uselessness) of Cultural Theory as a classification system. We are particularly interested in the question whether Cultural Theory (and its perspectives) can be recognized in other typologies, if there is a need to nuance, accentuate or ignore aspects within Cultural Theory, and if it is complete in terms of describing the full palette of possible perspectives. The latter issue will also provide an answer to the question whether the Fatalist perspective should be integrated within a typology to identify perspectives or that it should be left out because of its passive attitude towards policy and influencing ones course of life. Conclusions will be taken into account when further elaborating our method to map and measure perspectives on river management (see chapter 4).

To that end, we analyze the position of Cultural Theory in relation to six other typologies: Motivaction's mentality test (Motivaction International, 2008a; Motivaction International, n.y.), spiral dynamics (Straatsma et al., 2009; Graves, n.y.), TNS-Nipo's WIN model (TNS-NIPO, n.y.), mood consumption (Oustrup and Flaven, n.y.), IPCC/PBL worldviews (IPCC, 2001; MNP, 2007), and the WRR typology (Wetenschappelijke Raad voor het Regeringsbeleid, 1994) (see table 4). It is not our purpose to be exhaustive, but rather to broaden insight in the applicability of Cultural theory, and identify its weaknesses and strengths. The methodology used to perform the comparative analysis is described in paragraph 3.2. Chapter 4 will explain how we eventually applied Cultural Theory to Dutch river management.

Table 4: summary of the different typologies

	Cultural Theory	Mentality test	Spiral Dynamics	WIN-model	WRR	Mood consumption	IPCC/PBL
Goal	Classify, analyze and interpret behavior	Define audience groups for marketing	Making complex processes more transparent for more effective management	Visualize and characterize target groups for marketing	Translating sustainable development into manageable policy terms	Understand consumers to create more successful products and services	Exploring sustainability effects and risks of worldviews in the future
What do they measure	Ways of life (bias and social relation)	Lifestyles, audience groups and channels to reach these groups	Basic beliefs and worldviews	Different value ratings	Four action perspectives to construct scenarios	personalities, values and taste in design	Stylized societal types and related preferences for solutions
Underlying dimensions	Grid (high, low) and group (high, low)	Status (low, middle, high) and values (traditional, modern and postmodern)	Orientation (individual, group) and Behavior (visible behavior, invisible thoughts)	Importance (self, others), Progress versus conservation, Education (low, high) and Age (low, high)	Consumption (high, low) and production method (change, adaptation)	Abstract versus Concrete and organized versus spontaneous and emotional versus logical	Globalization versus regionalization and efficiency versus solidarity
Categories (total #)	Hierarchism Egalitarianism Individualism Fatalism (4)	Traditional Comfort Modern New conservative Cosmopolitan Upward mobiles Post materialists Post modern hedonists (8)	Beige Purple Red Blue Orange Green Yellow Turquoise (8)	Conservatives Engaged Hedonists Careerist Broad minded Professionals Care takers Balanced (8)	Utilizing Saving Managing Preserving (4)	Innovation Intuition Perfection Satisfaction (4)	A1 Mondial market A2 safe region B1 mondial solidarity B2 care taking region (4)

3.1   The different typologies

3.1.1   Cultural theory

Cultural theory (Douglas, 1970, 1996) distinguishes a group- and grid dimension, resulting in four quadrants. The group dimension refers to the strength of group

incorporation; the greater the incorporation, the more individual choice is subject to group determination. The grid dimension refers to the level of constraining prescriptions; the more binding prescriptions, the less of life is open to individual negotiation (Thompson et al., 1990). Following the grid and group dimension, four ways of life are distinguished: Egalitarism, Fatalism, Individualism, and Hierarchy. Accordingly, there are four patterns of social relationships: ego-focused networks (Individualism), egalitarian-bounded groups (Egalitarism) and hierarchically nested groups (Hierarchy) and involuntary exclusion from organized patterns of social relations (Fatalism)[6][7].

3.1.2   Motivaction

Motivaction International (located at Amsterdam, the Netherlands) developed a value and lifestyle Mentality test that focuses on marketing and policy questions to gain insight into audience groups, channels to reach these audience groups and ways to appeal to them (Motivaction International, 2008b; Motivaction International, 2008a; Motivaction International, n.y.). Examples of recent projects they performed include an exploration of citizen preferences for policies for long term development of the Dutch Randstad area (for the Ministry of VROM), the creation of a new and appealing bottle for the beer brand Grolsch, and the construction of an overview on different opinions on regional products (for the taskforce multi functional agriculture). The mentality test is one of their specialist tools and is said to better explain consumer and citizen behavior. Results of are -amongst others- applicable to sustainability issues, mobility, media, and politics. Within the typology eight main segments are distinguished which differ in terms of status (low importance, middle importance and high importance) and values (traditionally based on conservation; modern based upon possession and spoil; and postmodern based on self development and experience) (Motivaction International, 2008b; Motivaction International, 2008a; Motivaction International, n.y.).

3.1.3   Spiral dynamics

Spiral dynamics is an evolutionary development model in the shape of a spiral of worldviews (patterns of thought; also called VMemes) and based on the theory of Clare Graves (Graves, n.y.). Every VMeme attracts a package of beliefs, which come together in a unique social group with its own motivation pattern, organizational dynamic and goals and it can be applied to society as a whole, but also to organizational groups. Eight different groups are distinguished which are connected to a color. Every individual or group starts in the lower vMeme system (beige). Beige

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[6] Formally, Fatalism does not refer to a pattern of social relations: in fact it is a denial of the existence of such relations.
[7] Thompson et al. (1990) also distinguish a fifth perspective: the Hermit who voluntarily excludes himself from social interaction and may be located in the middle of the diagram/axes.

describes a society of hunters and fishers which is only driven by instinct and tendency to survive (comparable to a child in the period after its birth). After solving present problems of existence (for example maintaining physiological stability or living with self awareness), one reaches a stage of increasing complexity with different problems, values, goals, structures, motivations and ways of thinking, expressed by a different color and a different combination of VMemes. It is only possible to move one spiral up or down simultaneously; you cannot skip phases (Straatsma et al., 2009; Graves, n.y.). This reduces possible perspective changes to only two options. Although very generally, this offers possibilities to identify transitions and to argue when a shift towards an other level is forthcoming (Herold, 2005). In spiral dynamics, two axes are used to characterize different fields of personality (VMemes); individual orientation versus group orientation and interior (non visible thoughts about what people think and prefer) versus exterior (visible behavior) (Herold, 2005; Graves, n.y.). The interpretation of all four fields together offers a unique personality, VMemes and color.

3.1.4   WIN

WIN is an abbreviation for 'Waardensegmenten in Nederland' (Dutch for value segments in the Netherlands) and was developed by TNS-NIPO, the largest market research institute in the Netherlands and part of the globally operating marketing research group TNS. WIN encompasses a value research method (derived from Schwartz, 1990; Schwartz, 1992) to visualize and increase insight in target groups for different clients and focused on marketing. Seven categories are distinguished, and an eighth category ('the balanced') exists of people who have characteristics of all other 7 segments. People in the seven main groups differ significantly for lifestyle, motives and behavior. Scores on 4 different axes determine the position of a segment (see also appendix 1). These axes are: other(s) as most important versus self as most important, progress versus conservation, high educated versus low educated and high age versus low age. For each person a value rating is provided (Hessing and Reuling, 2003; TNS-NIPO, n.y.). Following Schwartz, starting point in a value rating is that every person possesses the same package of values. However, the importance attached to every value differs. The most important value for segment A may be the least important value for segment B. This differs substantially from Cultural Theory as the latter offers also possibilities to reject values, instead of only attaching lower value to it.

3.1.5   WRR

WRR is an abbreviation for "Wetenschappelijke Raad voor het Regeringsbeleid" (Dutch for 'the Scientific Council for Government Policy') which advises the Dutch government regarding future developments that are of particular societal interest, like sustainable development. In their report 'Sustained Risks: a Lasting Phenomenon', the WRR examines ways "in which the concept of sustainable development can be manageably translated into policy terms" (Nederlands scientific council for government policy,

1995; p.5). To that end, four action perspectives resulting from the scores on two axes (low consumption versus high consumption and adaptation of production methods versus a change in the nature of production methods) functioned as a basis for scenario analysis (Wetenschappelijke Raad voor het Regeringsbeleid, 1994; Nederlands scientific council for government policy, 1995). The four perspectives are thus used in a scenario exercise to explore possible future directions for sustainable policies.

3.1.6   Mood consumption

Mood consumption provides a marketing tool to better understand consumers, and to create more successful products and services. According to Oustrup and Flaven (n.y.) traditional demographic segmentation criteria such as age, gender and income are no longer accurate in explaining attitudes in a post-industrial world. They follow the idea that the present social order has reached a stage of increased complexity, wherein Mood consumption indicates a next step in describing consumer behavior following from an agricultural society, towards mass consumption, marketing led consumption, and finally mood consumption. It distinguishes three axes: abstract versus concrete, organized versus spontaneous, and emotional versus logical. The score on these axes determines one of the four main moods. It is also possible to adopt to a combination of moods which is called a "minor mood" (Oustrup and Flaven, n.y.).

3.1.7   PBL/IPCC

The Planning office for living conditions (Het Planbureau voor de Leefomgeving or PBL in Dutch) is an institute for strategic policy analyses regarding environment, nature and space. Before reorganization into PBL, the 'Milieu en Natuurplanbureau (MNP)' institute constructed a worldview typology wherein four worldviews were connected to TNS-NIPO's WIN model (see paragraph 3.1.4). These worldviews were used to conduct a sustainability exploration in the Netherlands in 2004 and 2007 (MNP and RIVM, 2004; MNP, 2007) to explore the effects and risks of each worldview into the future. The distinguished worldviews depend on the scores on two axes: globalization versus regionalization, and efficiency versus solidarity (MNP and RIVM, 2004), which were adopted from the IPCC in their report 'Special report Emissions Scenarios (IPCC, 2001).

3.2   Criteria and methodology

A typology offers a framework to -among other things- structure people, arts, political preferences etcetera into coherent and distinguishable subtypes. More specifically, the word 'typology' is defined as: *the study of classes with common characteristics; classification, especially of human products, behavior, characteristics, etcetera, according to type; the comparative analysis of structural or other characteristics; a classification or analysis of this kind* (Oxford English Dictionary, 2012). To highlight the

connectedness of subtypes (or classes) sometimes the term *segmentation* is used instead of *typology*. The definition of a segment, however, is rather empty as it refers to anything "being part of something, considered separately from the rest" (for more information about definitions see Geest et al., 2008). However, we are not so much interested in the interconnectedness of parts related to a larger entity but in different ways of thinking, beliefs or perceptions, which would call for a slightly richer definition that also highlights differences between the segments. Therefore, we consider the concept of 'perspectives' as being part of a typology to fit better into this idea. Perspectives refer to 'perceptual screens through which people interpret the world and which guides them in acting' (van Asselt, 2000). However, in this chapter we will use the terms segment and perspective interchangeably. Depending on the objective(s) of segmentation, specific criteria need to be addressed. Given our goal (the measurement of historical, present and future perspectives, perspective changes and support for water management strategies, while allowing a broad, but recognizable diversity of different perspectives) we follow Gankema and Wedel's (1992) criteria for a valid and effective segmentation (Gankema and Wedel, 1992; McDonald, 1995; Hessing and Reuling, 2003; Geest et al., 2008; Haasnoot et al., accepted):

1. The (sub)groups should be *easy identifiable*, allowing operationalisation in a univocal way. It should be clear to which segment somebody belongs, which we will call univocal measurability.

2. The typology should also be *heterogeneous*, meaning that the perspectivistic differences between the segments should be clear as well. In practice, a typology could be identifiable (criteria 1) but simultaneously fail the criteria on heterogeneity. For example, if people in two segments are considered to think equally about river management, but differ in their opinion about their most favorite color (blue or green), we could say the typology is identifiable (the preference for either blue or green determines your segment membership), but the typology fails to meet the criterion of heterogeneity (they all think equally about river management and are thus very homogenous).

3. To allow perspective change, segments have to be *accessible*. Individuals should have the opportunity to move in and out any segment (multi directional change). This implies that a typology with only one direction of change (for example spiral dynamics) does not comply with this criterion. Also a typology wherein changing segment membership is too constraint or directed by structures can be considered not accessible enough.

4. Of course, the typology should also be *stable*, meaning that perspectives are not allowed to change too often or easily. Segments should be accessible to individuals (criteria 3), but typologies wherein individuals may change their segment membership multiple times in 24 hours (for example) loose too much explanatory power to be used in our research to elaborate on the relation between perspective change and support for water management strategies.

5. The size of every segment should be *significant*, preventing the existence of too many groups consisting of only a few people, or the existence of groups that are hardly recognizable for people. However, it has to be stated that this heavily depends on the research scale (from organizational to international) and time framing of the research (from pre-historic times to the future). As we focus on perspectives on water on a national (Dutch) level, each of the groups should contain at least 10% of the number of people in the dominant segment to make up a viable subgroup. Also perspectives that could only be recognized in pre-medieval times (for example beige in spiral dynamics) is less significant given our research focus.

6. Within each perspective or segment, responses and evaluations should be *homogeneous* or at least comparable with respect to a given context. This does not necessarily mean that people have to respond in an expected way, or in line with theoretical assumptions. People belonging to the same segment should respond to a situation (for example a period of drought) in a comparable way.

7. The typology should reach a level of *influentiallity* by offering ideas on how human behavior within each segment can be steered, e.g. a marketing strategy. For this, the typology should give a description about preferred policy-options and/or aspects where people strive for.

Thompson et al. (1990) strongly advocate segments as compounds of at least two dimensions (axes), rather than categories as designations, because according to them, the latter (although being a typology) looses explanatory power and fails to be embedded in a theory. As we can see in table 4 all typologies in our analysis make use of underlying dimensions. Further, we only included typologies in our analysis for which we could confirm at least three aspects from the above mentioned 7 criteria. To accomplish the comparison we followed a stepwise procedure. First, we read key publications or information sources related to the typologies. The objective was to gain insight into the different distinguished subgroups, their underlying differences and the criteria upon which people are divided into the different categories. Subsequently we compared this information to the four perspectives distinguished in Cultural Theory and the grid-group axes where upon the perspectives are based. Ideally, one segment could be compared to one Cultural Theory perspective. However this was not always

the case and therefore we used a specific encryption system. In this system we used HIE to refer to Hierarchism, EGA to Egalitarism, IND to Individualism, and FAT to Fatalism (see appendix 1). If a segment describes a balanced combination between perspectives (for example between Hierarchism and Egalitarism) this will be indicated as HIE-EGA (both in capital). The order in which the perspectives are mentioned do not refer to differences in importance or the strength in which they are recognized in the described segment. Sometimes a description may be mainly Hierarchical (or any other perspective) while simultaneously possessing minor characteristics of another Cultural Theory perspective (for example Egalitarism). This will be indicated by HIE-ega (the second, less important or less recognizable perspective in small characters).

To analyze the extent to which Cultural Theory's grid-group dimensions and the resulting contradictions between Hierarchism, Individualism and Fatalism, Egalitarism (as they do not share a grid or group position) can be recognized in the other typologies we wrote the corresponding Cultural Theory perspective in the original Figures from the different typologies (see Offermans, 2010a, and figure 7 for an example), which gave an impression on how the different perspectives relate to each other in each typology.
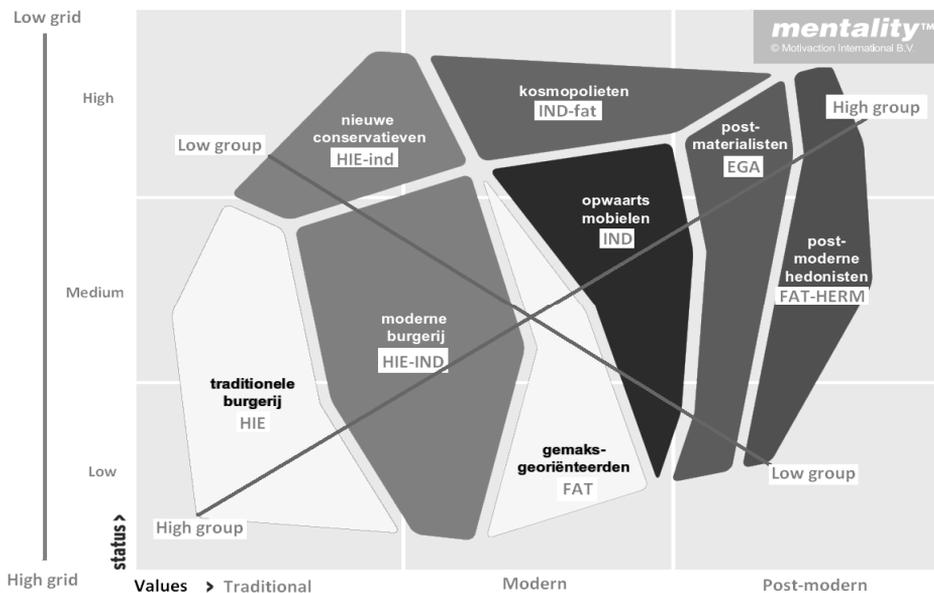
Figure 7: the position of the segments in the mentality test compared to each other (Motivaction International, n.y.) and to Cultural Theory. The relation of the segments differs from cultural theory. In the figure above, HIE and EGA as well as IND and FAT are opposing. In Cultural theory, HIE/ EGA and IND/FAT share the same group dimensions.

Of course, this analysis is the subjective outcome of a comparison made by one researcher. Such analyses are inherently subjective since they are influenced by the

values, preferences and tastes of the researcher involved. Although insolvable, the inter-reviewer reliability score can provide more transparency to the extent to which the researcher is influenced by his or her own personal value judgments. In this procedure, a second researcher will repeat (part of) the analysis done by the first researcher. Afterwards, the results will be compared and a percentage indicating similarities in the analysis will be calculated. In general, an inter–reviewer reliability of 80% or more is considered reliable. The inter reviewer reliability of this comparison is 75%[8] which is still relatively high given all the different possible options (16 per segment) and the fact that this inter reviewer reliability does not only measure the similarities between the findings of both researchers, but also the extent to which both researchers have knowledge about the content of the perspectives of Cultural Theory.

Next to the inter-evaluator reliability test, we tested the relations we found between the segments of the typologies and Cultural Theory perspectives empirically in the questionnaire we describe in chapter 6 (see appendix 2). This questionnaire consisted of four different types of questions: 1. Questions related to Motivaction's mentality test 2. Questions related to Cultural Theory 3. Questions related to Mood consumption and 4. General questions. The choice to include Mood consumption into the questionnaire resulted from its positive score on the aforementioned criteria (also see table 5).

Next to mood consumption we randomly chose one other typology (Motivaction's mentality test). We included twelve questions inspired by the Motivaction descriptions into our questionnaire. Answering each question implied making a choice (on a four point scale) between two opposite values (for example between security and adventure). Each opposite represented a perspective (a mentality perspective, but because of our comparison, indirectly also a segment of Cultural Theory). Depending on the answer, a perspective (and corresponding segment) received either two or one points. Two points were ascribed when choosing either answer option 1 or 4 (the extremes), one point was available for answer 2 and 3. All Motivaction questions together resulted in a score (varying from 0-12) for each mentality segment. The relative perspectivistic scores on the Motivaction questions were compared to the relative perspective scores on the Cultural Theory questions (15 in total) (see chapter 6 for more information about the scores on Cultural Theory). A comparable strategy was followed to validate the comparison of Cultural Theory with Mood consumption. The questionnaire resulted in separate scores for Cultural Theory, Mood consumption and

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[8] The completion of Mood Consumption and the IPCC/PBL worldviews were compared. 75% of the observations matched. The remaining 25% can be explained by missing combinations (e.g. it occurred that researcher one chose FAT whereas researcher two chose FAT-IND and researcher one chose HIE-ind where researcher two chose HIE).

Motivaction[9] that were translated into x, y, and z-values and mapped in a perspectives pyramid (see Figure 8 and for more information on the procedure chapter 4). Herein we see that the scores for the three typologies are very comparable, notably if we compare mood consumption and Cultural Theory. This is another indication that the comparison we have made is valid. Although using different names or colors, different segments or perspectives in different typologies seem to describe comparable personal characteristics.
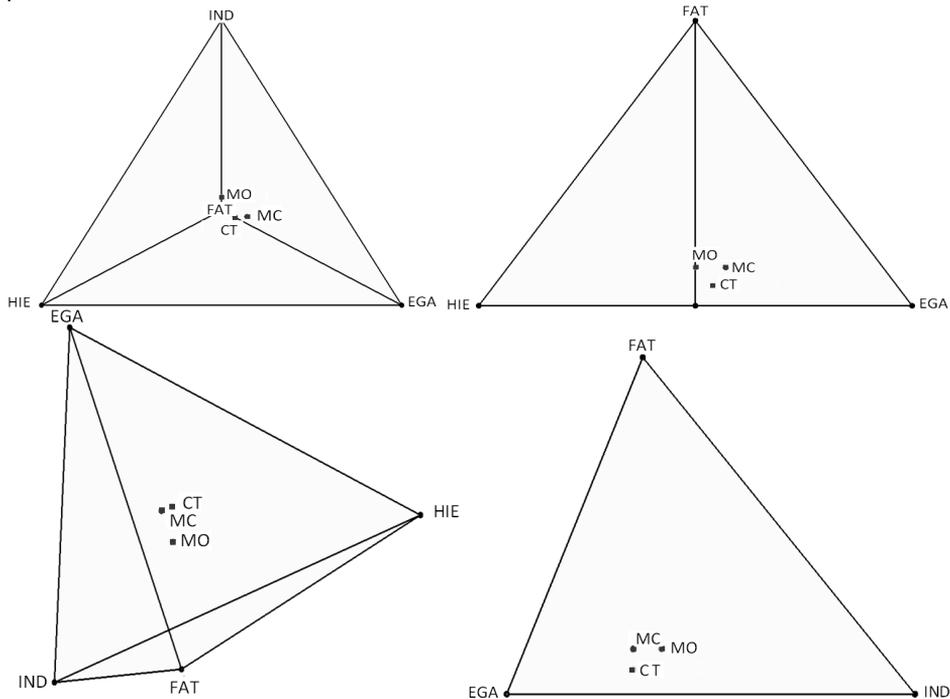
Figure 8: Plotted positions of the total results derived from Cultural Theory (CT), Motivaction (MO) and Mood consumption (MC). The x, y and z values[10] of the results from Motivaction, Cultural Theory and Mood consumption were respectively: x: 0.5, 0.54, 0.57. y: 0.33, 0.27, 0,27. z: 0.11, 0.06, 0.11. As the translation from Motivaction and Mood consumption towards Cultural Theory was based on our comparison, we can confidently state (taken the inter evaluator reliability into account as well) that the reliability of the comparison is high enough to draw valid conclusions.

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[9] For Motivaction: 25% (Hie), 27% (Ega), 37% (Ind) and 12% (Fat). For Mood consumption: 28% (Hie), 42% (Ega), 19% (Ind) and 11% (Fat). For Cultural Theory: 29% (Hie), 37% (Ega), 27% (Ind) and 7% (Fat).

[10] To plot the positions of the different perspectives into the triangles we followed a step-wise procedure. First, we calculated a sum for each perspective/ column in the perspectives map. Every marked cell represents a score of one. The sum totals were normalized to four, offering a normalized score for each perspective. To calculate the x-scores, we employed the following formula: Hie (normalized) value * xa (=0) + Ega (normalized) value * xb (=0.5) + Ind (normalized) value * xc (=1) + Fat (normalized) value * xd (=0.5). The y-values were calculated by replacing the xa, xb, xc and xd values with ya (=0), yb (=0.87), yc (=0) and yd (=0.29). The z-values, finally, were calculated by multiplying the Hie score with za (=0) + Ega score multiplied by zb (=0) + Ind score multiplied by zc (=0), + Fat score multiplied by 0.82. The pyramid coordinates for the stereotypical perspectives are (0;0;0) for Hierarchism, (1;0;0) for Egalitarism, (0.5;0.87;0) for Individualism and (0.5;0.29;0.82) for Fatalism.

3.3   Results

In general we can conclude that Cultural Theory fits well within other typologies we analyzed. We did not find segments that could not be placed within one of the Cultural Theory perspectives or a combination. Cultural Theory also scored well on the criteria mentioned in paragraph 3.2. It is recognizable and it seems complete. Nonetheless we will also mention points of attention as not all assumptions within Cultural Theory could be recognized in other typologies. It would be beyond the scope of this research to conclude which typology is right or wrong but we need to know what assumptions are safe to include in a questionnaire to measure present perspectives on water in the Netherlands and which aspects still seem to be too much debated.

3.3.1   Cultural theory and Mood consumption score best on indicators

To have a first rough impression on how the typologies scored on the 7 criteria (Gankema and Wedel, 1992; Hessing and Reuling, 2003) and the position of Cultural Theory herein we filled in a Table with + (good), +/- (not good, not bad), - (bad) and ? (no information available) (see Table 5). Most typologies scored well[11] on the criteria. The criteria which was met least, was the criteria of heterogeneity, indicating that each segment or perspective should differ clearly from others. Especially for the WRR typology it was difficult to distinguish the differences between the segments as three out of four had clear Egalitarian characteristics (see appendix 1). In the WIN model, most segments were easy to distinguish, however, differences between the careerist/luxury seekers and professionals were relatively harder to detect as both were strongly comparable to Individualism. The stability criterion was met by every typology, since every typology acknowledged the relative robustness of segment membership for change. Cultural Theory and Mood consumption scored particularly well on the criteria, followed by TNO's WIN model and Motivactions mentality test. Cultural Theory generally allows agentic movements into other perspectives, but as it argues that a movement out of Fatalism is usually not voluntarily or self-induced, we placed a remark (-fat) in Table 5 for the criterion on accessibility. Motivaction's mentality test scores a minus for heterogeneity as half of their segments possess clear Individualistic characteristics whereas only one segment has Egalitarian characteristics. Because of the emphasis on Individualistic aspects, differences between segments are sometimes blurring (for example for the segments 'Upward mobiles' and 'Cosmopolitans', see appendix 1), leading to a plus-minus for the identifiably criterion. Spiral dynamics scored relatively low on the first three criteria. This is explainable by the relative resemblance of the segments green and blue (identifiably, see appendix 1) and the fact that some of the lower segments (for example beige) do hardly occur in modern society anymore. The latter makes this typology (in the light of our research goal) score low on "size". Finally, people automatically move one spiral/segment up

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[11] According to the analysis of the author of this thesis

when they have managed to solve phase-specific problems of existence (see paragraph 3.1.3). This is rather deterministic and reduces possibilities for agentic perspective changes, explaining the "minus" for accessibility. As explained before, the WIN model fails to make the segments careerist and professionals heterogeneous enough. The WRR typology scores minuses because it assumes people 1) perceiving environmental risks unacceptable and 2) willing to make social adjustments. As a direct consequence, the heterogeneity is seriously affected as three out of four segments have Egalitarian and Hierarchical characteristics. Mood consumption scores well on each criterion and the PBL segments score low for identifiability and heterogeneity because the segments A2 and B1 seem to blur. For the two scenario-focused typologies in this analysis (WRR and PBL) perspectives were used to explore possible futures. A possible next research step (a back casting exercise to see how perspectives may be steered into a desirable, or less harmful future) was not part of their research goals. Therefore, we gave them a plus-minus on the criterion of influentiality.

Table 5: Scores of discussed typologies for the criteria of Gankema and Wedel (1992). Cultural theory and Mood consumption score very well, and also the WIN model and Motivation's mentality test score sufficiently. The final score was calculated by giving plusses the weight of +1, while giving minuses a weight of minus 1. Question marks and +/- had no impact on the total score.

	Cultural theory	Motivaction	Spiral dynamics	WIN	WRR	Mood	IPCC/PBL
Identifiable	+	+/-	+/-	+	-	+	-/+
Accessible	+ (-fat)	+	-	+	+	+	+
Size	+	+	-	+	+	+	?
Heterogeneous	+	-	+	-	-	+	-
Stable	+	+	+	+	+	+	+
Homogeneous response	+	+	?	+	?	+	?
Influential	+	+	+	+	+/-	+	+/-
Score total	7	4	1	5	1	7	1

3.3.2   General observations

In terms of the number of segments or perspectives, three typologies (excluding Cultural Theory) distinguished four (main) segments, and three typologies distinguished eight (main) segments. For most typologies, the number of segments is determined by the number of axes used, but it stays remarkable that all typologies encompass four (or it's duplicate eight) categories. No typology distinguishes more than eight main categories. If the number of categories would be extended, this may lead to difficulties regarding the criteria of size and heterogeneity as some groups might be too small and/or some groups might be too similar. Therefore there are no reasons to assume that the four categories in Cultural Theory are a too small or large number. Oftentimes the Fatalist perspective is ignored in (policy relevant) research (see for example Middelkoop et al., 2004; Valkering et al., 2008b; Offermans et al., 2011b; Valkering et al., 2011), as the Fatalist rejects the existence and influence of

policy. However, following the comparison in this chapter, a typology existing of only three segments would be atypical.

In Cultural Theory, Egalitarism and Fatalism on the one hand and Individualism and Hierarchism on the other hand, are considered opposites as they do not share a grid- or group-dimension. The equivalents of Cultural Theory in the WIN model show similar results. However, the Mentality test and Mood consumption show a different pattern wherein Egalitarism and Hierarchism as well as Individualism and Fatalism contradict. The IPCC/PBL worldviews finally, show a contradiction between Individualism and Egalitarism. Apparently it is not as easy as to say that some perspectives contradict, exclude or enforce each other. This observation rises questions to what extent the grid- and group-dimensions -as being used in Cultural Theory- are (the only) viable ones and whether these dimensions should be used to measure perspectives.

Some typologies (for example the WIN model) found that social characteristics as age, gender and education are more common in certain segments than in others. However, it is not clear whether social determinants may have a direct or indirect relation with certain segments (e.g. whether social determinants directly explain segment membership or whether people with some demographic values come together in a specific segment more easily). Following Cultural Theory we know that age and education may play a role in determining one's positions within the quadrants as Douglas (1996) reserved positions in the quadrant for young children (as being controlled by their parents; age), innovators, artists, leaders, (partially influenced by ones education), gypsies and so on (see chapter 4 for more information). Our research, and notably the questionnaire to measure present perspectives on water (see chapter 6) should therefore include these social characteristics and their possible influencing role on perspectives.

Out of seven typologies, one (Spiral dynamics) can be indicated as a transitional model. Our assumption is that such a model is too deterministic as it does not only identify into which direction people move, but it also indicates when people move to the next stage of maturity. After solving certain problems of existence (like living with self consciousness), or after reaching certain levels of maturity (reaching rest in thinking), people move on to the next stage of complexity, hence leaving no freedom to move into any other direction, staying within a segment, or practicing any agentic power. According to us, this is a too simplified model to explore perspective changes regarding water management and social support for strategies which makes the typology less useful for our research goal.

The next observation relates to the use of starting points. It is very tempting to formulate starting points for a typology, as they usually follow assumptions we genuinely consider to be right. However, there are some major disadvantages of using starting points, as they do not consider the aforementioned assumptions to change

over time[12]. In our comparison the WRR typology explicitly used the starting points that environmental risks are regarded as unacceptable and that there is willingness for social adjustments. How innocent such starting points may look, the consequences are real: in the WRR typology three out of four categories had Egalitarian characteristics. Starting points restrict the exploration and analysis of future possibilities and are less suitable for scenario analysis and the exploration of future support for policies, as possible futures will be restricted to perspectives matching with the starting point we formulate in the present. However, Cultural theory is also not free from starting points. As we saw in the comparison with Spiral Dynamics, a prerequisite to be incorporated within Cultural Theory is the existence of social relations. As such, the existence of social relations is a starting point of Cultural theory[13]. Depending on the objective of your study, this may be a reason to abandon Cultural Theory. However, because policy can only be implemented and evaluated in a context wherein people interact, this is not regarded problematic for our research goals.

Further, we have seen that a typology can roughly be presented in two ways: 1. Based upon a description of what people value and reject and 2. Based upon a ranking of values. Cultural theory is an example of the first category as it describes what people value (e.g. tradition, authority, safety) and what they reject or try to prevent (e.g. risk, too much individual freedom). The WIN model is an example of a value ranking system as it states that all people on earth share the same set of values, however, the importance attached to these values differs from person to person. People with comparable value rankings come together in one segment. To solve problems regarding the supposed but maybe less realistic incompatibility of some perspectives (e.g. FAT and EGA as they theoretically do not share any group or grid dimension), it may be promising to explore the possibilities of a value ranking system instead of a value description system. A value ranking system focuses after all to a lesser extent on contradictory value orientations. However, we see one major problem resulting from a ranking system, as it introduces the starting point that every person appreciates every value. If a value is ranked as least important, still it is labeled as important, there is no space to reject a value. However, individualist for example, highly value technological innovation and creativity. Egalitarians on the other hand do not value technological innovation or creativity less than an individualist but reject it instead.

3.3.3   Recognition of Cultural Theory perspectives

Two of this chapter's research questions were whether the perspectives of Cultural Theory can be recognized in other typologies and whether segments in other typologies could be recognized in the perspectives of Cultural Theory (or combinations

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[12] As we will see in chapter 5, perspectives on water are inherently dynamic, which asks for an approach that allows for a changing belief-system.
[13] Here we only focus on starting points underlying the construction of segments within the typology, not on starting points underlying the theory itself (see chapter 4).

between perspectives). Thompson et al. (1990) already indicated that segments comparable to Hierarchism and Individualism have been known perspectives within social sciences for centuries already (see also chapter 4 of this thesis). Egalitarism and Fatalism (or comparable perspectives with a different name) were much less known for a long time. This can also be confirmed by our comparison as segments equivalent to Hierarchism and Individualism could often be recognized. Also, there seems to be high consensus of the content of the Hierarchical perspective. Hierarchism is often described with the following keywords[14]: traditional values, acceptance of authority, rules and norms, risk aversive, security and safety, obedient, harmony and stability, discipline and regulations. Individualism was described even more extensively: freedom, technology minded, self development, achievement, challenge and risk, innovation, independency, risk taking, competitiveness, ambitious, risk accepting, novelties, autonomous, luxurious, and progress. Similarities in the descriptions of Egalitarism and Fatalism were also found however, the overall picture was less clear. Egalitarians were characterized by: solidarity, equality, sober, focused on well-being of others, and meaningful relationships. Fatalism was defined as belief in predetermined outcomes, pleasure and enjoyment, adventure and excitement, risk and challenge, and comfort. These descriptions are fully in line with Cultural Theory's interpretation of the perspectives and the interpretations we use in our research.

Next, every perspective of Cultural Theory[15] was recognized at least three times in other typologies (see Figure 9). Every typology distinguished a segment equivalent to Individualism. Four out of six typologies distinguished categories equivalent to Egalitarism and Hierarchism. The Fatalistic perspective was recognized three times. Besides, balanced combinations of the main perspectives (E.g. EGA-IND, EGA-HIE and HIE-IND) were also found in other typologies. Noticeable is that within the triangle of Hierarchism, Egalitarism and Individualism each (balanced and unbalanced) sub domain was recognizable in other typologies, with the exception of IND-hie and EGA-ind. We do not have a solidly ground explanation for this, however, hypothetically it can be said that a balanced mix of core beliefs and values is possible. However, if somebody has a strong direction towards one perspective, the corresponding values may become incompatible with values from other perspectives. In our sample, a strong focus on Egalitarism would then be incompatible with Individualistic values. This could be another reason to argue for a description based typology over a value ranking. Incompatibilities between perspectives may ask for possibilities to also reject values. Further it is remarkable that balanced combinations with the fatalist perspective did not occur. IND-fat occurred twice, and EGA-fat occurred once, other combinations with Fatalism were not recognized in other typologies. Hypothetically it can be said that the

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[14] Here we sum up keywords that came back in all (or most) descriptions of segments equivalent to the mentioned perspectives of Cultural Theory.
[15] Hierarchism, Egalitarism, Individualism and Fatalism.

Fatalist perspective is a rather isolated but recognizable perspective, which corresponds with insights from Cultural Theory.
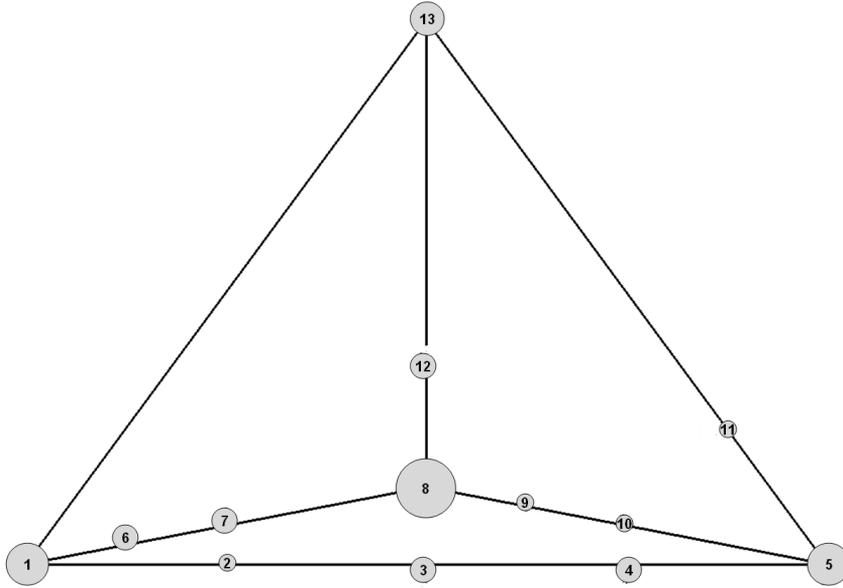
1	Hierarchism, Traditional citizen, Purple, Conservatives, Perfection
2	HIERARCHISM-egalitarism, Managing, Mondial Solidarity
3	Hierarchism-Egalitarism, Engaged, Saving
4	EGALITARISM-hierarchism, Care takers, Preserving
5	Egalitarism, Post materialists, Green, Intuition, Care taking region
6	HIERARCHISM-individualism, New conservatives, Safe region
7	Hierarchism-Individualism, Modern citizens, Yellow
8	Individualism, Upward mobiles, Orange, Professionals, Utilizing, Innovation, Mondial Market
9	INDIVIDUALISM-Egalitarism, Broad minded
10	Individualism-Egalitarism, Turquoise
11	EGALITARISM-Fatalism, Blue
12	INDIVIDUALISM-Fatalism, Cosmopolitans, Luxury seekers
13	Fatalism, Comfort oriented, Enjoyers/Hedonists, Satisfaction

Figure 9: Positions of all segments/perspectives from every typology discussed in this chapter in the perspectives pyramid. The sizes of the circles in the figure refer to the number of times that a perspective could be recognized in the typologies.

3.4   Attention points for research

The goal of this comparison was directed towards analyzing the position and completeness of Cultural Theory in relation to other typologies. As we have seen in the previous paragraphs, Cultural Theory can be considered suitable and complete to

function as a basis to explore past, present and future perspective(s) (changes) on water. Nonetheless we identified attention points that are summarized below.

3.4.1   Distinction government regulation and free market

In Cultural theory, a sharp distinction is made between government regulation (typical for Hierarchists) and the free market/liberalization (characteristic for Individualists). The stereotypical Hierarchist does not trust liberalization and the market, and Individualists fiercely reject controlling government regulations. However, this strong distinction cannot be recognized in other typologies. Although Individualists indeed seem to have a preference for liberal measures with minimal government interference and bureaucracy, the envy against any way of government interference as described in Cultural Theory, cannot be recognized in other typologies. Most typologies amalgamate the two extreme points of view, like the WRR typology does for describing the preserving perspective: "government intervention is allowed making use of all available means, for example via the market". Depending on the exact context, it can be defined as Individualistic or Hierarchical, or a combination. This would also be more in line with findings from Marris et al. (1998) and Dake (1991) who showed that Individualism correlated with trust in the government, and Hierarchism with trust in companies. Although it is not our goal to judge who is (more) right or (more) wrong, we state that -based on the comparison- an Individualist though preferring a liberal market model, does not automatically reject any form of government interference. This assumption will also be translated into our questionnaire to measure the present perspective on water in the Netherlands (see chapter 6). Concretely we won't include a statement wherein respondents have to choose between either a liberal market or government regulation as preferred management strategy or responsible authority for water management.

3.4.2   Role of age, gender and education

As described before, some typologies pay attention to social characteristics like age, gender and education as determinants for arranging people into segments (see also Oltedal and Rundmo, 2006). Although it seems that these characteristics play a role in segmentation, it is not clear what role they exactly play. One possibility is that they do have a direct influence on people's perspectives; another possibility is that they have an influence on people's tastes, preferences and values, which are on their turn determining for one's perspective. Eventual relations between social characteristics and perspectives may also increase our understanding of perspective change as change may then be related to changing demographic distributions and population characteristics.

3.4.3   Grid and Group as determining axes

The grid and group axis (as used in Cultural Theory and) resulting in the quadrant of perspectives, is not the only possible way to distinguish different groups in society and determine perspectives. It is not within the scope of this research to investigate if the grid-group distinction is the best way. However, since the scientific validity of the grid and group dimension as explanatory for assigning perspectives has not been proven satisfying enough yet (see for example conflicting conclusions regarding this issue in Rayner, 1992; Marris et al., 1998; Stern, Dietz and Guagnano, 1998; O'Riordan and Jordan, 1999; Rippl, 2002; Meader et al., 2006) it is not advisable to assign perspectives by measuring positions on the grid- and group axis (alone). Also, the opposing nature of Egalitarism and Fatalism (as they do not share a grid- or group dimension) and Hierarchism and Individualism (for the same reason) is a result of using this grid-group scheme. Within the WIN model, a comparable distribution could be recognized (namely that Hierarchism has least in common with Individualism, whereas Egalitarism has only little in common with Fatalism). However, in all other typologies a different distribution was recognized. For these reasons we won't use a score on grid and group characteristics as determinants for perspectives.

3.4.4   Inclusion of the Fatalist

In 50 percent of the analyzed typologies (Cultural Theory not included) a segment comparable to Fatalism was distinguished, and in typologies in which the distribution of the population in segments has been empirically tested, Fatalists encompassed a fair part of the total group[16]. Often, the Fatalist perspective is abandoned in policy relevant research as the Fatalist rejects consequences of policies as they consider everything to be predetermined by fate. However, this does not automatically imply that Fatalism is non-existing among stakeholders or that it has no influence on policy (makers) and public support for strategies. Besides, it may relate to questions about scale levels; a regional policy maker may still have a Fatalistic perception about the extent to which his decisions may influence policy on a global, European or even national level[17]. Further, Caulkins (1999) shows that even the Italian and Mexican political systems are at least partially based on Fatalistic beliefs. Following this, it can be stated that Fatalism is a vivid, however isolated perspective. Altogether, this observation leaves us little reason to exclude Fatalism in our research.

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[16] For example, Motivation found that 9% of the Dutch population exists of Fatalists (gemaksgeorienteerden); this is more than the population of new conservatives (8%), and almost equal to cosmopolitans, post materialists and postmodern hedonists (each 10% of the Dutch population).

[17] This was also confirmed by M. Krol (Associate Professor at Twente University, department of water engineering and management) during a personal conversation in October 2009 at Dubrovnik.

3.5   Reflection

To analyze perspectives and explore future perspective changes, we need a valid framework to start from. A valid framework is -amongst others- complete (incorporating all existing perspectives) and recognizable in both reality as well as comparable existing typologies. Cultural Theory has been used as a framework to analyze perspectives on water (see Hoekstra et al., 1997; Hoekstra, 1998a; Middelkoop et al., 2004; Valkering et al., 2008b) but this application has never been tested comprehensively. Therefore, we compared Cultural Theory perspectives (Douglas, 1970; Thompson et al., 1990) with six other typologies to analyze the extent to which Cultural Theory perspectives and presumptions can be recognized in other typologies, to identify neglected factors in Cultural theory, to nuance it where necessary and to conclude whether Cultural Theory is indeed a suitable typology to base our analysis for present and future support for water management strategies upon. The four Cultural Theory perspectives and its combinations (excluding combinations with Fatalism) were recognized in most other typologies. The Fatalist turns out to be a rather isolated, however vivid[18] perspective in society. The grid-group distinction as characteristic for Cultural Theory and determining for people's perspective was not recognized in other typologies. Neither could the discrepancy between perspectives that follow from these axis be strongly recognized (with the exception of the WIN model). The distinction made in Cultural Theory between government regulation and free market liberalization was not found equally strong in other typologies. Finally, age, education and gender were included in some typologies as determining factors for perspectives. We will add questions regarding these characteristics in our questionnaire to measure perspectives on water (see chapter 6) to learn more about possible relations. When these attention points will be taken into account, we conclude that Cultural Theory is a suitable framework to analyze different perspectives on Dutch River management. In the next chapter we will show how Cultural Theory and its underlying assumptions can be applied to river management and what often heard critiques related to Cultural Theory are.

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[18] As empirical research from Motivaction shows and as will also be proven in chapter 6

Chapter 4

FROM MONTESQUIEU TILL THE PERSPECTIVES METHOD; A HISTORICAL OVERVIEW

4   INTRODUCTION

In the previous chapter we have explored the position of Cultural Theory in relation to other typologies and we concluded that Cultural Theory does have the potential to be a valid and useful framework to explore past, present and a broad range of future perspectives on water and river management. It may help to find regularities in human behavior that help explaining and even predicting (or retrodicting) the human construction of meaning (also see Thompson et al., 1990). In this chapter an overview of developments regarding Cultural Theory will be provided, with the objective to give the reader a first knowledge base on principles inherent to Cultural Theory, its application to water management, and the context wherein Cultural Theory had the opportunity to be developed. Rather than trying to be complete, we want to provide the reader with insight about the evolvement of Cultural Theory. It is arguable that the earliest roots of Cultural Theory can be dated back to Aristotle when he started -almost three and a half centuries before Christ- to classify types of governments to better understand differences in what is considered deviant within societies. After Aristotle, numerous social scientists have tried to find a satisfying typology to describe social groups and their differences. Alignment with classificatory schemes developed by influential social theorists like Emile Durkheim, Karl Marx, and Max Weber was one of the aims of Cultural Theory. The second aim was to align this typology with new empirical evidence collected in ethnographic studies (Verweij et al., 2006). The first part of this chapter summarizes the rich overview provided by Thompson et al. (1990 part two) in which they show that despite the unconventional language of "grid" and "group" Cultural Theory has similarities and common starting points with other social scientific theories. In the second part we will focus on the use of Cultural Theory in Integrated Assessment and water research.

4.1   Classifying social systems

When writing about typologies and classificatory social systems, a few influential social scientists should be mentioned by name. One of them is Charles Baron de Montesquieu (1689-1755) who was philosopher but often referred to as the ancestor of sociology. He built upon the work of Aristotle as he supplemented the three types of government with three types of social organizations with differences in cultural bias. He distinguished a republican government with virtue as organizational type, a monarchical government with honor, and a despotic government with fear. He argued that different segments exist within society and each segment requires different beliefs and practices to remain viable. Following from this, different groups of people have different requirements and characteristics, and thus different ways to maintain their way of life. This implies a shift away from universalism, that would focus on unraveling homogenous aspects that all societies need to maintain. Besides, Montesquieu went beyond the classical distinction between primitive and modern

societies, which only allowed for two types of societies determined by their level of civilization (Thompson et al., 1990). Despite Montesquieu's efforts to step away from universalism, other scientists kept trying to find universal laws to explain the necessary conditions of life, collapse or characteristics that are common to all people (Thompson et al., 1990; Fay, 1996).

The philosopher Auguste Comte (1798-1857) argued that a lack of value consensus and strong adherence to different values within one society would respectively result in competing ways of life and breakdown of that society (Thompson et al., 1990). Further, Comte distinguished two societal groups; industrial groups based upon self regulation and voluntary action and militant group based on a central regulating authority. Societies cycle in and out these different groups, according to their level of hostility. This attempt to raise consciousness about the dynamic and changeable character of societies turned out to be valuable for Cultural Theory (Thompson et al., 1990). One of Comte's principles was that the function of religion is to regulate (comparable to Douglas' grid) and to combine (comparable with Douglas' group), which leaves only one viable way of life: hierarchism[19]. Like Comte, the civil engineer and sociologist Herbert Spencer (1820-1903) tried to indentify general conditions to hold a society together. Spencer argued that differentiated (heterogeneous) societies are on the whole better adapted to their (changing) environment than homogeneous social structures[20] (Thompson et al., 1990), an idea that plays an important role in the theories on 'clumsy solutions' by Verweij et al. (2006) as well. An overview on historical developments regarding social classifications within society won't be complete without referring to the well known philosopher Karl Marx (1818-1883) who distinguished the bourgeoisie which owned the means of capital and exploited the second category: the workers in capitalistic societies. The latter are exploited but have the capacity to overthrow capitalism for communism if all workers would unite. However, false consciousness would prevent workers to become aware of their suppressed position, hence reproducing the existing situation. This contributed to the insight that power relations may play a role in explaining and maintaining the legal, governmental and ideological superstructure (Thompson et al., 1990).

According to Thompson et al. (1990), the founding father of sociology Emile Durkheim (1858-1917) can be regarded as one of the most influential scientists for Cultural Theory as we know it today. Durkheim researched various topics, but is best known for his work on suicide and solidarity. He regarded society as a moral phenomenon, held together by solidarity which can either be mechanic (in preindustrial, undifferentiated groups where cohesion is based upon a common set of beliefs) or organic (in industrial, differentiated groups where cohesion is based on rules and regulations) (Smith and Riley, 2009). This dichotomy of mechanical and organic solidarity is directly connected

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[19] Hierarchism is the only perspective scoring high on the group and grid axis.
[20] Douglas' concept of social structures was later called ways of life by Thompson et al. (1990) (Hoekstra, 1998b)

to the distinction between group integration and individual integration; which are essentially identical with Douglas' group and grid dimensions. The difference is however that Durkheim does not specify how these two dimensions interact. Further, he approached culture as deliverer of consensus and integration, making it almost impossible to explain conflict and exclusion (Thompson et al., 1990). Further, Durkheim critically reflected upon the role of Individualism: on the one the hand he approached it as being antisocial, on the other hand he thought that even individualism had to be a social product. He mainly focused on questions related to function diversity (e.g. what is the function of suicide or crime). To a lesser extent he questioned the function of *calling* something criminal or suicide (how and why do people judge what is criminal). He was one of the first researchers acknowledging that social relations generate ways of perceiving the world that contribute to the maintenance of those relations (Thompson et al., 1990) and having a critical attitude towards determinism. Besides, he was crucial for the development of holism. Durkheim claimed that society is irreducible to individual behavior and that even individualistic appearing acts are a function of the broader social unit (Fay, 1996). The sociologist Georg Simmel (1858-1918) focused on society as the product of interactions of individuals as well. He claimed that individuals have the choice to imitate others (and thereby experiencing the psychological benefit of security as a member of a collectivity) or to express themselves as an individual (and being distinctive) (Smith and Riley, 2009). However, together with Durkheim he agreed that there is a threshold -constrained by social relations- beyond which you cannot go in expressing yourself differently from the collectivity. Simmel furthermore stressed the urgency to find a midway between determinism and agency, an idea which was later adopted by Pierre Bourdieu and Anthony Giddens (Smith and Riley, 2009).

The sociologist Max Weber (1864-1920) innovatively tried to go beyond the traditional/modern dichotomy in which only two types of society are distinguished. Central in his work is his acknowledgment of society as being *divided into several social strata that are characterized by specific lifestyles and a distinctive worldview* (Thompson et al., 1990; p.161). Group membership instructs individuals on what to prefer and adhere to. Weber does not identify dimensions which makes his classification end up with as many ways of life as there are groups in society. Besides, his classification of types of domination (charismatic, traditional and legal), as well as his two modes of action (Wertrational, or action that is driven by cultural beliefs and goals[21], and Zweckrational which is driven by norms and efficiency) are insufficient to explain an Egalitarian position (Thompson et al., 1990; Smith and Riley, 2009). Despite Weber's and Montesquieu's efforts to step away from universalism, the search for conditions essential to all societies in order to survive continued. Surviving -in this context- refers to the ability to flexibly reproduce norms, values and structures that bond people into a society. Alfred Radcliffe-Brown (1881-1945), Bronislaw Malinowski (1884-1942) and Talcott Parsons (1902-1979) shared this attempt towards universalism

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[21] Wertrational could be translated as 'value oriented rationality', Zweckrational as 'goal oriented rationality'.

but agreed that a given practice is only understandable in terms of the system of which it is part (Thompson et al., 1990). However focusing on a single common value system leaves individuals with only two choices: normative conformity (meeting the requisites) or non-normative deviance (not meeting the requisites to survive and being accepted within society) (Thompson et al., 1990).

4.1.1   Finding a midway between determinism and agency

A highly debated topic within social sciences is the dichotomy between structural determinism and agentic individual freedom. As we have seen in the previous section, Emile Durkheim and Georg Simmel can be seen as two of the firsts researchers trying to find a midway between determinism and agency, or in other words to combine the explanatory power of structures and individual action to explain human behavior and the way it is both enabled and restricted by surrounding social structures. The relationship between structural systems[22] and human agency has long been a theme within the social sciences. Some social scientific movements, such as symbolic interactionism, ethnomethodology (Thompson et al., 1990; Smith and Riley, 2009), nominalism and reductionist constructionism stress the power of the agentic actor. Others, such as Neo-Marxism, Parsonian functionalism, structuralism, and objectivism give more power to structures as constraining and enabling human behavior (Thompson et al., 1990; Smith and Riley, 2009). During the final decades of the twentieth century, social sciences became increasingly concerned with bridging the gap between these two extremes, which also shaped Cultural Theory as we know it today.

Most known for such efforts are Pierre Bourdieu and Anthony Giddens. The work of the French sociologist Pierre Bourdieu (1930-2002) cuts over a number of fields (like education, popular culture, arts) and disciplines (anthropology, sociology etc.). He argued that in order to theorize the relation between structure and agency, we need awareness of our biases as a prerequisite for finding a balance between objectivism and subjectivism (reflexive sociology). In other words: parts of reality exist independent from human interpretations (the structures), but part of our reality is also shaped and constructed by the agentic interpretations of actors. As Smith and Riley (1996) show, Bourdieu defines his most well known concept of 'Habitus' in various ways, amongst others as lifestyle, embodied behavior, a worldview or cosmology held by actors, and practical social competence. Habitus allows people to get through life as competent actors. It refers to internalized behavior, like stopping for a red traffic light. It allows people to efficiently react to circumstances, without rethinking and calculating before responding, but can also be changed temporarily or permanently.

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[22] Essentially structures is synonym to structural systems, both concepts refer to the conditions for the possibility of human action and guides what and how actions should be performed. Agents produce and reproduce these structures by their actions (Fay, 1996).This reinforcing process is meant with the term 'duality'.

Although Bourdieu leaves an open door to agency, some critics state that he over-emphasized structure and system reproduction while not paying enough attention to agency and change, partially because Bourdieu did not explain how change may be generated from within a system (Smith and Riley, 2009). Pierre Bourdieu and the British sociologist Anthony Giddens (1938-….) are often cited in one sentence. Giddens' theory of structuration is widely held to present one of the most influential efforts to overcome the dichotomy of structure and agency. He uses the term duality (as opposed to dualism) to show the mutually interdependent relation between structure and agency. Structures enable and constrain human behavior and agents produce and reproduce these structures through their actions (Fay, 1996; Smith and Riley, 2009). As such, structure is both the medium and the outcome of action. Contrary to Bourdieu, Giddens is often accused of giving too much attention to the role of agency as he seems to suggest that society could suddenly change if only people thought and acted differently (Smith and Riley, 2009). The structural limit beyond which people cannot go as long as they want to be accepted in a group or society -as argued by Durkheim and Simmel- seems overlooked in Giddens' argumentation.

4.1.2   Mary Douglas and the birth of Cultural Theory

It is arguable that Cultural Theory as a classification typology as we know it today, was born in 1970 when Mary Douglas (1921-2007) published her book "Natural Symbols" wherein she related religion, rituals and symbols to other branches of social thought. Before explaining her well-known grid-group axes more in detail, we look back at the work of Basile Bernstein (1924-2000) who (together with Durkheim) was an important inspiration for Douglas (Rayner, 1992). Bernstein researched linguistics and the use and meaning of speech and communication in families. He distinguished two related dimensions: 1. elaborated speech versus socially restricted speech (referring to the extent to which speech may be used to exert control or combine ideas) and 2. speech for positional- versus personal family control, referring to the extent to which speech transmits structures or emotions. In 'Natural Symbols' Douglas (1970) argues that rituals -like speech- can be approached as transmitters of culture generated in social relations and exercising a constraining effect on behavior. Symbols only have meaning in relation to other symbols in a context. Without a context of traffic regulations, an orange traffic light has no meaning; it is the context that provides meaning (Douglas, 1970). The same is true for behavior: each type of behavior is embedded within a social context. What is desirable in one context (culture) can be rejected in another. Douglas developed a model to organize a rich store of information on cultural biases, while simultaneously being flexible, dynamic, and capable of incorporating change. Innovative was that Douglas added a third and fourth category of organization (what we now call Egalitarism and Fatalism) to the already known categories of Hierarchy and the liberal Market. Also, change and heterogeneity were empathetically taken into account (Douglas, 1970; Thompson et al., 1990).

In Douglas' typology (see Figure 10 for an overview) two dimensions are identified: the vertical axis refers to the grid dimension, indicating the extent to which individuals behave according to prescribed rules, norms and social constraints[23]. These constraints can result from a public classification system (at the top of the diagram), or a private system of classification (the bottom of the diagram). In the middle of the axis, there is an absence of classification which leads to a situation of rulelessness, anomy, and confusion as there is uncertainty about what kind of behavior is appropriate, and how to behave (Douglas, 1970). The stronger the classification system (highest and lowest parts in the Figure), the stronger the boundary between purity and impurity (Douglas, 1970; Thompson et al., 1990). The horizontal axis refers to the group dimension. On the left (weak group), people live independent from others and free from group pressures. On the right (strong group), people are controlled by others and being part of strong group memberships. In the middle of the horizontal axis, pressures and counter pressures are balanced out which results in a situation of indecision. In general, people located on the right are controlled by people from the left. The more support people on the left gain from people on the right, the more power they can exercise (Douglas, 1970; Thompson et al., 1990). One of the purposes of this grid/group analysis is to provide a framework to analyze differences in organizational structures and explain how those structures may be sustained (Rayner, 1992). Following the quadrants, Douglas distinguishes four main categories of cosmologies:

1. *The big man system* (now Fatalism): characterized by strong grid and weak group pressures. A Big man needs support from existing institutions and people on the right of the scheme. Personal honor is important and decisions are based upon loss-benefit calculations. The higher in the quadrant, the more powerful and remote a leader is. At the end, control is exerted by objects (e.g. parking meters) rather than persons (Douglas, 1996).
2. *The thinker* (now Individualism): characterized by low grid (private system of classification) and a weak group membership. Fellow humans are not important for decisions to be made in life. People located at the left of the quadrant are the more successful ones who receive support from others. More towards the middle of the diagram are the eccentrics who experience freedom at costs (e.g. indecision, confusion) (Douglas, 1996).
3. *The monastic, military society* (now Hierarchism): characterized by high prescriptions (high grid) and strong group control. They strongly believe in a moral world, punishment, faithfulness and routinized authority. They have a lot of duties and prescriptions, varying from what to eat over how to groom their hair to how to bury. It is good to be loyal and obedient. Again, more towards the middle of the diagram (in the middle of the axes) confusion exists: people face contradictory rewards and impossible goals (Douglas, 1996).

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[23] This is essentially comparable to Durkheim's concept of 'social regulation'.

4. *Small group* (now Egalitarism): characterized by low grid (private system of classification) and strong group memberships. Group members know each other well and are not very conscious about remote control by leaders located on the left. Destiny is in your own hands and there are strict boundaries between good (we) and evil (them). Here is also where ignored innovators, unsuccessful artists and (former) leaders without support are located (Douglas, 1996).
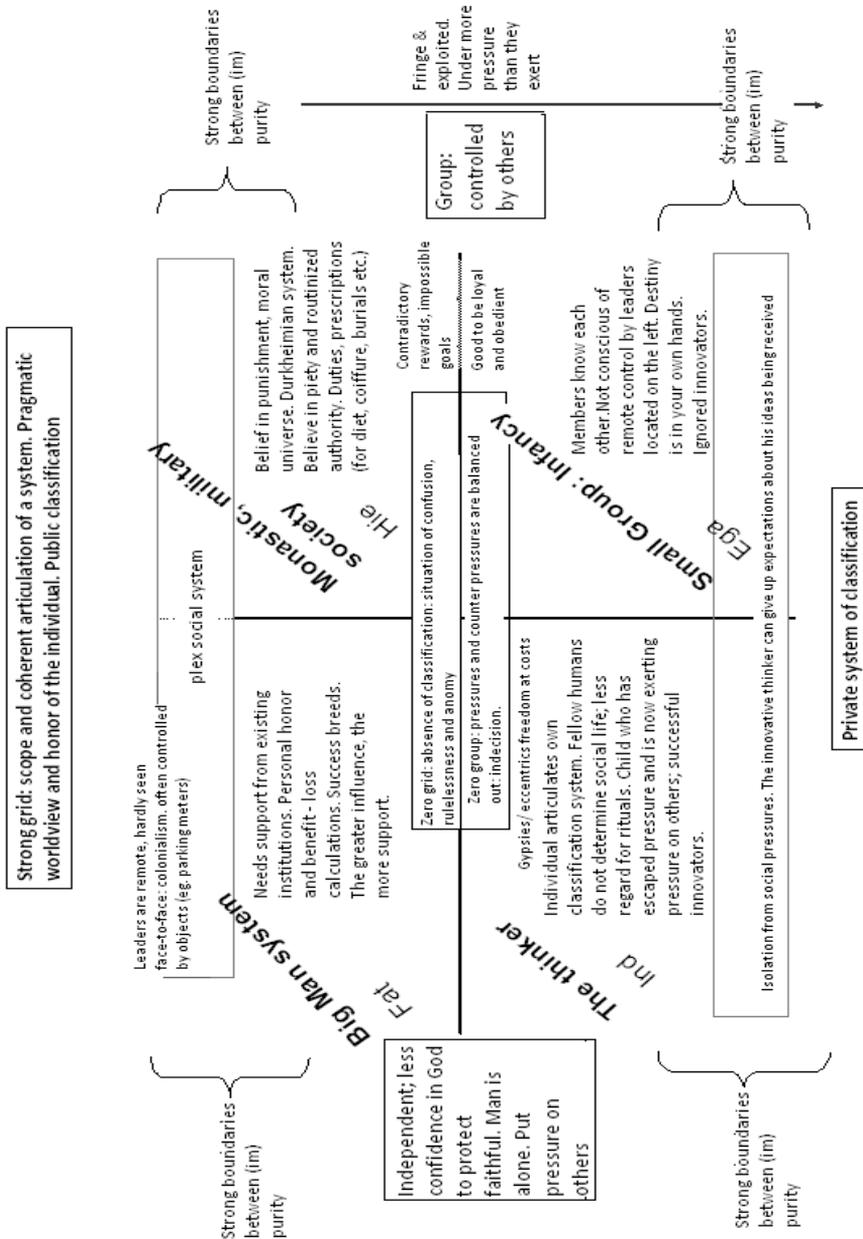
Figure 10: Summarized representation of Douglas' (1970; Douglas, 1996) distinguished groups following the scores on the grid- and group axes.

4.2   Cultural Theory and ways of life

In this section some of the most essential starting points and principles underlying Cultural Theory will be explained. The goal is to provide the reader with a basic level of understanding of the Theory. For more (detailed) information, see Thompson et al. (1990). Some basic knowledge on Cultural Theory is considered to be necessary to fully understand the Perspectives Method and its application to water (see paragraph 4.3 and 4.6).

4.2.1   Thompson, Ellis and Wildavsky: an extension of the theory

After Douglas, Michael Thompson, Richard Ellis and Aaron Wildavsky can be considered influential persons for Cultural Theory as we know it today. They also stepped away from Douglas' terminology of "the theory of grid-group cosmologies" towards "Cultural Theory". They concretized concepts used by Douglas, applied the theory to (the use of) natural resources and gave it the policy relevance that was still missing in Douglas' book. In their book 'Cultural Theory' (1990) they start with defining the concept of culture. In general it can be considered vague, much defined, and there is no agreement about its content or meaning. Thompson et al. (1990) defined culture as consisting of three different, but related elements:

1. *Cultural biases*, which refer to shared values and beliefs. Biases are the unspoken theories people hold about the world, enabling them to make sense of a broad palette of information (Thompson *et al.*, 1990). It refers to the automatic pilot which is responsible for decisions being made in everyday life and is comparable to Bourdieu's habitus and to 'heuristics' as defined by decision theorists.
2. *Social relations*, referring to patterns of interpersonal relations
3. *Ways of life*, which are viable combinations of cultural biases and social relations and comparable to our understanding of 'perspectives' and Douglas' understanding of 'social structures'.

4.2.2   Five ways of life and the myths of nature

Thompson et al. (1990) strongly advocate categories as compounds of at least two dimensions (axes), rather than categories as designations, because according to them, the latter (although being a typology) looses explanatory power and fails to be embedded in a theory(also see chapter 3). They use – following Douglas (1970, 1996)- the group and grid dimension (see paragraph 4.1.2). Within the grid-group dimension,

four ways of life are derived[24]: Egalitarism, Fatalism, Individualism, and Hierarchy. Accordingly, there are three patterns of social relationships: ego-focused networks (Individualism), egalitarian-bounded groups (Egalitarism) and hierarchically nested groups (Hierarchy). Besides, there is one other position, namely involuntary exclusion from organized patterns (Fatalism). According to Thompson et al. (1990) there are only five ways of life that meet the conditions of viability: Hierarchism, Egalitarism, Fatalism, Individualism and Autonomy. Although five may seem an unfeasibly small number (Renn, 1992) it doubles the conceptual variety available in former theories of social organization (which were usually restricted to categories comparable to Individualism and Hierarchism) (Thompson et al., 1990; Hoekstra, 1998a). For a short description of every perspective, see table 6 or Thompson et al. (1990) for a detailed overview.

Table 6: Description of the four ways of life, derived from (Thompson et al., 1990)

Perspective/way of life	Description
Hierarchism	Focus on control, regulation, harmony and differentiation of roles. Collective sacrifice now will lead to group gain tomorrow. Willing to take acceptable risks as long as decisions are made by experts. Hierarchists will always miss some opportunities. Typical surprise: they do bad, or others do better without being as knowledgeable or careful as they are. Group is more important than individual, premium on sacrificing for the collective, restrict individual autonomy.
Egalitarism	Focus on prevention, rejection of other societal groups and building 'walls of virtue' that protect insiders from outsiders. No authority or control, which makes conflicts difficult to resolve. Speaking in name of the group. Economic growth and abundance make it difficult to maintain equality. Accentuating risks, even risks that are missed by others, but consequently miss opportunities. Typical surprise: If they do not well or if others do better. Group is more important than individual; premium on sacrificing for the collective, restrict individual autonomy.
Individualism	Focus on adaptation, skills, enterprises and the creation of positive sum games in which everybody is better off. Boundaries are open for negotiation. Exert control over others. Prefer economic growth because it will result in having more for all. Risks are opportunities, and should always bring awards. Typical surprise: if they do not very well or if the market fails. Combine good luck, quick wits and hard work to advance.
Fatalism	Focus on coping, autonomy is restricted, doing well is never a result of own efforts. Excluded from group membership. Happy to see more wealth (economic growth), but they think they cannot access. Do not knowingly take risks, but they also do not worry. Typical surprise: if they or others do consistently well or bad (predictability).

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[24] Formally there is also a fifth way of life: Autonomy, or the Hermit who is located in the middle of the axis. As the Hermit deliberatively withdraws from or minimizes social interactions this perspective won't be included as a separate, clearly different perspective. Of course, people may still be located in the middle of the quadrant but we won't consider this an additional perspective, but a perspective wherein elements of all other perspectives are combined. Also, more specifically, the Hermit is characterized by its view on nature that –according to him- is changeable and inherently dynamic; an assumption that can also be applied by changing interpretations within the four standard perspectives. Finally, and referring back to the previous chapter, it is highly questionable whether Hermits would account for a significant perspective within Dutch river management as they withdraw from any interaction and live a knotty life.

Besides extending Cultural Theory, Thompson et al. (1990) translated cultural biases towards perspectives on human nature and (the use of) natural resources. This was a new approach since Mary Douglas (especially till 1982) merely focused on cultural biases related to rituals, religion and sin (Douglas, Kaberryf and Forde, 1969 ; Douglas, 1970). While studying managed ecosystems (like forests and grasslands) ecologist Holling (1979; 1986) discovered that different managing institutions, faced with the same situation, did different things (Thompson et al., 1990). Resulting from this, Holling (1979) derived four myths on natural resources namely; expansionism, preservationism, conservationism and fatalism. Thompson et al. (1990) connected these four to Douglas' (1970) cultural biases and respectively renamed them into nature is benign (Individualism), nature is ephemeral (Egalitarism), nature is robust within limits/perverse (Hierarchism) and nature is capricious (Fatalism).

Every myth of nature is a partial representation of reality, which means that 'right' or 'wrong' myths simply do not exist. People will always be surprised, independent from their perspective. This tells us that the world is never just one way: it is constantly changing. Steg and Sievers (2000) argue that myths on natural resources influence more specific environmental beliefs, which correlate with certain policy preferences. When for example adopting a worldview in which natural resources are regarded to be limited and nearly exhausted, one will regard specific environmental issues (water, biodiversity, rainforests) with care, resulting in a preferred policy of prevention of hazards and disturbances. Steg and Sievers (2000) conclude that Cultural Theory -in contrast to common theories about environmental concerns- more explicitly links risk perception to solutions to reduce these risks. For a description of the perspectivistic views on human nature and the use of natural resources, see table 7 or Thompson et al. (1990).

Table 7: A short description of the different perspectives on natural resources and human nature, based on Thompson *et al.* (1990)

Perspective	Description
Hierarchism	Nature is rich when used in the right way and by the right people. Nature is perverse and tolerant, however vulnerable to some occasions. Regulation of nature. Conservationism. People are inherently bad, but can be redeemed by good institutions. Focus on regulation.
Egalitarism	Mankind is trapped in a downwards spiral of resource depletion. Nature is accountable and ephemeral. Preventionism and treat ecosystems with great care. Humans are inherently good, but corrupted by evil institutions (markets and hierarchies). Focus on cooperation.
Individualism	Nature is a skill controlled cornucopia; resources are intangible and ever expanding. Nature is benign. Laissez faire, trial and error, experimentation and expansionism. Humans are inherently self seeking and focused on competition.
Fatalism	Sometimes there is an abundance of resources, and sometimes not. Nature is ephemeral. Coping with erratic events. Human nature is chaotic, unpredictable and differs from person to person, distrustful.

4.2.3   The need for rival ways of life

Each of the four ways of life (or 'perspectives') has a perception about how the ideal (stereotypical) world would be, who we are and how we should behave (Douglas, 1970; Thompson et al., 1990; Caulkins, 1999). The Hierarchist prefers a world with strong government responsibilities, strict confirmation to rules and emphasis on safety. Egalitarians prefer a world wherein humans live in harmony with nature, with enough space for water and nature, limited human intervention in nature and a rigorous decrease in human demands. Individualists prefer a technological world with fast and multiple interactions. Hard workers are rewarded with high income, freedom and possibilities of self development. Fatalists prefer a world in which people are not worrying about the future. Instead they prefer to live like gathering rosebuds while maying. All these perspectivistic ideals can be imagined, desired or contested, but not lived in, because they fail to recognize that rival ways of life are needed, either to cooperate, to define themselves in opposition against, or to utilize (Thompson et al., 1990; O'Riordan and Jordan, 1999). A nation in which the different ways of life are present is less vulnerable to being surprised and will have a wider repertoire to draw from in responding to novel and surprising situations. Of course, it will still blunder but it will blunder less than societies which are more homogeneous (Thompson et al., 1990; Verweij et al., 2006). Because of the dependencies between different ways of life, for every way of life there must be at least four ways of life in existence in order to be able to be reproduced (Thompson et al., 1990; Pendergraft, 1998; Caulkins, 1999; Verweij et al., 2006). Thompson et al. (1990) refer to this as the requisite variety condition, indicating that there can theoretically be more than four ways of life, but there cannot be fewer. However, that no way of life can exist alone does not mean that every way of life has to be equally represented within a group (Thompson et al., 1990; Pendergraft, 1998). Although adherents of each way of life rely on adherents of other ways of life to compensate their own shortcomings, they simultaneously compete against each other to attract as much supporters as possible (Thompson et al., 1990; Caulkins, 1999). In any particular group and period in time, one way of life may be dominant, only to give way to another way of life at a later moment. A dynamic equilibrium wherein different ways of life compensate for the limitations of others is the result (Thompson et al., 1990; Caulkins, 1999; Verweij et al., 2006).

4.2.4   Power distribution and collaboration between rival ways of life

It is the inward conflict (being both attracted to and repelled by rival ways of life, see previous section) that generate dynamic mechanisms of continually fusing, breaking apart and (re)forming of alliances (Thompson et al., 1990). Alliances refer to relations between ways of life (what do they have in common and how do they differ, independently from their power or strength). It refers to one (usually decision making) group in which different ways of life come together. Coalitions subsequently refer to the relative power of one way of life (or a combination of two or more ways of life) that exists in a given group or society and distinguishes dominant and non-dominant

ways of life. Coalitions can be formed either by groups who share common ideas (e.g. Egalitarians and Individualist share a low position on the grid axis, indicating that they will both try to restrict governmental control) or by groups who are very different, hence do not appeal to similar voters and do not need to worry about loosing supporters (Thompson et al., 1990). Besides, adherents of different ways of life do not necessarily need to agree on everything in order to agree on particular issues (Thompson et al., 1990). Shared dimensions might produce similar policy preferences, but also opposite dimensions might share some beliefs (e.g. Hierarchists and Individualists both have a relative positive view of technological innovation). Further, adherents of all three active ways of life can reach consensus on certain strategies, while trying to achieve different goals. The major green rivers approach for example, may be acceptable for both Egalitarians and Hierarchist, however for different reasons. The former may perceive it as initiative to create larger nature areas while providing more space for water, whereas the latter perceives it as a measure to control the discharge and guarantee more safety. Coalitions of representatives of all three active ways of life can exists for longer periods, regimes (most powerful and decision making group in a coalition) that incorporate all three active ways of life are according to Thompson et al. (1990) rare and extremely short-lived. History (e.g. in wartime) showed instances of regimes existing of all ways of life that were mainly formed to put aside differences for defeating a common adversary. However, these regimes were usually also unable to come to agreement. Such regimes cannot be sustained for more than fleeting moments (Thompson et al., 1990).

4.2.5   Ways of life and consistency in cultural bias and social relations

In the previous paragraph, we discussed how different ways of life could come together in coalitions or alliances. In this paragraph we discuss the relation between cultural biases and social relations. A cultural bias refers to implicit theories people hold about the world, whereas social relations refer to patterns of interpersonal relations. Viable combinations of cultural biases and social relations come together in ways of life (Thompson et al., 1990, see paragraph 4.2.2). Theoretically and following the compatibility condition, different biases cannot be matched with social relations that do not support these biases (Thompson et al., 1990) as social relations generate preferences, perceptions and strategies (cultural biases) that in turn sustain those relations. Besides, using the rhetoric of culture X to support positions of culture Y involves the risk of universal monism. If all individuals could use the more successful rhetoric of another culture, we would have much less variation in the world today (Thompson et al., 1990). Nevertheless, in reality we sometimes see people acting inconsistent with their cultural bias. According to Thompson et al. (1990), Steg and Sievers (2000), and Dietz et al. (1998) taking a position inconsistent to one's way of life is a path of danger, but possible on occasional issues. Further, people can behave in contradiction to their biases, because this relation is mediated by other factors such as

situational constraints, group pressure or social contexts (Stern et al., 1998; Steg and Sievers, 2000).

4.2.6   Combining ways of life: an issue of compatibility

Next to mixing biases of culture X with social relations of culture Y, mixing beliefs from different biases is also possible but not always easy. This stems from the interconnected character of beliefs. Exceptions on one's cultural belief are acceptable (e.g. if you have great trust in a liberal market, but think that public transport can best be arranged by national governments). However, if exceptions accumulate, the rule itself (liberal market) comes into question. The interdependence of beliefs thus makes it difficult to reject a significant part without extricating the whole. Mixing beliefs from different cultural biases may happen unconsciously or consciously if it is believed that different biases are beneficial (Thompson et al., 1990). This cultural disloyalty would however be suspect. If somebody adopts more characteristics of another cultural bias, pressure will be felt either to move back to the original position and cultural bias or to become something different by adopting a new way of life (Thompson et al., 1990). Marris et al. (1998) highlight the possibility of people to be located on every spot in the grid-group diagram, hence also referring to the possibility to combine cultural biases.

Although ways of life are not likely to be mixed too heavily or often, the world does not consist of stereotypical people adhering to only one way of life. Thompson et al. (1990) acknowledge that most people recognize themselves in all (or most) of the four ways of life. The extent to which people recognize themselves in a given way of life depends (amongst others) on the social context you are looking at (Thompson et al., 1990; Grendstad and Selle, 1997). Research from Grendstad and Selle (1997) shows that different contexts may indeed result in different cultural biases; one might well be an Individualist in one sub domain (for example in secondary school) and a Hierarchist in another sub domain (for example during family Christmas celebrations). Marris et al. (1998) and Rayner (1992) refer to this as the *mobility version* of Cultural Theory, indicating that people will adopt different cultural biases as they move from one institution to another. This idea is opposed to the *stability version* of Cultural Theory (Marris et al., 1998) indicating that people will adhere consistently to the same cultural bias independent from the context, resulting in the assumption that individuals mainly move to institutions that are corresponding with their own cultural bias. None of the two versions have proven true, but it is plausible that people will try to bring at least some consistency in their social environments and will mostly engage with social contexts matching their cultural bias (Grendstad and Selle, 1997; Rippl, 2002). We have seen that the existence of stereotypical biases can be considered unlikely. However, it is also unlikely that people perceive objects equally through the four cultural biases. In such a situation, acting becomes very difficult as every object provokes four different values and possibilities to respond. In other words: there are a lot of questions, but no single answer, leading to indecisiveness. However, an individual in one of the stereotypical corners of the diagram sees all objects through the same cultural bias. In

such cases, it is almost impossible to cooperate with anybody adhering to a different cultural bias (Thompson et al., 1990). The limited amount of cultural biases facilitates communication between people. We know not everybody agrees with our cultural bias and we heard arguments of other ways of life more than once. This increases understanding of other cultural biases outside our own frame of reference (Thompson et al., 1990).

4.2.7   Changing ways of life and the role of surprise

Independent from the cultural biases or social relations people adhere to, ways of life are susceptible, however also resistant, to change. Parker (2000) indicated that people in general distrust change as it is often accompanied with suspicion and hostility towards those who want to bring about change, and with feelings of throwing away past efforts (Parker, 2000). Thompson et al. (1990) state the following regarding change:

"[..] our system is always in disequilibrium, always on the move, never exactly repeating itself, always having a definite shape, yet never staying the same shape, the system itself is indestructible" (Thompson et al., 1990, p.86)." [...] Stability without change is like trying to balance oneself on a bicycle without turning the pedals" (Thompson et al., 1990; p.80)

Change occurs everywhere, sometimes beyond our personal control, and it is necessary for stability (Thompson et al., 1990). Inconsistencies between reality and expectations (revealed by so called 'surprises') are an important explanatory factor for changing ways of life. Usually, such inconsistencies are initially explained away, ignored or just not noticed (Thompson et al., 1990). However, as evidence builds up against expectations and cultural biases people may be forced to adapt or change their expectations. Inconsistencies result from surprises that refer to events, developments or information expressing a discrepancy between the expected and the actual (Thompson et al., 1990; Hoekstra, 1998a). This distinction between reality and possibility is also central in risk concepts (Renn, 1992); if the future would be equal to expectations, the term 'risk' would not make much sense. Due to resistance to change, surprises may initially be explained in a way that it still fits within the expectations resulting from the cultural bias. For example, a dike breach was not due to the fragility of the dike, but due to a lack of governmental maintenance. However, if evidence builds up against cultural biases, people are forced to adopt an alternative way of life that fits better to reality. As stated before, people will always be surprised, independently from their perspective and even after changing their way of life. This tells us that the world is never just one way: it is constantly changing and the four perspectives are equally valid (Thompson et al., 1990; Pendergraft, 1998; O'Riordan and Jordan, 1999). The theory of surprise has three main principles (Thompson et al., 1990):

1.   *An event is never surprising itself*
2.   *It is potentially surprising only in relation to a particular set of convictions about how the world functions*
3.   *It is only surprising if it is noticed by the holder of that conviction*

Although what is surprising for one way of life is predictable and solvable from another, it is not always clear towards what direction (way of life) people change after confrontation with surprises. Take the example of a Hierarchist with trust in dikes. When confronted with an accumulation of surprises (like floods) the Hierarchist's trust in dikes may get lost, followed by trying to find a more satisfying way of life. It is however not univocal to what way of life the Hierarchist will change (Fatalism, Egalitarism or Individualism). The direction of change is -amongst others- dependent on the surprising event itself, on the spirit of the age, habits, experiences and available alternatives (see chapter 5 for more information). As explained before, traditional theories only identified two viable ways of life that were comparable to Hierarchism and Individualism (Thompson et al., 1990; Hoekstra, 1998a), therefore only one direction of change was possible (towards Hierarchism or Individualism) (Thompson et al., 1990). In Cultural theory however people can always change into three different directions[25]. Douglas (1970) already argued that people change their positions within the diagram according to their age, occupation, success, desires and support. Habits and experiences lead to resistance to change, although surprises and interventions facilitate change. Most changes are voluntary, except for movements away from Fatalism. Once established in Fatalism, people lose agentic power resulting in a passive attitude towards change, acting and policy (Thompson et al., 1990). Still, Fatalists may desire a better or different life but contrary to the other ways of life they regard improvements as solely dependent on fate. Adherents of the other ways of life however, will try to incorporate Fatalists into their own way of life to enforce their strength, making the presence of Fatalists a foundation for competition between the other ways of life (Thompson et al., 1990). Hence, movements away from Fatalism are usually not initiated by Fatalists themselves, but provoked by adherents of other ways of life.

4.2.8   Five ways of universal rationalities

In general, Cultural Theory rejects universal claims about human behavior. There is no single type of behavior likewise for all people. Nonetheless it is acknowledged that there may be objects or situations which are universally approached independent from cultural biases and ways of life. Thompson et al. (1990) provide the example of a water wall rushing towards a group of people. One could argue that we do not need Cultural Theory to tell us to get away, and it is likely that everybody would agree on danger.

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[25] As a Hierarchist one can change towards Egalitarism, Individualism or Fatalism; every way of life has three possibilities for directional change, making the total possible number of movements twelve.

However, attitudes and ways of responding to a water wall may differ from person to person. Cultural Theory helps to explain why some people adopt an attitude of "women and children first" or "each for himself" or "follow the leader" (Thompson et al., 1990). The same may be true regarding protection for floods. It is often argued that all people (independent from their cultural bias) value flood protection. Essentially this could be true, however people may still not agree on acceptable protection levels, ways to achieve this protection, responsible authorities etcetera. Cultural Theory helps to explain these differences.

According to Cultural Theory there are five rational and sustainable solutions to every problem or situation. This also means that human behavior is never rational or irrational in itself but only in relation to a particular context or in relation to certain ways of life. Cultural Theory thus does not reject rational choice theories, but states that more than only one way of reacting rationally to situations exists (Rayner, 1992; Renn, 1992; O'Riordan and Jordan, 1999).

4.2.9   Ways of life: a duality of agency and structure

Thompson et al. (1990) explicitly state that scientific controversies may be useful to make analytical distinctions, but needlessly create underrepresentations of dependencies between phenomena. Examples mentioned are controversies between culture and structure, change and stability, and voluntarism and determinism. Cultural theory states there is no need to choose between controversies and instead proclaim a focus on existing mutual interdependencies. The focus should thus not be on *either* cultural biases *or* social relations, but on their interdependent and reinforcing nature. The same is true for determinism and voluntarism. On the one hand people are constrained by social pressures and expectations telling them how to behave (high grid in terms of Cultural Theory), on the other hand, however, people have possibilities to also change these structures, expectations and pressures (low grid). Cultural Theory thus allows for duality of structure and agency[26].

4.3   Application to Integrated Assessment and Water

According to Verweij et al. (2006) Cultural Theory can be applied to any possible domain, except fact driven physics. Examples of topics Cultural Theory has been

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[26] Ways of life characterized by high grid (Hierarchism and Fatalism) may seem to miss duality. The social context is determining for maintaining these ways of life, hence missing the opportunity to express agentic power. However, still there are plural ways of life, giving individuals extensive, if finite choice to move (Thompson *et al.*, 1990). Especially medium grid ways of life will challenge people to find a balance between individual choice (agency) and prescriptive social structures. Also, within Cultural Theory individuals have the freedom to behave in a non- confirmative way (Fatalism).

applied to are: religion (Douglas, 1970), nature and resources (Thompson et al., 1990), uncertainty (Rayner, 1992; Renn, 1992; Rotmans and de Vries, 1997; van Asselt, 2000), climate change (Janssen and de Vries, 1998; Pendergraft, 1998; O'Riordan and Jordan, 1999; Verweij et al., 2006), biodiversity (Beumer and Martens, 2010), car use (Steg and Sievers, 2000), transport risks (Oltedal and Rundmo, 2006), environmental risk (Douglas and Wildavsky, 1982; Rayner, 1992), risk in general (Rayner, 1992; Renn, 1992; Rotmans and de Vries, 1997; van Asselt, 2000), problem structuring (Hoppe, 2011), genetically modified food (Finucane and Holup, 2005), the high Atlas in Morocco (Funnell and Parish, 1999), common property resources (Buck, 1989), health (Hilderink and van Asselt., 1997), biochemical cycles (den Elzen et al., 1997), local waste facilities (Van Baaren, 2001) and energy (Janssen and de Vries, 1998).

4.3.1   Integrated Assessment: the TARGETS and PRIMA approach

Integrated Assessment acknowledges that complex issues can usually not be understood in one single, objective way. There are multiple ways to interpret complexities and possible future developments. This makes it difficult for policy makers to make well informed decisions and to judge about (the likeliness of different) future developments. The TARGETS (Tool to Assess Regional and Global Environmental and health Targets for Sustainability) approach (Rotmans and de Vries, 1997) aimed at providing a platform for scientific communication to inform policy debates about likely trends for the next 100 years or so. Rather than defining sustainable development in an objective way, the TARGETS team accommodated multiple definitions as they believed that human values and beliefs largely determine the specific interpretation people give to sustainable development. Within TARGETS, Cultural Theory perspectives were used to construct a selective number of future directions to assess global developments in terms of population and health, energy, land- and water use and biochemical cycles. The methodology comprised assessments in which a number of controversies related to global change were addressed from different perspectives, using model experiments and perspective-based model routes. These model routes represented a chain of biased interpretations of uncertainties in the models. Cultural Theory was used to investigate the model routes coherently and making subjective judgments explicit. In that way, differences in future projections could be understood as the outcome of divergent perspectives. Besides the application of Cultural Theory to risk perception and the interpretation of model uncertainties for policy making, the TARGETS team made the use of the concepts 'worldview' and 'management style' explicit. They distinguished active perspectives from passive perspectives and introduced the concept of utopias and dystopias. Perspectives were defined as:

"Aggregations of the different points of view humans have, and […] consistent hybrid descriptions of how the world functions and how decision-makers should act. Perspectives can thus be characterized by two dimensions: (i) a worldview, which

entails a coherent view of how the world functions, and (ii) a management style, i.e. policy preferences and strategies" (Rotmans and de Vries, 1997, p. 211).

More in detail, a worldview encompasses a description of Thompson's 'myths of nature' (see paragraph 4.2.2), a view on humanity and a view on ethical attitudes (anthropocentric or eco-centric). The TARGETS team used Cultural Theory to characterize the different worldviews and to assess conceptual boundaries for plausible interpretations. A management-style comprises response strategies and preferences regarding policy instruments. Here again, Cultural Theory was used to ascribe stereotypical management styles to the various perspectives[27]. Resulting from this, the Hierarchist is associated with a preference for bureaucratic management focused on control. The Egalitarian prefers communal anti-managerialism and prevention, and the Individualist favors an anti-intervention lasses-faire attitude based on adaptation. The Fatalist -which was considered to be a passive perspective-, was excluded in the TARGETS approach as it was assumed that Fatalists could not systematically be ascribed to any management-style and are frequently excluded from participation in debates. Hierarchism, Egalitarism and Individualism were framed as active perspectives and included in the analysis. Further, to indicate risks associated with global change and to communicate the role of uncertainty and its consequences for decision making, utopias and dystopias were constructed by matching each perspective's management-style to its worldview. In a Utopia, the dominant perspective is equal to the reigning worldview, but in a Dystopia worldview and management-style mismatch. Especially Dystopias were considered useful to communicate the role of uncertainty for decision making.

One of the TARGETS members, Marjolein van Asselt (see van Asselt, 2000) developed a Pluralistic framework for integrated uncertainty management and risk analysis (the PRIMA approach) to set up pluralistic trajectories that enable practitioners to deal with uncertainty and risk and to consider the possibilities and consequences of various development pathways. Following TARGETS she used the three active perspectives of Cultural Theory to structure pluralities. Further, she renamed the perspectives[28] and summarized them in terms of heuristic rules. Heuristic rules comprise features regarding economy, nature, management principles and attitude towards risk. Each perspective interprets and prioritizes these features in its own way[29].

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[27] Management-style and social relations (as used by Thompson et al. (1990)) do not necessarily refer to the same. Management style potentially covers a broader spectrum than the concept of social relations. The latter focuses on how people behave in interactions, whereas the former also focuses on behavior independent from human interaction. In chapter 7 we explore the relation between worldview and management style more in detail.

[28] To: the controlist (instead of the Hierarchist), the Environmental worrywart (instead of Egalitarian) and the Market optimist (instead of the Individualist).

[29] Van Asselt (2000) visualized these different interpretations in a table that can be seen as the precursor of our perspectives map (see Table 2).

4.3.2   Application to Water

One of the first persons publishing on perspectives on water was Arjen Y. Hoekstra (Hoekstra *et al.*, 1997; Hoekstra, 1998b; Hoekstra, 1998a) who was also part of the TARGETS group (Rotmans and de Vries, 1997 also see previous paragraph). Hoekstra introduced the AQUA tool for integrated water assessment on a global- and river basin level. Cultural Theory perspectives were used to gain insight in how uncertainties regarding water (management) could be handled and how controversies can be positioned within a context of coherent points of view (Hoekstra, 1998b). Hoekstra (Hoekstra *et al.*, 1997; 1998b) developed coherent stories wherein water policy, global change and different ways of managing supply and demand were integrated. The three active perspectives were used to identify different water futures, both in a quantitative and qualitative way. The Hierarchist was projected to expect medium trends (for example for climate change), the Egalitarian high trends, and the Individualist low trends. Hoekstra concluded that translating Cultural Theory perspectives to water issues could be done reasonably well without deviating from the main assumptions of Cultural Theory and without under-representing the prevailing controversies. Also, controversies between water researchers and policymakers could be explained from the existence of different cultural perspectives. It seemed easier to understand different opinions in the debate on water if basic attitudes and beliefs of people were taken into account. From a scientific point of view, it would -according to Hoekstra (1998a)- be advisable to involve different perspectives in studies related to water management. An additional argument for doing so is that Hoekstra (1998a) found that basic assumptions and perceptions influence outcomes of tool analyses probably more than anything else.

Janssen and de Vries (1998) were among the first researchers who visualized the three stereotypical perspectives into a triangle, wherein each corner represented one of the stereotypical perspectives. Besides, they modeled and visualized perspective *change*. They confirm that individuals may be located on and move to every spot within the perspectives triangle. The position of individuals in the triangle is determined by expectations and translated to scores on parameters (like expected technological development, climate sensitivity and costs). The values of several parameters are assumed to differ for the three perspectives (see Janssen and de Vries, 1998 for more information) and people may change their value orientations throughout the time.

After TARGETS, the framework of the IRMA-SPONGE/NOP program (IRMA -SPONGE program, 1999; van Asselt *et al.*, 2001; Middelkoop *et al.*, 2004) used the three active perspectives of Cultural Theory to develop integrated scenarios for water management. Integrated scenarios take multiple dimensions (for example user functions) and perspectives into account. Three different water management styles were evaluated under different perspectivistic futures, showing costs, risks and benefits of different strategies according to the different perspectives, resulting in dystopias and utopias (van Asselt *et al.*, 2001; Middelkoop *et al.*, 2004). Within the

NOP project, the utopia and dystopias were (content-wise) elaborated and connected to ideas of desirability. The ultimate goal was to identify robust water management strategies for the Rhine and Meuse. Robust strategies were defined as strategies that have a prospect of a favorable future while avoiding unfavorable futures, but simultaneously being flexible so that they have the potential to be adapted to new insights. The study concluded that management styles that are robust or successful within one worldview may cause problems under other worldviews (now and in the future). A robust management style (or water management strategy) should thus lead to a favorable situation in all different perspectivistic futures (van Asselt *et al.*, 2001; Middelkoop *et al.*, 2004; Valkering *et al.*, 2008b). They also show that a Hierarchical strategy of 'win-win' is not necessarily robust as it could easily lead to a 'loose-loose' situation if climate changes more severely than is expected under a Hierarchical worldview. In this dissertation we consciously build upon these insights. We however, approach social robustness from an *evaluation* rather than an *expectation* point of view. As a result we do not focus so much on whether perspective dependent expectations (for example regarding climate change) become true, but on the complementary question on how uncertain future developments (like again climate change) will be evaluated by the different perspectives and what consequences are for social support for strategies.

In 2005 The European project MATISSE (part of the FP6 program) -Methods And Tools for Integrated Sustainability aSsEssment- started with the development of methods and tools for integrated sustainability assessment (ISA) of water related issues (Tabara and Ilhan, 2007; 2008; Valkering *et al.*, 2009). The outcome was a conceptual ISA-water model that could potentially identify scenarios that integrate hydrological, land-use, social-cultural and institutional processes, while taking the behavior of stakeholders and decision-makers into account. A concept questionnaire to measure perspectives on water in a participatory agent-based simulation game was also part of the ISA model. Along with the MATISSE project, the Dutch one-year BSIK project 'Perspectives in Integrated Water Management' started in 2006 (Valkering *et al.*, 2008b) which was generally approached as a follow up of the aforementioned IRMA-SPONGE/NOP project. The aim of this project was to explore the possibility to develop sustainable water management strategies involving social uncertainties. The three active perspectives of Cultural Theory were used to explore social uncertainties and social support for different water management strategies. This project offered first insights on how to operationalize and measure non-stereotypical perspectives on water, and how and why these perspectives may change over time. Further, and more recently, Cultural Theory perspectives have been used in several Dutch water studies like 'Attention to safety' (Aerts et al. 2008), 'Klimaatbestendigheid van Nederland Waterland' (Kwadijk et al. 2008), 'Scenario exploration for the North sea' (Wolters *et al.*, 2010), transition dynamics in water management (van der Brugge, 2009) and others.

4.4   Measuring perspectives

There are few examples of research wherein Cultural Theory perspectives have been measured. Most of these examples stem from the field of risk research, wherein perspectives became increasingly important as from the 1980s. In this section a short overview of efforts to operationalize and measure perspectives will be provided. It is not our intention to be entirely complete in this effort, but to provide the reader with a balanced overview of methods that seem successful or not in measuring perspectives. In 1990 Dake (1991) (a graduate student of Wildavsky) introduced a measurement instrument that is now largely used in quantitative studies on Cultural Theory and risk (Dake, 1991; Rippl, 2002). According to Marris et al. (1998) Dake conducted the majority of the empirical work on operationalizing and measuring perspectives regarding risk. His measurement instrument is comparable to a questionnaire consisting of questions on a five point likert scale. The answers to these questions result in a score between one and five for every cultural bias (Marris et al., 1998; Rippl, 2002). People were classified in a perspective if their score for that perspective was above the mean, whereas the scores for the other perspectives were below the mean scores (Marris et al., 1998). To construct his questionnaire, Dake (1991) took items from several instruments that were originally developed to measure personal attitudes towards confidence in institutions, patriotism, law, order etcetera. Respondents were expected to have a high score for one particular cultural bias and a low score for the three others. However, only 41 respondents (32%) could clearly be classified to one single bias. 80 respondents (62%) were a mix of two or more cultural biases, as they had an above-average score for more than only one cultural bias. Four respondents (3%) scored below mean for all the biases, which means -according to Dake- that they had no cultural bias at all (Marris et al., 1998).

Dake's questionnaire is often criticized because of the one-sided focus on cultural biases and its ignorance of the role of social relations (Rippl, 2002). Besides, the reliability of the formulated questions may be questioned as they seem to be biased towards Egalitarism (Marris et al., 1998) and not clear enough to distinguish between the different cultural biases (Marris et al., 1998). Also, the significant correlation between all four biases with socio-economic variables such as age and education may question the reliability of Dake's instrument and makes it questionable whether Dake is measuring perspectives or (also) socio-economic variables (Marris et al., 1998). This may inhibit the risk that socio-economic variables have a larger explanatory value in the analysis than cultural biases (also see Marris et al., 1998). Therefore, Rippl (2002) states that Dake's measurement instrument does not measure culture but processes that are connected to culture.

Whereas Dake included the Fatalistic perspective in his measurement instrument, Pendergraft (1998) decided to exclude Fatalism in his study. This decision was mainly based on skepticism regarding the question whether Fatalists would respond to surveys at all. According to him, studying Fatalists demands specialized ethnographic

methodologies of data collection rather than using statements combined with cultural indices as he did. Pendergraft (1998) developed eleven statements consisting of three cultural indices each. This combination resulted in 33 possible correlations. It was for example expected that respondents scoring high on Egalitarism would also express higher levels of concern on multiple domains. Examples of statements are: 'If I had to choose between freedom and equality I would take equality' and 'humans have no innate or God-given mandate to dominate the planet'. All correlations were in the expected direction and 32 of them were statistically significant at less than 0.01 (P) level. Each answer possibility to each statement was assigned points for the three active perspectives. The points for each cultural bias were summed, and the percentage of the respondent's total score of each culture was calculated. Respondents with similar scores were classified in three different clusters. In no cluster Hierarchism was strongest (see table 8). Even though most worldviews appear to consist of a combination of all perspectives, preferences for one of the perspectives could be recognized. Most respondents who scored high on Hierarchism, also scored high on Individualism in opposition to Egalitarian values. Pendergraft states that it is not clear whether this is due to an invalid measurement or a power balance wherein Hierarchism and Individualism reinforce each other against Egalitarism. Further, some statements were formulated in a way that hardly allows for drawing conclusions (weak reliability). An example of such a statement is 'Our food supply, due to modern agricultural methods, is better and safer than ever before'. A negative reaction to this statement does not tell us much since it stays unclear whether the respondent does not agree with the important role of modern agricultural methods, with food supply being safer, with food supply being better than before, or with all aspects. Emphasis on modern agricultural methods could indicate an Individualistic perspective, whereas an emphasis on safety would refer to Hierarchism.

Table 8: strength of each cluster, adopted from (Pendergraft, 1998,p.655)

Cluster	N	Hierarchism	Egalitarism	Individualism
1	103	0.402	0.172	0.426
2	199	0.307	0.327	0.365
3	139	0.232	0.510	0.258

O'Riordan and Jordan (1999) performed a survey among residents of Norwich (United Kingdom). Respondents were sampled statistically for representativeness. The study consisted of two phases; in the first phase respondents had to answer questions regarding cultural solidarities, in the second phase the researchers' goal was to assess fairness rules for hypothetical situations. Ideally, respondents who could be assigned to a particular perspective in the first phase could be assigned to the same perspective in the second phase. This was true for 23% of the respondents, besides, for almost all respondents and residential groups there was a high level of unanimity within the groups, and huge divergence between the groups (O'Riordan and Jordan, 1999). O'Riordan and Jordan (1999) concluded that Cultural Theory, if gently applied and not too strictly pursued, may at least help to explain how certain patterns of thinking

shape communication, information gathering and interpretative aspects of topics like climate change.

Meader et al. (2006) following Stern et al. (1993) distinguished 3 value orientations regarding car use: biospheric (towards environmental consequences of car use) social (towards social consequences or car use like the danger of accidents) and egoistic (towards increased comfort while travelling). Their initial assumption was that Hierarchists will try to combine these three orientations, Egalitarians will try to optimize biospheric values, Individualist will optimize egoistic values while diminishing biospheric and social values, and Fatalists were not assumed to have any preference. Here it should be noted that these assumptions are not in line with Cultural Theory as they assume Individualists to oppose both Hierarchists and Egalitarians, whereas in Cultural Theory Individualism and Egalitarism share a low grid position. Results suggested that the content of the four worldviews do not generalize across cultural, environmental and economic issues regarding car use which made Meader et al. (2006) conclude that Cultural Theory is an anthropological theory of social organization rather than a psychological theory of individual types[30].

Contrary to Pendergraft's (1998) conclusions, Oltedal and Rundmo (2006) show that individuals with different worldviews do not perceive (transport) risk according to the patterns described in Cultural Theory. Oltedal and Rundmo (2006) adopted 23 items from Dake's measurement instrument and added new items that were supposed to be applicable to transportation safety issues. The primary objective was to find groups of similar respondents wherein individuals were allowed to adhere to more than only one worldview. Eventually, four clusters were made wherein the relation between cultural bias and risk perception seemed sporadic and unsystematic. Hence Oltedal and Rundmo (2006) concluded that there must be other factors that are more important for transport risk perception than the perspectives of Cultural Theory (Oltedal and Rundmo, 2006).

Steg and Sievers (2000) conducted an online questionnaire consisting of four elements: (1) measurement of myths of nature wherein respondents indicated which statements on nature and environmental risk management strategy corresponded with their beliefs. (2) Measurement of beliefs regarding car use, consisting of statements that could be rated on a five point likert scale, (3) measurement of a preferred management strategy with three perspectivistic options (technology, radical reductions in car use, and government regulations, also on a five point likert scale) and (4) an evaluation of different policy measures (various push- and pull strategies) for which respondents could indicate their expected effectiveness on a five point likert

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[30] Firstly it can be questioned whether this conclusion is an outcome of wrong assumptions underlying the measurement instrument. Secondly, Thompson et al. (1990) clearly state that Cultural Theory is principally a theory of social organization. However they also say that social networks and organizations are the sum of social relations. Therefore each individual could be depicted in the grid- group diagram. The relationship of all group members depicts a location of the entire organization.

scale. Results of the four different sections were bundled and a factor analysis was performed. Steg and Sievers (2000) concluded that myths of nature, specific environmental beliefs and policy preferences (push- and pull measures and a necessity of car use reduction) correlated in the expected directions. For example, people whose environmental belief could be characterized by 'nature ephemeral' (Egalitarian) tended to have a preference for reducing car use. Respondents characterized by 'nature is benign' (Individualist) instead preferred pull strategies and (to a lesser extent) push strategies, which can be approached as regulation by a (partially) free market. In general, nature ephemeral (Egalitarism) was associated with a higher problem awareness. Steg and Sievers (2000) hence agree with Stern et al. (1998) that value orientations, general beliefs and worldviews influence specific beliefs, attitudes, and norms. However, they do not necessarily directly relate to behavior (Steg and Sievers, 2000).

The above mentioned measurement tools are examples wherein questions and propositions are based on already existing descriptions of perspectives and their extreme reference points. The assumption is that historical, current, but also future perspectives can be located somewhere in the group-grid diagram or the perspectives pyramid. A different method to measure value orientations is Q-methodology. Here, researchers start with a list of statements (sometimes questions or values) that needs to be completed, filled in or ranked by respondents. A next step is clustering the different answers given by the respondents to define categories. The categories resulting from Q-methodology do not describe a wide range of (extreme) reference points but time-bound and detailed differences and similarities between respondents who filled in the questionnaire. It says something about *present* perspectives. This methodology is -for our research- considered less suitable than methodologies described before (see paragraph 6.2.3 for more explanation). Good examples of the application of Q-methodology to measure temporary perspectives are Cuppen (2009, on unstructured problems) and Vugteveen (2010, on water management).

Overall, it is hard to compare the oftentimes contradicting and ambiguous conclusions from different studies. The suitability of Cultural Theory regarding its operationalisation or verification by quantitative research methods depends on multiple factors including the choice for scale levels, application domains, methods applied, formulation of questions and chosen statements.

4.5   Critique to Cultural Theory

Although being a promising theory, Cultural Theory is not without limits and can be criticized for different reasons. In this paragraph we will briefly mention and reflect upon the most important and most commonly heard critiques. First, and maybe most importantly, people refer to a lack of convincing empirical evidence to support fundamental assumptions within the theory (see previous paragraphs). Rejection

mostly relates to the content of the perspectives, their similarities and contradictions, but also to the validity of the grid-group dimension. Related to the latter issue, Caulkins (1999) states that the grid-group dimensions may be theoretically distinguishable, but it has not been proven that they are empirically separated dimensions as well. In order to be useful in cross-cultural research, the grid- and group dimension should be empirically distinguishable, which definitely asks for more research. Further, a lack of univocal empirical evidence may raise the question whether ways of life are measurable at all or whether it is too difficult to reveal and consciously reflect upon (Renn, 1992). As already mentioned in chapter three, the explanatory power of the grid- and group dimension as well as the resulting contradictions between Hierarchism-Individualism and Egalitarism-Fatalism are questionable. However, this does not automatically imply that the distinguished ways of life are questionable as well (see chapter 3 where we concluded that Cultural Theory perspectives can be recognized in multiple other typologies).

Next, Cultural Theory is not specific on the relation between *interests* and *cultural biases*. It is not clear whether specific biases induce certain interests and preferences, or the other way round (Renn, 1992). The same can be said about the relation between ways of life and social contexts (Rayner, 1992; Renn, 1992). Do people consciously become a member of social contexts that are in correspondence with their way of life, or do specific social contexts result in a particular way of life? Of course, it would be very interesting to gain more insight into this topic and for psychological research it may even be necessary, but for the goal of our research we do not consider this knowledge gap a crucial obstacle. For us, it is important to know that there is a relation between preferences, interests, worldviews and social contexts. How this relation exactly is shaped, is less relevant for our research.

Given the important role of contexts, Cultural Theory is said to have a stronger focus on "nurture" than on "nature" (Renn, 1992), possibly leading to cultural determinism wherein culture and social patterns lock individuals into a particular worldview. However, Cultural Theory is not a psychological theory of personality types, but a sociological/anthropological theory that considers a cultural bias to be unavoidable and also dynamic. Therefore we cannot speak of cultural determinism. Individuals have a (be it limited) number of perspectivistic packages to freely choose from. This leaves space for agency which gives power to the individual to structure his or her life, to change social contexts and rejects cultural determinism (Rayner, 1992; Renn, 1992).

Further, Verweij et al. (2006) and the CIESIN institute (1995) state that the strong interrelation between social relations and perceptions may leave out various other influences on people's thought and behavior, such as gender and individual character. We acknowledge -also following Douglas (1996)- that variables such as age and social status may influence people's position in the diagram. However, for our research it is essentially important to know what people think and how their way of thinking affects

social support. This implies that for this research it is less vital to know why (according to which psychological principles) people think the way they do.

Some argue it may be simplistic or reductionist to partition culture into only four segments, especially because Douglas (1970) initially referred to tribal societies (Renn, 1992; Caulkins, 1999; Verweij et al., 2006). This raises questions whether there may be social groups or worldviews that cannot be captured by these four perspectives. Of course, we should not be blind for the possibility of more existing perspectives than the four identified by Cultural Theory. However, to abandon the theory because there may be another unidentified perspective cannot be the right solution. For the time being we have no reason to assume that there are perspectives that cannot be captured by one of the stereotypical Cultural Theory perspectives, or a combination between them (also see the conclusions in chapter 3). Moreover, we acknowledge that it would be too reductionist to divide the diversity of worldviews in only four stereotypical perspectives. Therefore we allow perspectives to be non-stereotypical.

Further, Verweij (2006) argues that Cultural Theory may notably be suitable to social domains in which people meet, interact, argue and communicate and which allows them to justify themselves in face-to-face interaction. This makes Cultural Theory probably less suitable for explaining large scale macro changes where direct human interaction is less evident. Whether this is a serious shortcoming of the theory depends -again- on research objectives (Verweij et al., 2006). If a detailed description of the European and American economic crisis was a topic of research, Cultural theory would probably be less advisable than theories on large scale institutionalized changes. For our research, that mainly focuses on perspectives and perspective changes on a national policy and societal level we do not see an objection to use Cultural Theory following from this critique.

Another, related issue, focuses on Cultural Theory's inability to accommodate differences of scale and competing cultures within one society (Rayner, 1992). Although Cultural Theory talks about alliances and coalitions (see paragraph 4.2.4), it does not specify how the different perspectives interact within alliances and coalitions, what the role of power differences may be and how dynamics occur. As such it becomes difficult to understand how power distributions within alliances and regimes may change. The only explanation Cultural Theory gives is that perspectives change due to surprises. Surprises may lead to a changing distribution between perspectives in alliances and regimes. As Rayner (1992) says it would however be strange to ignore issues of power and self interest, especially as these concepts are important in other theories (for example economic theories). Of course, we could also argue that each Cultural Perspective has its own distinguishable topic of self interest (for example self development and creativity for Individualist and safety and security for Hierarchists). Nonetheless we acknowledge that attention for processes of cooperation and competition may be important to explain perspective change, notably on a policy level. Therefore we include insights from transition theory (Rotmans, 2003 ; Loorbach, 2007;

van der Brugge, 2009) and the Advocacy Coalitions Framework (Sabatier and Jenkins-Smith, 1993) in our Perspectives Method (see paragraph 4.6 and 7.2.1).

A next point of critique is that assumptions of Cultural Theory lead to cultural relativism and solipsism, as any person's version of the world has a valid claim to be scientifically true (Rayner, 1992). Although essentially correctly assumed, main assumptions on how the world functions are considered to be reducible to only one of the four stereotypical worldviews, or a combination between them, leaving us with a limited amount of scientifically true claims on how the world functions (Thompson et al., 1990). However, as Renn (1992) also argues, mixes of stereotypes may induce perspectives to loose (part of) their explanatory power. To that end it may be useful to investigate ingredients (beliefs) that come together in one perspective. This leaves us with the explanatory power of perspectives on a belief-level.

Next, CIESIN (1995) questions whether it is appropriate to apply Cultural Theory to biophysical phenomena in integrated assessment models as the TARGETS group did (see Rotmans and de Vries, 1997). According to them, uncertainties in such parameters are very weak functions of cultural biases, and have more to do with ignorance about the Earth's complexity than with cultural characteristics. Too many essential features of Cultural Theory are left out (for example on historical background and personality) and the parameterization of cultural aspects into models gives too much space for subjective biases that affect model outcomes (CIESIN, 1995). We acknowledge that aggregation levels and the choice for parameters, beliefs and their interpretation are fundamental for the validity and reliability of a measurement instrument (also see paragraph 4.4). We regard this to be more a challenge of proper methodological procedures instead of a challenge inherent to Cultural Theory. Further, we do not agree with CIESIN that uncertainties in parameters are a result of ignorance. Our understanding of the development of parameters is only a (perspectivistic) snapshot in time and can never be predicted with 100% certainty.

Further, Cultural Theory's claim of universality is highly controversial (CIESIN, 1995; Pahl-Wostl et al, 2008). Other typologies (like Motivaction's mentality test, see chapter 3) make no claims of universality. Cultural Theory however claims to provide a universal basis for its grid-group taxonomy which is -as we have also seen in chapter 3-questionable in itself. Indeed, this issue strongly relates with an aforementioned point of critique that raised the possibility of the existence of a perspective that cannot be captured by Cultural Theory. Somewhere on earth we may find a society to which Cultural Theory is inapplicable. However, the claim of universality has never been enfeebled in a satisfying way either. So far it functions as a useful framework to explore historic, present and future perspective changes and provides a broad framework to cover diverse future perspectives. Nonetheless, closely monitoring and continued investigation on the applicability of the theory to countries with different cultures, or with comparable cultures but different problems would be advisable.

Besides it would be interesting to research the comparability of perspectives across cultures (e.g. is a Dutch Hierarchist comparable to a French Hierarchist?).

Finally, as social sciences is inherently connected to subjective interpretations of the researcher involved, people may argue that the way perspectives will be interpreted is too much susceptible for the worldview of the researcher (Renn, 1992). We do not deny this issue but believe that the extent to which researchers are influenced may be limited to acceptable norms by being transparent in the decisions made, to use methods like the inter-evaluator reliability test and to constantly reflect on preferences regarding the stereotypical perspectives. Further –and as explained in previous paragraphs- it is important to realize that no perspective is better or more correct than any other.

4.6   The Perspectives Method

The Perspectives Method is constructed to help evaluating different water management strategies in an uncertain future considering social robustness and flexibility. Understanding the changeable character of perspectives and the operationalisation of perspective(s) (change) plays an important role. In our approach we consciously build upon previously mentioned theories and assumptions and try to focus more explicitly on non-stereotypical (real life) perspectives that exist of interpretations from different stereotypical perspectives. We furthermore develop a method to make perspectives (and therefore also perspective change) measurable and visible. By investigating perspective dynamics we generate more knowledge on directions of change and possible consequences for social support for different water management strategies. So there is an explicit orientation on the future and social robustness. The latter refers to the extent to which different water management strategies and their effects on the system state remain acceptable in different futures. This is a normative rather than a descriptive parameter. The Perspectives Method combines a perspectives-based qualitative evaluation of water management strategies with an impetus for a quantitative effect analysis (see chapter 8). Although the accent lies on Cultural Theory perspectives, the Perspectives Method also uses insights from Transition theory (Rotmans, 2003 ; Loorbach, 2007; van der Brugge, 2009) and the Advocacy Coalitions Framework (Sabatier and Jenkins-Smith, 1993) to better understand the character and role of coalition dynamics in perspective change.

4.6.1   The Perspectives' Method application to water

The application to water was done in two different ways; first we started reasoning from the basic descriptions and starting points of Cultural Theory to fill in how an ideal water system would look like in a stereotypical Hierarchical, Egalitarian, Individualistic and Fatalistic world. Secondly, we checked the completeness of those ideas by reading policy and scientific reports on water management to see if stated ideas, assumptions

and solution directions could be reduced to one of the stereotypical ideal worlds or a combination. This resulted in storylines and (later) in the perspectives map referring to the stereotypical interpretations of water issues from each perspective. These interpretations were subsequently checked by scientists and professionals who have been working on water projects and Cultural Theory for several years. Hierarchists believe in controlling water and nature, government responsibilities, research and expert knowledge. Water is mainly seen as a threat to human safety. A sustainable water system highlights safety and flood prevention and leaves space for some economic and natural development. As a consequence, preferred water policy options are 'Dike building', 'Raising or widening dikes', and 'Channeling' (Offermans et al., 2011b). Egalitarians on the other hand, prioritize ecological recovery and natural development. More space should be given to nature and water. They prefer participatory decision making processes with equal voices for everyone. The needs of animals and plants should also be seriously considered. As a consequence, preferred water policy options are 'Room for the river', decrease in human demands, relocation to higher areas and precautionary actions. A sustainable water system focuses on strong sustainability with space for natural and ecological processes and reconsideration of human demands (Offermans et al., 2011b). Individualists adhere to a more opportunistic point of view. They do not approach water as a threat: on the contrary, water offers great opportunities in terms of economy, creativity, self-development and recreation. They prefer an adaptation approach, high trust in technology and a liberal market. In correspondence with their beliefs, their preferred water management policies focus on innovative projects, such as 'Amphibian living', 'Living on water' and 'Building offshore islands'. A sustainable water system is inspired by weak sustainability (Williams and Millington, 2004) with a focus on economic opportunities and innovative, technological solutions to unsustainable situations (Offermans et al., 2011b). The fourth perspective, the Fatalist is not concerned about the future and sees life as a lottery. Everything is predetermined by destiny, which cannot be influenced by policy or individual actions. One has to enjoy every day and make the most of the present. Short term pleasure and enjoyment are very important and adjusting one's behavior to prevent future problems is useless. Developments like climate change or technological innovation are inherently vague; information about the past does not say anything about the future. Today developments may follow trend A, tomorrow it may be B or C. As a consequence, they adopt a passive management strategy of doing nothing.

These stereotypical perspectives are useful as typology and for scenario analysis wherein exploration of a broad, diverse and extreme future is fundamental. In reality however, perspectives tend to exist of a combination of stereotypical elements (Thompson et al., 1990; Verweij et al., 2006; Valkering et al., 2008a; Valkering et al., 2008b; Offermans et al., 2011b). Therefore, we suggest a more multi-perspectivistic approach wherein people can adopt to combinations of cultural biases. This would also give more credit to Thompson et al. (1990) and Douglas (1970) who already argued

that most people adhere to more than one cultural bias and that prototypes can hardly be found in reality. The focus should hence be on mixtures of cultural biases and the generation of better insight in which aspects of worldviews are, or are not exclusive (Wildavsky and Dake, 1990; Marris et al., 1998; Pendergraft, 1998).

4.6.2   The Perspectives Method measurement of Perspectives

Following paragraph 4.4 we could choose between a value-oriented measurement tool and Q-methodology. As explained, the latter is considered to be a valuable method if scientific knowledge about categories or value orientations is missing, or if the main research goal relates to describing current preferences of a group of people. However, if the research goal (like ours) relates to an exploration of future behavior or support we consider Q-methodology less valuable. Describing present-date perspectives (which is very timely bound) does not guarantee that these categories will be diverse enough to also describe and explain changing and future perspectives. Next to that, and independent from using questionnaires or Q-methodology, it is fundamentally important to develop a measurement instrument that is valid and reliable. The validity says something about the extent to which the separate items in a questionnaire measure the same underlying concept (in our case: perspectives). This validity can be calculated by means of the so called Cronbach's Alpha which has a value between zero and one. The closer to one, the higher a test's validity. Usually 0.7 (or higher) is considered a sufficient validity score for a measurement instrument. Reliability has - amongst others- to do with interpretation (am I measuring what I think I am measuring and do the respondents understand my questions and answer options?). Having a large, diverse and randomly selected response group combined with a correct question formulation increases a tool's reliability. In our search for an appropriate value oriented measurement tool we took several aspects into account: The tool (1) should allow to measure non-stereotypical perspectives. (2) should also be able to measure perspective change (3) should allow to base an exploration of possible future perspectives upon (should hence also be extreme enough) and (4) should be easy and fast enough to be used in participatory simulation sessions.

Decomposing the stereotypical perspectives into a set of 15 beliefs, allows to endorse beliefs of various stereotypical perspectives (Douglas, 1970; Offermans et al. 2011b; Offermans and Corvers, 2012; Thompson et al., 1990; Verweij et al., 2006; Valkering et al., 2011; Valkering et al., 2012). The beliefs resulted from the same process as explained in the previous paragraph that led to the translation and application of Cultural Theory perspectives to water. Initially we started with a table covering around five pages and multiple beliefs. Removing less relevant beliefs and -most importantly-categorizing separate beliefs under less detailed beliefs made us end up with the 15 beliefs shown in table 9. Reducing the initial table to a workable format of 15 beliefs was necessary to meet requirement four; to have a fast and easy to understand measurement tool that would not interrupt procedures during participatory simulation sessions (see chapter 7). To structure the 15 beliefs we used three categories; beliefs

on a worldview level, focusing on fundamental values and beliefs upon which uncertainties are interpreted, beliefs on a management style-content level directed towards guiding principles in taking action and beliefs on a management style-process level directed towards responsibilities involved in managing a water system (Valkering et al., 2009; Valkering et al., 2011). Compared to the map in chapter two, we included the Fatalistic interpretations of beliefs and some beliefs (on drought, flooding and important values) that were often heard during discussion but did not explicitly come back in the initial table. We removed the belief regarding the integrality of water management as this row was always filled out hierarchically during the try-out phase and respondents argued having difficulties in applying this belief to present and future water management. This made the belief become controversial and it was not clear whether its interpretation referred to an evolutionary process or to different valid interpretations. The beliefs, including their perspectivistic interpretations come together in the so called 'perspectives map' (see table 9). The map includes the set of 15 beliefs on Dutch river management (second column) and for each belief, the Hierarchist, Egalitarian, Individualist and Fatalist positions are given (columns 3-6). To measure a perspective, one decides for each belief which position is supported (having the possibility to mark none, one, two, three or four positions per belief). The combination of positions for all beliefs together represents a perspective, which consequently can be visualized on the perspectives pyramid (see Fig. 19-21 in chapter 6) thereby indicating the similarities of the measured perspective with the four archetypes. The dots in the pyramid are calculated by summing up the scores per column in the perspectives map, normalizing them to four and calculating x-, y- and z values in a standard barycentric pyramid (see footnote 10 for more information). The corners of this pyramid correspond to the extreme, stereotypical positions; but every combination of beliefs can be mapped on this pyramid (see Offermans, Haasnoot et al. 2009; Valkering, Van der Brugge et al. 2010).

Table 9: The perspectives map wherein perspectives of Cultural Theory are translated to water. To map a perspective, one decides for each belief which position is supported (having the possibility to mark none, one, two, three or four positions per belief).

		Hierarchist	Egalitarian	Individualist	Fatalist
Worldview	Value of water	Discharge of water, ice and sedimentation	A source of rest, space and nature	A source of material prosperity & self development	Making my life more comfortable
	Nature of problems	Seriously, but manageable	Seriously and hardly manageable	Something we do not need to worry about	Useless to think about or prevent
	Climate change	Average trends, as predicted and forecasted by experts	Extreme trends; climate will change even more drastically than thought right now	Minimal trends; I do not think that climate will change clearly	Not identifiable
	Trust in technology	Moderately; it is important to thoroughly investigate potential consequences. Not too large-scale	Low. Risks are too high. I prefer behavioral changes over the use of technology	Large. I mainly see opportunities. Available technologies should be implemented quickly and at a large scale	Not clear, results from the past do not give guarantees for the future
	Important values	Structure and stability	Harmony and solidarity	Freedom and independency	Comfort &pleasure
Management style content	Water function priority	Preservation of current functions	Ecological recovery, compensation and nature development	Economic functions, self development and innovation	Comfort, providing me with enough water
	Safety	Flood prevention and control of discharge	Via avoidance of flood prone areas and acceptation of water	Via adaptation to water by utilizing opportunities & innovation	Interference is useless.
	Response to drought	Following guidelines and laws	Fair distribution between nature and human consumption	Market forces; rising prices in times of scarcity	No need to think about it. It will be alright
	Water supply	Demand driven	Supply driven	Market driven	Not different from now
	Water system organization	Control and regulation	Natural development and resilience	Opportunism and innovative technologies	Passivity, interference is useless
	Principle of spatial planning	Water follows functions, preservation of existing space	Water steers; functions follow water. Give up space if necessary	Water offers opportunities; functions utilize water. Creation of space on water	Water should be used to make fun
Management style process	Damage due to flooding	Should be prevented and otherwise refunded by government	Is a matter of solidarity; everyone is financially responsible	Is a matter of individual responsibility. Known risk of living in flood prone areas. Insurances	I do not want to look ahead for that
	Responsibility	National Government	Regional governments and NGO's, in fact everybody contributes its own mite	Private companies and in risky areas (for example in flood plains) individuals	As I have enough water I can make decisions myself
	Decision making based on	Norm standards by expert knowledge and research	Participatory processes with input of all stakeholders	Functioning of the free market and privatization. Cost-benefit analyses determine best choices	Not applicable: it is a waste of time
	Identity; water contributes to	National identity and traditional export product	Catchment identity and solidarity	International identity and innovative image	My own identity and pleasure

4.6.3   The Perspectives' method interpretation of change and social robustness

By using the perspectives map and its pyramid-based-visualization in different time frames, perspective change can be measured and visualized. Perspectives change due to the occurrence of surprises and a lack of reproduction events (see paragraph 4.2.7). Monitoring perspectives in combination with an Integrated Assessment Meta Model (IAMM) in a participatory simulation game (see chapter 7) teaches us more about the type of events and circumstances that contribute to changing dominant perspectives. A dominant perspective refers to the majority interpretation of the perspectives map. An undercurrent exists of people with a non-dominant but more or less shared interpretation of beliefs. Changes may lead to different power distributions between dominant perspectives and undercurrent(s), therefore, present undercurrents may (under specific future conditions) grow and eventually become dominant (see also chapter 5). It is crucial to better understand the dynamics behind perspective change as a changing dominant perspective may alter expectations and the extent to which a strategy and its effects are considered acceptable. A strategy that remains acceptable under all (or most) perspectives and future developments (for example climate and economy) can be considered socially robust. The evaluative screen inherent to the concept of social robustness says something about the present situation; do people with different perspectives consider a strategy and its effects acceptable? But social robustness also says something about the future. What if people change their ideas on how water should be managed, would they still consider a strategy to be acceptable? And what if climate changes different from what has been expected: do we still think that the effects of a strategy are acceptable? We assume that if a majority of people agree that a strategy is (not anymore) acceptable, social support to continue a strategy may be lost (see for example chapter 5). In the next chapter we start with a historical exploration to gain more insight in perspective dynamics and (changing) support for strategies. In chapter six we analyze the social robustness of strategies proposed in the Dutch Delta report (Delta Committee, 2008). This analysis encompasses two tracks: first we analyzed the extent to which the perspective inherent to the policy document matches the present dominant perspective among Dutch water professionals. This says something about present support for, and robustness of, proposed measured. Second, we compared the perspective inherent to the Delta Report with existing undercurrents. Undercurrents may -under the influence of surprises- grow and eventually become dominant. Considering future social robustness, it is important to analyze how socially robust the proposed measures are in the light of the undercurrent and future perspective changes. Of course, we do not have guarantees that the present undercurrent will eventually grow and become dominant. Therefore, chapter seven tries to provide more insight in future perspective changes. It tries to answer questions like: when do perspectives change into which direction, and what effects do perspective changes have for the choices for measures? Finally, chapter eight purely focuses on *future* social robustness. It argues that every perspective has its own 'acceptability threshold'. Surpassing this threshold makes a strategy, its appearance or

its effects on indicators unacceptable. A quantitative exploration of future effects of strategies given a diversity of climatic and socio-economic scenarios gives an overview of a strategy's possible performance in an uncertain future. Analyzing these effects through the different perspective-dependent acceptability thresholds says something about a strategy's social robustness. Comparing the different strategies provides an overview on different gradations of socially robust water management strategies. The challenge remains to identify a strategy that is (relatively) robust, or that is flexible enough to adapt to changing social conditions (perspective change).

Chapter 5

LEARNING FROM THE PAST:
CHANGING PERSPECTIVES ON RIVER
MANAGEMENT IN THE NETHERLANDS

5   INTRODUCTION

In the previous chapter we have seen how Cultural Theory and -more specifically the Perspectives Method- has evolved through time. In this chapter we will apply the Perspectives Method to a historical case study of Dutch water management history as from 1900 to withdraw methodological lessons regarding changing perspectives, social uncertainties and the extent to which water management can learn to cope with it. Following earlier chapters, we consider a water management strategy to be socially robust if it is able to cope with changing societal perceptions and preserves social support. A strategy that lacks social robustness may -under specific future conditions- loose social or policy support, possibly leading to indefensible situations and forcing policy makers to take expensive adaptive measures quickly or cancel plans. Information regarding Dutch water management history is widely available, but approaching this information from a perspectivistic point of view however, is rather new. Historical analysis offers information for the future, and provides a first analytical fundament indicating what may be relevant aspects to include in a future exploration for social robustness. Besides it functions as validating component for further research results. Derived from Cultural Theory we distinguish three perspectives to analyze and structure information from the past and to provide first steps towards a future exploration of social support and socially robust water management strategies. In this article we will first explain the Perspectives Method. Then we provide an overview of major developments in Dutch water management as from 1900, and analyze these developments in terms of perspectives and perspective change, providing insight in the effects of different events on perspectives and support for specific policies. Finally, we argue how the Perspectives Method can be useful for scientists and policy makers.

5.1   Methodology

Water management strategies can easily become controversial, and therefore a problem for society and policy makers. The traditional approach is that we need more scientific facts and knowledge to solve such problems. However, most of these problems are not grounded in any lack of knowledge, but rooted in different values and interests. Sarewitz (2004) and others make clear that scientific facts cannot value disputes and competing interests; that scientific knowledge is not independent from the political context, but co-produced by scientists and the society within they are embedded; that different stakeholders in environmental problems possess different

bodies of contextually validated knowledge; and that boundaries between science and policy or politics are constantly being renegotiated as part of the political process (Sarewitz, 2004, pp 386). Further, the simple, linear formulations leading from 'more science' to 'less uncertainty' to 'political action' are inherently flawed (Sarewitz, 2004, pp 397). From this position it seems inevitably to develop methods for integrating values and interests into scientific research that aims to support decision-making in public affairs (see also McNie, 2007; Sarewitz and Pielke, 2007), for example in long-term water management. The Perspectives Method, in our approach operationalised as an analytical tool to explore (changing) perspectives, may be a step in the right direction. In this chapter we use the Perspectives Method to classify the broad variety of human perceptions on water, to analyze history in terms of (changing) perceptions and to gain insight in the social robustness of water management strategies. Perspectives can be defined as: perceptual screens through which people interpret the world (worldview) and which guides them in acting (management style) (van Asselt, 2000). Perspectives steer the individual and collective response, both content wise as process wise (what do people want to achieve, and how do they want to achieve it?), and in turn determine social support for strategies, policies and measures.

As we have seen in chapter four, within the Perspectives Method three active, stereotypical perspectives can be distinguished: the Hierarchist, Egalitarian and Individualist[31]. Applied to water management (Hoekstra, 1998b; van Asselt et al., 2001; Middelkoop et al., 2004; Valkering et al., 2008b; Offermans et al., 2011b), the Hierarchist believes in controlling nature and water, high government responsibilities, the importance of research and expert knowledge. Water is mainly seen as a threat to human safety. A sustainable water management strategy highlights safety and flood control, and leaves space for some economic and natural development. As a consequence, preferred water policy options are: 'Building dikes', 'Leveling up or widening dikes', and 'Channeling'. Egalitarians on the other hand, prioritize ecological recovery and natural development. They urge for more space for nature, water and natural developments. Society has gone too far in controlling nature, or even thinking it is able to control it. They call for participatory decision making processes with a more equal voice for everyone. Also the needs of animals and plants should be seriously considered. As a consequence, preferred water policy options are 'Room for the river', decreasing human demands, relocation at higher areas, and precautionary actions. Individualists adhere to a more optimistic point of view. They do not approach water as a threat but as a substance offering great opportunities in terms of economy,

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[31] Besides these active perspectives, a passive, fourth perspective the Fatalist is distinguished. As the Fatalists approaches life as a lottery in which everything is predetermined and in which the course of life cannot be influenced, we regard this perspective redundant in policy research. However, this does not mean that Fatalists cannot be present in society (see Offermans, 2010a; Offermans *et al.*, 2011a). Offermans (2010a) advises to include the Fatalist into the Perspectives method. However, as Fatalists in general do not ventilate their opinion publicly we found it very hard to recognize any Fatalistic characteristics in history. They may have been present in history, but the present methodology does not allow for recognizing them retrospectively.

images, creativity, self development and recreation. They claim for an adaptation approach, great trust in technology and a liberal market. Corresponding with their beliefs, their preferred water policies focus on innovative projects, like 'Amphibian living' (buildings or infrastructures suited both to float on the water surface as well as to be on solid ground), 'Living on water', and 'Building off shore islands'.

Following these general descriptions, Offermans et al. (2011b) developed a method to operationalize perspectives on water management and make them measurable (Valkering et al., 2008a; Valkering, 2009). This method embraces the so called perspectives map (see table 10) existing of eight beliefs[32] (first column) followed by three different perspectivistic interpretations (second-fourth column). To measure perspectives one needs to mark interpretations for beliefs according to own values or values as found in reports in an interpretative way. Since real perspectives tend to be a mix of stereotypes (Thompson et al., 1990; Valkering et al., 2008b) for every belief (left column) people can mark 0, 1, 2 or even 3 interpretations. All interpretations for the eight beliefs together form a perspective (for more information see Offermans et al., 2011b). The sum per column offers a score for each perspective. This score is normalized to three, translated into x- and y values and plotted in a standardized triangle (see Figure 11, chapter 2 and 4). By visualizing perspectives, perspective change can be indicated and related to changing social support for water management strategies. Although not articulated as such, this method fits nicely within a social psychological expectancy-value framework that models attitudes as the sum of beliefs about an object (Stedman and Hammer, 2006). In society different perspectives occur, for example because different stakeholder groups have different objectives and interests, and as we have seen in chapter four, within this broad spectrum of perspectives a dominant perspective and (one or more) undercurrents can be distinguished (Valkering et al., 2008b). Because of perspective's dynamic nature, the interpretation of beliefs may change over time, as well as the distribution between dominant perspectives and undercurrent(s) (Valkering et al., 2012). Eventually, an undercurrent may become dominant at costs of the previous dominant perspective. Perspectives and the distribution between dominant perspective and undercurrent change due to surprises (Thompson et al., 1990; Verweij et al., 2006; Valkering et al., 2008b) that are events (like disasters, floods, new evidence), developments (like changing conditions, economic decline) and occurrences (possibly catalyzed by people or the media) which indicate a mismatch between expectations and reality. Besides, events may function as a reproduction mechanism, confirming once expectations about reality and hence enforcing the perspective. An accumulation of surprises and a

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[32] In the pilot phase of the project (see chapter 2) we analyzed perspective changes in water management history in the case study of the Meuse valley in the Netherlands in a participatory stakeholder workshop (Valkering, 2007). To analyze the extent to which those results match with the results of this chapter, we decided to use the same perspectives map as during the pilot. This map is very comparable, but slightly less extended than the one we use in the other chapters of this thesis. We expect no differences in methodological lessons between the use of this pilot perspectives map and the newer one.

lack of reproduction mechanisms may lead to a changing dominant perspective and the social support for a given water management strategy may also change. To avoid protests, indefensible situations or other difficulties concerning the implementation of a strategy, the social robustness of a strategy needs to be tested in advance. A robust strategy scores well under different perspectivistic and climatic futures. This makes the water system not only climate proof (able to deal with possible consequences of climate change), but also future proof as it will simultaneously be able to cope with social uncertainties and perspective changes (Haasnoot et al., 2011; Offermans et al., 2011b)

Table 10: The perspectives map wherein perspectives of Cultural Theory are translated to water. The shaded cells refer to the dominant Dutch perspective in the period between 1900 and 1960. This interpretation is done by the first author of this article. Within the social sciences, a common method to guarantee a minimum level of objectivity is the inter-evaluator reliability test. In this test, a second (and if desired a third or fourth) person repeats part of the analysis done by the first researcher. The interpretations made by the different researchers should match for at least 80% to allow the analysis to be reliable. The inter-evaluator reliability of this analysis is performed by a second researcher and equals 92 %.

	Hierarchist	Egalitarian	Individualist
Water function priority	**Discharge** of water, ice and sedimentation	Source of **rest**, space and nature	Source of **prosperity & self development**: important for the Dutch' image
Trust in technology	**Moderately**; however I think it is important to investigate potential consequen-ces and to assure that application is not too large-scale	**Low**. Risks are too high. We should deal very carefully with technologies. I prefer behavioral changes over the use of technology	**Large**. I see opportunities regarding the use of innovative technologies. Available technologies should be implemented quickly & at a large scale
Climate change	**Average** trends, as predicted and forecasted by experts	**Extreme** trends; climate will change even more drastically than thought right now	**Minimal** trends; I do not think that climate will change clearly
Economic context	**Average trends,** following business as usual patterns. I do not expect deviations from current trends as extrapolated by experts	**Minimal** growth & possibly decline. I think population & economic growth, pressure on space will stabilize and possibly even decline after a while.	**Strong growth.** I think that population numbers in the Netherlands will increase sharply, as well as demand for space and economy
Safety	**Flood prevention and control of discharge**	Via **avoidance** of flood prone areas and acceptation of water	Via **adaptation** to water by utilizing opportunities **& innovation**
Principle of spatial planning	**Water follows**; water follows functions, preservation of existing space	**Water steers**; functions follow water. Give up space if necessary	**Water offers opportu-nities**; functions utilize water. Creation of space on and around the water
Responsibility	**National Government**	**Regional** governments and NGOs, in fact everybody contributes its own mite	Private companies and in risky areas (for example in flood plains) individuals
Decision making based on	Norm standards by **expert knowledge** and research	**Participatory** processes with input of all stakeholders	Functioning of the **free market.** Cost-benefit analyses determine best choices

To gain more information on surprises, perspective changes and the use of the Perspectives Method for policy relevant research, we conducted a perspectivistic analysis of water management in the Netherlands as from 1900. A stepwise procedure to select and organize information about Dutch water management history was followed. In general, information regarding Dutch water management history is widely available. Approaching this information from a perspectivistic point of view however, is rather new. It is not our purpose to present a comprehensive overview of developments in Dutch water management history, but to analyze the most important developments in terms of perspective change and changing social support for strategies. To that end, we read one of the most well known detailed historical overviews about Dutch water management history; Gerard van der Ven's book 'man-made lowlands' (van de Ven, 2004). Further, we read van Heezik (2006) wherein historical developments and citizen responses are described in an integrated and detailed way, Van der Brugge (2009), focusing on transition dynamics in Dutch water management, and The Netherlands Committee of the International Association of Hydrological Sciences (NHV and IAHS, 1998), providing an overview of human interventions in natural conditions in the Netherlands. In every book we read the relevant sections (about water management between 1900 and now) and wrote down the topics, developments and events that were discussed in the literature. Later on we merged this list into an extensive Table of 16 pages, indicating what happened, when it happened, how the policy and societal responses are described in the literature, and whether we identified the event or development as a surprise or reproduction mechanism. While merging the list, we removed items that were only mentioned in one literature source, unless we had the impression that the mentioned events played an important role in perspective change and changing social support. Later on, we used the perspectives map (see table 10) according to the procedure mentioned before, to categorize and visualize these responses into perspectives and time frames.

5.2   Changing Perspectives on water management in the Netherlands

In this section we present major developments in Dutch water management as from the 20th century. Changing perspectives in society and policy, and the consequences of these paradigm shifts for (support for) water management strategies, are the central focus point. Of course, it is impossible to summarize Dutch water management history extensively in one chapter. It is explicitly not our aim to be comprehensive in our historical description, but to withdraw lessons for changing perspectives and policy support. Hence we will focus on those events and developments that demonstrate the dynamic nature of perspectives and their consequences for water management. Summarized, developments in Dutch water management in the 20th century can be divided in three different periods with different dominant perspectives on water (see Figure 11-13).
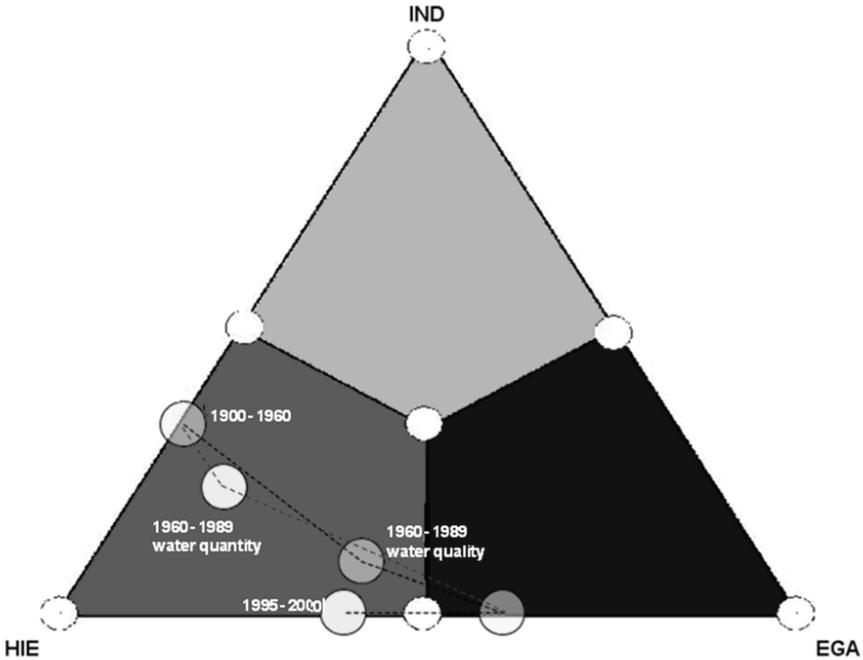
Figure 11 Perspectives triangle with Hierarchism (Hie), Egalitarism (Ega) and Individualism (Ind) and the transition path of the dominant perspective in the Netherlands from 1900 till 2000. The dots are gained through summing up the scores per column in the perspectives map (see table 10), normalize them to three and transform them into x and y-values on a triangle (see footnote 10). The shift from one period to another does not represent a stochastic movement. Perspectives change gradually.

1900-1960: Hierarchism-Individualism with an emphasis on manipulability, progress and technological optimism. This period represents the heyday of channeling and controlling the river flow and discharge. It was characterized by belief in the manipulability of natural systems, progress, technological optimism and trust in policy making and expert knowledge. Water and nature can be controlled and used by society which would result in a desirable situation. The Zuiderzee project (closing off the IJsselmeer Dam and reclaiming parts of the former Zuiderzee) is an outcome of this policy which was highly inspired by a Hierarchical-Individualistic perspective. Problems (floods, droughts, soil subsidence and later salinization) were explained through the infantile state of the normalization activities and waste water was purified instead of reduced or combated at its source. Water quality problems were solved within the traditional framework of control wherein a strong Egalitarian voice was missing. Following cultural theory, a Hierarchical-Individualist perspective is vulnerable (likely to be surprised) for ecological or technological disasters and increasing inequality. As from the 1920s an Egalitarian undercurrent with their typical focus on prevention and

detection of risks started to arise and grew under influence of increased connection to nature and natural values (as a consequence of spending more free time outdoor resulting from free Saturdays and paid holidays) and removal of natural areas to make space for the Rotterdam Harbor. Following the Perspectives Method, these were warning signs towards a more Egalitarian period, wherein the paradigm of control and technological optimism would loose support. Of course, whether or not the Egalitarian undercurrent would grow and become dominant is not predictable. However, certain events and developments catalyze specific undercurrents that may threat the dominant perspective and facilitates the undercurrent. Warning signs that happened in the period described below could have been noticed as surprises leading to decreasing support for normalization activities and dike strengthening and a growth of the Egalitarian undercurrent. Below we give an example on how to adapt to this situation to prevent the lost of support or to adapt policy in such a way that it remains robust.

1960-1989 Towards more Egalitarism and divergence of water quality and water quantity issues. A general trend with less faith in progress and growth is paralleled with different development pathways for the water quality and water quantity domain. Perspectives regarding water quality issues moved earlier towards a more Egalitarian oriented approach than in the water quantity domain. A number of visible calamities, worrisome publications, increased public involvement and a general contextual trend wherein environmental protection played an important role led to increased resistance against the Hierarchical-Individualistic paradigm of economic prosperity and control. A political shift towards a centre-left oriented coalition brought an ecology oriented approach into the policy field. From a perspectives point of view, decreasing support for dike related measures and stronger demand for spatial, environmentally friendly measures could have been expected. Therefore, a different response to the protests resulting from removal of natural areas would have been advisable. Of course, as the dominant perspective was still Hierarchical, the final outcome (removal of natural areas in favor of Rotterdam's harbor) is defendable. However, neglecting the (growing) Egalitarian undercurrent did not contribute to increased robustness of the policies. To reassure Egalitarians, to meet their concerns and to act in a way supportive for the Egalitarian perspective, compensation areas could have been sought. New natural area could have been developed elsewhere or guarantees could have been given to protect other, already existing natural areas. In the early 1980s, the economic recession tempered the attention for environmental issues and showed that the paradigm of economic growth also had some weaknesses. In the late 1980s, environmental calamities (e.g. foam covered rivers and lakes, starving fish, red colorization of the Rhine and the Chernobyl disaster) brought the societal and policy attention back to environmental issues and ecologically friendly ways of managing water. Combined with salinization problems, confronting publications like "limits to growth" and "silent

spring" and the so called policy plan "Stork[33]", water distribution was put in a more Egalitarian context with a stronger focus on preservation and restoration of natural values while simultaneously guaranteeing safety.

	Hierarchism	Egalitarism	Individualism	Hierarchism	Egalitarism	Individualism
Water function priority	Discharge of water, ice and sedimentation	A source of rest, space, nature	A source of prosperity, development	Discharge of water, ice and sedimentation	A source of rest, space, nature	A source of prosperity, development
Trust in technology	Moderately	Low	Large	Moderately	Low	Large
Climate change	Average trends	Extreme trends	Minimal trends	Average trends	Extreme trends	Minimal trends
Economic context	Average trends	Minimal growth or decline	Strong growth	Average trends	Minimal growth or decline	Strong growth
Safety	Flood prevention and control of discharge	Avoidance of flood prone areas, accept water	Adaptation, using opportunities and innovation	Flood prevention and control of discharge	Avoidance of flood prone areas, accept water	Adaptation, using opportunities and innovation
spatial planning	Water follows	Water steers	Water offers opportunities	Water follows	Water steers	Water offers opportunities
Responsibility	National government	Regional governments, NGOs	Companies and individuals	National government	Regional governments, NGOs	Companies And individuals
Base decision making on	Norms, experts and research	Participatory processes	Free market, (cost-benefit)	Norms, experts and research	Participatory processes	Free market, (cost-benefit)

Water quality domain 1960-1989   **Water quantity domain 1960-1989**

Figure 12 Perspective maps for the period 1960-1989 for the water quality domain (left side) and the water quantity domain (right side).

1989-2000 Movement towards Egalitarism turned towards Hierarchism. In the beginning of the 1990s the trend towards Egalitarism became more intense. Plan Stork initiated the restoration of side channels, natural development and a disconnection between agriculture and nature. The extremely high water levels in the major rivers in 1993 functioned as a reproduction mechanism in the water policy domain, resulting in a continuation of lowering the floodplains and developing nature. Citizens however, were surprised by the emotional, physical and financial consequences of the overflowed river banks and after the rejection of controlling policy options in the previous period, citizens shifted towards a more Hierarchical perspective with support for dike reinforcements again. In 1995 the Netherlands had to contend again with high water levels in the rivers which led to increased faith in dikes (policy and citizens) and natural development (mainly on a policy level). According to policy makers, dikes alone would not be enough to guarantee safety on the long term. However, for citizens safety was priority number one again; and the ecological perspective as well as providing more space for nature and water was given lower priority. Although both

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[33] 'Plan Ooievaar' in Dutch was the winning idea in a spatial development competition. This plan intended to combine flood protection with natural development while simultaneously improving agriculture and preserving historical values. It initiated the restoration of side channels and flood plains, and a disconnection between nature and agriculture.

citizens and policy makers shifted towards Hierarchism, on a policy level more importance kept to be given to the Egalitarian approach of natural development.

Initial movement towards Egalitarism 1989-1993

	Hierarchism	Egalitarism	Individualism
Water function priority	Discharge of water, ice and sedimentation	A source of rest, space, nature	A source of prosperity, development
Trust in technology	Moderately	Low	Large
Climate change	Average trends	Extreme trends	Minimal trends
Economic context	Average trends	Minimal growth or decline	Strong growth
Safety	Flood prevention and control of discharge	Avoidance of flood prone areas, accept water	Adaptation, using opportunities and innovation
spatial planning	Water follows	Water steers	Water offers opportunities
Responsibility	National government	Regional governments, NGOs	Companies and individuals
Base decision making on	Norms, experts and research	Participatory processes	Free market, (cost-benefit)

Movement towards Hierarchism 1993-2000

	Hierarchism	Egalitarism	Individualism
Water function priority	Discharge of water, ice and sedimentation	A source of rest, space, nature	A source of prosperity, development
Trust in technology	Moderately	Low	Large
Climate change	Average trends	Extreme trends	Minimal trends
Economic context	Average trends	Minimal growth or decline	Strong growth
Safety	Flood prevention and control of discharge	Avoidance of flood prone areas, accept water	Adaptation, using opportunities and innovation
spatial planning	Water follows	Water steers	Water offers opportunities
Responsibility	National government	Regional governments, NGOs	Companies And individuals
Base decision making on	Norms, experts and research	Participatory processes	Free market, (cost-benefit)

Figure 13 Perspective maps for the period 1989-1993 (left side) and 1993-2000 (right side).

In the short historical overview above, we see that changing social support for water management strategies, and consequently policy changes, can be *initiated by stakeholders or policy makers*. Changes occurring in the 1960s are an example of the former: social groups, scientist and citizens protested against the bad ecological quality of the water system, which they perceived as inevitable side effect of the dominant water management strategy. Protest groups put more pressure on the policy arena, and policy makers realized that there was only very little social support to continue the Hierarchical-Individualistic management approach. Saeijs (who used to be director of the department of waterways and public work) wrote a new style policy document with attention for the ecological quality of rivers, natural restoration and water as starting point in spatial planning. This new strategy could count on more social support and became a new direction for water management and policy. However, also policy makers can take a leading role in perspective change by proposing a new policy. After the 1953 disaster flood, that resulted in the inundation of large parts of the provinces of Zeeland and South-Holland (over 1.800 people died and it caused enormous damage to houses and property), it were policy makers who convinced society about the necessity of highly innovative ways to combat the water. It was the start of the Delta works, and it took more than 40 years and billions of Euros to complete it.

We have also seen that *external events* played an important role in changing perspectives on water. Events, developments and persons ('Al Gore' effect) outside the water system and/or the chosen case-area (in our example the Dutch delta) had a major impact on people's perspective on water and the way water should be managed.

For example, in 1986 when contaminated fire extinguishing water leaked into the river Rhine near the Swiss Sandoz factory in Basel and all fish in a radius of 100 kilometers downstream died, this had an important effect on the way the Dutch perceived their rivers and waters. Other examples of external events and developments that had an effect on the Dutch water perspective are publications regarding the human use of natural resources, the Chernobyl explosion, and increased leisure time (free Saturdays). These developments led to a more Egalitarian oriented perspective in *general* (also given contextual developments like the post-war wave of democratization), but also to a more Egalitarian perspective on *water* which led to increased demand for ecologically friendlier ways to manage water.

Next, the *role of the media* in catalyzing perspective change should not be underestimated. The media (translating messages from policy makers, scientists and other stakeholders to the general public) had a great influence on the way people perceived developments and situations within the water system. By paying attention to certain aspects, and ignoring others, we have seen that the media was able to influence the popularity of the dominant perspective and the attractiveness of the undercurrent. In the 1970s when the department of waterways and public works decided to implement new dikes and reinforce existing dikes, the media started to pay attention to the bad ecological quality and the fact that historical buildings and typical landscapes would have to be destroyed in order to enforce and implement dikes. The department of waterways and public works was depicted as a driver of an everything destroying bulldozer (this campaign is known under the name "Atilla at the Bulldozer"), raising fierce citizen protest which contributed to strengthening of the Egalitarian undercurrent and decreasing the popularity of the Hierarchical-Individualistic dominant perspective and related strategies.

Further, we have seen that *visible events* were often mentioned as reason to induce citizen responses. We noticed that water pollution problems gained increased attention when pollution became visible by means of dying fish, foam, etcetera. Also, the destroyed appearance of the landscape after removing natural areas (in favor of the expansion of the port of Rotterdam), or after removing buildings to make space for dikes seemed to induce an unfettering of passions. Events that are not visible, but sensory in a different way also seemed powerful (for example the unpleasant smell of stationary surface water, or the strange taste of chlorinated drinking water). Visible and noticeable events and developments also seem to attract media attention (see previous aspect) which reinforces the power of these events for perspective change. It is interesting to approach the effects of climate change in this prospect. Climate change as such is an invisible process. The consequences of climate change (floods, drought, heat waves, changes in nature, etcetera) are the visible manifestations of a phenomenon. Because events (and especially the more visible ones) seem to have an important influence on people's perspective, future climate variability may be even more important for future perspective changes than climate change (also see Haasnoot *et al.*, 2011). It is hard to provide a blueprint with ingredients for perspective

change, because change is highly dependent on a specific context with a specific history, dominant perspective and undercurrents. However, in the past we have seen that a combination or accumulation of the following aspects contributed to perspective change: A. Events or calamities with a visible and supra-regional impact are more likely to induce perspective change than invisible events with a regional or local impact. B. Icons like people (e.g. Saeijs or Al Gore), media figures (like Atilla at the bulldozer), a group of persons (like the Club of Rome) and even reports (like plan 'Stork') with a contra dominant message. C. Available alternatives which can be thrown into society right after a surprise (for example the Delta plan already existed before the disaster flood of 1953, but was thrown into the public right thereafter) and D. Media attention.

Although many events functioned as surprise, we have also seen examples of events that functioned as reproduction mechanism. The *dominant perspective, undercurrent and timing* seem important factors to determine an event to function as a surprise or reproduction mechanism. First of all, the dominant perspective needs to be receptive of being surprised. A dominant Egalitarian perspective for example, won't easily being surprised by a dike breach since it does not have much trust in dikes anyway. Undercurrents -sometimes with help from appealing persons or the media (Atilla at the Bulldozer)- can seize the opportunity of an event to decrease support for the dominant perspective and increase support for its own (hence using the event as a reproduction mechanism for themselves and as a surprise for the dominant perspective). The timing and accumulation of events seem to play a role as well. Both the 1993 and 1995 high discharges were recognized by policy makers as solvable and explained thought the infantile state of the ecological restoration policies at those times, hence reinforcing the dominant perspective and increasing demand for spatial solutions. The sooner an event occurs after implementation, the smaller the chance that it will function as a surprise; it will be used as argument to justify the taken measures, which also happened after the events in the 1920s. Besides, an accumulation of events (as we have seen as from the 1960s) tended to change perspectives. After the first event, people may explain it away, the second event already increases concerns and every next event makes more and more people change their perspective (also see Thompson *et al.*, 1990; Valkering *et al.*, 2012).

The direction of change depended -amongst others- on *available undercurrents and the type of events* occurring. The Egalitarian undercurrent in the 1940s got nurtured by events eventually made it become dominant, hence shifting the dominant perspective. Following Cultural Theory it can be said that certain types of events, nurture certain undercurrents. For example, events regarding ecology, environmental pollution or biological values tend to reinforce the Egalitarian perspective (as happened in the 1960s). Floods or threats to human safety tend to Hierarchism (as happened in the 1990s). Examples of events resulting in strengthening the Individualist perspective were rather limited in recent water history. The 1953 flood can be seen as an event indicating that Hierarchism is not sufficient enough to guarantee safety, resulting in

more innovative, Individualistic ideas. We have also seen that perspectives changed in *different velocities* for different domains. Changes in the water quality and water quantity domain developed differently as both moved into an Egalitarian direction, however not simultaneously; the shift in the water quantity domain started later than in the water quality domain and it took around 50 years between the rise of an Egalitarian undercurrent (as from the 1930s) and the development of a dominant Egalitarian perspective (late 1980s, early 1990s).

5.3   The Perspectives Method; benefits for science and policy

Adopting a perspectives based approach on controversial societal and policy issues may be beneficial for scientists and policymakers. For the scientific community, historical analysis of water management through the Perspectives Method offers insight into the dynamic nature of perspectives. It provides knowledge about triggers for societal and policy change, as well as the direction of change. As such it provides an analytical tool to explore the effects of perspective changes under different future developments. Water management strategies can be tested under these various future developments which offers insight in opportunities and risks under specific, but changeable futures. The advantage of using Cultural Theory as starting point in our analysis is that it embraces a tested typology that is believed to be universal in time and space (Douglas, 1996). Hence we can assume future perspectives to be positioned somewhere within one of the stereotypical perspectives, or at a position wherein two or more perspectivistic characteristics are combined. The perspectives map has proven to be a workable tool to analyze, measure and visualize non-stereotypical perspectives on water. Besides, the high inter-evaluator-reliability regarding the interpretation of the map offers promising thoughts on its transparent and relatively objective character. However, simultaneously we should also acknowledge that the chosen beliefs in the perspectives map, as well as the equal weight given to the different beliefs, are far from objective. Different beliefs may have led to different scores for the perspectives. However, even though we acknowledge that more research is needed to verify the equal importance of the beliefs mentioned in the perspectives map, the main messages on (triggers for) change will probably remain the same. Further, although Cultural Theory is believed to be universally applicable, this is not necessarily the case for its translation to water. More research is needed to investigate the similarities and possible differences between Hierarchists, Egalitarians and Individualist from different countries over the world.

For policy makers the Perspectives Method is valuable because changing societal perspectives have a strong correlation with changing social and policy support for water management strategies. Ideally, a sustainable and robust water management strategy is able to cope with these changing perspectives, hence being acceptable under or adaptable to different perspective changes. The application of the

Perspectives Method to policy or concrete measures provides us with a better understanding of the social robustness of these water management strategies. For example, the policy implementation of floating buildings and infrastructures asks for a society with faith in technology, a focus on adaptation and the willingness to approach water as providing social and economic opportunities, or in terms of the Perspectives Method, a society where the Individualistic perspective is dominant, or at least widespread. Equally important, the Perspectives Method helps to identify perspective related risks that may possibly lead to decreased support. Such insights allow policy makers to prepare for and proactively anticipate on such risks in advance, for example by identifying alternatives, assuring the flexibility of a strategy, anticipating on growing undercurrents, or providing specific information. A future move towards individualism may be possible (like any move into any perspective). Innovative ideas (like an off-shore tulip-shaped island or floating constructions in Rotterdam) indicate growing Individualistic undercurrents. Improvements in the current economic situation and more space for private companies to get involved in innovative projects may catalyze a movement towards individualism. Policy makers may be heavily influenced by such a perspective shift, for example regarding the future management of lake IJssel. Natural restoration of its banks, or norm specified controlling of incoming and outgoing water (amongst others to control discharges of rivers like the IJssel) could possibly loose support in favor of (for example) osmotic energy generation. Another benefit of the Perspectives Method for policy makers is that the perspectives map can be used as basis for discussion and dialogue. When filled in by different stakeholders, it reveals similarities but also differences and shows on what beliefs disagreement exists. Identification of disagreement may be a first step towards a dialogue possibly leading to more synergetic and robust solutions. Besides, according to Pahl-Wostl *et al.* (2008) learning about differences and how to deal with differences constructively increases the social learning capacity of stakeholders in river basin management.

Further, it is good to realize that water management deals with a natural water system (the environment) in which policy targets need to be reached and a social system (society) wherein societal demands should be met. Both policy and societal demands should ideally be taken into account by the water management sector, resulting in four general future situations (see Figure 14). 1. A situation wherein water managers and policy makers reach their targets and wherein society is satisfied with the chosen strategies and outcomes (in general this was the situation till the first decade of the 20th century). In such a case it is likely that the chosen strategies will be continued. 2. A situation wherein the water managers and policy makers reach their targets, but wherein society is not satisfied (like in the late 1960s). Dependent on the intensity of dissatisfaction and the (prospected) time of it, strategies and policies may have to be changed or adapted. 3. A situation wherein the water managers and policy makers do not reach their targets, but wherein society is still satisfied (like in the late 1920s) it is likely that the chosen policies will be intensified or that additional measures will be implemented. 4. A situation wherein neither water managers and policy makers, nor

society is satisfied (in the late 1980s) in such a case changing strategies seem insurmountable.

	Water system targets reached	Water system targets not reached
Societal support	1. Continue First decade 20th century	3. Intensify Mid 1920s
No societal support	2. Change? Late 1960s	4. Change Late 1980s

Figure 14: Focusing at results in the water system (e.g. are the policymakers satisfied with the reached results?) and societal support, we can distinguish four situations. All of them occurred in Dutch water management history as from 1900.

5.4   Reflection

It is always easy to be right afterwards, but would things have gone differently in the 20th century with the knowledge we have today? One thing is clear: by making use of the Perspective method we could have foreseen that the technocratic approach of the early 20th century would not remain robust under an Egalitarian future. Especially since the late 1940s when the first Egalitarian undercurrents started to grow, the likeliness of an Egalitarian future increased, hence increasing the risk for the technocratic strategies to loose social support. A world wherein water and nature are controlled and wherein people believe in guaranteeing absolute safety, works well in a Hierarchical world. However, in an Egalitarian or Individualistic world this leads to problems (Offermans *et al.*, 2008). According to the Individualist, Hierarchical measures are too traditional and reactive. For them it would be better to use innovative techniques and treat water as an opportunity instead of a threat. Egalitarians (as is also proved by history) would reject the regulation of nature and water, because they would deserve more space. Besides, Egalitarians would argue, it is better to focus on prevention instead of controlling the consequences of for example climate change. Exploring the future from a perspectivistic point of view would have given the opportunity to think about ways to anticipate on these Egalitarian undercurrents. For example, instead of increasing the number of purification plants, it would have been wise also to focus on preventive measures. Also, the disappearance of the natural areas for the benefit of the harbor of Rotterdam in the last century could have been tackled in a different way, for example by compensating lost ecological values and protect these values in other areas. An approach that nowadays is tested in

the construction of the Second Maasvlakte nearby Rotterdam. Regional projects to protect valuable natural areas would have sat minds on rest, providing protesters with less reason to worry and protest. Of course, the Perspectives Method would not have prevented all disturbances or worries and it is very hard (if not, impossible) to identify a single strategy which will remain robust under all possible climate scenario's and all possible perspectivistic futures. However, it provides us with insight in risks and threats of different strategies, hence giving the opportunity to anticipate on possible futures and keep different options open (being flexible enough to adapt). Our operationalisation of the Perspectives Method will be further developed to more specifically indicate risks attached to the present dominant perspective and possibilities, opportunities and threats for the future.

Chapter 6

THE DUTCH DOMINANT PERSPECTIVE ON WATER; AN EXPLORATION OF PRESENT AND FUTURE SUPPORT FOR RIVER MANAGEMENT

6 INTRODUCTION

As we have seen in the previous chapter, water management represents man made work that is inherently connected to a subjective range of beliefs, priorities and values. Facts do not determine behavior so much as perceptions about facts, mediated by a range of factors such as public understanding of complex systems and the role of the media (Niemeyer, Petts and Hobson, 2005). Our view on environmental issues and the desirability of different goals and objectives is a consequence of what we have learned throughout history and how we currently evaluate and balance people, planet and profit. These views, or perspectives, tend to be dynamic and changeable over time. A sustainable water management strategy is able to cope with uncertainties and changes in our environmental and social system (see chapter 2 and 5). A strategy that -under certain future conditions- may become unacceptable is lacking social robustness. Once a strategy –or its effects on the water system- becomes unacceptable, public support may be lost that forces policy makers into sudden and oftentimes expensive decisions. Therefore, it is important to analyze a strategy's current and future robustness, and taking a diverse palette of perspectives into account. In this chapter the results of our empirical research to assess and analyze the present dominant perspective on water in the Netherlands will be presented. Particular attention will be paid to the question in how far the policy perspective (Deltacommissie, 2008; DeltaCommittee, 2008) corresponds with the dominant perspective of Dutch water professionals. This tells us more about the present social robustness of the measures in the Delta report. The dominant perspective on water among Dutch water professionals was measured via a questionnaire (with a Cronbach's alpha[34] of 0.83 and a 95% confidence interval) and analyzed with SPSS. The Delta Report perspective was identified by reading it in its full length and completing the Perspectives map (see previous chapters). We recapitulate the Perspectives Method in the first part of this chapter, followed by explaining the methodology and used procedures. Thereafter the results will be presented, divided into a description of the dominant perspective inherent to the Delta report (the policy perspective) and the dominant perspective among Dutch water professionals as derived from the questionnaire. Later we compare these two perspectives to analyze the extent to which the Delta report can count on support now, but also in the future. Further, we will illustrate that our methodology contributes to a more constructive

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[34] The Cronbach's Alpha is a measure for the internal consistency of a questionnaire. It calculates whether different questions in a questionnaire measure the same aspect (perspectives in this thesis). Questionnaires with a Cronbachs Alpha of 0.8 or higher are usually considered to be internally consistent.

dialogue as it provides better insight into the specific beliefs where upon (dis)agreement exists. In other words: knowledge on perspectives brings us one step further in understanding why disagreement exists, allowing a more concrete dialogue with attention for different perspectivistic beliefs ideally resulting in synergetic, and hence more robust solutions (also see Verweij *et al.*, 2006). We conclude with reflecting upon aspects that may be useful to construct a socially robust water management strategy.

6.1   Theoretical Background

In order to measure perspectives, that are often described as 'perceptual screens through which people interpret the world and which guides them in acting' (van Asselt, 2000) we need a typology that captures a diversity of different personalities into a limited number of segments. In chapter 3 we compared several typologies and decided to use the Perspectives Method -which is derived from Cultural Theory (Douglas, 1970; Thompson et al., 1990; Verweij et al., 2006)- as a segmentation (or classification) system. Segmentation constructs groups with comparable persons that allows for finding regularities that help explaining and even predicting (or retrodicting) the cognitive human construction of meaning (Thompson et al., 1990; Offermans, 2010b). Cultural Theory was initially developed to classify, analyze and interpret communities' behavior according to their (religious) rituals (Douglas, 1970), but has also been used to analyze different views on nature and resources (Thompson et al., 1990), uncertainty (Rayner, 1992; Renn, 1992; Rotmans and de Vries, 1997; van Asselt, 2000); climate change (Janssen and de Vries, 1998; Pendergraft, 1998; O'Riordan and Jordan, 1999; Verweij et al., 2006), car use (Steg and Sievers, 2000), and transport risks (Oltedal and Rundmo, 2006). Further, it is a useful typology to interpret and classify perspectives on water (Hoekstra, 1998b; Middelkoop et al., 2004; Valkering et al., 2008b) [35]. Cultural Theory distinguishes four perspectives through which people interpret the world (a worldview) and which guides them in acting (a management style) (van Asselt, 2000); the Hierarchist, Egalitarian, Individualist and Fatalist. Applied to water, the Hierarchist believes in controlling water and nature, government responsibilities, research and expert knowledge. Water is mainly seen as a threat to human safety. A sustainable water system highlights safety and flood prevention and leaves space for some economic and natural development. As a consequence, preferred water policy options would be 'Dike building', 'Raising or widening dikes', and 'Channeling' (Offermans et al., 2011b). Egalitarians on the other hand, prioritize ecological recovery and natural development. More space should be given to nature, and water. They prefer participatory decision-making processes with equal voices for

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[35] Offermans (2010a) compared seven typologies on criteria for good segmentation (McDonald, 1995; Hessing and Reuling, 2003; Geest et al., 2008) and concluded that Cultural Theory and Mood consumption (Oustrup and Flaven, n.y.) scored best on the aforementioned criteria (see chapter 3).

everyone. The needs of animals and plants should also be seriously considered. As a consequence, preferred water policy options are "Room for water", decrease in human demands, relocation to higher areas and precautionary actions. A sustainable water system should be management along principles of strong sustainability (Williams and Millington, 2004) with space for natural and ecological processes and reconsideration of human demands (Offermans et al., 2011b). Individualists adhere to a more opportunistic point of view. They do not approach water as a threat but as an opportunity in terms of economy, creativity, self-development and recreation. They prefer an adaptation approach, high trust in technology and a liberal market. In correspondence with their beliefs, their preferred water management policies focus on innovative projects, such as 'Amphibian living', 'Living on water' and 'Building offshore islands'. A sustainable water system is inspired by weak sustainability (Williams and Millington, 2004) with a focus on economic opportunities and innovative, technological solutions to unsustainable situations (Offermans et al., 2011b). The fourth perspective, the Fatalist is not concerned about the future and sees life as a lottery. Everything is predetermined by destiny, which cannot be influenced. One has to enjoy every day and make the most of the present. Short-term pleasure and enjoyment are very important and adjusting behavior to prevent future problems is useless and therefore not smart. Developments like climate change or technological innovation are inherently vague; information about the past does not say anything about the future. Today developments may follow trend A, tomorrow it may be B or C. Related to water management, they tend to deny the usefulness of any measure and advocate a do-nothing approach.

These stereotypical perspectives are useful as a typology and for scenario analysis wherein exploration of a broad future is fundamental. In reality however, perspectives tend to exist of a combination of stereotypical elements (Thompson et al., 1990; Verweij et al., 2006; Valkering et al., 2008b; Offermans et al., 2011b). Decomposing the perspectives into a set of 15 beliefs (in our case: regarding water management), allows perspectives to become operationalised and to endorse beliefs of various stereotypical perspectives (Douglas, 1970; Thompson et al., 1990; Douglas, 1996; Verweij et al., 2006; Valkering et al., 2008a). To structure these beliefs we used three categories; beliefs on a worldview level, focusing on fundamental values and beliefs upon which uncertainty is interpreted (encompassing five beliefs), beliefs on a management style-content level, directed towards guiding principles in taking action (6 beliefs) and beliefs on a management style process level (4 beliefs) directed towards responsibilities involved in managing a water system (Valkering et al., 2011; Valkering et al., 2012). The beliefs on a management style-content and –process level come together in a management style (for more information see chapter 4).

Variety and diversity do not only exist within one single perspective, but also within groups on a societal level. In society different perspectives occur, for example because different stakeholders have different objectives, interests and cultural backgrounds. Following our conceptual model of societal perspective dynamics, a dominant

perspective and (one or more) undercurrents can be distinguished within this spectrum (Van der Brugge et al., 2005; Loorbach, 2007; Valkering et al., 2008b; van der Brugge, 2009; Valkering et al., 2011; Valkering et al., 2012). A dominant perspective consists of interpretations of beliefs upon which the majority of people in a group (family, policy, nation) explicitly or implicitly agree (Valkering et al., 2008b; Valkering et al., 2011; Offermans and Corvers, 2012). For example a Hierarchical idea of control and regulation resulting in a preference to reinforce dikes. Undercurrents refer to interpretations of beliefs according to the minority of people in a group or a subgroup, for example an Individualistic perspective with focus on opportunities and innovation and a strong preference for 'Amphibian living'. Because of perspective's dynamic nature, the interpretation of beliefs may change over time, as well as the relative dominance of dominant perspectives and undercurrent(s) (Valkering et al., 2011). Eventually, an undercurrent may become dominant at costs of the previous dominant perspective. In our example this would imply loosing support for dike reinforcements and growing popularity and attention for amphibian infrastructures. Perspectives and the relative dominance of dominant perspective and undercurrent change due to an accumulation of surprises and a lack of reproduction mechanisms (see chapter 4 or Thompson et al., 1990; Verweij et al., 2006; Valkering et al., 2008b). A changing dominant perspective may change the social support for certain water management strategies. Present undercurrents are thus important as they may indicate in which direction the dominant perspective might move in the future. To avoid protests, indefensible situations or other difficulties concerning the implementation of a strategy, the strategy needs to be and remain acceptable in the present and future. The social robustness of a strategy -also in the light of existing undercurrents- thus needs to be tested in advance (see Offermans et al., 2011a for more information). This contributes to make the water system not only climate proof (able to deal with possible consequences of climate change), but also future proof as it will simultaneously be able to cope with social uncertainties and perspective changes (Haasnoot et al., 2011; Offermans et al., 2011b; Offermans and Corvers, 2012).

6.2   Methodology

To analyze the extent to which the professional- and policy perspective match -now and in the future- we first need to identify the present dominant perspective on water in the Netherlands. To that end we analyzed a recent Dutch policy document (the 2008 Delta report) and we set up an online questionnaire targeted at Dutch water professionals. The perspectives map of table 11 was used to analyze the perspectives inherent to the Delta policy report and as a foundation for the development of the online questionnaire.

6.2.1 Measuring the Delta Policy report

The Delta report was produced by a committee appointed by the Dutch government to explore the possibilities to adapt to possible consequences of climate change on the long term and in a sustainable way. The Delta report includes 12 recommendations to keep the Netherlands safe and sustainable. We analyzed this report thoroughly by reading it in its full length and marking sentences that had a typical perspectivistic message, for example;

"Regarding the effects of climate change on sea levels and discharges the Delta committee considers the upper probabilities in climate scenarios" (Deltacommissie, 2008, p.27)[36] [Egalitarian]

"Climate change as such does not per definition function as a threat. On the contrary: new opportunities will be created as well" (Deltacommissie, 2008, p.27) [Individualistic]

"Our water related knowledge and our capacity to let water flow the way we want it to flow has been increased substantially over the past centuries. Therefore we trust in time, knowledge and resources to keep the Netherlands prosperous and safe while guaranteeing the availability of enough clean and fresh water for humans and nature" *(Deltacommissie, 2008, p. 37*) [Hierarchical]

"Circumstances and prospects will change continuously" (Deltacommissie, 2008 p. 97)[Fatalism[37]]

The marked sentences were used -following interpretative content analysis (Wester and Atteveldt, 2006)- in an interpretative way to mark cells in the perspectives map (Valkering et al., 2008b; Valkering et al., 2009; Offermans et al., 2011b; Valkering et al., 2011; Offermans and Corvers, 2012; Valkering et al., 2012). The map includes a set of beliefs on Dutch river management (second column) and for each belief, the Hierarchical, Egalitarian, Individualistic and Fatalistic positions are given (columns 3-5). To map a perspective, one decides for each belief which position is supported (having the possibility to mark none, one, two, three or four positions per belief). The combination of positions for all beliefs together represents a perspective, which consequently can be visualized in the perspectives pyramid (see figure 19-21) thereby indicating the similarities of the measured perspective with the four archetypes. The corners of this pyramid correspond to the extreme, stereotypical positions; but every combination of beliefs can be mapped in this pyramid (see Offermans et al., 2011b; Valkering et al., 2011; Offermans and Corvers, 2012, and chapter 4). The perspectives

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[36] Please be aware that the Dutch and English versions of the report have a slightly different set-up. The quotes provided in this paper are translated from the Dutch version into English by the author of this thesis.
[37] There were only very few examples of Fatalistic sentences in the report, which is not surprising as the Delta report is a policy report focused at efforts to keep the Netherlands safe and sustainable. Fatalists will deny that these efforts (or any efforts) may be beneficial.

map was used to analyze the dominant perspective in the policy document of the Delta report and as foundation for the development of an online questionnaire (see next paragraph).

6.2.2   Development of the questionnaire and responses

The questionnaire consisted of 15 beliefs-related questions to measure the present dominant perspective on water among Dutch water professionals (see appendix 2). These questions were reviewed by five experts from our interdisciplinary project team who have been working on projects regarding the Perspectives Method in relation to water issues for at least 8 years now. These experts notably reviewed the extent to which the answer categories correctly reflected the four perspectivistic interpretations. One of the project members developed an online interface for the questionnaire. The link to this webpage including an invitation to fill in the questionnaire was spread through newsletters, networks like LinkedIn, and randomly through personal e-mail correspondence. The questionnaire was filled in and returned by 152 respondents with an average age of 44. Different professional backgrounds were represented (water board districts, ministry of waterways and public works, water research organizations, consultancy, NGOs, contractors) (see table 12). The majority (77%) has had an academic education, 76% of the respondents were men, 24% women. Respondents were evenly spread throughout the Netherlands in terms of their place of residence, measured on zip code[38] level.

We applied the Anova-test (Analysis Of Variance test) to identify significant differences between respondents with different professional backgrounds. Respondents from government and consultancy answered the beliefs on water supply and drought in a more Individualistic way than researchers linked to a university (who had generally a more Egalitarian view on these issues)[39]. Consultants and Government employees were more often convinced that water scarcity and drought problems could best be solved through water pricing and the free market (market driven approach). Academia on the other hand preferred a fair water distribution between nature and humans indicating a supply driven approach. Besides these two differences, no significant differences between groups with different backgrounds could be identified. As the differences between backgrounds were neglectable, we could stop the questionnaire intake after receiving 152 responses wherein professionals from different backgrounds were represented in a way comparable to the overall population (see table 12). Given 152 returned questionnaires, assuming a standard dispersion of 50%, and following a

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[38] The Netherlands are divided in 90 different zip code regions. 58 were directly covered, 11 respondents did not specify their zip code area. The 58 areas were nicely spread throughout the Netherlands (in terms of north- south/east- west).

[39] Water supply: $F= 2.664$, $P=0.013$. Drought: $F= 2.782$, $P= 0.010$. Simplified, the F-value is calculated by dividing the difference in mean between the identified groups by the differences in mean within the groups. The higher (and more removed from 1) the F-value is, the more the different groups differ. This difference is significant if the P-value is equal to, or lower than 0.05

95% confidence interval with a 5% exceedance probability offers an error margin of
6.7%. This means that if we subtract and add up 1.645 times the error margin from all
presented results this would encompass 95% of all results that are expected to be
found in a repeated sample survey. Or, in other words; there is a 95% chance that our
sample reflects the total population of water professionals correctly, with a maximum
standard deviation of 6.7%. To identify a dominant perspective and one or more
undercurrents we used a clustering option within SPSS. As most variables had a
nominal character we used the Two-Step clustering method. This method offered two
sets of answer sequences and decided for every respondent whether he/she has more
answers in common with the first set, the second or none (a rest group that could not
be divided into a coherent answer sequence).

Table 11. The perspectives map wherein perspectives of Cultural Theory are translated to water. To map a
perspective, one decides for each belief which position is supported (having the possibility to mark none,
one, two, three or four positions per belief).

		Hierarchist	Egalitarian	Individualist	Fatalist
Worldview	Value of water	Discharge of water, ice and sedimentation	A source of rest, space and nature	A source of material prosperity & self development: important for the Dutch' image	Making my life more comfortable
	Nature of problems	Seriously, but manageable	Seriously and hardly manageable	Something we do not need to worry about	Useless to think about or prevent
	Climate change	Average trends, as predicted and forecasted by experts	Extreme trends; climate will change even more drastically than thought right now	Minimal trends; I do not think that climate will change clearly	Not identifiable
	Trust in technology	Moderately; it is important to thoroughly investigate potential consequences. Application should not be too large-scale	Low. Risks are too high. I prefer behavioral changes over the use of technology	Large. I mainly see opportunities. Available technologies should be implemented quickly and at a large scale	Not clear, results from the past do not give guarantees for the future
	Important values	Structure and stability	Harmony and solidarity	Freedom and independency	Comfort and pleasure
Management style- content	Water function priority	Preservation of current functions	Ecological recovery, compensation and nature development	Economic functions, self development and innovation	Comfort, providing me with enough water
	Safety	Flood prevention and	Via avoidance of flood prone areas	Via adaptation to water by utilizing	Interference is useless.

		control of discharge	and acceptation of water	opportunities & innovation	
	Response to drought	Following guidelines and laws	Fair distribution between nature and human consumption	Market forces; rising prices in times of scarcity	No need to think about it. It will be alright
	Water supply	Demand driven	Supply driven	Market driven	Not different from now
	Water system organization	Control and regulation	Natural development and resilience	Opportunism and innovative technologies	Passivity, human interference is useless
	Principle of spatial planning	Water follows; water follows functions, preservation of existing space	Water steers; functions follow water. Give up space if necessary	Water offers opportunities; functions utilize water. Creation of space on and around the water	Water should be used to make fun
Management style process	**Damage due to flooding**	Should be prevented and otherwise refunded by government	Is a matter of solidarity; everyone is financially responsible	Is a matter of individual responsibility. Known risk of living in flood prone areas. Insurances	I do not want to look ahead for that
	Responsibility	National Government	Regional governments and NGOs, in fact everybody contributes its own mite	Private companies and in risky areas (for example in flood plains) individuals	I can make decisions myself
	Decision making based on	Norm standards by expert knowledge and research	Participatory processes with input from all stakeholders	Functioning of the free market and privatization. Cost-benefit analyses determine best choices	Not applicable: it is a waste of time
	Identity; water contributes to	National identity and traditional export product	Catchment identity and solidarity	International identity and innovative image	My own identity and pleasure

Table 12. Different professional backgrounds within the population of Water professionals in the Netherlands (estimation and representation in the questionnaire)

Professional background	Percentage in population (estimation)	Percentage in questionnaire
Water board districts	39%	25%
Ministry of waterways and public works	17%	18%
Water researcher (universities)	9%	15%
Water researchers (other than universities)	6%	6%
Governments (local or provincial)	9%	11%
Consultancy and advice	9%	15%
Contractors	9%	1%
NGOs with water objectives	2%	5%

6.2.3   Questionnaire setup

Each belief from the perspectives map was rephrased into a statement or question (see Figure 15) with four different (perspectivistic) answer options. Contrary to common social sciences methods, we sometimes used answer categories consisting of two or more parts. This is for example the case for the third (Individualistic) answer option in Figure 15 which indicates that water is both a source of material prosperity as well as a source of self development. Social scientific research methods would argue that this is a wrong way of offering answers as it never becomes clear whether respondents agree on both parts of the statement, none or only one. However, as we use the Perspectives Method as our frame of reference we also used stereotypical answer categories to be able to classify people within one of the perspectives or a combination. The objective of the exercise is to identify the dominant perspective on water in the Netherlands that asks for answer categories referring to perspectives. Nonetheless, in follow up research it would be interesting to see if people would indeed agree or disagree on both aspects in the categories. Other methods (like for example Q methodology) cluster respondents based on their preferences, answer categories or the distribution of statements in a parabola but do not offer a tested framework for possible future perspectives (see paragraph 4.4 for more information). To allow non-stereotypical perspectives, respondents were permitted to choose any combination of answers (between zero and four for each question). Each answer possibility (and combination) was translated into codes (varying from 1 to 13). These codes were used to analyze how often an answer (and corresponding perspective) was chosen. This exercise offered useful information about agreed-upon interpretations of beliefs (dominant views), and sub-dominant (but significant) deviations from the dominant view.

2a. The main value of water for me is:

☐ A trustful source for the fulfillment of various water functions

☐ It makes my life more comfortable

☐ A source of material prosperity and self development: important for our image

☐ A source of tranquility, space and nature

Figure 15. An example question (translated from Dutch into English). The answer categories represent the different perspectives on water (respectively Hierarchism, Fatalism, Individualism and Egalitarism). Respondents were allowed to choose any possible combination of answers. Options were translated into codes (1-13). These codes were used to analyze how often each answer category (and corresponding perspective) was chosen (see below).

6.3   Results

6.3.1   Delta report results

In this section, we present the results from the Delta report analysis (Deltacommissie, 2008; DeltaCommittee, 2008). Our analysis shows that the Delta report mainly reports on uncertainties in our physical environment with an emphasis on climate change, sea level rise and river discharges. However, besides uncertainties in our physical environment, uncertainties in the socio-economic and societal environment are important as well. The Delta committee mentions these developments and states that pressure on space and willingness to invest are important long term socio-economic determinants, but these variables do not seem to reoccur in the choices for measures. Regarding perspectives and related needs, values and priorities the Committee states: "*we only need to go back to the year 1900 [….] to face the precarious nature of attempting to imagine how the world will look like in 100 years [….]. Would we have been able to explain our grandmother's grandfathers how life in a motorized world with transatlantic air connections […] and gen technology looks like*?" (Deltacommissie, 2008, pp 33). However, the role of (social) science is not to *predict* the future, but to start from 'what if" reasoning to *explore* the consequences of possible perspective changes on the water system and social support for measures. To that end, we do not exactly need to know why perceptions change (e.g. because of gen technology, motorization), but how changes may alter the way strategies and their effects will be evaluated.

The Delta report emphasizes norms, government responsibilities, control of water (through 'Increased safety norms', 'Sand suppletion', and 'Climate dikes'), continuation and extension of existing water functions and a reliable and large fresh water stock, which fits into a dominant Hierarchical perspective that can also be visualized in the

perspectives pyramid of Figure 19-21. Besides, attention is paid to ecological processes (mainly the restoration of meadow areas and tidal dynamics) and the reservation of space for increased discharges. Activities in the winter bed should not hinder the discharge of excessive river water and the protected Wadden area may grow due to coastal sand suppletions, making continued existence in their current shape questionable (Egalitarian). Further, the report highlights that water does not only threaten human safety, but it also offers opportunities if managed in the right way (Individualistic). The government is the main responsible authority who should take decisions based on expert knowledge (Hierarchical) and should have a facilitating role in informing and warning people living in dangerous (flood prone) areas, but inhabitants should bear an individual responsibility to take protecting measures (Individualistic). In general, the dominant perspective is mainly Hierarchical (see table 13) with Egalitarian, and to a lesser extent also Individualistic characteristics. Some Egalitarian desires (e.g. restoration of tidal dynamics) will be managed in a Hierarchical way (in this example through sand suppletion) (Deltacommissie, 2008; DeltaCommittee, 2008; Offermans *et al.*, 2008). Table 13 shows the perspectives map for the Delta report with a distributional perspectivistic pattern.

Table 13. Perspectives map for the Delta Committee Report (2008). The shaded cells refer to the perspective inherent to the Delta report.

Belief	Hierarchism	Egalitarism	Individualism	Fatalism
Value of water	To fulfill different functions	Source of rest & space	Source of wellbeing and development	to make my life more comfortable
Water problems	Seriously, but manageable	Seriously and hardly manageable	Something we don't need to worry about	Useless to try to prevent
Climate change	average	Extreme	Minimal	Not identifiable
Technology	Moderate trust	Low trust	Great trust	Trust is not clear
Important values	Structure and stability	Harmony and solidarity	Freedom and independency	Comfort and pleasure
Water function priority	Preservation of current functions	Ecological recovery, compensation and nature development	Economic functions, self development and innovation	Comfort, providing me with enough water
Safety	Flood prevention and discharge control	Avoidance of flood prone areas, accep-tation + avoidance	Adaptation and utilization of opportunities	Interference is useless, we cannot change destiny
Response to drought	Following guidelines and laws	A fair distribution between nature and human consumption	Market forces. Rising prices in times of scarcity	We do not need to think about it. It will be alright.
Water supply should be	Demand driven	Supply driven	Market driven	Not different from now, useless to think about
Water system organization	Control and regulation	Natural development and resilience	Opportunism and innovative technologies	Passivity, human interference is useless
Relation with spatial planning	Water follows	Water steers	Water offers opportunities	Should water be used to make fun
Damage due to flooding	Should be prevented, but otherwise refunded by government	Is a matter of solidarity; everyone is financially responsible	Is a matter of individual responsi-bility &risk of living in flood prone areas. insurances	I am not going to look ahead for that
Responsibility for water management	National government	Regional governments, NGOs and in fact all individuals together	Market parties and in risk prone areas individuals	I don't care: as long as I have enough water I decide for myself
Decision making	Based on expert knowledge and research	Based on participa-tory stakeholder processes	Liberal market forces, cost-benefit analyses	Not applicable: decision making is a waste of time
Water contributes to	National identity; traditional export products	Catchment identity and solidarity	International identity and innovative image	My own identity and pleasure

6.3.2   Questionnaire Results in general

In this paragraph the present dominant perspective among water professionals in the Netherlands and existing undercurrents will be presented. Undercurrents may grow (increase in popularity) in the future and comparing the perspective of the Delta report with the dominant perspective and undercurrents offers useful insights into present and future societal acceptance of the Delta report strategies.

The present dominant perspective among Dutch water professionals is also relatively Hierarchical (see table 14). On a worldview level, the majority of water professionals indicated that water related problems are serious, but manageable (Hierarchical). This was the most agreed upon belief as 84% of the respondents (n=127) indicated that the present state of water problems in the Netherlands is serious, but manageable. Water's most important value is its fulfillment of different water functions, like discharge of water, navigation, recreation, drinking water supply etc. Climate change is taken into account as most respondents expect (not too extreme) climate change trends as forecasted by experts. Trust in technology is relatively large, although most respondents attach value to thorough research before new technologies are implemented. Important values are Egalitarian (harmony and solidarity) and Individualistic (freedom and independency). On a management style level, Egalitarian interpretations of beliefs were chosen most frequently. Ecological recovery, nature compensation and natural development should -according to the majority of the respondents- be prioritized in water management. In times of water shortages, available water should be equally shared between ecological users of water (flora and fauna) and humans, and respondents prefer a supply driven water system, rather than demand driven. Water in spatial planning should be used to utilize opportunities for example through combining natural developments with adaptive policies that even contribute to assure safety. On a management style process level, high agreement exists regarding the question who should bear responsibility for water management issues (government) and what the basis for decision making should be (experts knowledge, research and participatory stakeholder meetings). Damage due to flooding should be prevented as much as possible, but if it happens, either government is responsible for refunding damage, or individuals who have the desire to live in flood prone areas. Finally, it is believed that water contributes to both a catchment identity and an innovative image on an international scale.

Table 14. Results from the questionnaire presented in the perspectives map. The italic numbers between parentheses refer to the number of times an answer was chosen. The closer the sum of each belief (last column) is to 152, the less different answers were chosen by the respondents. A sum close to 152 combined with one standing out belief indicates large agreement for that specific belief. Shaded cells refer to the dominant overall perspective for each belief resulting from the questionnaire, regardless from the dominant group, undercurrent or the remaining group (see later). An interpretation of a belief is considered to be dominant if it is chosen most often (highest italic number per row) or if it deviates less than 12% from the answer that was chosen most frequently.

Belief	Hierarchism	Egalitarism	Individualism	Fatalism	Total
Value of water	To fulfill different functions *(104)*	Source of rest and space *(76)*	Source of wellbeing and development *(62)*	to make my life more comfortable *(56)*	298
Water problems	Seriously, but manageable *(127)*	Seriously and hardly manageable *(25)*	Something we don't need to worry about *(5)*	Useless to try to prevent *(1)*	158
Climate	average *(114)*	Extreme *(28)*	Minimal *(9)*	Not identifiable *(12)*	166
Trust in technology	Moderate *(67)*	Low *(15)*	Great *(59)*	Not clear. *(30)*	171
Important values	Structure and stability *(70)*	Harmony and solidarity *(97)*	Freedom and independency *(86)*	Comfort and pleasure *(13)*	266
worldview	*(482)*	*(241)*	*(221)*	*(112)*	
Water function priority	Preservation of current functions *(68)*	Ecology, compensation and nature development *(100)*	Economic functions, self development + innovation *(80)*	Comfort, providing me with enough water *(26)*	274
Safety	Flood prevention and discharge control *(88)*	Avoid flood prone areas, acceptance & risk avoidance *(94)*	Adaptation and utilization of opportunities *(103)*	Interference is useless, we cannot change destiny *(2)*	287
Response to drought	Following guidelines and laws *(38)*	Fair distribution between nature & humans *(119)*	Market forces. Rising prices in times of scarcity *(40)*	We do not need to think about it. It will be alright. *(1)*	198
Water supply should be	Demand driven *(40)*	Supply driven *(99)*	Market driven *(45)*	Same as now, useless to think about *(3)*	187
Water system organization	Control and regulation *(63)*	Natural development and resilience *(141)*	Opportunism and innovative technologies *(54)*	Passivity, human interference is useless *(2)*	260
Relation to spatial planning	Water follows *(10)*	Water steers *(76)*	Water offers opportunities *(93)*	Should water be used to make fun *(40)*	219
MS-Content	*(307)*	*(629)*	*(415)*	*(74)*	
Damage due to flooding	Should be prevented, but otherwise refunded by government *(97)*	Is a matter of solidarity; everyone is financially responsible *(54)*	Is individual responsibility & risk of living in flood prone areas. insurance *(93)*	I am not going to look ahead for that *(4)*	248
Responsibility	National government *(123)*	Regional governments, NGOs & individuals *(108)*	Market parties and in risk prone areas individuals *(17)*	I don't care: as long as I have enough water I *(1)*	249
Decision making	Based on expert knowledge and research *(117)*	Based on participatory stakeholder processes *(115)*	Liberal market forces, cost-benefit analyses *(22)*	N.A. decision making is a waste of time *(1)*	255
Water contributes to	National identity (traditional export product) *(82)*	Catchment identity and solidarity *(90)*	International identity and innovative image *(103)*	My own identity and pleasure *(17)*	282
MS-process	*(419)*	*(367)*	*(235)*	*(23)*	

6.3.3 Differences between the dominant group and the undercurrent.

Table 14 presents the overall results for all respondents together. In the descriptions below we divided the total respondent-group in a dominant perspective group and an undercurrent. To distinguish between a dominant perspective and an undercurrent we clustered the respondents. Because of the nominal character of the variables we used the TwoStep clustering method within SPSS. This method offered three groups: a dominant group consisting of 87 respondents, an undercurrent consisting of 38 respondents and a remaining group of 27 respondents. The latter consists of a diversity of people that cannot be clustered into a coherent subgroup. The overall dominant perspective on water in the Netherlands is mainly Hierarchical on a worldview level, and Egalitarian on a management style level. Compared to the dominant perspective, the undercurrent is less Egalitarian, but more Individualistic and Fatalistic (see Figure 16).
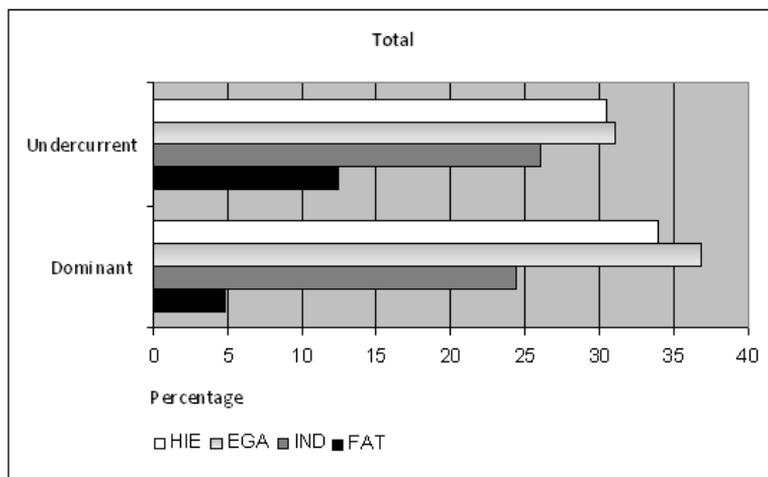

Figure 16: An overview of the total scores for the four perspectives divided by group membership (dominant or undercurrent) within the group of Dutch water professionals.

The differences between the dominant perspective and undercurrent are significant for all beliefs except 'climate change' and 'the nature of water problems'[40]. This indicates a high agreement level between the dominant perspective and the undercurrent for these beliefs (both mainly Hierarchical). Although both groups differ significantly for all other beliefs, the differences are in general small. Here we will discuss the beliefs for which the differences were not only significant, but also large enough to be worthwhile to describe. Regarding the value of water the dominant perspective has a clear preference for the Hierarchical perspective (44%, P=0.000)

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[40] Tested with the Anova test and a 0.05 significance level (see section 6.2.2). See paragraph 9.3.2 to read more about our concern regarding the very small differences between dominant group and undercurrent.

arguing that water is foremostly a trustful source to fulfill different water functions (see Figure 17). The Egalitarian (water is a source of rest and wellbeing), Individualistic (water is a source of prosperity) and Fatalistic answer (water makes my life more pleasant) scored less with respectively 26%, 20% and 10%. Within the undercurrent, each perspective scored around 25%. Where the dominant perspective has a clear preference for the Hierarchical option, the undercurrent values the different water functions equally important.
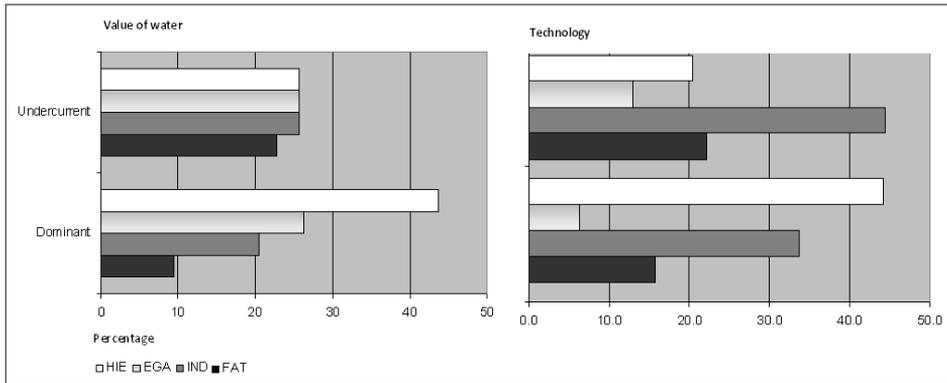

Figure 17: Scores for the different perspectives for the 'value of water' belief in the dominant group and the undercurrent (left) and scores for the different perspectives on the 'technology' belief in the dominant group and the undercurrent (right)

Regarding the use of technologies, the undercurrent has more trust in technology than the dominant perspective (P=0.000). Whereas the former suggests a short term and large-scale implementation of available technologies, the latter is hesitant to implement technologies on a large scale and argues that it is very important to thoroughly investigate technologies and their possible consequences before implementation. In both groups, the Egalitarian perspective (I have very low trust in technology and therefore prefer behavioral adaptations over the implementation of technologies) scored relatively low (see Figure 17). Harmony and solidarity (Ega) are the most important values in both the undercurrent and the dominant group. Besides, they equally value freedom and independency (Ind) and structure and stability (Hie). They differ (P=0.000) however in the valuation of the Fatalistic values of short-term comfort and pleasure. These encompassed 11% of the chosen answers in the undercurrent; in the dominant perspective this was less than 1%. The same trend (a higher Fatalistic component in the undercurrent) is also true for the belief 'water priorities' (see Figure 18). In both groups, ecological recovery, compensation and natural development (Ega) scored high (27% in the undercurrent, 39% in the dominant group), followed by economic functions, innovation and development (Ind) and preservation of currently existing functions (Hie). In the undercurrent, the Fatalistic answer (comfort and supply of enough water for personal purposes) scored higher in

the undercurrent (21%) than in the dominant group (7%). To achieve safety, the Individualistic perspective is most popular in the dominant group (adaptation and making use of opportunities). In the undercurrent the Egalitarian view (avoidance of flood prone areas and acceptance of water) was most popular. Besides, in the undercurrent the Fatalistic answer (interference is pointless, we cannot prevent all floods) had a representation of 18%; in the dominant group this was less than 7%. When it comes to water supply, both groups favor an Egalitarian, supply driven approach (59% in the dominant group, 49% in the undercurrent). The Individualistic approach of balancing demand and supply through the market was more popular in the undercurrent (32% compared to 19.5% in the dominant group) than the Hierarchical perspective. In the dominant group, the Hierarchical perspective of demand driven supply was more popular than the market driven approach. Both groups agreed that water contributes to identity, especially on an international level emphasizing the Dutch identity of innovative water managers (38% in the dominant group, 32% in the undercurrent). In the undercurrent, more people agreed with the Hierarchical answer (national identity which is part of our national history) than with the Egalitarian (catchment identity and solidarity towards people in other countries). In the dominant group, this was the other way round. The Fatalistic answer (water contributes to my own identity by providing me pleasure) represented 11% in the undercurrent and less than 5% in the dominant group.
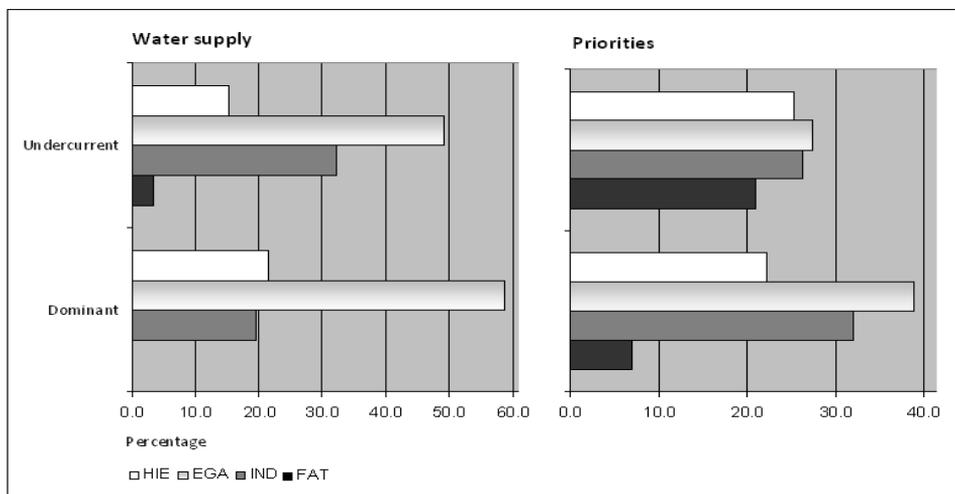

Figure 18: Scores for the different perspectives on the 'priorities' belief in the dominant group and the undercurrent (left) and the 'water supply'' belief (right).

Summarized the undercurrent scores higher on Fatalism than the dominant group and does not prioritize the Hierarchical value of water (fulfillment different water functions) over other values. Besides, the undercurrent has more trust in technology and values the contribution of water to personal pleasure and enjoyment more than the dominant group does. Further, the undercurrent worries less about flood

prevention as they (more than in the dominant perspective) have the feeling that floods cannot always be prevented. To achieve safety, the Individualistic perspective is most popular in the dominant group (adaptation and making use of opportunities). In the undercurrent the Egalitarian view (avoidance of flood prone areas combined with acceptance of water) was most popular. According to the undercurrent, water supply should combine a supply and market driven approach whereas the dominant group prefers the combination of increasing supply and reconsideration of demands.

6.3.4   Differences between the professional- and policy perspective

To assure enough support for implementation, the present dominant perspective on water should match with the proposed measures and ideologies presented in the Delta Report. Besides, the proposals in the report should be able to cope with changing perspectives to also assure enough support in the future. When looking at the distribution of cells in the perspectives map (see table 15), we gain insight in similarities and differences between the present dominant perspective on water and the policy recommendations provided by the Delta committee (also see Figure 19). If we compare the dominant professional perspective on water with the Delta report perspective, we see that 81% of the cells in the perspective map match; a same percentage occurs if we compare the Delta report perspective with the undercurrent. This is a high percentage that indicates large similarities between the present dominant perspective on water and the Delta report.

Table 15: Indication of similarities and differences between the dominant perspective on water among water professionals and the perspective inherent to the Delta report. Empty cells indicate interpretations of beliefs that were neither inherent to the Delta report nor to the water professionals. Non-shaded cells refer to interpretations that are supported by the Delta report *and* water professional. Light shaded cells with black text refer to interpretations that are only supported by the Delta report, dark shaded cells with white text refer to interpretations that are only supported by the water professionals and not by the Delta report.

	Belief	HIE	EGA	IND	FAT
WORLDVIEW	Value of water	To fulfill different functions	Source of rest and space		
	Water problems	Seriously, but manageable			
	Climate change	average	Extreme		
	Trust in technology	Moderate		Great	
	Important values	Structure and stability	Harmony and solidarity	Freedom and independency	
MS CONTENT	Water function priority	Preservation of current functions	Ecological recovery, compensation and nature development		
	Safety	Flood prevention and discharge control	Avoidance of flood prone areas, acceptation	Adaptation and opportunistic	
	Response to drought	Following guidelines and laws	Fair distribution between nature & humans		
	Water supply should be	Demand driven	Supply driven		
	Water system organization	Control and regulation	Natural development and resilience		
	Relation of water & spatial planning	Water follows		Water offers opportunities	
MS PROCESS	Damage due to flooding	Should be prevented, but otherwise refunded by government		Individual responsibility &risk. insurances	
	Responsibility for water management	National government			
	Decision making	Based on expert knowledge and research	Based on participatory stakeholder processes		
	Water contributes to			International identity	

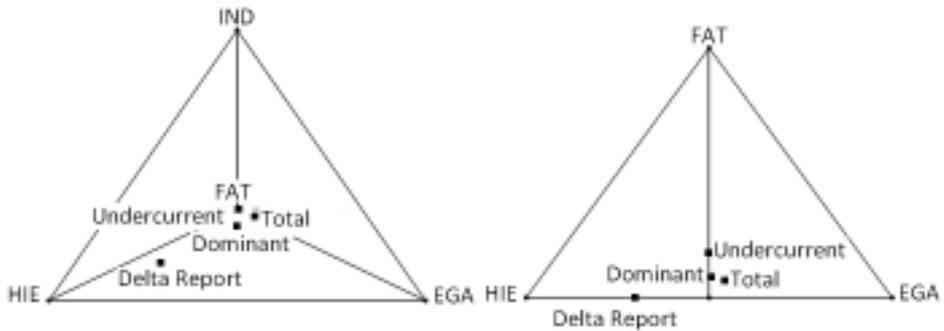| Similarities between Delta policy report and Questionnaire (water professional) |
|---|
| Delta policy report |
| Questionnaire (water professional) |

Figure 19: Positions (square dots) of average perspectives inherent to the Delta committee report, the present dominant perspective among Dutch water professionals, the undercurrent among Dutch water professionals and the total group of Dutch water professionals (dominant and undercurrent together). The positions refer to the overall perspective of all beliefs together (worldview and management style). See footnote 10 on page 44 for an explanation on how the positions of these dots in the pyramid are calculated.

On a worldview level (see Figure 20 and table 15) the Delta report perspective matches quite well with the dominant perspective among Dutch water professionals and (to a lesser extent) the undercurrent. This means that fundamental values and the way uncertainties are interpreted in the report can count on social support in the *present*. Most agreement existed on the worldview belief '*nature of water problems*', as both the Delta report and 84% of the respondents agreed that present water problems in the Netherlands are serious, but manageable. However, perspectives -and therefore support- may change, notably if present trends (which we already see in the undercurrent) may become more intense. Therefore, it is advisable for the Delta committee to more specifically focus on Individualistic and Fatalistic values to preserve *future* support as well. Involving Individualistic and Fatalistic adherents in policy negotiations not only contributes to making strategies more socially robust, but also to more synergetic strategies, the so called 'clumsy solutions' (Verweij *et al.*, 2006) that may be acceptable for different perspectives instead of only one or two.

Although resemblance on a worldview level, large differences exist between the Delta report and the present dominant perspective on a management style content level (see Figure 21). This means that differences exist regarding action principles (e.g. what needs to be done to achieve targets resulting from the worldview?). The main reasons for this difference lay in different interpretations of the values 'response to drought', 'water supply' and 'relation of water to spatial planning'. The Delta report adopts a Hierarchical view on these beliefs wherein guidelines, demands and human activities determine the shape and size of water areas. In the present dominant perspective however, the emphasis is more on natural development of water and nature, a supply driven approach, and adaptation of human activities to water levels, which is mainly Egalitarian. This strong Hierarchical perspective in the Delta Report does thus not only pose a threat for future support for strategies, but also for present support to implement the proposed strategies. To counterbalance this threat more perspectives

besides Hierarchism should be taken into account on a management style level-content. Regarding safety, the Delta report is following a promising track as it indeed tries to integrate Hierarchical (flood prevention and control), Egalitarian (avoidance of flood prone areas) and Individualistic (adaptation to water) solutions in different areas. Besides such a spatial stratification, another way to adapt to decreasing social support is to test and increase a strategies' flexibility in advance. 'Broadened dikes' for example may proof not to be very flexible, but flexibility may be required if we shift towards an Individualistic or Egalitarian future.

Figure 20. Positions of perspectives on a worldview level, indicating the similarity of perspectives with each other and the four archetypes within the pyramid. See footnote 10 (p. 45) for an explanation on how the positions of these dots in the pyramid are calculated. As the positions of the dots are relatively close to each other, we can conclude that there is resemblance of perspectives in the Delta report and the present dominant perspective among Dutch water professionals. In the left pyramid we see that the Delta report (compared to the dominant Dutch perspective) is however less Individualistic.

On a management style process level, smaller differences exists between the Delta report- and dominant perspective which are again explainable through a relatively one sided focus in the Delta report on Hierarchical values (see Figure 21). Disagreement mainly exists on the belief 'decision making based on'. Contrary to the Delta report (that focuses on government responsibility and the role of experts and expert knowledge) the dominant perspective and undercurrent ask for more input and responsibility from various stakeholders.
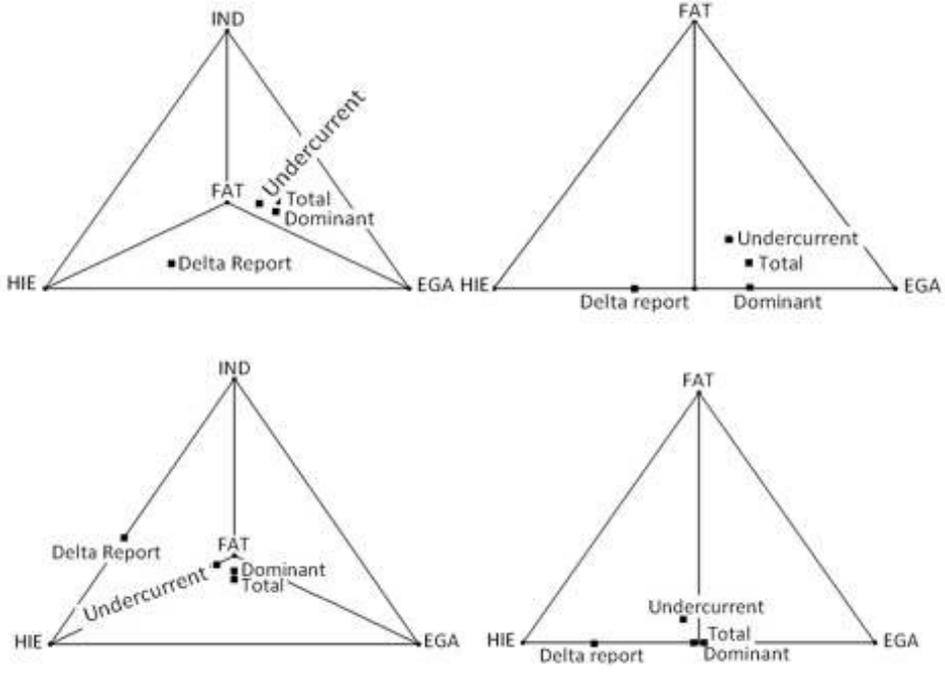
Figure 21: Positions of perspectives on a management style content level (above), and management style process level (below) indicating similarities of perspectives compared to each other and the four archetypes within the pyramid. See footnote 10 (p. 45) for an explanation on how the dots in the pyramid are calculated. This figure shows that the Delta report is both absolutely and relatively quite Hierarchical. This may offer problems in terms of present and future social support.

6.4   Reflection

In this chapter we identified and compared the present Dutch perspective among water professionals on the one hand and the perspective inherent to the Dutch water policy plan on the other hand. Information about present support and social robustness could be provided by focusing on similarities and differences between the policy- and professional perspective. To guarantee enough present support for the implementation of measures, it is important to find enough similarities between the policy perspective and the professional perspective. The application of our Perspectives Method to the Delta policy report shows that present support may be questionable, notably on a management style content level. The analyzed policy report focuses strongly and solely on Hierarchical issues, whereas the Dutch water professional asks for a more Egalitarian oriented approach. To guarantee present

support we suggest to closely focus on those beliefs where upon significant disagreement exists between the Delta report and the professional perspective. These beliefs include: *water supply* and on how to deal with *drought* (demand driven versus supply driven), the role of *water in spatial planning* (water follows versus water offers opportunities).

However, analyzing present support for strategies encompasses only one first step in a social robustness analysis. To assure enough support on the long term, the measures proposed in the policy report have to be and remain acceptable under diverse future perspectives as well. Given the Hierarchical focus of the Policy report, we can -now and in the future- count on enough support for the in the report suggested measures if we where and stayed within a Hierarchical society. However, what would be the consequences for social robustness of a gradual societal shift towards Egalitarism or Individualism? If we would move towards Egalitarism, the currently proposed measures may not be considered acceptable any longer. River related measures should be enforced towards providing more space for the river. This implies that the (Hierarchical) measures we choose now should at least be flexible enough to be adapted to changing societal conditions. If we move towards Individualism, space reservations will be approached as unacceptably unnecessary and even wasteful. Here we see only two examples showing the relevance of taking societal developments and perspective changes into account when analyzing or constructing long term water management. Social robustness and the extent to which strategies are considered acceptable highly depend on perspectives and perspective change. Perspectives are inherently dynamic (see chapter 5) and changeable over time. We thus need to analyze the consequences of perspective change on the acceptability (social robustness) of strategies and their effects on the water system proactively. Resulting from the findings in this chapter, it is advisable to include Individualistic and Fatalistic perspectives into the Delta report as these perspectives are only weakly represented in the Delta report. The Fatalistic perspective seems particularly important as the undercurrent already attaches value to Fatalistic interpretations. If the undercurrent increases in importance, the dominant perspective may become more Fatalistic leading to less support for complicated large scale strategies. A shift towards Individualism on the other hand is also not unimaginable and would increase demand for innovative ways to deal with water. Water offers opportunities for spatial planning and people may ask for tulip shaped off-shore islands or large scale 'Amphibian living' areas with corresponding infrastructure. Recreation and economic functions of rivers will gain in importance and support for relatively expensive and space demanding nature projects will decrease sharply.

Of course, the clear distinction that has been made in this chapter between policy perspectives and professional perspectives is contestable. Policy is in general made by professionals leading to a blurred boundary between policy makers and professionals. However, the water professionals that were involved in construction of the report do not necessarily resemble the average water professional in the Netherlands, making

this exercise valuable regardless of the aforementioned blurred boundaries. Besides, the described method could also be applied to measure perspectives of different stakeholders to reveal differences and similarities in their opinions and beliefs. Next, it is of course questionable whether a different perspectives map (for example with more detailed or generalized beliefs) would have led to different results. The dominant and policy perspective may have looked more similar or different than is the case right now. We acknowledge this problem and therefore advise to investigate the content of the perspectives map and the equal weight given to each belief more thoroughly. Nonetheless, even if the perspectives map changes content wise, the methodology and applied procedures would still apply. Our current exercise still offers useful (however maybe not fully complete) information on the present and future social robustness of measures and ideologies proposed in policy reports.

In the next chapter we will explore future perspective changes, events and developments that may induce changes into certain directions and the result of perspective changes on (changing) choices for water management strategies. This may increase insight into the likeliness of certain future perspective changes, and warnings that indicate a forthcoming change in perspective and social support.

Chapter 7

EXPLORING FUTURE PERSPECTIVE CHANGES

7   INTRODUCTION

Climate adaptation is not an easy task for water management as it is surrounded by uncertainty. These include uncertainties in the natural environment (e.g. the magnitude of climate change and its impacts on regional water systems), in the socioeconomic context (economic and demographic developments) and in the societal responses to climate change (Offermans et al., 2011b; Valkering et al., 2011; Offermans and Corvers, 2012; Valkering et al., 2012). In chapter five we explored first lessons regarding perspective change and -dynamics based on an analysis of historical developments. In this chapter we focus on future perspectives, perspective changes and choices for water management strategies. Insight in future perspectives dynamics contributes to our ability to explore future acceptance and social robustness of water management strategies in changing physical and societal futures. How a strategy (and its effects) will be evaluated depends on the perspective through which developments and effects are evaluated. This chapter will answer part of sub question six (see paragraph 1.3) on the kind of insights that can be gained regarding future perspective changes. To that end we focus on choices for measures, factors contributing to the choice for measures, factors contributing to perspective change and directions of change. In chapter eight we focus on perspectivistic differences in the way future developments may be evaluated. We start this chapter with a brief summary of the game description, based on previous publications (see Valkering et al. 2012, Haasnoot et al. accepted). Each game session offers a storyline. We will elaborate on analyzing the storylines with the Perspectives Method. At the end of this chapter we will show how these results contribute to our understanding of socially robust water management strategies.

7.1   Perspective based simulation game

Uncertainty can be explored through environmental scenario analysis that is concerned with exploring the future of coupled environment-society systems (Alcamo, 2008). A variety of scenario analysis approaches exists, including quantitative and qualitative approaches, forecasting and back-casting studies, descriptive and normative scenario types, and combinations of those, each with their own strengths and weaknesses (see van Notten, 2005 for overviews; Bishop, Hines and Collins, 2007; Alcamo, 2008). Current scenario studies, however, are subject to limitations. First, they only implicitly reflect the development of societal perspectives. This implies that they focus on 'conventional' uncertainties (e.g. in climate, demography, land use, and economy) and much less on (changing) perceptions and 'new ways of thinking' emerging in a society (Valkering et al., 2012; Haasnoot et al., accepted). Second and strongly related to the first, current scenarios mainly reflect linear development paths wherein developments follow continuous trends. In reality, however, contextual developments, lifestyles, perspectives and policies tend to develop in a discontinuous

way (Offermans et al., 2011b; Valkering et al., 2011; Offermans and Corvers, 2012; Valkering et al., 2012). Current scenarios oftentimes under-represent society's responses to events and developments in the environment and water system. Inclusion of societal responses in scenario analysis to represent environment-society interactions, discontinuity and surprise is considered an important challenge in scenario development practice (van Notten, 2005; Alcamo, 2008; Valkering et al., 2011) and crucial to develop scenario based storylines wherein water management strategies can be analyzed for their social robustness in different futures. To that end, we developed a perspective based simulation game that embraces a participatory game set-up to explore how the societal perspective on water management co-evolves with developments in climate, the river system, and the broader societal context.

Simulation games can be defined as "experi(m)ent(i)al, rule-based, interactive environments, where players learn by taking actions and by experiencing their effects through feedback-mechanisms that are deliberately built into and around the game" (Mayer, 2009, p. 825). Simulation games can serve as analytical tool to gain insight in complex issues or as a learning tool for participants (Bots and Daalen, 2007; Valkering et al., 2011; Valkering et al., 2012). Especially the first kind of simulation game may lend itself to develop scenarios in which societal responses and environment-society interactions are deliberately built into the game (Valkering et al., 2011; Valkering et al., 2012). In this chapter we address the development and implementation of our perspectives based simulation game wherein the environmental context and societal response develop in a coherent -and possibly discontinuous and surprising- way. We will also discuss some first, illustrative insights resulting from playing the game in 12 sessions.

Our game approach builds upon perspective-based scenario analysis; a method that was developed for the integrated modeling of global change (Rotmans and de Vries, 1997; Hoekstra, 1998b; van Asselt, 2000; Vries, 2001, also see chapter 4) and has also been applied to develop long-term scenarios for the Rhine and Meuse in the Netherlands (van Asselt et al., 2001; Middelkoop et al., 2004; Valkering et al., 2011). In perspective-based scenario analysis, a diversity of interpretations of uncertainties, management preferences and evaluation criteria are included as part of distinct, stereotypical cultural worldviews. Choices made by participants are guided by these different interpretations and lead to different ways of evaluating the effects of measures. Our simulation game aims to extend the existing method by describing 'real-world' societal perspectives in the scenarios (rather than only the stereotypical ones), and by including the dynamics that may eventually lead to perspective change. This 'extended perspectives approach' was developed conceptually in the BSIK project 'Perspectives in Integrated Water Management' (Valkering et al., 2008b; Valkering et al., 2011) that focused on the management of the River Meuse in the Dutch Province of Limburg (see chapter 2 and 4).

In this chapter we set out the game's design that closely follows theoretical concepts of the Perspectives Method, the Advocacy Coalitions Framework theory (Sabatier and Jenkins-Smith, 1993) and societal transitions (Rotmans, 2003 ; Loorbach, 2007; van der Brugge, 2009) presenting complementary views on social change (Valkering et al., 2012). These concepts are translated into the game format wherein players take up the role of water managers of a river stretch within a delta. They respond to events and developments in the water- and society system, under specific realizations of a climate scenario. Besides choosing (different) river management options, the response involves a reflection upon interpretations in the perspectives map and a reaction to societal support for the implementation of strategies. A gaming session typically covers 100 years of river management and results in integrated storylines (scenarios), in which the water system and the societal response develop in a coherent -and possibly discontinuous and surprising- way. In the next section we present the game's design, its format and procedures and we present first illustrative results that can be generated with the game. The reader should realize that this chapter describes work in progress as the method is still under development. Therefore, the presented results should be regarded as preliminary and illustrative for the methodology to understand perspective dynamics and socially robust water management strategies.

7.2   Game design

7.2.1   Conceptual framework

The game's starting point is formed by the Pressure – State – Impact - Response (PSIR) model (OECD, 1993; Rotmans and de Vries, 1997; Hoekstra, 1998b) that describes the interactions between water system and social system in the form of a pressure–effect chain (see Figure 2, paragraph 2.1 or Valkering et al., 2012). Relations between pressures, states and impacts are relatively well understood and can be modeled with environmental modeling techniques such as system dynamics and GIS, drawing upon knowledge from climate science, hydrology, geography, ecology, economy and so on (Valkering et al., 2009). Although this is not an easy task as it involves a number of difficulties like information gathering, the choice of aggregation and scale, and the management of uncertainties, the main challenge lies in understanding the dynamical nature of the response and the influence of people's perceptions on the social robustness of strategies (Valkering et al., 2009; Valkering et al., 2012).

Players of the game can autonomously decide which goals to achieve and act accordingly. However, following the PSIR chain, they are operating within, and influenced by, a societal context with a dominant societal view on water that is only supportive for some measures. Players can generally only implement measures that are supported by the societal context. Hence, the dominant perspective constrains the behavior of individual stakeholders and policy actors, but at the same time -

considering the duality of structure and agency- expressed by Giddens (1984) and Bourdieu (1970) (also see chapter 4) actors have the capacity to influence and change these beliefs and public support, for example through neglecting citizen voices or through processes of social learning (see Pahl-Wostl et al., 2008). The players of the game have the opportunity to neglect lacking social support for suggested measures once during the game. This happens through a so-called 'amendment' that has to be approved by a two third majority of all players involved in the game. Where the PSIR framework describes the dynamics between water system and social system, we use the Perspectives Method (Offermans et al., 2011b), the Advocacy coalitions framework (Sabatier and Jenkins-Smith, 1993) and Transition theory (Rotmans, 2003; Loorbach, 2007; van der Brugge, 2009) to describe dynamics within the different subsystems of the social system (see box 1-3). This thesis focuses on the Perspectives Method as described in section 4.6 wherein also insights from the Advocacy Coalitions Framework and transitions theory are integrated.

Box 1: The Perspectives Method

To analyze (differences in) perception within the response part of the PSIR scheme, we use the perspectives method (see chapter 4). Perspective change occurs on all three subsystems (individual stakeholders, policy arena, water culture including a dominant perspective) but not necessarily at the same time. In chapter 5 we have seen that perspective change can both be initiated within the policy domain as well as on an individual level. Perspective change in the autonomous response may impact support for the policy arena and related policy measures, possibly forcing the policy arena to adapt their policy and change their perspective. When making use of the right (media) channels and/or seizing developments or events as surprise, the policy arena may have an important role in changing perspectives on an autonomous response level. If perspectives change on a policy and autonomous level, the dominant perspective has been changed as well. We distinguish three stereotypical perspectives that –amongst others- differ in the goals they want to achieve, the way they evaluate the effects of strategies and their preferences for measures. The resulted storylines will be analyzed on perspectives, perspective changes, triggers for perspective change and consequences of change to better understand the dynamic nature of perspectives and the effects of perspective (change) for social support for strategies.

Box 2: The advocacy coalition framework: perspective based coalitions

Changes in the policy arena can be understood by referring to the Advocacy Coalition Framework (ACF) (Sabatier and Jenkins-Smith, 1993). The ACF explains these dynamics at the level of the policy subsystem. The policy subsystem is defined as the set of actors dealing with a particular policy problem. These actors -referred to as 'policy elites'- may hold various positions, such as public official, interest group leaders, and researcher. Policy actors that share a particular set of beliefs are assumed to form coalitions that advocate certain policy strategies that usually differ from strategies proposed by other coalitions. The policy process is thus a competition among the different coalitions. As in the perspectives method there is a stratification of beliefs that determine the desired direction of a policy (deep core beliefs, policy core beliefs and secondary, instrumental beliefs). Policy core beliefs are resistant to change, but are more malleable than deep core beliefs. Following ACF theory, coalitions co-evolve over time, involving a change of the coalitions' perspectives - visualized as changing position on the perspectives landscape - and a change of their relative strengths – visualized by increasing or decreasing of the coalitions' size or power. Each coalition strives for a different desired future, holds different expectations about the future, prefers different water management strategies, and responds differently to events. Yet, they have to cooperate as none of the coalitions has full control over the water system. Moreover, the success of water management strategies depends not only of the coalitions' perspectives, but also on changing public opinions, political contexts and societal support. This factor is included through a so-called external 'citizen perspective' representing the general public's view and indicating the extent to which different strategies can count on social support and can thus be implemented or not.

Box 3: Transition Theory

Where the Perspectives Method helps in explaining changes in personal mindsets, it does not sufficiently explain how structural social change takes place. It may increase understanding in triggers and consequences of change but does not specify institutional and structural processes inherent to major changes. Fundamental societal changes require changing structures and institutional arrangements on all subsystems. Transition theory describes and explains the dynamics of how societal systems may change fundamentally (Rotmans, 2003; Loorbach, 2007; van der Brugge, 2009; Offermans, Haasnoot and Valkering, 2011b). This generally entails the characterization of the dominant actors, processes and structures in a societal system -which is called the regime- and the processes underlying fundamental changes within this regime. Transitions can be understood as a destabilization of the incumbent regime on the one hand, and the emergence and up-scaling of new niches that eventually give rise to an alternative regime, or –in other words- large shifts in dominant perspectives in a societal system (Van der Brugge, Rotmans and Loorbach, 2005; Valkering et al., 2012). The main driving forces are slow macro-trends, external events (calamities), internal adaptation and emerging innovative niches (van der Brugge, 2009). Shifts between dominant perspectives and undercurrents correspond to transitions in which new water management strategies can come to the fore. Combining the notion of dominant perspectives and niches -or undercurrents- with the ACF, the present dominant perspective (Hierarchical-Egalitarian, see previous chapter) is understood as a relatively large and strong coalition. In contrast, the undercurrent (with stronger Fatalistic characteristics) is seen as a relatively small coalition: a small but distinguishable 'societal movement', which advocates a different perspective then the dominant one. Undercurrents may exist for a long time while hardly being noticed. However, large scale trends, nagging problems, calamities and innovations may form a breeding ground and may stimulate the growth of the undercurrent to eventually replace the dominant perspective (Valkering et al., 2012).

7.2.2   A participatory river model

The PSI cycle is modeled using a computer based Integrated Assessment Meta Model (IAMM) derived from a more detailed, physically based simulation model which serves as an approximation of the input/output transformation that is implied by the simulation model. The resulting black-box model is also known as a response surface (Haasnoot et al., accepted). The IAMM consists of a set meta models describing parts of the cause-effect chain. The different models are fully integrated and based on the results of complex hydrological and impact models applied in previous studies (van Asselt et al., 2001; Middelkoop et al., 2004). Integrated Assessment Models (IAMs) have been successfully applied to analyze climate change and the effects of emission mitigation strategies (see Haasnoot et al., accepted for an overview). Our IAMM was designed to run fast enough to calculate 100-year transient scenarios in interactive participatory game settings. The IAMM is also able to implement individual measures and strategies chosen by the players of the game (Haasnoot et al., accepted). Subsequently, the model output should be understandable to users, and the performance of strategies should be quantified by relevant indicators. Currently the model calculates the effects of water management strategies on indicators like river discharges (and floods due to high water levels or dike fragility), causalities, total damage, agricultural damage, number of (false) alarms given, shipping suitability (related to drought), ecological area and ecological diversity (see Figure 22).

		Damage	Benefits
People	Number of missed floods	1	
Risk indicators	Urban area flooded km²	1.03	
	Number of flooded dike rings	1	
	Number of false alarms	0	
	Casualties	16.29	
Profit	Total damage (Million Euro)	1.064	
Economic damage	Agricultural damage (Million Euro)	22	
	Non navigable time %	6	
Planet	Nature area km²		13.160
Nature Indicators	Diversity index		0.41
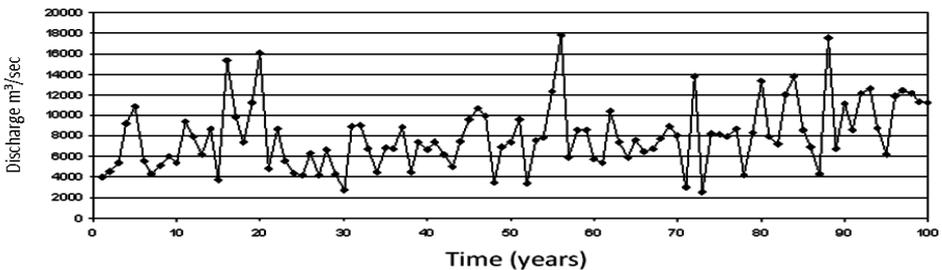
Figure 22: example of the IAMM model output with scores on indicators (above) and discharges (below)
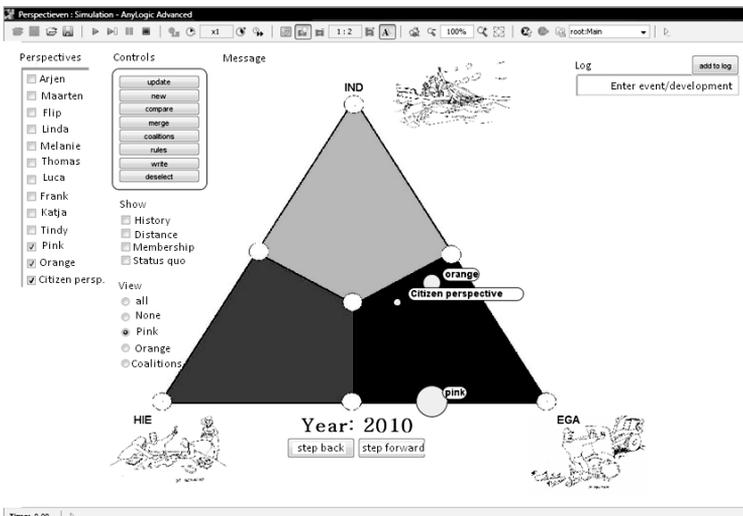
Figure 23: screenshots of a news paper heading (top) and the java application visualizing perspectives in the perspectives triangle (below) to partially reflect the response part.

The response part of the PSIR chain is partially reflected by participant's choices for measures that can be implemented in the IAMM to calculate (long term) effects of strategies on the water system. Besides, participants are confronted with news paper headings reporting on events or developments outside the case study area (for example on major water quality problems in Poland). Citizen responses to events and developments in the water system or newspaper headings (see Figure 23) are also presented to participants. Depending on the citizen responses, their support for certain measures may increase or decrease. If citizen support for measures is lacking, it becomes impossible to implement those strategies straight away. Next, perspective

changes are recorded on coalition level as coalitions are asked to reflect on the perspectives map at several stages during the game (see section below). These changes are visualized in a perspectives triangle by making use of a java application (see Figure 23).

7.2.3   Study area

In our research we used a hypothetical case study which offers several advantages over using a real life case. First, it allows to carefully and sometimes creatively reflect upon the type of information needed for the development of a method to explore perspective changes and the sustainability of water management strategies. The goal was not so much to fit as closely as possible to reality and keep adding (interesting but maybe less relevant) information, but to develop a coherent method for the exploration of sustainable water management strategies. Second, it allowed players of the game to reflect more easily on the game concept and additional value of the method instead of focusing on details regarding a real life case and third, it allows for a more experimental approach wherein it was easier to explore a broad range of possible futures instead of limiting one selves to scenarios that seem to be likely. Even though the case was hypothetical, it was realistic as most calculations and cause-effect relations were based on available data for the Waal and Rhine rivers. Besides, we used realistic climate change data generated by the Royal Dutch Meteorological Institute (KNMI) and translated to trends for rainfall, increased discharges and drought. The major disadvantage of a hypothetical case over a real life case is that it remains unclear to what extent the method would function comparably in a real case. We come back to this aspect in the reflection in chapter 9. The hypothetical case study, called the Waas, is inspired by a low-lying river stretch in the Rhine delta of the Netherlands (the river Waal). The river and floodplains are highly schematized, but have realistic characteristics. The river is bound by embankments and the floodplain is separated into five dike rings (Figure 24). The river flows from the back to the front in Figure 24. A large city is situated on higher grounds in the south-east part and smaller villages exist in the remaining area, including greenhouses, industry, nature and pastures.

A game session starts on the basis of a 'report' of the assumed 25-year history wherein two flood events appeared, which flooded four dike rings in total. The total water-related damage in the past 25 years was 2,818 billion Euros. On average, the available time for shipping was 92%, thus averagely 33 days per year water levels were too low for navigation. After the first flood event, the Waas population showed their resilience and willingness to manage the river in such a way that safety could be guaranteed. The flood was considered as a matter of bad luck that would be prevented in the future by means of control- and engineering policies. After the second flood inhabitants realized that climate change may have a stronger influence than expected; the control driven approach may not be sufficient to guarantee safety on the long run. Therefore, they shifted from a dominant Hierarchical to a more Hierarchical- Egalitarian perspective wherein safety and the provision of more space for the river were combined.

Furthermore they realized that in the future, climate change and socio-economic developments may increase the pressure on available space and potential future damages, so additional strategies may be needed.
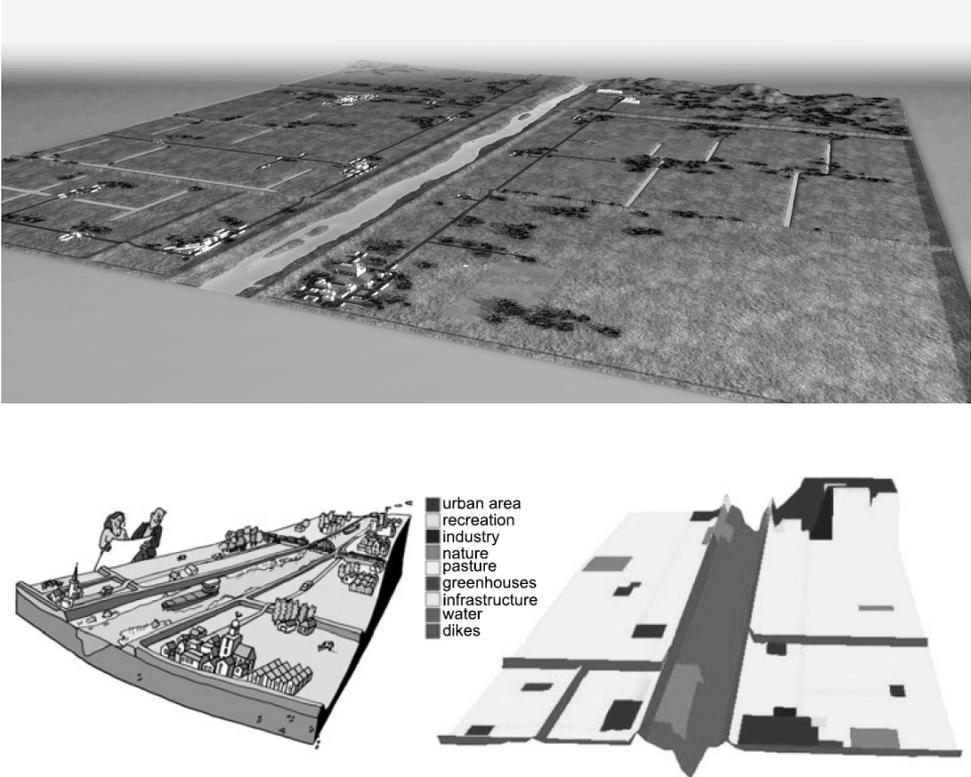

Figure 24: A schematization of the study area of the Waas river

7.2.4   Process design

After an introduction about historical events and responses (see previous paragraph) the game starts. The game is generally played with 10-20 players and takes about 2-4 hours to play. Players are given the general role of 'water managers', rather than specific stakeholder roles (see figure 25). Pre-knowledge about water management is not necessary, but will help the players in understanding expected effects of measures on the system state and will probably support their learning experience. Participants are assumed to reason from their individual perspective and not from specific, imposed interests. Before or at the start of the session, players fill in the perspectives-map, following the same procedure as described in chapter 4, 5 and 6. The perspective map information is used to form two coalitions of players with a relatively large agreement among their perspectives. Each team appoints a 'team captain' and a 'reporter'. Changing coalitions during the game is allowed, but rarely happened in the

game sessions we played. The citizen perspective is generally played by one of the researchers. This person may interactively engage with the game -shifting perspective in response to the various developments and events- but the development of the citizen perspective may also be prepared beforehand in relation to newspaper headlines that enter in the game or expected river discharges in a pre-selected climate scenario. The citizen's opinion may influence preferences of the water managers and may even block or postpone certain measures due to a lack of societal support (see appendix 3 for the support map indicating when measures loose social support). After the game introduction (explaining rules and objective of the game, the context of the river Waas, and forming initial coalitions) the game follows a few (3-4) cycles of the following steps (see Figure 26):

- *White paper development*. Each coalition formulates a 'white paper' including a proposal for a water management strategy and the underlying motivation. They select two concrete river management measures from a deck of 27 'measures cards' (see Figure 26).

- *Negotiation*. In case wherein the two coalitions are of equal size (having an equal amount of members) the two teams are obliged to agree on a common water management strategy consisting of a maximum of two measures. To this end, the reporters engage in a short negotiation process. In case of high dominance of one coalition, negotiation is skipped; the dominant coalition is allowed to implement its preferred strategy.

- *Societal support* check. The project-team decides whether the envisioned measures are in line with the citizen perspective. Possibly, one or both measures are rejected. The initial citizen perspective is determined by the historical developments in the case study area (see previous paragraph) but may change according to events and developments in the game (also see appendix 3).

- *Implement measures*. The selected measures are implemented in the water system model (IAMM). Results are calculated for a time period of typically 10-20 years.

- *Water system impacts*. The main impacts on flooding, drought, nature development and shipping are presented by the project-team. They are visualized in graphs and tables and briefly discussed with the players.

- *Contex*t. Possible contextual events and developments regarding, for example, water quality issues or technological breakthroughs in neighboring countries -and their impact on the citizen perspective- are presented in the form of newspaper headlines.

- *Perspective change*. Monitoring perspective changes on a coalition level was carried out in two different ways. In early sessions, it was carried out by a project team member through observation of discussions within and between coalitions, notably of the motivations underlying the whitepapers and the way coalitions

evaluated the achieved results. In later sessions, participants were asked to reflect explicitly on the perspectives map themselves[41].

Figure 25: Participants during the session at the Delta conference ('Deltas in times of climate change') in October 2010. Internal discussion on what measures to choose.

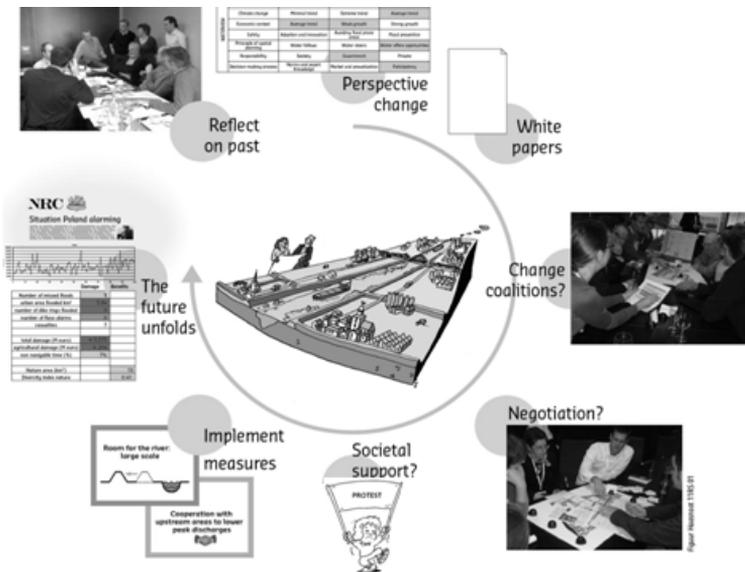Figure 26: Overview of the process design of the participatory game

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[41] These different methods did not result in any significant differences in terms of perspective changes. The sessions observed by the project team member resulted in a higher agreements factor between the coalitions at the end of the game. However this can be explained as the agreement factor was also higher at the start of the game session.

7.3   Methodology for analyzing storylines

The used methodology combines the game concept with an analysis of storylines. Typically, every game session encompasses river management of the Waas area for the next 100 years, resulting in a storyline (see Figure 27), encompassing information on yearly discharges, scores on indicators, proposed and implemented measures, (changing) citizen perspective, support for measures and perspective changes on a coalition level. In every session the discussions within and between the coalitions were either taped or typed out by the researchers. Changes in perspective (which were indicated by coalitions by changing counters on a polystyrene foam perspectives map) were either photographed or directly inserted in our java based visualization program. All together we have played 15 gaming sessions. As the first three were used to refine the methodology, game set up and timing of the different cycles these will be ignored in the analysis of the storylines. See table 16 for an overview of included game sessions.
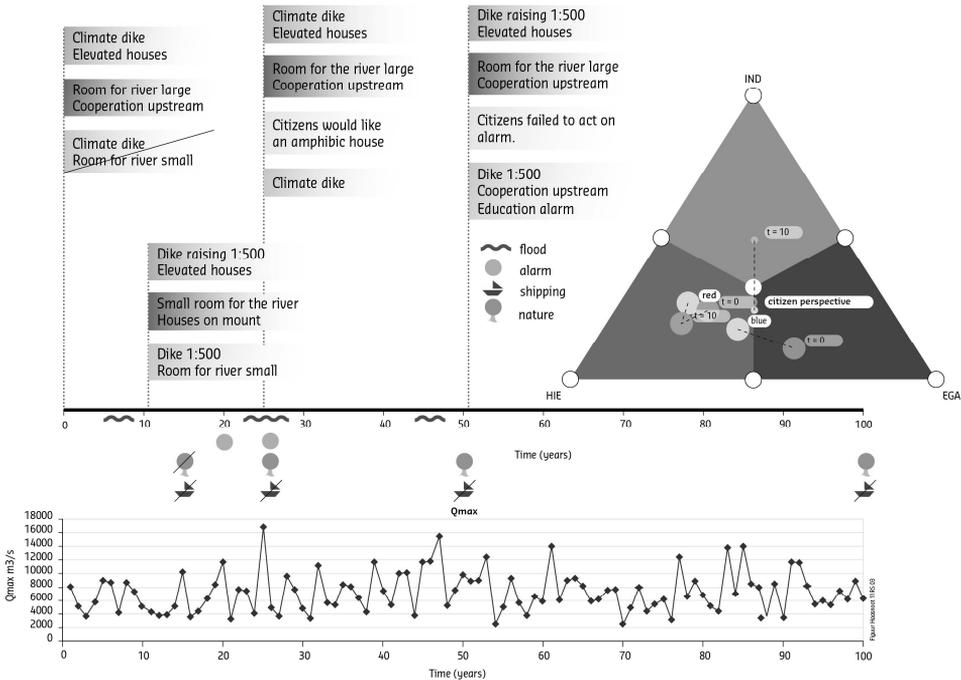
Figure 27: Example of a water management storyline developed at the Dutch water service in Lelystad. The figure shows the two coalitions and the water management measures they proposed in each time step. The citizen's perspectives and attitude towards water management are also indicated. It also shows the river management measures that emerged from the coalitions' negotiation, possibly scored out in the case they were rejected by the citizens (for example at time = 0). The bottom of the figure shows the discharge time series the players were confronted with. This series and the implemented measures strongly influence the impacts, for example regarding flooding, shipping and nature. Finally, we see the development of the coalition's and citizen perspectives during the game in the perspectives triangle.

Table 16: overview of gaming sessions that were included in the storyline analysis

Date	Place	With whom
18-12-2009	Maastricht	Project team
15-01-2010	Delft	Scientists
02-03-2010	Utrecht	Students
06-04-2010	Lelystad	Water board
11-05-2010	Enschede	Scientists
01-10-2010	Rotterdam	Conference participants
14-12-2010	Rotterdam	Delta program
11-01-2011 (2x)	Wageningen	Students
01-06-2011	Enschede	Students
17-06-2011 (2x)	Utrecht	Students

For every storyline we have analyzed the short (see Figure 27) and long (typed out) storylines. To support conclusions derived from this qualitative analysis and to backbone conclusions in a quantitative way, we also applied a statistical analysis by inserting storyline information into SPSS. We used one row for every time step and every coalition, offering us around 10 rows for each storyline/game session. We included information on scores on indicators, directions of perspective change, changing beliefs, agreement indicators and chosen measures (see appendix 4 for a full overview). Some scores were kept up on a nominal scale (for example the target group with whom we played the game or the direction of perspective change), others on a continuous scale (for example damage) or ordinal scale (for example floods events that could be non-existent, small or large scale). Each row thus provides information on what happened in the water system (e.g. floods, damage, and ecological diversity) and social system (news paper headings in favor of specific perspectives), how the coalitions responded in terms of perspective change and the choice for measures and which measures were implemented after negotiation. This information provides an overview of the type of measures that were chosen in which time slots and which beliefs changed into what perspectivistic directions. Besides, it offered opportunities to analyze whether the choice for measures and/or perspective dynamics could significantly be explained by scores on parameters like a flood, the agreement between coalitions or events. To this end we used the ANOVA test (in case of nominal or ordinal values) or the independent sample T-test (in the case of scale variables, see also paragraphs 1.4 and 6.2.2 for more information). Both tests provide information on significant differences between groups. For example, one could analyze if the type of flood event that occurred (no flood event, almost flood event, small flood event or large flood event) influenced the coalition's responses in terms of perspective change or the choice for measures. Here it is not only important to focus on possible differences in average or mode (e.g. no floods lead to changes towards Egalitarism, whereas large flood events more often induced change towards Hierarchism), but also on significance. In other words: we also have to proof that observed differences are not due to coincidence but to a different (sub) group membership (e.g. a small or large flood event). As we want to reduce the role of coincidence to 5% or less, we use a P-value (exceedance probability) of 0.05 or lower. Significant differences provide

information to better understand perspective change, particularly on events that trigger change and the direction of change.

Below we describe our results starting with a general overview of measures that were chosen during the games, and measures that were likely to survive the negotiations. Subsequently we focus on events that significantly determined the choice for measures. Next we describe general patterns of perspective change and events or factors that led to specific perspective changes. Please keep in mind that -given the experimental character of the game and the focus on the methodology instead of the content- these results should be regarded as illustrative for the methodology instead of blueprinted results for sustainable water management.

7.4   Results

The main goal of the here presented results is to gain more insight in (future) perspective dynamics. To that end we focus on choices for measures (when are coalitions tempted to choose which measures?), changing perspectives (when do coalitions change into which direction?) and the way worldview and management style are related. This includes an analysis of events and surprises that possibly explain the choices for measures or perspective changes (on a belief level and on an aggregated perspectives triangle level).

7.4.1   Choices for water management strategies

In table 17 we report on suggested (left) and implemented measures (right) during all time periods in all storylines. It indicates that the measures 'Room for the river', 'Cooperation with upstream areas' to lower peak discharges, and 'Dike raising' are suggested and implemented relatively often compared to other measures. 'Room for the river' and 'Dike raising' relatively often survived the negotiations between coalitions (respectively 15 times out of 21 and 13 times out of 16 times). 'Cooperation with upstream areas' however, only survived in roughly 50% of the times it was suggested (14 out of 26 times). Further, 'Climate dikes' relatively often survived the negotiation (which can partially be explained by the fact that both coalitions often suggested 'Climate dikes'). 'Development of nature area', 'Houses on artificial mounds' and 'Elevated houses' however, often perished during the negotiation.

Table 17: overview of chosen measures by the coalitions together (left) and by the coalitions separately (before negotiation with the other coalition) at the right (absolute numbers)[42.]

Measure Chosen before negotiation with other coalition	Times chosen	Measure Chosen after negotiation	Times chosen
Cooperation with upstream areas	32	No measure	19
Room for the river	29	Room for the river	15
Dike raising	24	Cooperation with upstream areas	14
No measure chosen	24	Dike raising	13
Dredging	23	Dredging	8
Climate dike	17	Climate dike	8
Increase nature area	9	Adaptation of the trigger for alarm	7
Adaptation of the trigger for alarm	9	Small boats	4
Medium boats	8	Medium boats	2
Houses on artificial mounds	5	Increase nature area	2
Small boats	4	Houses on artificial mounds	1
Elevated houses	2	Educating people about water	1
Floating houses	2	Dike ring around the cities	1
Dike ring around the cities	2	Floating houses	1
Large boats	1	Elevated houses	0
Educating people about water	1	Dikes with grass coverage (current situation)	0
Wave overtopping resistant dikes (asphalt coverage)	0	Wave overtopping resistant dikes (asphalt coverage)	0
Dikes with grass coverage (current situation)	0		

In Figure 28 we see that *'Room for the river'*, *'Dike raising'*, *'Adaptation of the trigger for alarm'* and *'Dredging'* have been chosen during all time frames[43, 44].

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[42] In the game, more diversification in measures was available. In order to be able to identify patterns and have slightly bigger groups despite the small number of games sessions, we merged all dike raising measures into 'Dike raising' and different intensities of Room for the river (small, medium, large) into 'Room for the river'. We did not merge small-and medium sized ships into one category as these (more than the measures discussed before) may be chosen by coalitions with different perspectives ('Small boats' is more likely in Egalitarian futures, whereas 'Medium boats' may also be possible in Hierarchical, and even Individualistic futures).

[43] This was independent from the climate scenario used in the IAMM

[44] Although theoretically impossible, in 58.33% of the storylines (7 out of 12) measures have been chosen more than once during one game (in different time slots). In six out of those 7 storylines, this was true for the measures 'Room for the river' and 'Dike raising'. Besides, 'Upstream cooperation' and 'Dredging' were also implemented in several time slots within the same storyline (respectively three and two times).Theoretically, once a measure has been implemented, it has taken place and remains, also when it has not been chosen for a second time. Nonetheless this may indicate that 'Room for the river', 'Dike raising', 'Upstream cooperation' and 'Dredging' are relatively robust as coalitions chose them again, also after events, developments and perspective changes have taken place.
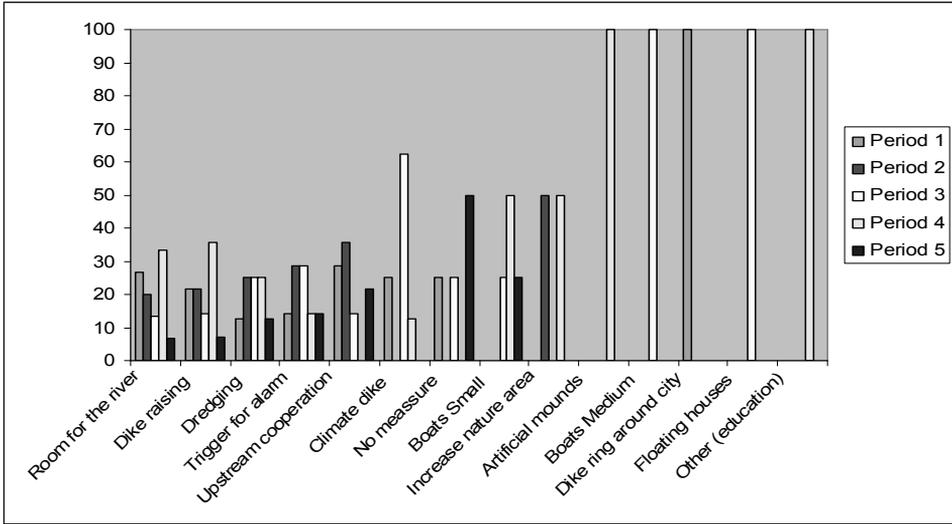
Figure 28: overview of the different measures represented in the game subdivided by the timeframes wherein the measures have been chosen. The sum per measure equals 100%.

Next, and following our line of reasoning in chapter 1 and 2, a socially robust water management strategy is considered acceptable under a broad variety of perspectives. To that end we analyzed a coalition's visual position in the perspectives triangle each time when they proposed a measure in their whitepapers. If a coalition was located on the border between two or three perspectives, both or all perspectives were scored. Otherwise we only scored the dominant perspective. Therefore, the sum of chosen measures in the table below differs from the numbers in table 17. The table below (table 18) shows that 'Climate dikes', 'Dike raising', 'Room for the river', 'Upstream cooperation', 'Houses on artificial mounds', 'Dredging' and an 'Increase of natural area' have been chosen independently from the coalition's perspective.

Table 18: Number of times that a measure was proposed (whitepapers) and the coalition's corresponding perspective at that moment. If a coalition was located at the border between two perspectives, both perspectives were scored in this table.

	HIE	%	EGA	%	IND	%
No measure	22	14	4	9	5	18
Climate dike	15	10	1	2	2	7
Dike raising	23	15	4	9	2	7
RfR (Room for the river)	23	15	9	20	3	11
Upstream cooperation	25	16	9	20	5	18
Elevated houses	2	1	0	0	0	0
Dikes around the city	1	1	0	0	1	4
Houses on mounds	2	1	2	5	2	7
Floating houses	1	1	1	2	0	0
Trigger for alarm	7	4	4	9	0	0
Education, other	0	0	1	2	0	0
Dredging	19	12	2	5	6	21
Medium boats	6	4	3	7	0	0
Large boats	0	0	0	0	1	4
Small boats	4	3	0	0	0	0
Increase nature	6	4	4	9	1	4
Total	156	100%	44	100%	28	100%

In our game, a strategy consists of two measures where upon coalitions could agree. Looking at combinations of measures into a strategy, we see that 'Room for the river' was oftentimes combined with 'Upstream cooperation' (five times during all storylines together). Besides, 'Upstream cooperation' was combined with 'Dike raising '(4 times) and 'Dredging' (4 times). When coalitions only chose one measure (in case they could not agree on a second measure), this was also oftentimes 'Upstream cooperation'. Apparently, coalitions can agree relatively easily on 'Upstream cooperation'; the costs are low and it does not hurt to try. If a measure is frequently chosen in combination with another measure this may indicate that both measures complement each other in terms of perspectives. For example, 'Upstream cooperation' would be a good solution according to a Hierarchist, but the Individualist could have problems with this measure as it is regarded as an inefficient strategy that gives too much power to governments and makes us too dependent on upstream countries. Combining 'Upstream cooperation' with 'Dredging' could result in a so called 'clumsy solution' (see Verweij et al., 2006) that makes the strategy more synergetic and more acceptable for individualists as well (Offermans et al., 2008).

7.4.2   Role of events, surprises and other factors for the choice for measures

A next step in our analysis to better understand choices for measures in different and uncertain futures is to see if certain events or circumstances contributed to the choice for a specific measure. As explained in the methodological section of this chapter we

only discuss scores on indicators[45] that had a significant effect on the choices for measures (with a P-value of 0.05[46] or less). Of course, as the number of storylines is limited and the possible choices for measures relatively large, the reliability of the provided results will also be limited. Increasing the number of cases for each (type of) measure would increase the reliability of the analysis. Therefore we reduced the categories of measures to wet (for example 'Dike raising') and dry (for example 'Dredging') measures. However, no significant differences in choices for wet and dry measures based on events and developments in the game could be found[47].

Going back to the broad variety of measures we could still find significant relations between flooding and the choice for specific measures. Flooding of a relative large number of dike rings was followed by 'Room for the river', 'Dike raising', 'Medium sized boats' or 'Educating people'[48] (see Figure 29). The choice for 'Medium sized boats' after a major flood seems surprising but may be explained by looking at the shipping suitability in the same simulation run. Even in case of floods, the summer might have been dry, causing navigation problems. Although not significant, an increased number of flooded dike rings usually resulted in decreased shipping suitability (taking all storylines together). Nonetheless, in almost all cases, 'Navigation with smaller boats' was combined with a so called 'wet measure' like 'Dike raising', 'Climate dikes', 'Upstream cooperation', and 'Adaptation of the trigger for alarm'. 'Dike raising' and 'Room for the river' have been chosen multiple times after a relatively large number of flooded dike rings. The measure 'Educating people' was only chosen once, although this was after a flood with an extremely large amount of flooded dike rings (see Figure 29). This may be coincidence, but may also indicate that people search for alternative ways to deal with floods and water safety when the number of flooded dike rings is exceptionally high. Dike rings either protect urban- or agricultural area. During the games, coalitions oftentimes stressed the urgency to act after a flood had hit urban area. Sometimes they were willing to compromise to any measure instead of not indulging on their preferences, achieving no agreement and not doing anything at all. Nonetheless, it was not always possible to agree on measures in the case of flooded urban area. Flooding of agricultural area was generally approached as less problematic, hence also reducing the urgency to act and compromise. In general, the more urban area was flooded (measured in square kilometers), the more need was

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[45] Occurrence of a flood, number of flooded dike rings, number of flooded urban area, total damage, agricultural damage, natural area, ecological diversity, shipping suitability, coalitions perspective, number of changed beliefs in the perspectives map, agreement indicator at the beginning and end of the game, occurrence of social event, citizen response, percentage wherein worldview and management style match.

[46] This means that the observed differences have a change of 5% or lower to be attributed to coincidence or other factors than the tested variables. If differences are significant, there is a 95% change (or more) that differences in tested variables are responsible for differences in chosen measures. This however says nothing about the strength of observed effects.

[47] Dry strategies were only chosen when coalitions had a Hierarchical or Hierarchical- Individualistic perspective. This relation was however not significant (P=0.056).

[48] P=0.000, F=5.7, for an explanation of the F value, see footnote 39

felt to compromise and the more inclined coalitions seem to choose 'Artificial mounds', 'Educating people', 'Room for the river', 'Climate dikes' and 'Smaller boats'[49] (see Figure 29). Coalitions chose 'Floating houses' if dike rings were flooded without affecting urban, but agricultural area. This is however not surprising as 'Floating houses' have to be located in areas with newly built houses and hence did not function as a solution to sustainably protect existing urban area. Further, as already stated above, 'Artificial mounds' and 'Education of people' were only chosen once, hence it can be coincidence that in those runs large urban area was flooded. However, it may also mean that if floods are really severe coalitions are searching for other solutions than the more known ones like 'Dike raising', 'Room for the river' and 'Climate dikes' that are relatively often chosen if the amount of flooded urban area is high, but not too extreme.
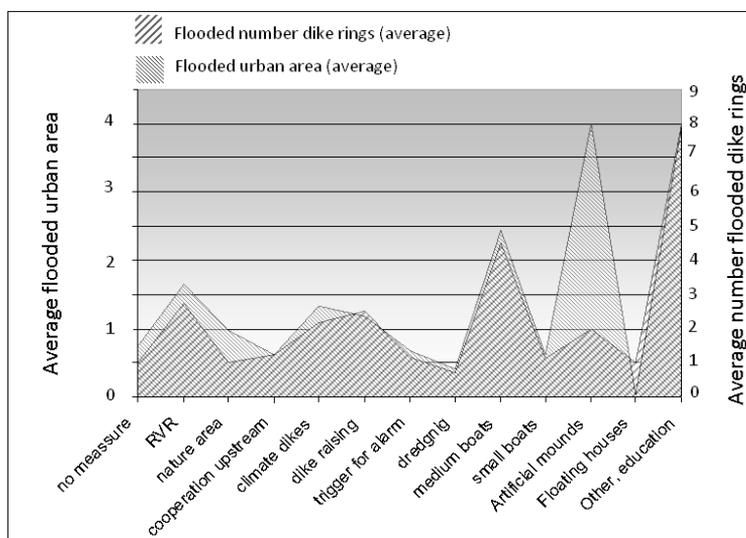

Figure 29: choices for measures divided by the number of flooded dike rings and affected urban area (in km²).

Comparable conclusions can be drawn when looking at total damage and agricultural damage[50]. When the damage is relatively large, coalitions tended to choose for 'Small or Medium sized boats' (see previous paragraph for an explanation), 'Educating people' or 'Adapting the trigger for alarm'. Especially the latter can be categorized as a reactive instead of preventive measure as floods won't be prevented or decreased in intensity, but the number of casualties or affected people may be lower. When the damage was relatively low, coalitions choose 'Upstream cooperation', 'Dike rings',

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[49] P=0.001, F=2.35 (for more information on the meaning of these values, see footnote 39)
[50] P=0.001, F=2.96 and P=0.007, F=2.36 respectively with the remark that only damage resulting from floods was taken into account. Damage due to drought and low shipping suitability were not included. It is strongly advised to also include damage resulting from drought.

'Floating houses', 'Dredging' or coalitions could not agree on measures. After floods that caused a lot of damage (more than 313 million Euros) coalitions could always agree on measures (see Figure 30). Finally, we have seen that water managers (contrary to scientists, students and mixed groups) more often choose Hierarchical water management solutions, whereas the other groups more often chose Egalitarian solutions. This difference however, is not significant. Experiences during the simulation games further show that the dominant perspective does not sufficiently explain the choice for measures (see paragraph 7.4.1), but it (the dominant perspective) does explain the motivations behind the choices for measures. Motivations behind the choice for 'Room for the river' are a good example: this measure was oftentimes chosen to enable the managers to let the river flood in a controlled way and to better meet citizen's demands to create more space for nature and water to preserve support. This is mainly hierarchical and not -as expected by only looking at the measure itself- Egalitarian.
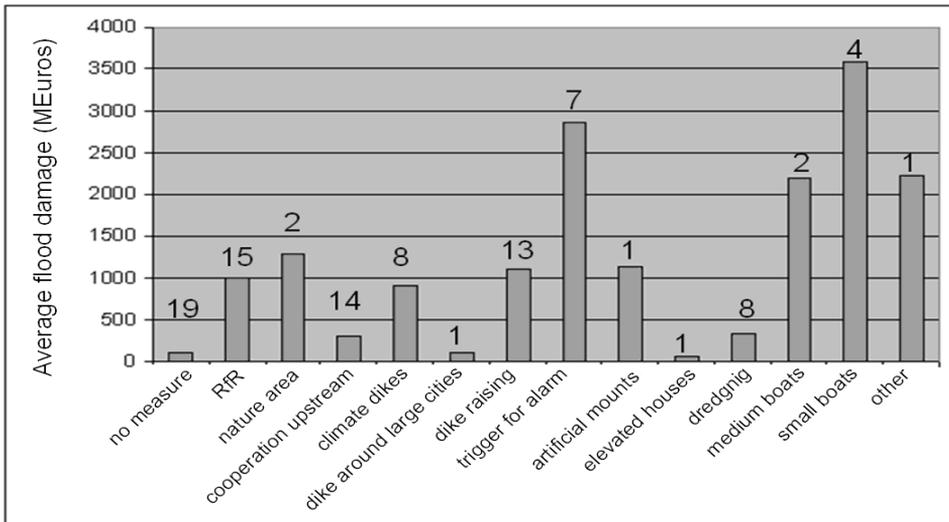
Figure 30: measures that have been implemented (or "no measures") specified by the average total flood damage preceding the choices for measures. The numbers above the bars refer to the number of times the measure has been chosen during all games together (see table 17).

Summarized, in the case of no event or a small event, coalitions seem to be favor of 'Dredging, 'Floating houses', 'Increasing nature area' or not taking any measures at all. After major floods, 'Room for the river', 'Smaller boats' and 'Education' seemed popular (see table 19).

Table 19: Responses after large and small flood events

	Large # flooded dike rings	Small # flooded dike rings	Large # flooded urban area	Small # flooded urban area	High damage (Euros)	Low damage (Euros)
Measures	Room for the river Dike raising Smaller boats Education	Dredging Floating houses Nature area No measure	Room for the river Climate dikes Smaller boats Education Artificial mounds	Dredging Floating houses Nature area No measure	Trigger for alarm Smaller boats Education	Upstream cooperation Dike rings Floating houses Dredging No measure

7.4.3   Perspective change – belief level

Changing perspectives change the way water management strategies and their effects will be evaluated; some strategies may gain in popularity, others may loose support. The same is true for motivations behind the choices for measures: some will become more important, others may loose importance. Hence, insight in perspective change contributes to our understanding of socially robust water management strategies. In this section we will analyze directions of perspective change and relations between directions of change and events or developments in the simulation runs. We find that - for all storylines together- all beliefs in the perspectives map have been susceptible for change (see table 20). A remark that has to be made is that the belief on developments in the socio-economic context only changed in runs wherein participants were explicitly fed with storylines regarding the socio-economic context (economy, pressure on space and demography).

Table 20: number of times the individual beliefs in the perspectives map were changed during all storylines (n=12) together.

Beliefs	
Water function priority	13
Trust in technology	8
Climate change	13
Economic context	3
Safety	12
Principle of spatial planning	13
Responsibility	2
Decision making based on	7

In table 20 we observe that notably the belief on responsibility seems to be robust for change. The Hierarchistic interpretation of this belief (government as primary responsible for water management) seems relatively independent from future events and developments. Resulting from this, we could conclude that the government will remain responsible for water management in all different future scenarios and that

private initiatives (in case of an Individualistic future) regarding water management should also involve the government as final responsible in order to guarantee social and public support. However, at this point we should also reflect on the used methodology as we may not have succeeded in imagining and letting the participants experience future situations wherein the government withdraws from responsibilities, preventing change of the belief on responsibilities. Besides, some (other) beliefs may look mistakenly robust because the present game structure (notably decision making processes and the way information is presented) inclines too strongly towards Hierarchism. Nonetheless, it is interesting to see that the beliefs on water function priorities, climate change, safety and water's relation to spatial planning are subject to regular changes (on average minimally once in every storyline). Their interpretation seems to be less robust than for other beliefs and hence more susceptible for change. If we look at how coalitions' perspectives (at a belief level) changed during the simulation game, we can not identify significant patterns of convergence or divergence between coalitions. However, in mixed groups coalitions filled out the perspectives map (the interpretation of beliefs) more identically than groups with only students, scientists or notably water managers[51] (see Figure 31). Hypothetically we argue that a high agreement leads to easier negotiations wherein coalitions relatively easier agree on measures compared to groups with a low agreement indicator. Also, when confronted with the same events and developments, perspectives may change into a comparable direction, having a comparable effect on the extent to which measures are (still) regarded acceptable. The current storylines per subgroup were however not sufficient to either reject of validate this hypothesis.

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[51] $P=0.00$, $F=27.02$ for the agreement indicator at the start of the game and $P=0.000$, $F=23.62$ for the agreement indicator at the end of the game
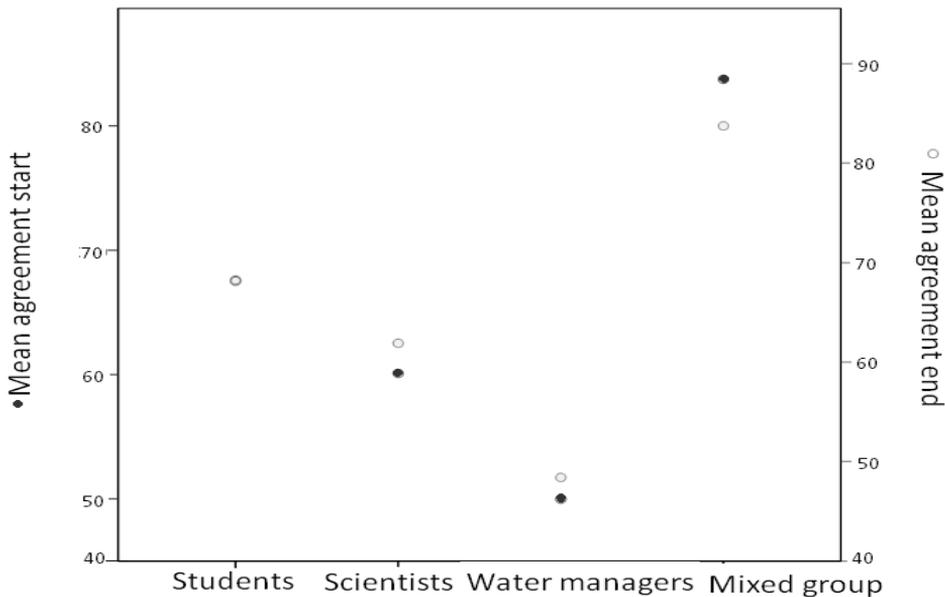
Figure 31: Mixed groups had a higher agreement indicator, which means that their interpretation of beliefs in the perspectives map is relatively comparable. This is the case both at the start and the end of the game. Water managers generally had a lower agreement.

7.4.4   Role of events and surprises for changing beliefs on water management

In the next step we analyzed to what extent perspective changes could be explained from developments and events that happened during the game. As explained in the methodology part of this chapter, changing interpretations of beliefs in the perspectives map were kept up in different ways: by a project team member who listened to negotiations within and between coalitions and changed the interpretation of beliefs accordingly, and by a reflection of the coalitions themselves. There are no significant differences regarding changing interpretations done by the researcher or the coalitions themselves. We could however not find any significant factors (see footnote 45 in paragraph 7.4.2 for an overview of the analyzed indicators) that either contributed to movements of specific beliefs or the number of beliefs that changed. This suggests that changing interpretations in the perspectives map cannot (only) be explained by events and developments in the game or any of the other indicators (agreement between coalitions, respondent characteristics). However, during some games we observed that coalitions had the tendency not to change the interpretation of beliefs easily. The coalition members sometimes approached change as being inconsistent or wrong at the start of the game. In those cases, the project members had an important role to explain the coalition members that changing interpretations had nothing to do with being right or wrong. Following and related to this, the project members had to find a balance between concretization of beliefs (making empathization, reflection and indication of change easier for the participants) and

generalization of beliefs which was considered to be more approachable, less infringing for the game process and less time consuming, however expecting at least some knowledge on perspectives and the way how separate sub-ideas relate to the eight different beliefs.

7.4.5   Perspective change - perspectives triangle level

In this section we report how coalition perspectives moved throughout the perspectives triangle during the simulation games. Every movement is a consequence of changing beliefs in the perspectives map (see previous two sections). As change implies that one or two perspectives become stronger at costs of another perspective we distinguish change *into* a certain direction and change *away* from a certain direction as both movements may be useful to think about perspective change. In general we can remark that movements into an Individualistic perspective as well as rigorous turnovers from one extreme perspective to another were underrepresented in the simulation games so far (also see Figure 32).
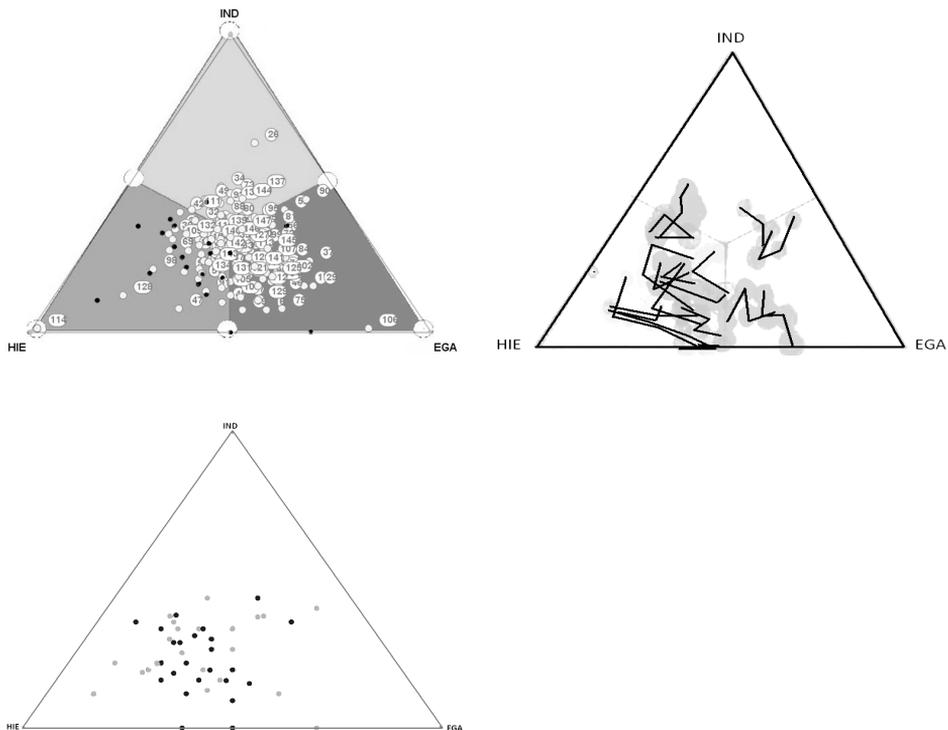
Figure 32: The perspectives triangle with -on the upper left- the numbered positions resulting from the questionnaire to measure the present Dutch perspective on water among water professionals in the Netherlands (see chapter 6) and (the dark black dots) start situations of all coalitions in the beginning of the simulation games. At the upper right we see the pathways of perspective changes (mainly within the Hierarchical corner of the triangle) followed by the coalitions during the game. At the lower left we see the start situations of the coalitions (light dots) and the end situations (dark dots).

7.4.6   Role of events and surprises for aggregated perspective change

Again, we analyzed for each game indicator (see footnote 45 in paragraph 7.4.2) if it's score influenced the direction of perspective change. First, the score on *navigation suitability* had a significant effect on the direction of perspective change: navigation without major (drought related) constraints, often led to a movement into the direction of *Egalitarism*. If shipping is constrained for a longer period a year (with an average of 6.6% or more), a movement towards Hierarchism becomes more likely[52]. A possible explanation would be that a low score on shipping suitability leads to a desire to more strongly control the river, wherein control is preferred over innovation or 'Large scale dredging'. A high score on shipping suitability decreases the desire and importance of controlling the river more substantially, leaving space for a more natural approach to deal with water. Second, a *high score on nature area* (more than 16km²) oftentimes led to a movement into the direction of *Individualism*. A low score on nature (less than 14.5km²) induced movements into the direction of Hierarchism[53] (also see Figure 33).
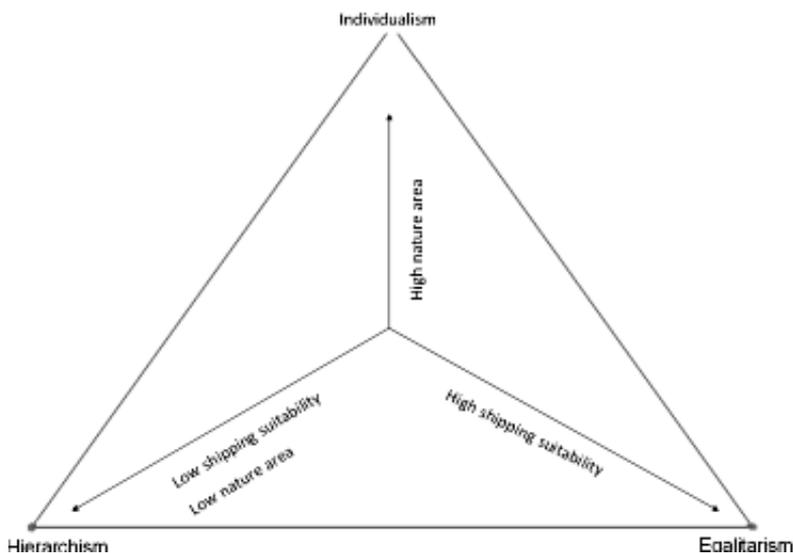
Figure 33: a high score on nature area oftentimes led to a movement into the direction of Individualism. A low score on nature area and low shipping suitability often led to changes into Hierarchism, and high shipping suitability frequently led to movements into Egalitarism.

Regarding movements away from certain perspectives, in all simulations were players were confronted with false alarms coalitions moved away from Egalitarism and/or Hierarchism; they never moved away from Individualism[54] (see Figure 34). The same is true for high agricultural damage; high damage (more than averagely 35 million Euros)

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[52] P=0.000, F=3.602
[53] P=0.038, F=3.602
[54] P= 0.024, F=3.524

prevented coalitions to move away from Individualism[55.] In runs were agricultural damage was really high (averagely 46 million Euros or more) coalitions tended to particularly move away from Hierarchism. Next, the higher the number of affected people (206 or more on average), the more inclined coalitions were to move away from Individualism[56]. In cases of less affected people (53 on average) coalitions more often moved away from Egalitarism. Further, the effects of citizen responses on perspective change on a coalition level were analyzed. To that end, we divided citizen responses in the games (either through newspaper headlines or a project team member representing the citizens' perspective) into five categories: 1. Citizens showed trust in the present policy/they were happy with it 2. Citizens asked for action 3. Citizens were angry 4. Citizens were skeptical, lost trust or were scared 5. Citizens responded in a different way. We could however not find any significant effects on perspective change resulting from (different) citizen responses. Regarding the target group with whom we have played the game, we can state that water managers moved away from Individualism more often than other target groups, but they never moved away from Hierarchism in any of the simulation games[57].
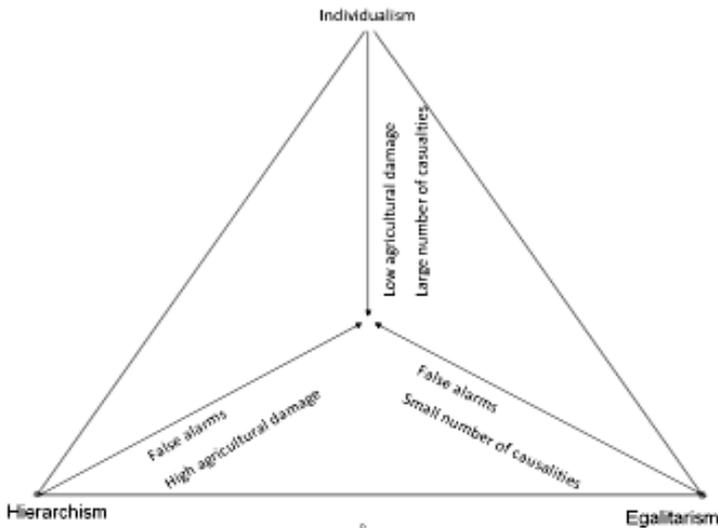
Figure 34: in cases of false alarms, coalitions never moved away from Individualism. Coalitions tended to move away from Individualism if agricultural damage was relatively low or in cases with a large number of casualties. Movements away from Egalitarism were stimulated by small numbers of casualties, movements away from Hierarchism by high agricultural damage. See paragraph above for more information.

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[55] P=0.012, F=2.807
[56] P=0.005, F=3.986. Here it should be added that the only time the participants were confronted with the extremely high number of 1629 affected people , the coalitions moved away from Individualism.
[57] P=0.015, F=3.937

7.4.7   Relation between worldview and management style

As we have explained in chapter four, the relationship between worldview and management style is a relatively overlooked and complicated topic within the Perspectives Method. This can partially be explained by the multi-interpretable way of defining what is meant with management style and by existing disagreement on the cause-effect relation(s) between the two concepts. A verifiable match between dominant perspectives and choices for measures would substantially increase our understanding of socially robust measures as perspective change could directly be translated into changing management preferences and/or vice versa. However, in chapter six we saw that worldview and management style do not necessarily match in practice. To test the relation between worldview and management style we designated perspectives (usually one, sometimes two) to the different measures (see appendix 5). In the next step we compared the designated perspectives with the positions of the coalitions in the perspectives triangle at the moment they chose a measure. This comparison resulted either in a match or not. If all suggested measures in one storyline for one coalition matched with the designated perspectives, the match would be 100%. In our storylines we have found that worldview and management style averagely matched in 50% of the time (with a minimum of 12.5% and a maximum of 88.9%, see table 21). We have analyzed the proposals of each coalition (the whitepapers) and the ultimate proposals for implementation (after negotiation). In both cases the match lies around 50%. These results do not convince that worldview and management style (defined as respectively a dominant perspective and the choice for measures) match significantly. Therefore we should be careful in designating perspectives to measures and to attach value orientations for different measures based on worldviews. Preferences for measures can thus not (always) be explained through the dominant perspective. As we have seen in paragraph 7.4.1, motivations behind the choices for measures can be more easily explained from the dominant perspective than the choice for measures in itself.

Table 21: Percentages wherein worldview and management style matched during the storylines in the whitepapers (left) and after negotiation (right).

	Match worldview and management style – whitepapers (%)	Match worldview and management style – after negotiation (%)
Mean	49.2	50.2
Std. Deviation	18.6	12.5

7.5   Reflection

7.5.1   Summary of the main results

In this chapter the conceptual and technical framework that forms the backbone of our methodology to explore perspective change and social robustness of water management strategies under an uncertain future has been presented. The method allows exploring how the societal perspective on water coevolves with developments in climate, the river system, the broader societal context and choices for measures. As mentioned before, this method is still under development, and the results presented here only refer to twelve storylines we have developed during the project. Therefore, these results should be regarded as illustrative for the methodology. After refining the methodology and playing it multiple times for a broad variety of different futures, we can more confidently conclude on the content of the results.

The preliminary results show that measures like 'Room for the river' and 'Dike raising' have been chosen independently from the climate scenario and multiple times during some simulation games. Besides, these measures (including others as well) have been chosen independently from the coalition's dominant perspective. Further, frequent combinations of measures into a strategy ('Room for the river' with 'Upstream cooperation' and 'Upstream cooperation' combined with 'Dike raising' and 'Dredging') may be an indication for so called "clumsy solutions" wherein shortcomings from a mono-perspective point of view in one measure can be compensated by another, making the total strategy (more) acceptable under more perspectives.

Additionally we tested the influence of events, surprises and scores on indicators on the choices for measures. We found that severe floods (with high damage and large parts of flooded urban area) stimulate innovative or new solutions compared to the more known solutions like 'Dike raising', 'Room for the river' and 'Climate dikes' that were often chosen if the amount of flooded urban area was high, but not extreme. Subsequently, a large number of flooded dike rings often led to the choice for 'Room for the river' and 'Dike raising'. High damage often led to 'Adapting the trigger for alarm', whereas low damage often led to 'Upstream cooperation', 'Heightening of dike rings' and 'Floating houses'. Changing perspectives could not directly be translated to (a changing) choice for measures. Neither could we find convincing proof on a match between worldview and management style. (Perspectivistic) motivations behind the choices for measures seem more important and determining for the choice for measures than the dominant perspective at hand.

We also learned more about aggregate perspective changes, namely that false alarms or high agricultural damage prevent coalitions to move away from Individualism, and that a relatively large number of affected people induces a movement away from Individualism. Other examples are that movements into the direction of Hierarchism become likely when nature area and/or shipping suitability score low. High shipping suitability led to movements into Egalitarism, a high score on nature on the other hand

oftentimes led to changes towards Individualism. We have also seen differences in audiences as water managers never moved away from Hierarchism, but relatively often away from Individualism, contrary to the other audiences (students, scientist and mixed groups).

On a belief level, the belief on water management responsibilities seems relatively robust for change, whereas 'water function priorities', 'climate change', 'safety', and 'water's relation to spatial planning' were subject to regular changes. However, changing beliefs could not significantly be related to specific scores on indicators or other storyline characteristics (see appendix 4 for an overview). The overall conclusions offer interesting insights into perspective change, the circumstances under which specific strategies are chosen and -to some extent- the social robustness of different water management strategies.

7.5.2   Meaning for socially robust water management strategies

As stated before, a sustainable water management strategy is able to cope with uncertainties in the physical and social system. If a strategy and its effects on the water system are not any longer considered acceptable, the strategy is lacking social robustness. The challenge is to find a strategy that stays acceptable under a broad variety of climatic and social (perspectivistic) futures. It should hence be acceptable under the different perspectives. In this section we will discuss how the results presented above may contribute to our understanding of socially robust water management strategies. To that end we focus on four aspects: 1. Measures than have been chosen by coalitions with different perspectives as they therefore can be considered acceptable for the different perspectives (present and future social robustness). 2. Measures that have been chosen in different climate scenarios as they can be regarded acceptable independent from climate related impacts on the water system. 3. Measures that have been chosen multiple times in the same simulation game. The first time measures are chosen, they are considered acceptable (present social robustness). If the same measure will be chosen again, it apparently remains acceptable (future social robustness). 4. Measures that often survive the negotiation. Usually, coalitions have different perspectives on water. Measures that often survive the negotiation are considered to be acceptable under different perspectives (again, present social robustness).   Following these indicators, we have seen that the measures 'Room for the river' and 'Dike raising' can be considered (relatively) robust. 'Elevated houses', 'Artificial mounds' and 'Medium sized boats' however, seem to be tight to specific perspectivistic and climatic futures, hence decreasing their level of robustness (see table 22).

Table 22: a first overview on social robustness, based on the above stated results. Results show that (based on the storylines derived with our game) next to 'Room for the river' and 'Dike raising', 'Dredging', 'Climate dikes' and 'Upstream cooperation' also seem relatively robust. For the measures that are lacking robustness, the picture is less clear, although it seems that (based on the analyzed storylines) 'Medium sized boats' and 'Elevated houses' seriously lack social robustness.

	From different perspectives	Different climatic futures	Multiple times in 1 session	Surviving negotiation
High score on robustness	Room for the river Climate dikes Dike raising Upstream cooperation Artificial mounds Dredging Nature area	Room for the river Dike raising Trigger for alarm Dredging	Room for the river Dike raising Upstream cooperation Dredging	Room for the river Dike raising Climate dike
Low score on robustness	Elevated houses Trigger for alarm Medium boats	Education Floating houses Dike rings around city Medium boats Artificial mounds	x	Elevated houses Artificial mounds Nature area

Of course, as we only have a small sample of twelve storylines where these results are based upon, statements on robustness must not be given too much weight. Further, figure 32 shows that the social robustness of water management strategies in our game sessions was mainly tested in Hierarchical and -to a lesser extent- Egalitarian futures. This is -amongst others- due to the current structure of the game. Decision rules within the game, as well as available measures and the way results have been presented by the researchers incline towards Hierarchism and to a lesser extent towards Egalitarism. Also, socio-economic developments followed a (Hierarchical) business as usual scenario and participants turned out to be slightly stronger Hierarchistic -already at the start of the game- than the average Dutch water professional (see chapter 6 and Figure 32). It is thus not totally surprising that Hierarchical ('Dike raising', 'Climate dikes') and Egalitarian ('Room for the river', 'Upstream cooperation') measures seem to be relatively robust in comparison to other (Individualistic) measures. An extended game version will lead to more complete insights regarding the robustness of water management strategies and the role of Individualistic measures herein (see next section).

In this paragraph we assumed that the choice for measures implied a positive (and hence acceptable) evaluation of the given strategy. However, if this is really the case depends -among others- on how the strategy scores on indicators and how those scores are evaluated retrospectively from the different perspectives. Whether a strategy is acceptable under a broad variety of futures can only be evaluated retrospectively, once it is known how the strategy performed. To this end we need to know till what threshold a strategy is acceptable according to the different perspectives and when it reaches its "acceptability threshold" beyond which it is not any longer perceived desirable. This is the topic of the next chapter.

7.5.3   Towards an improved game concept

In the extension of the method, there are certain elements than deserve more attention to guarantee a full and representative exploration of perspective change and the social robustness of strategies under an uncertain future:

1. More attention should be paid to the evaluation of strategies chosen during the game. As the concept of robustness is strongly related to acceptance of a strategies' effects, more information needs to be available on how participants evaluate a strategy and its effects on the water system given a multitude of future scenarios. This increases insight on how robust a strategy is and whether additional strategies are chosen to make up for deficits of the previously chosen strategy or to prevent any problems in the future. With the information available now we can only partially decide on a strategies' social robustness (see next chapter). More information on evaluations possibly also allows for an analysis on the relation between (perspectivistic) motivations and choices for measures (see paragraph 7.4.7).

2. There should be more emphasis on inclusion of uncertainties in demography, land use and economy. So far, it is assumed that these trends follow business as usual patterns that can be considered Hierarchical. This limits the possibility of Egalitarian and notably Individualistic futures, and restricts the capacity to analyze the effects of changes in these patterns on perspective change, preferences for measures and social support.

3. Diversification in decision-making processes should be included in the game. Currently, a Hierarchical system of negotiation and deliberation is followed. To properly simulate future changes towards Egalitarism and Individualism, players should have the opportunity to change the decision making process towards consensus (for Egalitarians), a costs-benefit analysis or decision making driven by power differences (for Individualists).

4. The same is true for the way information is presented to the players of the game. Currently, players do not have the choice for which time frame they want to receive information, hence formally ignoring differences between perspectives. For example, Individualists are not very interested in long term expectations, but Egalitarians all the more. Besides, presenting facts and figures by experts suits itself very well for Hierarchical decision making, but not for Egalitarian or Individualistic decision making. To take the latter two into account, more information should be available to choose from regarding stakeholder opinions, market expectations and cost-benefits. Also, the content of information provision can be adapted to different perspectives. Hierarchists are in favor of detailed information from various disciplines; Individualists however, would prefer more general trends for economy, demography and climate.

5. There should also be more variety in possible measures to choose from. Currently, there is a broad variety in controlling measures. There should be a comparable variety in natural and innovative measures. Especially the latter may turn out to be a challenge given the new character of these measures and the need to think 'outside the box' when coming up with these measures. Besides, creativity of (Individualistic) players could be stimulated by offering more possibilities to invent and implement new measures that are not part of the standard package of measures yet. Also measures than do not necessarily refer to an intervention in the river system (for example the possibility of insurances, education or changing the way decisions are made) could be part of the game. Even if we have to conclude that there is no direct link between worldview/perspective and management style/choice for measures it is good to include more innovative and nature-based measures. Combining the choice for measures with a more extensive explanation of the motivations behind the choices also allows analyzing the link between perspectivistic motivations and the choice for measures.

6. Currently, agricultural- or total damage is solely a result from flooded agricultural and urban area. Damage resulting from drought (e.g. for shipping suitability or nature) is not yet included into the game. This may provide a rather one-sided view on the role of damage for perspective change, motivations, evaluations and robustness. Therefore we advise to also include damage resulting from drought into the game.

7. Conclusions on robustness and gradations of robustness can only be justified after playing the game multiple times. To keep the results pure, each future situation needs to occur multiple times, under different perspectives and with different scores on indicators. As such, the game needs to be played very often, which demands a workable tool that can be played without too many facilitators. At this moment we would consider the tool as workable, but we should try to reduce the amount of facilitators needed to play the game (which is around 3 to 4 people at this moment).

8. After playing the game multiple times, response rules may be extracted from the results describing "if x happens, y (perspective change or changes in measure preferences) will follow". X may refer to events (floods, droughts), surprises (news paper headings), developments (economic or demographic) and other characteristics in the game (for example agreement between coalitions). Y can be thought of as perspective change, choices for measures or the way scores on indicators may be evaluated. Such response rules may eventually allow a (semi) automatic version of the simulation game to explore an even larger amount of different futures. However, the emphasis remains on exploring future developments and not so much on forecasting or predicting future perspective change. Therefore, a constant reflection and the possibility of receiving feedback on response rules remains required. Decisions made by players of the game thus

both offer input for the response rules and simultaneously function as validation for the same response rules. Players of the game can reflect on the extent to which the response rules would indeed match with their response in a specific situation.

9. Of course, uncertainty does not only lie in the limited number of storylines we have analyzed, but also in uncertainty inherent to model calculations. The latter refers to the extent to which the model correctly reflects reality and succeeds to let participants experience the calculated outcomes properly. Model in- and output should be part of an ongoing reflexive learning process and open to adjustments. This also implies that response rules (see previous point) should remain part of a reflexive participatory process to constantly monitor and -if necessary- adapt the determined rules.

10. Also following the conclusions in chapter five, it has proven to be impossible to forecast the role of surprises beforehand. We need more information about the specific role of surprises for perspective change. The current methodology allows to experiment with the timing and content of surprises in different perspectivistic and hydrologic settings that will further increase our understanding on the role of surprises in perspective change.

11. Formally and as discussed in chapter 3, there is very little reason to exclude the Fatalistic perspective from our perspective based methodology. Although reasons can be provided to assume that Fatalists -given their fierce rejection of policy processes and decision making processes- won't get involved as policy makers (hence participants) in the game, society may evolve in a Fatalistic direction, indirectly effecting (support for) water management options. Fatalism as direction for future societal developments or citizen perspective should therefore be included in the game.

Other attention points include a more in-depth investigation of the strength of relationships between events and the choice for measures or perspective changes. This may also increase insight in the effects of the occurrence of two events that lead to developments in opposite ways. For example, what if low shipping suitability parallels a high score on nature? The former leads to a movement into the direction of Hierarchism, whereas the latter leads to a movement into Individualism. Which aspects have a stronger influence and are more determining for the way perspectives may change? Combining the here described methodology with a more qualitative approach (for example through in-depth interviews with the players of the game) could also allow to gain more insight in how people may respond to events in specific future circumstances. Another aspect deserving more attention relates to the difficult nature of finding a balance between including the aforementioned aspects into the game on the one hand, and keeping the game understandable and interesting to play on the other hand. Participant involvement, willingness and eagerness to play the game are as important for the generation of useable and realistic results as completeness of game

procedures and components. The game should thus be understandable and smoothly to play as well. This asks for constantly re-evaluating procedures and contents of the game.

Chapter 8

AN OUTLOOK TOWARDS SOCIALLY ROBUST AND SYNERGISTIC SOLUTIONS

THE ROLE OF ACCEPTABILITY STANDARDS

8   INTRODUCTION

The idea of social robustness is inextricably connected to the concept of acceptability (see chapter 1). The Oxford English dictionary defines acceptability as: "the quality of being tolerable or allowable; not a cause for concern; within prescribed parameters". Following from this, we consider a water management strategy socially robust as long as it is considered acceptable, that is as long as its visual appearance and its effects on the system state -independent from climatic or contextual developments- can be considered tolerable or allowable, not a concern and/or within prescribed parameters. However, acceptability and parametric thresholds may differ for the different perspectives. To test a strategy's social robustness we thus need more information about perspective dependent acceptability standards. As our current perspective based simulation game lacks the collection of information on the way strategies were evaluated retrospectively we do not have enough information on these acceptability standards yet. The aim of this chapter is to argue for taking different acceptability thresholds into account, to give the reader an idea on the type of lessons that this inclusion may offer and to give a first outlook on how these thresholds can be identified. This chapter won't focus very much on perspective change, but on the consequences of perspective changes for the way strategies and their effects will be evaluated. To successfully analyze a strategy's social robustness it is important to explore a broad range of different futures. To this end we need to focus on:

1. The entire range of future developments in climate (e.g. precipitation and river discharges). The IAMM (see chapter 7) was randomly fed with three different climate scenarios established by the Royal Dutch Meteorological Institute (KNMI): no climate change, G and W-plus scenario (Hurk *et al.*, 2007). These climate scenarios vary (amongst others) in temperature rise (between zero and plus 2 degrees Celsius), increased winter time precipitation (from zero to 14.2%), and summer time precipitation (varying from minus 19% till plus 2.7% compared to the current situation). For each climate scenario, ten realizations of precipitation and evaporation were considered for the next 100 years (climate variability), resulting in 30 different realizations of future climate.

2. The effects of the above mentioned future climates on the water subsystem. To this end, the IAMM calculates different scores on nature, discharges, navigation, damage and flooding based on differences in climate scenarios. This results in ranges for minimum, maximum and average scores for each indicator for each climate scenario. For more information on the calculation procedure, see chapter 7 or Haasnoot *et al.* (accepted).

3. The effects of implemented measures on indicators, given the aforementioned variety in climatic scenarios and different socio-economic scenarios. It is not only the climate and weather patterns that determine the score on indicators, but also the type of measures that will be implemented. The inclusion of variation in socio-

economic developments is important as urban developments may increase the damage after a flood, or decrease the available space for nature. This results in minimum, maximum and average scores for each indicator and measure under each climate- and socio-economic scenario (see next section). A diversity of measures can be implemented in the IAMM (see chapter 7) by changing input maps (e.g. dike height or position), adapting the effect relations (e.g. damage function), or changing the river inflow (e.g. after a successful cooperation with upstream areas) (see Haasnoot *et al.*, accepted or the previous chapter for more information).

4. An evaluative screen is needed to judge whether a strategy's results can still be considered acceptable. Of course, it is also possible that a strategy only remains acceptable in a limited number of futures, for example because it cannot cope well with the effects of extreme climate change. It that case it is lacking social robustness but can still be relatively robust compared to strategies that become unacceptable in all climate scenarios.

The first three aspects are already part of our participatory simulation game (see previous chapter). Regarding the fourth aspect it is important to realize that each perspective may have its own (range of) acceptability standards that do not only relate to absolute scores for indicators, but also on the sequential occurrence (or the stay away) of events. We will argue that knowledge on acceptability standards is crucial to assess a strategy's robustness and provide the reader with a visual overview on how a strategy may perform on several indicators under different futures. Social robustness can be expressed in years (see chapter 1). A strategy that possibly becomes unacceptable after 80 years has a longer tenability than a strategy that may become unacceptable after already 40 years. Different levels of acceptability may in different climatic and perspectivistic futures lead to a different tenability for strategies. By offering a full overview of the tenability of strategies under different futures, different gradations of social robustness become visible. The longer a strategy's tenability, the more socially robust it can be considered. We conclude with a description on how acceptability standards may be measured and defined.

8.1   Perspective-based acceptability standards

Different strategies have different effects on the water system. Depending on how the future unfolds, scores on indicators like navigation, damage and nature are shaped. Subsequently, effects on indicators will be evaluated differently by the different perspectives. What is considered acceptable from one perspectivistic point of view, may be unacceptable from another perspectivistic point of view (see table 23). A relative low score on nature diversity may be acceptable for Individualists while being unacceptable for Egalitarians. A strategy's acceptability thus depends on the climate scenario, the climate realization, socio-economic developments and the dominant

perspective at stake. The challenge is thus to identify strategies that offer (relatively) acceptable scores for the indicators under all (or most) perspectives, climate scenarios and socio-economic scenarios. Studies that don't include perspective change only assess a strategy's robustness given present acceptability standards.

Table 23: Perspective dependent levels of acceptability for each indicator

	Hierarchical acceptability	Egalitarian acceptability	Individualistic acceptability	Fatalistic acceptability
Damage	Medium	High	Low	Low- medium
Floods	Low	High	Medium	Medium
Shipping suitability	Medium	Low	High	Medium
Nature area and diversity	Medium	High	Low	Medium
False alarms	Low	High	Low	Medium

Next to the gaming sessions as described in the previous chapter, numerous computer based simulation runs were executed to calculate minimum, maximum and average scores on indicators for each measure under all climate realizations. Below we give an example of the results of this calculation for the measure 'Large scale room for the river'.

'Large scale room for the river' literally refers to the provision of more natural space for the river and nature. Flood plains are restored into a more natural state wherein discharge hindering obstacles -like buildings- are removed. The idea is that nature development can be combined with a controlled flooding of the winter bed to temporarily collect excessive river water and prevent ground swells. In the Waas case (see previous chapter) 'Large scale room for the river' implied an increase in nature area from 14 km² to 20 km². In the IAMM simulation runs (including 3 different climate scenarios with 10 climate realizations each) the average number of floods within 100 years of water management equaled five flood events (with a total average of 8 flooded dike rings and a standard deviation of 4 dike rings). The minimum number of floods was 2, with 3 flooded dike rings. On a 100-year average, 5.2 km² urban area flooded (with a standard deviation of 2.4 and a minimum of 2.0 km²). The average total damage equals 4705 million Euros, with a standard deviation of 2683 million Euros and a minimum of 1676 million Euros. For agriculture these numbers respectively represent 148, 88 and 43.1. Ships were able to navigate in averagely 91% of the time with a standard deviation of 3.2 % and a minimum of 85.6%. Nature area scored 20.1, with a standard deviation of zero. The ecological diversity equaled 0.40, again with a standard deviation of zero (see table 24).

Table 24: Average scores and standard deviations for the 'Room for the river' measure on flooding, damage, shipping suitability and natural area. These are the averages and standard deviations of the total scores for the 'Room for the river' measure in 100 years of river management given the 30 different climate scenarios. For example, when the 'Room for the river' measure will be implemented, we will be faced with an average of 5 floods in 100 years of river management.

	Room for the river
μ number of floods	5
σ number of floods	2
μ flooded urban area (km²)	5.2
σ flooded urban area (km²)	2.4
μ total flood damage (in million Euros)	4705
μ agricultural damage (in million Euros)	148
shipping suitability (in percentage of total time)	91%
Min. shipping availability (in percentage of time)	86%
Nature area (km²)	20.1
Ecological diversity (between 0 and 1)	0.40

Here we see that in the "best" scenario we can still expect three flooded dike rings in 100 years of river management. Of course, adding one or more other measures may decrease or increase this number, but whether three flooded dike rings -and other scores- are acceptable or not, depends on the perspective at stake. Following literature (Thompson et al., 1990; Douglas, 1996; Verweij et al., 2006; Offermans, 2010b) and the stereotypical perspectivistic descriptions, it can be expected that -given the high acceptability of floods, room for the river's high scores on nature and ecological diversity and the relatively low importance attached to economical values like navigation- 'Room for the river' may remain acceptable under an Egalitarian future. Under an Individualistic future however, this strategy is expected to induce resistance, partially because of its space demanding nature and preventive character. As -from an Individualistic point of view- pressure on space is large and expected to increase it would be wasteful not to integrate the water surface and floodplain into spatial planning. Subsequently, the damage resulting from this strategy in some climate realizations will probably be unacceptably high for Individualists. Also a possibly hindrance for navigation of 14% will be considered too high for Individualists. Hierarchists, on the other hand would initially praise the extent to which the river is allowed to flood in a controlled way, preventing flooding of urban or infrastructural areas. However, as the IAMM runs show, we may still expect a number of floods in the next 100 years of river management (5 on average). We can expect those floods to function as a surprise for Hierarchists and generate a willingness to return to the old paradigm of control and dike building. Hierarchists may question the extent to which 'Room for the river' controls river discharges properly enough to guarantee safety. An increasing demand for control, dikes and dike building goes not easily together with the 'Room for the river' concept. Besides, Hierarchists may argue that 'Room for the

river' results in 'appearance safety' as the government would still be held responsible for water safety, but cannot protect citizens living in the winter bed. For Hierarchists this would be confusing and unacceptable. Fatalists won't even understand all consternation and interferences needed to realize 'Room for the river'. Nature and water are hard to control and if an area is predetermined to flood or loose natural values, it will do so regardless of strategies being implemented. Especially removing discharge hindering obstacles and buildings may encounter resistance from Fatalists, notably if those obstacles used to function as recreational and living objects. Indicators that have a direct and sensible effect on people (for example flooded area and damage) should score relatively well to keep Fatalists happy, which is at least questionable for this strategy given the above presented results.

Given these different ways to interpret the possible effects of 'Room for the River' we can conclude that it is lacking social robustness for Individualistic, Fatalistic and in some situations Hierarchistic[58] futures. Implementing 'Room for the river' and ending up in futures for which it is not robust, generally means that social support for continuation will be lost (see chapter four). This may lead to social upheavals and may force policy makers to quickly change the way water is managed. Ways to proactively anticipate on limited robustness are to either adopt the strategy to make it more acceptable for other perspectives or to make the strategy flexible enough to be adapted to a strategy that fits better to a changing dominant perspective. Following the first option, 'Room for the river' could consider allowing the creation of innovation polders or innovative ways to use the winter bed to compromise on Individualistic beliefs. Some areas can be arranged as amphibian innovation centers where rivers can flood in times of high discharges and buildings can easily adapt to the water surface. The application should however not be too large in scale as this would make it unacceptable for Egalitarians who want to reduce human activities in the winter bed. Besides, following Individualists, 'Room for the river' should not affect the ability of rivers to function as transportation vain, cooling water or irrigation. For Hierarchists, there should be more attention to safety, for example by building additional dike rings around cities and preparing good functioning and tested evacuation plans in case a higher discharge than expected will enter the area. If areas will be used for innovative amphibian infrastructures, safety (for drowning and accessibility for emergency services) should receive attention as well. Also, it should clearly be stated that the government stays responsible, also in innovation areas. For Fatalists, it is important not to intervene too much with existing recreational or enjoyment values in the winter bed, unless those values can be compensated close by. Besides, the provision of more space to nature and water should not result in constrains for recreational navigation, drinking water supply or any other human use of water. The second option to

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[58] In one run, the number of floods is limited to two (relatively small) floods in 100 years. This is expected to be acceptable under Hierarchical futures. Here once more, we see the importance of knowing more details on what is supposed to be acceptable or not.

anticipate on limited robustness (the increase of a strategy's flexibility) means that a strategy can be changed into another strategy that can count on more support for reasonable time and money efforts and with limited negative side-effects. The implementation of a 'Climate dike', for example is less flexible than 'Small scale dredging' as it cannot easily be "stopped", removed or reversed. Reservation of space may (in some socio-economic scenarios) be crucial to keep options open. The reserved space in the 'Room for the river' approach can relatively easy be used for other implementations if this turns out to be desirable. This makes it a relative flexible measure.

8.2   The conceptual approach of tenability

As we have seen in the introduction, a strategy's robustness can be expressed in years. A strategy that remains acceptable for at least 50 years has a longer tenability than a strategy that may become unacceptable after 20 years already. A strategy's tenability depends on contextual developments (climate, demography) and perspective dependent acceptability thresholds. What is considered acceptable from a hierarchical point of view, may be totally unacceptable from an Egalitarian or Individualistic point of view. It is crucial to know more about these perspective dependent acceptability standards as it allows us to get a complete overview of a strategy's robustness in a broad range of climatic, socio-economic and perspectivistic futures. An overview of the tenability of each strategy under each climate change scenario and the four different perspectives ideally provides us with minimum and maximum levels of social robustness (see Figure 35-39). Comparing strategies consequently shows different gradations in robustness time-frames (the time wherein social support may be guaranteed). A relative robust strategy that is also flexible can be considered a sustainable strategy for long term water management (see chapter 2).

Figure 35 provides a simplified example of gradations in robustness for different water management strategies under (30) different climatic futures, given the Hierarchical perspective and (only) focused on the parameter of damage due to flooding. It shows that if no policy measures will be taken, the acceptability threshold will be surpassed somewhere between 10 years and 57 years from now, depending on the exact climate scenario. Some measures (for example DH500; 'Dike raising to a norm of once in 500 years' and DH1000; 'Dike raising to a norm of once in 1000 years') have a relative large dispersion, indicating that their tenability in Hierarchical futures heavily depends on the climate realization that will take place. DH1.5 ('Dike raising to 1.5 times the second highest discharge ever') seems to be a relatively robust measure; in the worst case (climate) scenario damage will become unacceptably high after 84 years (again, in a Hierarchical future), but in other climate realizations, the measure will remain robust for the next 100 years. The same is true for DH500, DH1000 and RfRlarge (large scale 'Room for the river'); in best case climate scenarios they may remain robust for the

next 100 years, however, in other climate realizations they become unacceptable after respectively 16 (twice) and 45 years already.
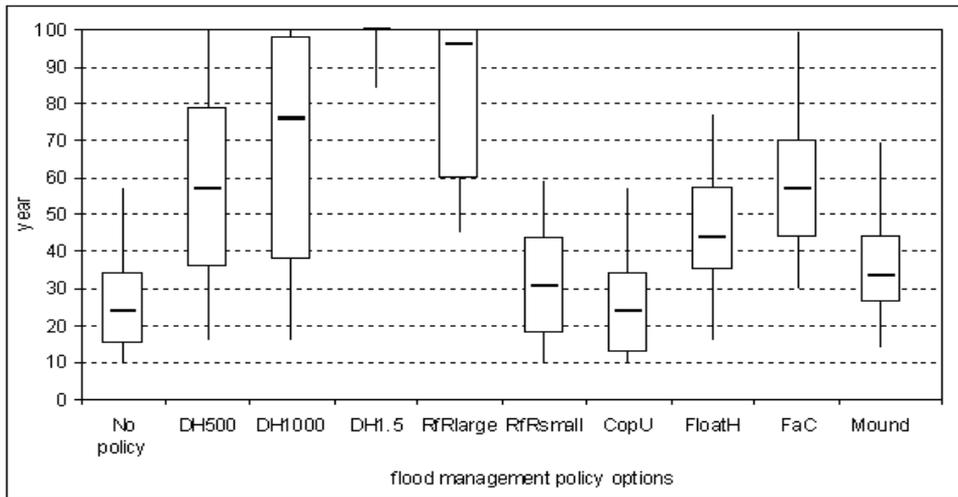

Figure 35: Acceptability for all climate scenarios for the Hierarchical damage criteria. We employed a threshold of 2500 million Euros of damage which is not based on empirical data, but on the assumption that 2500 million Euros of damage would be a realistic damage threshold in our current Hierarchical context (Haasnoot et al., accepted).

We can construct similar figures for the Egalitarian and Individualistic acceptability thresholds. Following our translation of the Perspectives to water related issues, we expect Egalitarians to accept more, and Individualists to accept less damage. For simplicity reasons we assume the Egalitarians to accept the double amount of damage (5000 million Euros, see figure 36), and the Individualist half (1250 million Euros, see figure 37) of the amount accepted by Hierarchists. In Egalitarian futures, most measures remain acceptable for a longer period than in Hierarchical futures (see figure 35-36), although differences are relatively small for most measures. The differences are bigger for the measures FloatH ('Floating houses'), FaC ('Dike rings around the cities") and RfRlarge. For the FaC measure, for example, this means that it may loose robustness after 30 years in a Hierarchical future, or only after 63 years in an Egalitarian future. In Individualistic futures the damage-related robustness is relatively lower compared to Hierarchical and Egalitarian futures. DH1.5 has highest changes to remain acceptable for the next 100 years; however, in some climate scenarios it looses acceptability after 5 years already.
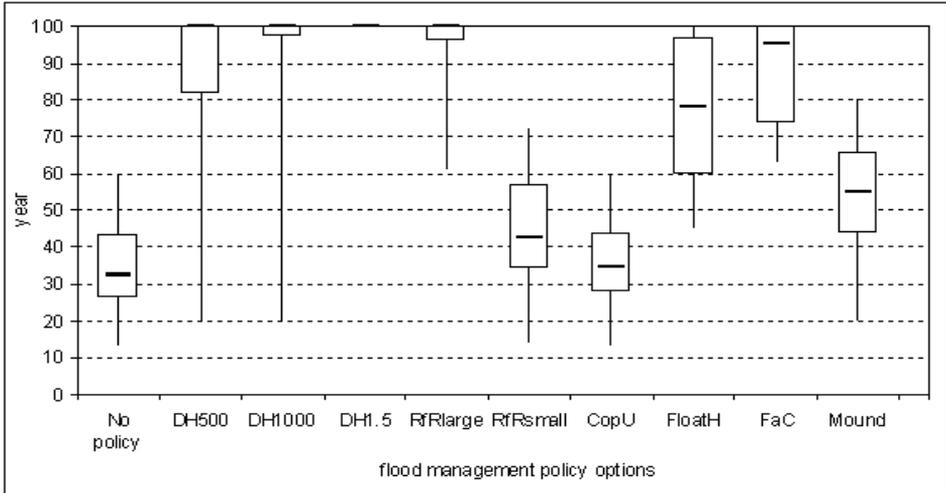
Figure 36: Acceptability for all climate scenarios according to the damage criteria for the Egalitarian (5000 million Euros).
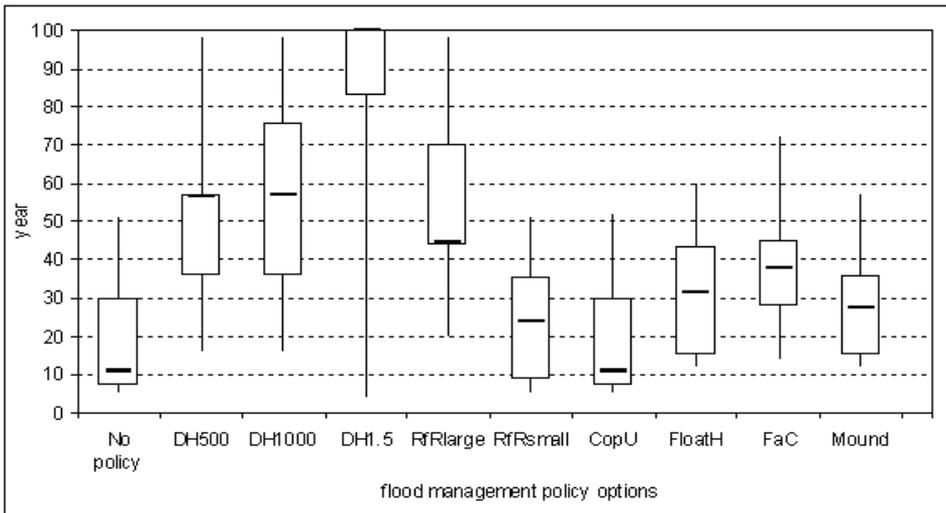
Figure 37: Acceptability for all climate scenarios according to the damage criteria for the Individualist (1250 million Euros).

As we cannot predict in what climatic or perspectivistic future we will arrive, it is important to analyze a measures' robustness for all climate scenarios and in the three different perspectivistic futures. To that end we combined Figure 35-37 into one Figure (see Figure 38). In figure 38 we see the acceptability dispersion per measure. The overview of all measures together, provides information on measures that are relatively robust. In general (and again, only focused on the damage criteria) we see that DH1.5 seems relatively robust. Only in some Individualistic futures, it looses

acceptability in the next couple of years already (4 years to be precise). We also see that if we do not take any policy measures in our Waas area (see also chapter 7) acceptability will be lost within the next 60 years in all perspectivistic and climate scenarios. Besides, Figure 38 teaches us that the acceptability of measures like FloatH and FaC heavily depend on the dominant perspective at stake. Other measures (like DH1.5 and RfRsmall) more heavily depend on the climate scenario that will become true.
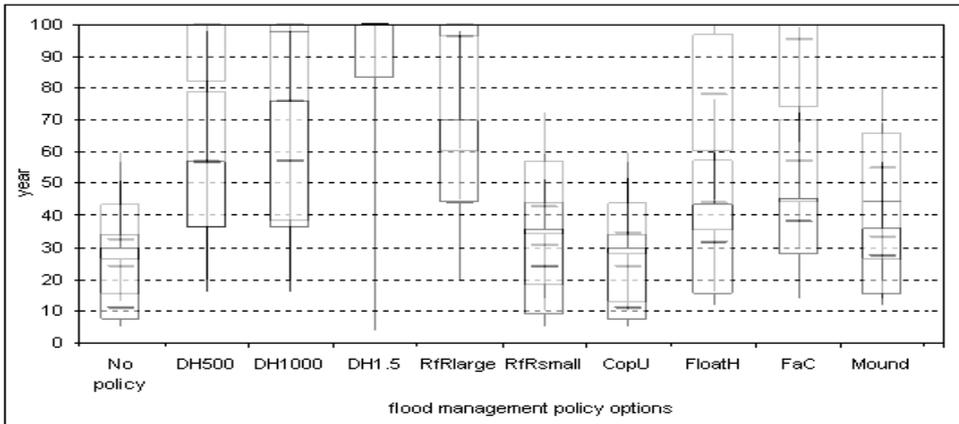

Figure 38: Acceptability for all climate scenarios according to the damage criteria in all perspectivistic futures.

Of course, it is important to note that Figure 38 only focuses at the *costs* indicator. For other indicators (like nature diversity or shipping suitability) graphs may look very different. The combined results of graphs for *all indicators* provide a complete overview on a strategy's performance under different futures and hence also about its robustness and tenability under different futures. Figure 39 shows an illustrative example on how this may look like. Figure 39 is built upon the criteria mentioned in table 23; consequently the tenability in years is purely based on *estimations*. Therefore, Figure 39 is essentially illustrative. In the next section we will explain how we can construct a more valid and empirically tested figure. However, let's assume that Figure 39 is based upon existing data on a strategies' performance under different futures; what would we learn from it? We see that the widthwise tenability of measures varies substantially depending on different climate- and perspectivistic futures. Some strategies, like number 13 ('Room for the river large scale' combined with 'Dike rings around cities') score well under all different futures, indicating that the strategy has a long tenability and can be considered robust. Others, like number 18 ('No measures') score relatively bad under all futures. In the best case it looses acceptance after 40 years, but it may also loose tenability after 4 years already. The tenability of other strategies even more heavily depend on climate and perspective, for example strategy 4 ('Dike raising' combined with 'Artificial mounds'), that has a

tenability between 12 and 100 years, depending on the exact climate realization and future perspectives. Some strategies' tenability heavily and mainly depend on the perspective at stake (for example strategy 16; 'Room for the river large scale'). In an individualistic future, the strategy may soon become unacceptable. In an Egalitarian future, however, it may stay acceptable for the next 100 years. In general, the challenge lies in defining a strategy that is relatively robust and has a relative high level of flexibility to adapt in those futures to which it is not robust.
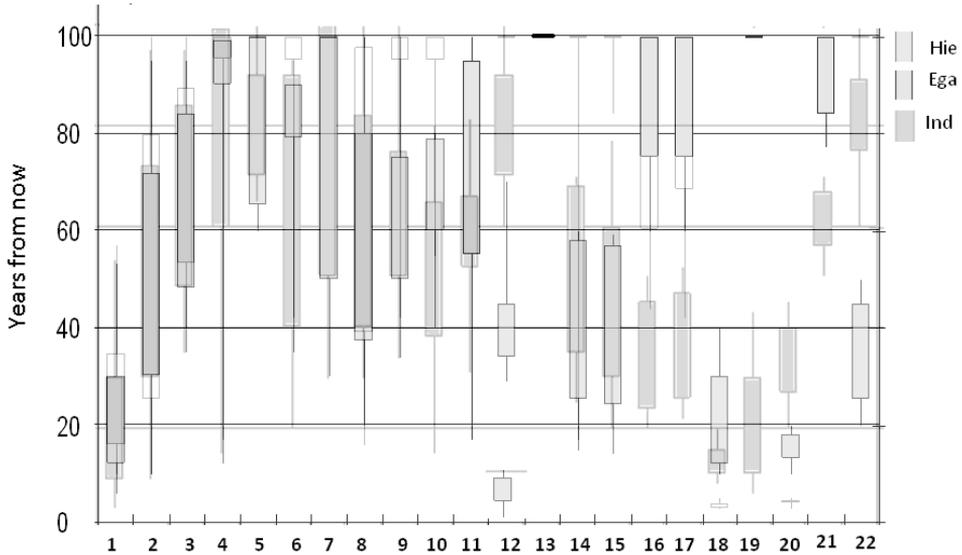

Figure 39: Hypothetical scores for different measures or strategies (numbers 1-22, see appendix 6 for the full names for each strategy) for different perspectives under all climate scenarios and for a combination of indicators (floods, damage, nature and shipping suitability). The boxes indicate the first and third quartile of the durability of measures in different futures. Here we see that under some perspectives, measures may have a very long durability (social robustness), however in other perspectivistic futures, this social robustness may be much shorter. Measures that score relatively well under different perspectivistic futures and under different climate scenario's are relatively more robust than others; they have a longer tenability[59]. See appendix 6 for an overview of the measures belonging to the numbers in this graph.

8.2.1   How to define perspective dependent acceptability standards?

As we have shown in previous paragraphs we already developed a tool to calculate the effects of different strategies on several indicators under different climatic futures (Haasnoot, 2011; Haasnoot, accepted). The results of the calculations we discussed in this thesis refer to the hypothetical case study of the Waas (see previous chapter), but by the time this thesis will be published we expect to have a tool with the same functionality for the Dutch Rhine-Delta. To calculate a strategy's robustness, however,

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[59] The Fatalist is not included in the graph to keep the overview and because the Fatalist was not included in our perspective nased simulation game yet.

we need more empirically based information on perspective dependent acceptability thresholds.

A first step in this analysis would be an interview-based exploration of thresholds for indicators like nature, shipping suitability, floods, (false) alarms, citizen support and damage, taking the dimension and sequence of events into account. Here it is important to create an interview environment wherein the respondent is encouraged to imagine him- or herself in future situations with the occurrence or stay away of several events. The emphasis is on a constant reflection upon a strategy's acceptability. As we can also measure a respondent's perspective we can -in the second step- try to find perspective related regularities in the answers of the respondents. Ideally, this offers a first overview on perspectivistic acceptability thresholds. These thresholds can be fed into our IAMM tool to calculate corresponding average, minimum and maximum number of years before the critical threshold will be met for every perspective and in the 30 different climate scenarios. As thresholds heavily depend on specific contexts, it is important to constantly reflect on the initially defined acceptability thresholds. The participatory simulation game as described in the previous chapter can be used for this, for example by building in a moment of reflection after every run. Players of the game can be asked to express their satisfaction for the strategy and its performance in the last decade(s). Unsatisfied players can be asked to further explain their dissatisfaction (do they for example think that the situation became unacceptable, when was the threshold surpassed, which indicator and/or event(s) has been most important for this etcetera). This approach may also clarify the role of socio-economic variables, news paper headings, citizen perspectives, and negotiation processes in what is considered to be (un)acceptable. This approach allows to -step-by-step- define perspective dependent acceptability thresholds in a more empirical and reflexive way.

8.3   Reflection

During the development of this thesis we followed a continuous journey to analyze perspective change and the social robustness of water management strategies in a changing and uncertain future. To that end we developed a theoretical framework, called the Perspectives Method to analyze different and changing perceptions on water and the way water should ideally being managed. In chapter 7 we reported on our participatory simulation game to explore perspective changes including cause-effect chains and the effects of water management strategies on indicators. This offered useful information on strategies that were chosen from different perspectives in different time frames. However, it neglected the aspect of acceptability as a retrospective evaluation of the chosen strategy and its effects on the water system. Therefore we used this chapter to show how acceptability plays a role in social robustness. Depending on climatic and perspectivistic futures, thresholds of

acceptability may be surpassed sooner or later. Creating an overview on these different moments offers a nice impression on gradations of robustness. Still controversial aspects may remain unsolved and there are several foreseen points of attention when identifying such thresholds:

1. The sequential occurrences of events. An acceptability threshold may be surpassed after one big event (for example a flood or drought), but the sequential occurrence of multiple smaller events may also be unacceptable even if the upper limit of acceptability still has not been passed yet.

2. Discounting of cumulative events. So far we look at cumulative sum totals for the scores on indicators, however we also have to take into account the effects of long periods without events. A major flood in year 5 will almost be forgotten in year 85 if nothing happens in between. Following from this we should possibly discount the sum total after a period without events. The exact discount rate however, remains questionable.

3. We should not become blind for new inventions. The currently defined set of measures is not static and new measures will be formulated within the next 100 years of water management. This means we should constantly reflect on existing measures for water management and keep options open to include new measures and their cause-effect chains into our models.

4. Model uncertainty. As van Asselt (2000) states, due to inherent uncertainty computer simulation models can never be fully neutral. The construction of a simulation game involves a variety of technical uncertainties (related to the appropriateness and simplification of data), methodological uncertainties (on structuring and interpreting uncertainties within the model) and epistemological uncertainties (relating to the appropriate representation of reality into the model). Therefore a constant reflection and validation of model data, cause-effect chains and the representation or real life phenomena is necessary. We should keep in mind that a model helps in exploring the future, rather than predicting it.

5. Interference with other measures. Dutch river management does not happen in a vacuum and will be influenced by decisions made in the domains of spatial planning, transport, recreation, agriculture etcetera. Measures in different sub-domains may effect, enforce or counteract consequences of water management measures. Such interactions are complex and difficult to model, but may be taken into account by building in an extra safety margin into the robustness analysis wherein we acknowledge that interferences in other domains may also effect scores on indicators in a positive or negative way.

6. Stereotypical versus real-life perspectives. As we assume that stereotypical perspectives do not exist in reality, the initial definition of thresholds as well as the continuous reflection will be guided through non-stereotypical

interpretations from real people. As perspectives may change into a more stereotypical direction in the future, we thus also need to consider more strict thresholds than the ones existing now. By making use of the perspective map, we can measure the distance of people from the stereotypical corners in the perspectives pyramid and use this distance to correct the thresholds to make them more stereotypical.

7. Of course, as we can seriously question whether a truly socially robust strategy - that remains acceptable under *all* futures- does actually exist, we have to ask ourselves what the alternatives are. Next to (relative) robustness we could focus on flexible strategies or we could try to increase the social robustness by trying to find synergetic (or clumsy) solutions that are acceptable under more perspectivistic futures (see pages 132 and 166 or Verweij *et al.* (2006) for more information on 'clumsy solutions'). Adaptation of present strategies is necessary to make them acceptable under all (or more) climatic- and perspectivistic futures. However, we also have to realize that attempts to increase flexibility or clumsy solutions are not free from perspectivistic interpretations either. Regarding flexibility we can say that every water management strategy is theoretically reversible. Whether this is *considered doable* however, depends on the amount of money and efforts you are willing to pay or take. An Individualist would less easily spend money to reverse strategies than an Egalitarian. Also the willingness to negotiate on synergetic solutions depends partially on the dominant perspective; Egalitarians would be more willing to find consensus than Individualists. However, in case of an equal representation of two or more conflicting perspectives, negotiation may be necessary and therefore beneficial to increase a strategies' robustness.

Chapter 9

CONCLUSION AND REFLECTION

9   WHAT HAVE WE LEARNED?

This research reports on a continuous journey to analyze perspective changes and the social robustness of water management strategies in a changing and uncertain future. During that journey, a theoretical and operational framework, called the Perspectives Method, was developed to analyze and measure different and changing perceptions on water and the way water should ideally be managed, eventually leading to more insight into a water management strategy's social robustness. In this concluding chapter, the sub questions, as indicated in the introductory section of this thesis, will be addressed first. Afterwards, we will reflect upon and answer the main question.

9.1.1   Relation of Cultural Theory to other typologies

The first sub question focused on the position of Cultural Theory's typology within other typologies and the extent to which the perspectives as described in Cultural theory could be recognized in other typologies. Although Cultural Theory has been applied to multiple topics -amongst which water- this application never seems to be explored in an empirically satisfying way. Before using Cultural Theory as a framework to analyze perspective changes regarding water management, we wanted to be sure about its suitability and completeness to do so. To that end, we identified criteria for a proper typology (see chapter three) and compared how Cultural Theory and six other typologies scored on them. Resulting from this, we concluded that Cultural Theory scored well (both absolutely and relatively) on these criteria. It can be considered complete and all perspectives (including the Fatalist) can be recognized in other typologies. The determining role of the grid- and group axes, however, could hardly be recognized in other typologies. This is also true for Cultural Theory's discrepancy between Hierarchists and Individualists on the one hand, and Fatalists and Egalitarians on the other as they supposedly do not share a position on the grid- or group axis. Besides, Cultural Theory's discrepancy between government regulation (as characteristic for the Hierarchist) and the free market (Individualist) could not be recognized equally strong in other typologies. Finally, the possibly determining role of characteristics like sex, age and education needs to be kept in mind. However, in our questionnaire we could not find any significant differences based on sex, age or education. As such we can conclude that Cultural Theory relates well to other typologies and that it -taken some attention points into account- may function well as starting point for our framework. Our framework (the Perspectives Method) applies the Cultural Theory perspectives to water and explores perspective change and social robustness of different water management strategies in an uncertain and changeable future.

9.1.2   Cultural Theory's application to water: the Perspectives Method

The second question focused on the application of Cultural theory perspectives to water and the fundamental starting points underlying this translation. We developed a

theoretical framework, called the Perspectives Method to analyze different and changing perceptions on water and the way water should ideally be managed. The Perspectives Method refers to the process of applying Cultural Theory perspectives to water management, while acknowledging the non-stereotypical and dynamic nature of perspectives and simultaneously offering a method to operationalize and measure perspectives on water in order to gain more knowledge on future perspective changes and socially robust water management strategies. General perspectivistic descriptions were translated to water issues by 1. Making use of descriptions in existing literature (Holling, 1979; Thompson et al., 1990; Wildavsky and Dake, 1990; Rayner, 1992; Renn, 1992; van Asselt et al., 1995; Douglas, 1996; van Asselt et al., 1996; Thompson, 1997; Janssen and de Vries, 1998; Pendergraft, 1998; van Asselt, 2000; Vries, 2001; Verweij et al., 2006) notably those focusing on water (van Asselt et al., 2001; Hoekstra et al., 1997; Hoekstra, 1998b; Hoekstra, 1998a; Middelkoop et al., 2004). 2. Reading water policy reports and guidelines and arranging information derived from those reports into one or more stereotypical perspectives and 3. Reasoning from the stereotypical perspectives to identify four ideal typical situations including problem perceptions and ways to solve problems. Step 1-3 implied a continuous journey wherein familiarization to, and getting acquainted with, Cultural Theory and its perspectives played a vital role. This was not only challenging, but above all stimulating for our enthusiasm for the Perspectives Method leading to (almost) unconsciously assigning perspectives to daily situations we faced. In paragraph 2.2.1 and 4.6 the reader finds an extensive and qualitative description of every perspective. In a nutshell, the Hierarchist focuses at control, meeting demands by controlling the water availability, government responsibilities and expert knowledge. The Egalitarian prefers natural development, adapting human behavior to available water resources, considering water needs of ecological conditions, providing space for the river and shared responsibilities with input from various stakeholders. The Individualist argues that water offers opportunities and innovative technologies will enable to adapt to changing water levels and the integration of water into spatial planning. Self development is important and decisions should be based upon expected costs and opportunities. The Fatalist adopts a more passive attitude towards water. Floods and water scarcity are predetermined and therefore not preventable. Carpe diem is the best and most clever way to deal with water and besides, water can contribute largely to enjoyment and pleasure.

Chapter four further summarizes starting points inherent to the Perspectives Method. Summarized, real life perspectives are never stereotypical and therefore exist of combinations of interpretations from two or more perspectives. Different perspectivistic interpretations of beliefs explain differences in preferences and support for water management strategies. Perspectives are also dynamic and may change due to surprises and a lack of reproduction mechanisms, possibly also effecting support for water management strategies. Lacking support for strategies may make it impossible to implement or continue strategies on the short term. A socially robust water

management strategy is however able to cope with uncertainties in our social system (perspective change). By applying the Perspectives Method, threats to social robustness can be identified proactively and in advance, providing policy makers with time to think on increasing the social robustness of water management strategies (adapting it in such a way that it is acceptable under more perspectivistic futures or increasing its flexibility, see chapter five). Because of the dependencies between the perspectives all 4 perspectives need to be in existence in order for any perspective to survive (see paragraph 4.2.3), so in a society we will always be confronted with a diversity of perspectives (see chapter four). Also, contrary to common rational choice theories, there are four different ways of responding in a rational way, which goes beyond weighting cost-benefits to determine best choices. Following from this, Cultural Theory does not have to explain us that people will run away when a flood wave is rushing towards them. However, the perspectives help explaining that people run away in different ways and have different motivations for their actions (women and children first, all individually, all together).

9.1.3   Measurement of perspectives and perspective change

Question three asked how perspectives on water and perspective change can be measured. To that end, the Perspectives map (table 9) is developed as part of the Perspectives Method. This map was developed to operationalize and measure perspectives on water and includes a set of 15 beliefs on Dutch river management (see table 9, second column). For each belief, the Hierarchist, Egalitarian, Individualist and Fatalist positions are given (columns 3-6). To measure a perspective, one decides for each belief which position is supported (having the possibility to mark none, one, two, three or four positions per belief). The combination of positions for all beliefs together represents a perspective, which consequently can be visualized on the perspectives pyramid (see for example Figure 19-21) thereby indicating the similarities of the measured perspective with the four archetypes. The dots in the pyramid are calculated by summing up the scores per column in the perspectives map, normalizing them to four and calculating corresponding x-, y- and z values in a standard barycentric pyramid (see footnote 10 on page 44 for an extended explanation of this calculation). The corners of the Perspectives pyramid correspond to the extreme, stereotypical positions; but every combination of beliefs can be mapped on this pyramid. By using the perspectives map and its visualization into a pyramid in different time frames, perspective change can be measured and visualized as well.

9.1.4   Learning from the past

Question four focused on the possible theoretical and practical lessons resulting from the application of the Perspectives Method to Dutch water management history. We learned that the application of the Perspectives Method to Dutch water management history offered relevant lessons regarding the dynamic nature of perspectives, changing social support and the utility of the method for policy and science (see

chapter five). Content wise we have learned that changes in the dominant perspective can both be initiated by stakeholders and policymakers. Events and developments inside and outside the chosen study area, notably those with a visible or sensory (smell, taste) character in combination with appealing icons, people or a group of people may contribute to the initiation and intensification of perspective change. Further, the availability of alternative ways to deal with nature and water and media attention can further catalyze perspective change. Regarding the direction of change, we have learned that this depends on present undercurrents and the type of event occurring. Besides, the dominant perspective needs to be susceptible for being surprised (e.g. an Egalitarian won't be very much surprised by technological disasters as they did not have trust in technology anyway). Further, we have seen that perspectives may change in different velocities for different domains (for example the water quality- and water quantity domain). In our historical case study, it took around 50 years between the rise of an (Egalitarian) undercurrent and the growth of this undercurrent into a new, dominant perspective. Next, the timing and sequential occurrence of surprises are essential. Usually people have the tendency to explain a surprise away or explain it in such a way that it still fits within their perspective. Single surprises will likely be explained to justify the chosen strategies ("you see, action was heavily needed") and will hence function as reproduction mechanism. However, this resistance is only tenable to a certain point. More surprises in a relatively short time frame cannot be denied and will therefore function as surprise, changing the dominant perspective.

Retrospectively we can identify historical decisions that helped to increase the popularity of the Egalitarian undercurrent and decrease support for the dominant Hierarchical perspective, like the removal of natural area 'de Beer' for the expansion of the Rotterdam harbor. Adapting to concerns stemming from the undercurrent (for example by appointing compensation areas with protected nature) may have prevented the severe loss of public support for intensified 'Dike raising' measures and may have increased the social robustness of the 'Dike raising strategy' of those times. For policy makers it is thus important to analyze the social robustness of a strategy in advance, not only to closely monitor events and developments that may impact the support for the strategy, but also to proactively think about how to adapt the strategy in case it is no longer socially acceptable. The Perspectives Method may help policy makers herein.

9.1.5   The present Dutch perspective on water

Question five asked about the present dominant perspective on water and its implications for present and future support for water management strategies. To that end, chapter six reports on the dominant perspective among Dutch water professionals that was measured via a perspective-based questionnaire. This dominant perspective was compared to the perspective inherent to one of the more recent policy reports (the 2008 Delta report) for long-term Dutch water management. Results

of both exercises were depicted in the perspectives map and perspectives pyramid, visualizing similarities and differences between the policy- and professional perspective.

On a worldview level, the policy- and professional perspective on water resemble to a large extent. This means that policy makers can count on public support for goals they now want to achieve. However, the beliefs on 'trust in technology' and 'important values' deserve input from more perspectives than only Hierarchism to make the Delta report (more) acceptable for the current dominant perspective. The present *undercurrent* is relatively comparable to the dominant perspective, but slightly more Fatalistic and less Egalitarian. Thus, on a worldview level, the Delta report also matches relatively well to the undercurrent. However, to guarantee enough future support for measures suggested in the report, it is advisable to also pay attention to Individualistic and Fatalistic values. Individualistic and particularly Fatalistic values are currently underrepresented in the Delta report. Especially since the undercurrent (which may grow in the future) already has Fatalistic characteristics, it is advisable to include these values into the report to also guarantee longer term support for suggested measures. On a management style-content level (what to do in order to achieve our objectives) large differences between the Delta Report and the Dutch dominant perspective exist. This is partially due to the fact that the Delta report approaches beliefs like 'response to drought', 'water supply' and 'relation of water to spatial planning' in a dominantly Hierarchical way with a focus on guidelines, demands and the determining role of human activities in shaping the water system. The Dutch water professionals however, merely focus on a more natural water system with a supply driven approach and adaptation of human activities to water levels (Egalitarian). This offers serious problems regarding present support for suggested strategies. To guarantee present and future support, the Delta report should -notably on a management style content level- more strongly focus on other perspectives than only the Hierarchical one. The differences on management style process level may also threaten both present and future support, as the report is (again) dominantly Hierarchical. This reveals itself in beliefs on 'responsibility' and 'decision making'. Contrary to the Delta report (that focuses on government responsibility and the important role of experts and expert knowledge) the dominant perspective and undercurrent ask for more input and responsibility from various stakeholders (Egalitarian).

Following these results, we can conclude that the Delta report may face difficulties in finding enough support on the short term as it mainly focuses on Hierarchism, whereas the dominant Perspective also has strong Egalitarian characteristics. As the report is rather Hierarchical, support will probably be guaranteed in Hierarchical futures. However, strategies may experience support difficulties in Egalitarian and notably Individualistic and Fatalistic futures. The Delta report strategies are thus lacking social robustness. In Fatalistic or Individualistic futures, policy makers may be forced into sudden and expensive decisions, unless the suggested strategies prove to be very flexible and easy adaptable to a changing dominant perspective. Fortunately, the

perspectives map provides a first framework for discussion, as it becomes clearer on what kind of beliefs present support may be lacking. Discussion on these specific topics may contribute to meaningful negotiations to find more synergistic and therefore multi-perspectivistic solutions.

9.1.6   Insight in future perspective changes and support for strategies

The last sub-question focused on the extent to which insights can be gained in future perspective changes and the social robustness of strategies under an uncertain future. Chapters seven and eight show that combining the Perspectives Method with an Integrated Assessment Meta Model in a simulation game format (chapter seven) or automated runs (chapter eight) offers useful insights in the effects of strategies under uncertain futures. Players of the game have to manage a river stretch sustainably for the next 100 years. They can choose water management measures, negotiate and agree on the measures that will be implemented with other coalitions and take the citizen's opinion into account. After implementation players will be confronted with the effects of their measures on indicators like floods, damage, nature, shipping suitability etcetera. Of course these consequences depend on the randomly chosen climate realization. After each run, the choice and negotiation for measures starts again. One play session usually encompasses 100 years of river management that comes together in a storyline reporting on perspective changes, happenings in the river system and responses from players (see chapter 7). Analyzing a large amount of storylines provides information on possible future perspective changes, causes for change and the effects of changes on the choice for measures. Besides, it may increase knowledge on the relation between worldview and management style. However, to increase the game's ability to explore social robustness and perspective change in a very broad variety of climatic, perspectivistic and socio-economic scenarios it is advisable to adapt the simulation game on some aspects. In chapter seven we argued that a broader range of demographic, land-use- and economic scenarios, measures and decision making processes is needed. Also the way information is presented to participants (both content- and process wise) should be adapted to better fit to other perspectives except Hierarchism. Also, the damage indicator should ideally include other types of damage than harm caused by floods, for example costs resulting from drought (navigation or nature). Also the Fatalistic perspective should be included (at least as possible citizen perspective) into the game.

Even when the above mentioned adaptations have been made, we need to know more on how strategies and their effects on the water system will be evaluated retrospectively and when perspective dependent thresholds of acceptability are surpassed to fully understand a strategy's robustness. The former (retrospective evaluations) can be added to the participatory simulation game, the latter needs a more extensive approach as described in chapter eight. As long as a strategy and its effects on the water system are acceptable under a multitude of perspectives and climate scenarios, it can be considered socially robust (it has a long tenability). Chapter

seven analyses the storylines that resulted from playing the simulation game. Each storyline provides one possible future pathway offering insights into future perspective changes. What we actually need to gain insight in different gradations of robustness is an overview on the minimum, maximum and average tenability of different strategies under various climatic and perspectivistic futures. Chapter eight provides the reader with first ideas on how perspective dependent acceptability thresholds can be defined. Chapter eight is the only chapter focusing on stereotypical rather than real-life perspectives. Chapters 5-7 tried to increase insight in perspectives, perspective dynamics and (changing) support for strategies. Chapter eight focuses on *possible* future developments in relation to acceptability thresholds, asking for a more diverse and extreme palette of perspectivistic evaluation screens.

9.2   Answer to the main question

Changing perspectives effect the way the water system will be arranged and the type of strategies that will be preferred or rejected. The central aim of this thesis was to further understand the interaction between society and the water system, perspective dynamics and to explore the sustainability of water management strategies under an uncertain future. We defined a sustainable strategy as a strategy that (including its effects on a multitude of indicators) is evaluated as acceptable under a wide range of (perspectivistic) futures. To that end, we formulated our main research question:

To what extent is it possible to explore the social robustness of different water management strategies, taking uncertain developments in our social and physical environment into account?

After our research we can conclude that this is definitely not an easy task as it involves many uncertainties in climate, socio-economic developments and social perceptions. It asks for an inter- and trans-disciplinary approach wherein the output of some discipline (for example hydrology) serves as input for other disciplines (like social science) and the other way around. Hydrological calculations on the performance of strategies are needed to explore perspective changes and to analyze when and under which perspectives a strategy may become unacceptable. The information on perspective change, tenability and social robustness is subsequently needed to identify possible adaptation pathways. However, regardless of these difficulties we succeeded to develop a method we refer to as The Perspectives Method. It offers an analytic framework to visualize and measure real life (e.g. non-stereotypical) perceptions on water in the past, present and future. It also offers a framework to analyze perspective changes and disagreement and to identify possible threats or opportunities for support inherent to the choice for specific measures. When combined with an Integrated Assessment Meta Model we can explore the effects of different water management strategies under different social and climatic futures, and the role of changing perspectives herein. As mentioned before –and explained in chapter 8- we are still

missing information on perspective dependent acceptability thresholds which prevents us from specifying empirically based gradations of robustness for different strategies. Still, however, we consider it valuable that we could provide the reader with insights on how to define these thresholds. Particular attention -in follow up research- needs to be paid to the identification of these perspective dependent acceptability thresholds and the extension of the simulation tool to include more diverse socio-economic scenario's, measures and game procedures (e.g. decision rules, the provision of information and results). As such we have to conclude that we did not fully succeed in developing and testing a method to explore the robustness of water management strategies, however, taking the advises in chapter 7 and 8 into account, we cannot conclude differently than saying that the exploration of social robustness of different water management strategies, taking uncertain developments in our social and physical environment into account is possible to a large extent. One of the most important lessons learnt from applying the Perspectives Method to water issues is that it is extremely dangerous to concentrate too much on one solution direction to the detriment of other aspects. Even when being absolutely sure about a decision and knowing to do the right things, it will only be a snapshot in time. Changing contexts, events, developments and relating perspective changes may seriously alter the way facts are regarded and evaluated. Therefore, it is important -in any situation- to analyze the social robustness of strategies beforehand to proactively adapt to changing perspectives and to take a strategies' flexibility into account[60]. By doing so, one prevents to metaphorically take the back of the horse that never achieves the finish. Instead -and in the worst case- you have to change horses in the middle of the race, still allowing you to achieve the finish in time. You may even change to newly breed horses that may appear on the stage during a race, as new management strategies will be invented throughout our lives as well. Not fixedly taking the back of the horse that seems best at present, leaves open the choice for alternative horses that do as good as, or even better than the horse you would bet on right now.

Finally, it needs to be stressed once more that it is highly questionable whether any strategy will remain socially robust into the long-term future. Even when assuming Cultural Theory to be fully inclusive in the sense that humanity will never develop outside the borders of the four stereotypical perspectives, measures will always encounter objections in specific climatic, socio-economic or perspectivistic future situations. However, this does not mean that it is not smart to chose for a strategy that is *relatively* robust under various (but not all) futures. Besides choosing for a relative robust strategy, a strategy may also be adapted to be more (or longer) acceptable under other perspectives (a so called clumsy solution), or its flexibility can be

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[60] For more information on flexibility and adaptation pathways, see Haasnoot et al. (accepted). Nonetheless we made the point that even a concept like 'flexibility' has a perspectivistic connotation. The amount of money and efforts one is likely to spend to reverse or drastically change strategies depends after all on your perspective.

increased. However, also the willingness to negotiate to adapt strategies as well as flexibility itself is perspective dependent (see chapter 8).

9.3   Reflection

Regardless of the enthusiasm we have experienced while working with the Perspectives Method and regardless of the useful possibilities we see to apply it to other domains than only water, we have to be realistic and acknowledge that there are still lots of aspects that need or deserve more attention before we can speak of a fully crystallized and scientifically sound (Perspectives) method. We would like to use this reflection to mention several limitations, imperfections and demands for further research. The following section will be divided into a reflection on the application of our Integrated Assessment Meta Model in a participatory setting to analyze future perspective changes and social robustness, a reflection on the Perspectives Method as methodology or theory and a reflection on the individual learning process of the author of this thesis.

9.3.1   The Perspective Method and the IAMM

As mentioned before, the present tool and game format turned out to be too mono-perspectivistic to cover the entire perspective pyramid in 100 years of water management. In the game session we oftentimes observed perspective changes within the Hierarchical part of the pyramid, or minor changes from Hierarchism into an Egalitarian or Individualistic direction. The failing occurrence of perspectivistic reversals was partially due to available measures, as well as decision making processes, information provision and (business-as-usual) patterns for socio-economic developments that are currently mainly Hierarchical. Therefore it is advisable to extend the number of Egalitarian and Individualistic measures and to add an option to implement new measures, invented by the players of the game during the game sessions (to stimulate Individualism). Besides it is advisable to diversify decision making processes and information provision to also allow Individualistic and more Egalitarian ways of decision making into the process to more extensively explore the effects of changing socio-economic and political contexts on our perspective on water and our ideas on how water should be managed (see chapter 7). Next, the inclusion of non-physical measures into the simulation game (e.g. education, insurances) is advisable to make it more realistic as well.

Another remark that needs to be made refers to the time horizon of the game. As we focus on long term, proactive water management, we have set this horizon on 100 years of river management. However, we have not realized enough that this choice is an inevitable outcome of our own perspective on water. As a consequence, we force participants with different perspectivistic backgrounds to look ahead and proactively adapt to expected water management events for the next 100 years. However, for

Individualists and Fatalists this is a very forced way to look at the future. They do not agree with the idea that proactive policy is better or more desirable than reactive policy. As a consequence they would prefer not to look much ahead, but try to adapt - if necessary at all- to events and developments in a reactive way. Forcing them to take measures in advance and to manage the river system for the next 100 years is artificial and may possibly limit their ability to act as real Individualists or Fatalist during the game. As a way to adapt more constructively to the preferences of players with different perspectivistic backgrounds, variation can be brought into the content and time horizon of provided information. Participants should then chose what kind of information they would like to receive (expert reports, financial information etc.), the broadness of future ranges (e.g. only the business as usual trends, or a very broad range with all possible future developments), the time horizon (e.g. 10 years, 50 years or 100 years) and whether they prefer information on general trends or on detailed specific domains. Adapting the game in such a way may allow more extreme perspective changes during the game, which on its turn allows for a more complete analysis of a strategy's robustness under different perspectivistic futures.

Another comment deals with the balance between flooding- and drought problems. Currently, the focus is mainly on flooding problems. Drought issues are included, but only regarding their effects on shipping suitability. In a next version of the game, effects on nature, drinking water supply and water use in general should be included to more precisely investigate the effects of drought on changing perspectives on water and water management. Typically, the simulation will be paused for reflection and the possibility to change water management measures after a major event that is usually a flood. After giving an equal importance to drought issues, the simulation should also be paused after a drought event with effects on nature and/or navigation. Another issue relates to the extent to which combinations of measures are logical or not. Of course, any judgment on this is -again- influenced by our own perspective. Combinations that are not logical from one point of view could make sense from another point of view. However, still it is questionable in how far measures like 'Room for the river' and 'Dike raising' really could go together on a small spatial scale. Also, changing from large-, to middle- to small ships in a relatively short time frame does not seem to be very coherent as a lot of organizational and financial resources will be spend in a less effective way than possible. To promote more logical choices a cost component could be added to the game. Participants would have a limited budget (of course this budget may vary in different sessions, depending on future developments in the economic context) to implement measures. A limited budget may lead to different choices for measures than an unlimited budget. Besides, variation in decision making processes may also lead to more logical combinations of measures. In the current game format, players had the task to manage the water system sustainably for the next 100 years. We sometimes observed that coalitions did not want to compromise on their measures mentioned in the white paper. Instead they focused on getting what they wanted, independent from the reciprocity from the other coalition.

This led for example to negotiations wherein a coalition was allowed to implement 'Room for the river' under the condition that the other coalition would be allowed to implement 'Dike raising'. Hence, more attention could be paid to explaining the coalitions that changing your mind or whitepaper does not mean you were wrong before and that the game as such does not offer winners or losers. To stimulate the search for synergetic and logical solutions, and decrease the competition between coalitions in the same game, we could explain the coalitions to be in a competition with players of other game sessions. Their task would be to manage the water system in the best way, and better than other groups have done before.

The Fatalist was not represented in the IAMM simulation game. As the previous project (Valkering et al., 2008b; Valkering et al., 2011) did not include the Fatalist because of its passive attitude regarding policy, we started our project with a two dimensional perspectives triangle and a three-perspective game format. However, in chapter three and four of this thesis, it was concluded that the Fatalists makes up an integral part of the Perspectives Method and probably encompasses a small, however vivid perspective within society. Besides, in chapter six we found reasons enough to assume that the present Dutch perspective on water has at least some Fatalistic characteristics, especially when looking at the undercurrent. Therefore, the Fatalist should be considered an important perspective to be incorporated into the exploration of the social robustness of water management strategies. Of course, it can be seriously questioned whether a Fatalist without having any trust in decision making can truly be a policy maker. It must -in the best case- be a depressing task for a Fatalistic policy maker to be occupied with something that makes -according to his or her own opinion- no sense whatsoever. To that end, a game format without Fatalistic coalitions could still work (although it could again be questioned whether some Fatalistic beliefs -like enjoyment- should not be considered more seriously in policy making). Advisable and necessary is the inclusion of Fatalistic components in the citizen perspective and news paper headlines in the game. Even if policy makers won't adapt to Fatalistic values, the support for their measures and their freedom to take measures may be severely effected by the extent to which the dominant perspective outside the policy arena can be characterized as Fatalistic. Finally we should state that it turned out to be hard to identify Fatalistic voices in the past (chapter five). Of course this can be explained by the fact that Fatalists in general do not give a lot of publicity to their opinions, and consequently we could not expect a lot of records on their preferences and point of views. Still it would be worthwhile to investigate how Fatalists can be recognized in history when reporting on their ideas is missing, for example through analyzing the percentage of people that did not vote for regional or national elections in different time frames. This gives us more information on their specific perspectives dynamics and the extent to which they may influence policy making.

The idea of scenario exercises is usually to explore a broad range of possible futures. The information presented in this thesis and mainly the lack of fierce perspective changes and – reversals, may give the reader the idea that such an attempt has failed.

However, we won't fully agree with this. The method presented here is still much richer than approaches wherein only a mono-perspectivistic business as usual scenario is developed. A small range is still better than only following a business as usual scenario. Therefore, we consider the Perspectives Method -even in its current shape- useful to explore the social robustness of water management strategies. It offers a new and innovative approach to integrate social and environmental sciences to explore the sustainability of water management strategies, even if the range of futures -as described above- can still be extended. As mentioned in chapter seven, more extreme perspective changes could be stimulated by improving the way in which participants can experience and image oneself in events, developments and their effects on the water system in the simulation game, and by adapting information provision and decision making rules within the game to non (or less) Hierarchical processes.

9.3.2   The Perspectives Method as theory and conceptual framework

Science is characterized by a continuous process of refining, validating and adapting insights to new experiences and knowledge. Without doubt, this is also true for the Perspectives Method. Although the present method shows a big step into the direction of integrating social and natural sciences on the topic of water management, it does not offer an indisputable and finished blueprint to explore water strategies' robustness. Below, aspects will be mentioned randomly that need more in-depth research to extend and complete the Perspectives Method to increase understanding of the dynamic nature of perspectives and its influence on support for water management strategies. First, the interrelationship between the different components within the response system of the PSIR framework (see figure 2) needs elaboration. Following lacking knowledge on relations between different building blocks within the response part, concepts like 'citizen perspective', 'policy perspective', 'societal perspective' and 'dominant perspective' have in this thesis often been used in an ambiguous and not too specific way. Mostly, 'dominant perspective' and 'societal perspective' referred to essentially the same: a black box showing the outcome of processes on a policy, stakeholder and individual level (water culture as referred to by Tabàra and Ilhan (2007)). Specification about differences and overlap between perspectives on different levels remained under-represented. Because of that, the description of the Dutch dominant perspective on water as reported in chapter six focused mainly on the position of the professional perspective; a position that is regretfully not too clear within the PSIR chain of Figure 2. It is mainly located in the grey area between the policy arena and individual stakeholder responses and has some direct overlap with the policy-arena as water professionals are generally also involved in the construction of water policy. This thesis does also not report on the average citizen's perspective on water, although we think that citizen's voices should also be included in the exploration of socially robust water management strategies, as they may affect support for strategies. However, in order to measure their perspective on water and to analyze their acceptability thresholds, we are probably in need of an

alternative perspectives map as Dutch citizens that do not have a special stake in the water management domain. It is unfair to consider them to have enough knowledge on water issues and the availability of different solutions to fill out the present perspectives map without (interpretation) problems. Within the broader project team the precarious but important interpretation of the response part was acknowledged as well which led to the decision to incorporate two postdoc researchers into our project to investigate the relations between scale levels and how perspectives (or perspective change) on one level may effect, or may be effected by perspectives on other levels. They will finish their work end 2012.

A second aspect refers to the equal strength given to the different beliefs in the perspectives map. One the one hand there was no specific reason to give different weights to the separate beliefs in the perspectives map, but it is on the other hand not unlikely that some beliefs may play a more fundamental role in constructing a perspective than others. This could possibly even depend on the person we are looking at and/or the perspective at stake. Some beliefs may play a very important role in water management or thinking about water management, while others may be considered less relevant. This may also mean that change of certain, 'important' beliefs has more effect on changing support for water management strategies than change of other beliefs. Technically, giving different weights to different beliefs does not raise problems for measuring or visualizing perspectives and perspective change, conceptually however, granting different weights to different beliefs may be challenging as this may also depend on various personal considerations and the perspective at stake. Asking people to rank the beliefs based on their importance and relating this to their (measured) perspective may be a step into the right direction. However, it also needs to be acknowledged that the current beliefs also have a dissimilar -and therefore hard to compare- character. Some are relatively normative and refer to processes that may differ in their intensity (like the belief of climate change) while others refer to the question how things can best be arranged (for example the belief on safety). Although future research may conclude that the perspectives map should be adapted content wise, the main conclusions in this thesis as well as the maps' use remain however the same. A comparison between professional and policy perspectives may not differ substantially but may be a refined version of the current results. Besides, the map in its current shape is considered to play an important role in negotiations, and defining similarities and differences in perspectives and does therefore function as a first fundament for discussion and the search for synergistic solutions to water related problems.

Next, the distribution between changing perspectives on the one hand and a changing distributional pattern between coalitions on the other hand needs more elaboration. In our research we identified two processes of change: perspective change (changing interpretations of beliefs) and changing dominance between a dominant perspective and an undercurrent wherein the dominant perspective looses support and the undercurrent simultaneously gains popularity. The first process assumes people to

change their mind after a confrontation wherein reality appears to be different from expectation, making coalitions change their positions in the perspectives pyramid; a process we have observed during the simulation games. The second process assumes more or less steady coalitions, but a changing number of supporters, something we could hardly observe during our games (it only happened once during all games together). We could however argue that this process played a role in Dutch water management history as the Egalitarian undercurrent grew in popularity at costs of the Hierarchical perspective. Besides –and as explained in chapter seven- the fact that participants did not change coalitions during the game may also be explained by the fact that individual participants felt a too strong identification with their initial coalition and/or had the idea that changing coalitions equaled admitting to be wrong beforehand. Transition theory and underlying assumptions on the dynamics between undercurrents and dominant perceptions show that processes of changing support for coalitions are worthwhile to further investigate. However, here we also have to remark that we could not recognize a strong division between undercurrent(s) and dominant perspective in our questionnaire or simulation game. This raised the question whether the distinction between undercurrent and dominant perspective is mainly conceptual or whether it can also be recognized in reality. Concluding, there is still a lot to learn about changing support for and dominance of coalitions.

A next point relates to the universal application of the Perspectives Method. Following empirical evidence and Cultural Theory's starting point that everybody's main assumptions on how the world functions are reducible to Hierarchism, Egalitarism, Individualism, or Fatalism (or a combination, see chapter 4) we feel confident about Cultural Theory's universal character. During the entire time span of our research we never came across situations that we could not explain by making use of the perspectives. Sometimes this demanded creativity and 'out of the box thinking' but the four perspectives were always sufficient to explain a situation or action. Of course, this does not automatically mean that the translation we made to water is also universally applicable. As this thesis only focused on the Netherlands no empirical evidence to verify or reject its universal application to water is available. Does a Dutch Hierarchist resemble a French, Austrian or Cameroon Hierarchist, or are perspectivistic interpretations effected by political contexts or the differences between flooding, drought or salinity problems? Unfortunately we cannot answer this question with the research done at this moment. Nonetheless we would truly like to investigate this topic more in detail as we sincerely think that people worldwide could benefit from the Perspectives Method. Its starting points are relevant and useful regardless of the context, for example about the fact that each water problem can validly be defined in multiple ways which may also explain differences in preferences for measures. Further the method shows that Perspectives -and therefore also solution directions- may change over time, even if we are very convinced about the properness of a specific measure at this moment. In addition, the perspective method offers a framework to investigate pro's and con's of different solutions, possibly leading to more synergetic

solutions. The perspectives map also gives insight on the question why people disagree. This is often a result from different ways of interpreting beliefs. The Perspectives Method offers insight in differences and similarities between two and more perspectives that are interesting to monitor regardless of your geographic location.

Another aspect that also strongly relates to the previous is in how far the hypothetical case study of the Waas area (chapter 7) can be translated to a real life case study of for example the Dutch Rhine Delta. The major challenge of translating our IAMM from a hypothetical case study to a real life case study probably lies in hydrological modeling as aspects like water distribution, tidal influences on river discharges and the distinction between regional and national effects of measures precisely need to be (re)investigated and modeled. Also, the connections between decision making on regional, local, national and international levels need to be applied to the game concept precisely. In the overall project, people are occupied with both challenges. As we have played the simulation game already with real stakeholders, we do not expect significant difficulties with translating our perspective concept to a real case. The method remains the same, but –as also explained in chapter 7 – results may be different as different cause-effect relations and hence different scores on indicators may be found.

As already indicated earlier in this conclusion and as extensively being discussed in chapter eight, we consider insight in acceptability thresholds from different perspectives for indicators used in the simulation game important. This thesis increased insight in differences in acceptability thresholds between the perspectives (e.g. Egalitarians accept more damage than Individualists, but an Individualist accepts a lower natural diversity than Egalitarians). However, we cannot specify exact numbers for these thresholds yet. In other words: we do not know when, and after which sequence Individualist consider a certain level of damage or ecological diversity as unacceptable. This information is important to analyze (gradations in) the social robustness in detail. Subsequently this allows analyzing the minimum, maximum and average tenability of strategies under various climatic and socio-economic futures. Chapter eight provides first ideas on how these thresholds can be identified. After identification, it is important to continue reflecting on these thresholds by confronting players of the simulation game with situations that should (or should not) lead to lost acceptance. This may also increase insight into the extent to which stereotypical acceptability thresholds differ from non-stereotypical (real life) thresholds. The hypothesis is however, that stereotypical perspectives may have stricter acceptability thresholds than real life perspectives. Measures that remain acceptable for a long period given extreme climate- and perspectivistic futures may remain even longer acceptable under non-stereotypical futures.

Initially we made a distinction between physical robustness and social robustness. These terms turned out to be useful to stimulate the dialogue between gamma and

beta researchers within and outside our project. However, a distinction between physical and social robustness is -in our point of view- not pure. Physical robustness refers to the degree to which our water system can cope with changes in our environment (for example climate change), so it assumes one objective evaluation criteria that judges on the extent to which the water system can (or cannot) cope with changing conditions. However, what we have learned during our research is that something like one single objective evaluation screen does simply not exist. Whether the water system functions well or not, solely depends on our perspective and in how far *we* consider the results of our measures acceptable under changing environmental conditions. Hence, social robustness, from our point of view, is sufficient to also analyze the performance of our water system given our current perspective that may -according to some- be an objective criterion.

One remarkable result from this research is that we could not verify the relation between worldview and management style. As we have seen in chapter four, Cultural Theory assumes a match between cultural biases (values and beliefs) and social relations (patterns of interpersonal relations, see also Thompson et al., 1990), somewhere in the nineties of the previous century this was translated to a conceptual match between worldview and management style (see Janssen and de Vries, 1998). Important to note is that the concept of management style (visible behavior, preferred policies and measures) is not the same as social relations. Therefore, we found it important to investigate the link between worldview and management style more in detail. If there would be a match, insight in future perspective changes could have been translated to changing preferences for strategies immediately. The risk would however be that every perspective has its own preferred policy options and lacking willingness to support strategies preferred by other perspectives as they would be fundamentally different. Negotiations resulting in a shared policy proposal would be difficult to achieve in such a case (there is no ground for compromise). However, as we have seen in chapter seven, there is no convincing evidence for a link between worldview and management style as defined in this research. It seems that it is not the perspective itself that determines the choice for measures, but motivations behind the choice for measures and the appearance of a strategy in the environment. Therefore, similar strategies may be chosen by coalitions with different perspectives and different motivations.

We could further question the stability of perspectivistic descriptions. This may for example raise questions about the extent to which the Egalitarian of today is comparable to the Egalitarian of 100 years ago. Hundred years ago more nature was available which could have made it difficult for Egalitarians to distinguish themselves on this aspect. However, this may also mean that the stereotypical perspectives may change content wise in one hundred years from now. Although we consider it very unlikely that perspectives will change outside of the borders of the perspectives pyramid, points of interest may change. A straight forward example for the Individualists is that what is innovative and new today, won't be innovative in 100

years anymore. This thus asks for a continuous reflection on the perspectivistic descriptions. We have to keep in mind that it must have been impossible to explain our grandfather's grandparents how life would look like in a digitalized world with fast airplane connections, internet, genetically modified food and long traffic jams. However, as also indicated in chapter 7, the Perspectives Method is not meant to predict or forecast changes in developments but to explore how consequences of these developments may influence perspective change and support for strategies.

Finally, even when trying to be as objective as possible, we as researchers are influenced by our own perspective and way of framing the world around us. Therefore we should inevitably acknowledge that we identify and classify the Perspectives from our present think- and analytical framework. We tried to be as transparent as possible on this issue by explaining our starting points in detail (chapter 4) and making use of an inter evaluator reliability test in chapter 3 and 5. The reader may nonetheless wonder about my own perspective, but I sincerely have to say that I see huge positive aspects in each perspective. When it comes to government control, expert knowledge and my anthropocentric view on nature's beautifulness, I definitely have Hierarchical characteristics. However, given the fragile character I would appoint to nature, its intrinsic value and a belief that humanity goes too far in controlling nature and water supply I am also partially Egalitarian. Further I highly appreciate Individualists' focus on opportunities and their innovative ideas on how to integrate nature and water in spatial planning. Finally I am also partially Fatalistic as I love recreation in water rich areas and also dry areas – like Fuerteventura – without compromising too much on my water use.

9.3.3   Reflection on personal experiences

Carrying out this research was an extremely valuable experience wherein I have grown as an independent researcher. I learned a lot about water management, sustainable development, Cultural Theory and social robustness. Also methodologically my knowledge has been broadened substantially. I have learnt about computer based simulation games and set-up and analyzed an online questionnaire. Being the main responsible for collecting data and analyzing the data (with the exception of chapter 7 that was a joint responsibility of the entire project team) now gives me the feeling of being owner of my own work. Also, the collaboration with researchers from different disciplines and scientific backgrounds was extremely valuable and sometimes also challenging as finding a shared language, research objective and point of view was topic of an ongoing process. I would like to advice policy makers to always approach water management through various perceptual screens. In this thesis I offer them a framework to identify, analyze and measures those different perceptual screens. A broad problem definition and openness to learn from other stakeholders with other perspectives and ideals is crucial. However, acknowledging the holistic and multi-stakeholder nature of water management involves the risk of becoming too broad in orientation and losing overview. The Perspectives Method may prevent a bog down by

an overflow of information and contesting interpretations. Finally, the impossibility to predict future developments regarding water management should not prevent policy makers from developing visions on the future and thinking about possibilities to adapt to societal and environmental changes. Once more, the role of social science is not to predict the future, but to explore effects of perspectives changes on support for water management strategies.

9.4   Outlook

Although being subject to a number of limitations, imperfections and shortcomings, I regard the Perspectives Method highly useful in analyzing, measuring and monitoring diverging and changing perceptions on water and water management. Besides, it may have an important role in identifying disagreement as it points out which different perspectivistic interpretations may lie at the bottom of disagreement, or in other words: on what beliefs do people agree or disagree? This may facilitate a directed dialogue and may contribute to finding synergetic solutions that are more robust than solutions that are formulated from a mono-perspectivistic point of view. Still, a lot of work needs to be done (see the reflection for existing knowledge gaps), but as the results of this dissertation show; we are on the right track. The approach helps us to better anticipate on changing realities, to deal with various stakeholders that hold various perspectives on water, and to proactively identify possible threats and opportunities for future support. From the perspective of sustainable water management, the challenge is to collectively decide what aim we want to achieve and how to achieve that, in a highly dynamic, uncertain and multi-perspectivistic context. Personally there are two topics of future research that are particularly interesting to me: the identification of perspective dependent thresholds of acceptability and an extended application of the Perspectives Method on water to other regions (with different political-cultural contexts or different water problems) or other research topics (for example joint knowledge production, sustainable development in general or tourism).

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APPENDIX 1: COMPARISONS OF CULTURAL THEORY WITH SIX OTHER TYPOLOGIES

Motivaction

In the Table below, a summary of every main segment within the motivaction typology is given, as well as the perspective to which each segment is comparable. If we compare the positions of every segment to the grid-group structure in Cultural Theory (see Offermans, 2010a, for more information) Egalitarism and Hierarchism as well as Individualism and Fatalism are opposed to each other. According to Cultural Theory however, Egalitarism and Hierarchism share a high group dimension, and Individualism shares a low group dimension with Fatalism.

Name	Description	Comparable to
Traditional citizens	Traditional values, family is cornerstone and most important, harmony & rest, acceptance of authority and rules, disciplined, risk aversive, soberly, traditional division of roles	HIE
Comfort oriented	Material wealth, freedom, entertainment, no solidity or responsibilities, little ambition, longing to appreciation, impulsive, consumption minded, outward appearance very important	FAT
Modern citizens	Balancing between traditional values and change, family cornerstone, social status important, authority and rules, longing to appreciation, security, income and experience, technology minded, regularity, traditional division of roles, risk aversive, consumption and entertainment	IND-HIE
New conservatives	Traditional values, protecting social status, hierarchical, critical, interested in politics and history, work is more important than private life, culture and arts, soberly, risk aversive, etiquettes	HIE-ind
Cosmopolitans	Success, self development, internationally oriented, interested in politics, tolerant, work is central motive, ambitious, materialistic, technology minded, impulsive and adventurous, status and etiquettes, arts and culture, focused on like-minded, consumption	IND-fat
Upward mobiles	Career, gaining social status, freedom from tradition and duties, change and modernization, international, longing to appreciation, work and achievement, income, materialistic, consumption and entertainment, technology minded, impulsive and adventurous, freedom, focused on like-minded	IND
Post materialists	Self development, solidarity, attention for immaterial values, interested in social life and politics, reflexive, critical, solidarity, tolerant, international, balance between work and private, being societal useful, principle, not consumptive and not entertainment focused, sober, arts and culture	EGA
Post modern hedonists	Freedom, independency, carpe diem, new experiences, tolerant, equal changes, not interested in politics or society, work subordinate to private, impulsive, adventurous, without obligations, arts and popular culture, experience focused, friends more important than family	FAT-HERM

Spiral Dynamics

In the Table below we see that there is no Cultural Theory perspective in which social relations are non-existent. Apparently it is assumed that even voluntary withdrawal from relations (as is the case for the Hermit) has some linkages to social relations.

Name	Description	Comparable to
Beige	Uses instincts and habits to survive, food, water, warmth, safety has priority, no conscious value system or sense of self, loose relations, do what you have to do to stay a live.	No social relations
Purple	Groups as tribes, tradition and safety, keeping the spirits happy and the tribes nest safe and warm, learning through classical conditioning, obedient and loyal to chiefs, elders, the clan etc., preserves valuable objects and customs, "our people versus them", paternalistic, strict role relations, focus on subsistence.	HIE
Red	Egocentric, groups as imperia, psychological survival, exploitation, power, the world is a jungle full of threats and predators, breaks free from domination and constraints, expects attention and respect, no guilt, immediate pleasure, us versus them walls, attention seeking and you have winners and losers.	Border HERM-no social relations
Blue	Life has a meaning with predetermined outcomes, eternal and absolute principles, righteous living produces stability now and guarantees future reward, laws, discipline and regulations, only one right way, obey rules and authority, adhere to tradition, moralistic lessons, peace and quiet, places for everybody, absolute value system.	EGA-fat
Orange	Progress by learning and seeking out best solutions, manipulates earth's resources to create and spread the abundance of good life, optimistic, risk taking, self reliant people deserve success, societies prosper through strategy, technology and competitiveness, delegating, independency, materialistic, achievement, change to progress, experiments to win, upwardly mobile.	IND
Green	The human spirit must be freed from greed and dogma, feelings and sensitivity supersede rationality, spreads the worlds resources equally among all, reaches decision through reconciliation and consensus, spiritual, harmony, enriches human development, putting into perspectives, love and kinship, socio-centric, seeks inner peace, all must collaborate, shared experiences, cooperation, open for insiders.	EGA
Yellow	Inevitability of change, principled, knowledge centered, self directed, shifting family roles, expects competence, appropriate technologies, power is dispersed, life is learning, rarely fearful, Live fully and responsibly, integration, flexible structures.	IND – HIE
Turquoise	Holism, experience, solidarity, peace in an incomprehensive world, deeper receptivity of multidimensional trans-rational perceptions, restoration of harmony, synergy, plan for long range, blends feelings and technology, maximize the brain, broad interest ranges, seeks outreach, highly diversified, not isolationist.	IND-EGA

WIN model

Name	Description	Comparable to
Conservatives	Focused on your own environment, security, family is most important, do not like to attract attention or seeing anybody else doing so, confirmation to rules and norms, bit impulsive, tidy people, preference for unconstrained entertainment like television, disappointed with society and politics, not really materialistic, but in favor of luxurious, modern stuff, confirmative.	HIE
Engaged	Harmony, stability, prefer to do activities together with a group of other people, often members of clubs or associations, deliberate and well considered, thinking about consequences of decisions for themselves and their environment, prefer reading over watching television, interest in arts, nature and politics, not materialistic, however interested in nice, tasteful, objects, not interested in new, innovative technologies, safety.	HIE-EGA
Enjoyers/ hedonists	Pleasure and enjoyment on physical and emotional level, more sportive than creative, challenge, risk, adventure and excitement, not a worrier, impulsive and showing things very easily (lazy), likes to go out in a group, not interested in social issues and politics, prefer watching television over reading, like to spend money on going out for diner, new and novel objects.	FAT
Luxury seekers/ careerist	Ambitious, success, appreciation, comfort is highly valued, not somebody who keeps seated, seeking challenges and does not really matter about (behavioral) rules, not very religious, ego centered, not involved in other's businesses, judge quickly and talk straight from the shoulder, interest in society, both television watchers and newspaper readers (mainly telegraaf), possess lots of modern objects and willingness to show these to others, technological developments cannot go fast enough, sensitive for trends, and you will be the first one possessing a novel object, achievement.	IND – fat
Broad minded/ progressives	Progressive and educated, lots of ideals who are mainly left wing, worried about social problems and trying to better the world, starting with yourself, environmental consciousness, keen on freedom, appreciate to make once own choices and to have a varied life with some risks, self development, make great demands on oneself and others, receptive for the world around, understanding, profundity, dislike prejudice, read a lot, politics and social issues come from the bottom of the heart, flexible, modern, engaged.	IND-ega
Professionals	Ambitious, independent, educated, self development, working hard and a quick and creative thinker, free liver ("life enjoyer"), stimulating and challenging life, often double earners, high income, buying luxurious, tasteful, trendy objects and sensitive to technological novelties, giving money for good causes, critical but receptive for new things and point of views, watches a lot of actualities and background programs on television, up to date for social issues and politics, self destination.	IND
Care takers/ traditionalist	Focused on well being of others, social person receiving energy from helping fellow human beings, sober, generous for others, traditional values and traditions which provide rest and security, no need for change, self effacing, community people, like to do meritorious work for the (church) community, not very creative, prefer implementation over preceding development processes, both reading and television watching, regional newspapers, up to date for social and political situation, fairly cheap products who are reliable,	EGA-hie

	social.	
Balanced	They are an average of all people. When it comes to interests, life style and so on, they are exactly in the middle or other people.	EGA-IND-HIE-FAT

WRR

Because the fatalistic perspective is missing and three out of four perspectives contain egalitarian components, the grid-group comparison cannot be made.

Name	Description	Comparable to
Utilizing	Humans have a need for natural products, plants and animals. Setting aside natural areas is not necessary; zoos, parks and cultivated areas satisfy. Ecosystems can be imitated, separate spaces are only necessary if valuable species or ecosystems cannot be sustained in cultivated settings, goal is then to supplement the populations in zoos and botanical gardens. Social dynamics can be adjusted, not directed. Environmental risk can never entirely ruled out. Some levels of pollution are acceptable; others can be mitigated by means of technological adaptations. Much can be achieved by technology. Scarcity of resources will mean a rise in prices, leading to endogenous substitutions. Nuclear energy must be considered. The problem of storage is nearing a solution. Population growth in the Third World is a major concern. The associated poverty results in major environmental problems. Tackling poverty is an important lever. An increase in prosperity in Western countries is also regarded as desirable and possible.	IND
Saving	Natural areas must be safeguarded for the future, at least one section of each ecosystem should be protected, size of landscapes should be adapted to self maintaining capacity, management to maintain important parameters, knowledge is already available or will be available in the short term, nature management using 'large grazers' is an example of this. Resilience of environmental and social system is considerable. Methods of production, including technology, cannot be changed rapidly. Environmental risks can be reduced by reducing the volume of consumption, also necessary for a fairer intra- and intergenerational distribution of scarce resources. Each world citizen should make limited use of natural resources. Equal rights of access to sufficient primary resources, before all kinds of luxury needs can be met. Environmental problems which could still arise are accepted as potentially insoluble or inevitable. Little confidence in the effectiveness of banning substances, recycling or replacement. Allow for a cautious margin for error by exercising restraint with respect to consumer needs, reducing dependence on natural resources.	EGA-HIE

Managing	Observing plants and animals under natural conditions is the only satisfying condition to contact with nature. Conservation should concentrate on preserving and developing plants and animals in their respective biotopes, recreation and education in natural areas is important, however should not disturb species and their biotopes, large national parks. Needs cannot be rapidly changed, environment is regarded as 'robust within limits', meaning that these limits need to be monitored to prevent accidents. Risks exceeding limits are not acceptable, new production methods should spare the environment as far as possible. Regulating adjustments in production, accumulation of information to provide for deliberate, future-oriented policy. This information is used in order to accelerate the dematerialisation of production, possibly followed by the dematerialisation of consumption.	HIE-ega
Preserving	Existing unspoiled nature must be allowed to develop unhindered, in eroded areas, nature should be restored, attention to future generations, preservation and restoration of wildlife is allowed to take up space, however not at costs of other functions, each component in an ecosystem has its own function and cannot be substituted (holism), people are part of the ecosystem, change both consumer and producer behaviour. Environmental risks are high, consumption should be adjusted and production activities changed. Social willingness, minimise the uptake of non-renewable resources, control the utilisation of renewable resources. Sober lifestyle. Risk aversive Confidence in technological contributions for solving environmental problems through recycling and renewables, Risks can be minimized, meeting priority needs for each world citizen now and in the future, New products can only be marketed if harmlessness to the environment, radical government intervention is allowed, making use of all the available means, for example via the market.	EGA-hie

Mood consumption

In mood consumption Fatalism and Individualism as well as Egalitarism and Hierarchism oppose, which is different from Cultural theory wherein HIE-IND and FAT-EGA oppose, but comparable to the distinction made in Motivaction's mentality test.

Name	Description	Comparable to
Innovation	Knowledge seeking, Bill Gates, people tend to plan, invent and configure, being competent, autonomous, concerned with questions like ' how does it work' and 'does it make sense'? Focused on improving, the world is a flexible network of logical possibilities, moved by skills. Ingenuity, willpower, achievement, trust reason, appreciate respect, choose products based on minimalist elegance with a classical edge over temporary fanciness. With regards to services, Innovation is against bureaucracy and unnecessarily complex. Asking questions rather than providing answers, logical.	IND
Intuition	Identity seeking, Mahatma Ghandi, people are teaching, counseling, deep and meaningful relationships, interpersonal integration, being empathetic and authentic, aware of people's feelings, self actualization, tact and sensitivity, benevolence, prefer a warm style, romantic, sentimental, trust intuition and appreciate recognition, do not intellectualize but act how they feel, close emotional relations are essential to well being and happiness, emotional arguments.	EGA

Perfection	Security seeking, George Washington, filtering, inspecting, protecting, reliability, respectability, well prepared, ethical, correct deeds in an organized manner, following tradition, trust in familiar and real things that happened before, social order, need for belonging, intensive planning, choose products by being cautious, conventional and dependable, design that is practical, correctly priced and with a good quality, detail conscious, pragmatic, status, trust authority and appreciate gratitude, adherence to rules and regulations, organizers, communication should be predictable without fancy surprises or speculation, concerned	HIE
Satisfaction	Sensation seeking, Pablo Picasso, promoting, displaying, composing, spontaneous, adaptable in action, outgoing sensation in the here and now, fun loving, impatient, easily bored, egalitarian and make sure that everybody gets their fair share, however also frequently showing their big egos, simple and short term significance of intellectuality, entertainment, great faith in themselves, shopping and material possessions, the firsts to try new trends, trust impulse, cheerful, optimistic, confident, assertive, nothing hurts more than being ignored.	FAT

IPCC/PBL Worldviews

Again, we can observe that Individualism and Egalitarism are contrasting, which does not correspond with Cultural Theory wherein Individualism and Egalitarism share a low grid dimension.

Name	Description	Comparable to
A1- Mondial market	Performance, ambition, concurrence, free market, technique, technology, innovation, privatization, adaptation, liberalism, freedom, progress, future generations will be smarter and richer, trust in global economy, growth, if the west does well, other parts of the world will do well too, concurrence is good: it improves quality, efficiency and improves price- quality ratio, self development, earning money is important, luxurious, comfortable and challenging life, opportunities, do not like patronizing and interfering government, privatization, less remittances, individual responsibilities.	IND
A2- Safe region	Private, safe and livable society, independency and safety, trust in politics and the law, arm oneself against undesirable developments, winners and losers, responsibility, subsidies, political leadership, obtained rights, only interfere in your own business, neo conservatism, distrust in people and institutions, trust in transatlantic market. Concerned about well-being and safety, should not forget our culture, norms and values, politics should listen to problems of people, government is responsible for protecting inhabitants, the welfare state is not up to date anymore and is making people lazy, give more responsibilities to the market, taxes have to be used for useful things, our own concerns are more important than concerns of other countries, there is no united Europe, we are not responsible for solving the problems of other countries, besides it is not clear if we could help at all, preservation.	HIE-ind
B1- Mondial	International and national solidarity, collaboration, government coordination for common goods and correcting market failures,	HIE-ega

solidarity	education and economic growth must lead to decrease of population growth, rules, public services, together we are strong, there is only one world, social democracy, equality, help the weaker, responsible for future generations, trust in strong Europe. Money alone does not make you happy; quality of life (for yourself and other people in the world) is also important, responsible for others and willing to help and to make sacrifices for that, world problems cannot be solved by the market: governments and NGO's have to put efforts in this, common services are essential, freedom and material well being are important, however within limits.	
B2- Care taking region	Living together with a sense of solidarity, responsible, careful, small is beautiful, own responsibility, sober, material well being has gone too far, debate, consultation, agreements, decentralization, better the world, start with yourself, comparable to religious movements, trust in humans, united families and neighborhoods, trust in regional communities, we do not have any influence on problems in Europe and the world, more important is to guarantee that we and our own neighborhood go well, more attention for each other, more importance for local governments who are better connected to people. No need for more challenge, higher, more and faster. Voluntary work, more social control (also behavioral), improve quality of own neighborhood, voluntary initiatives to care for each other, sacrifices for other people and trust in each other.	EGA

APPENDIX 2: QUESTIONNAIRE AND ANSWER KEY

Deze vragenlijst is onderdeel van het project 'Perspectives in Integrated Water Resources Management in River Deltas' en beoogt uw perspectief op water vast te stellen. Mits anders aangegeven, kunt u bij iedere vraag meerdere antwoordopties aanvinken. De antwoorden worden anoniem verwerkt. Het invullen van de vragenlijst kost ongeveer 10 minuten. De vragenlijst bestaat uit verschillende onderdelen: vragen over uw voorkeuren, uw visie op de maatschappij en uw visie op water(beheer).

Op onderstaande schaal dient u aan te geven welke stelling het meest aansluit bij uw voorkeuren

		2	1	1	2		
I	Ik houd van werken en presteren als **individu**	☐	☐	☐	☐	Ik houd van **samenwerken**	E
H	Ik streef naar **zekerheid**	☐	☐	☐	☐	Ik streef naar **avontuur**	I
I	Ik heb **ambities**	☐	☐	☐	☐	Ik leef van **dag tot dag**	F
F	In ons dagelijks leven hebben we **veel** regels nodig	☐	☐	☐	☐	In ons dagelijks leven hebben we **amper** regels nodig	E
H	Ik handel meestal **voorbereid**	☐	☐	☐	☐	Ik handel meestal **impulsief**	F
H	We moeten tradities in **ere houden**	☐	☐	☐	☐	Sommige tradities zijn slecht voor mens of milieu en moeten **veranderen**	E

Hieronder vindt u (een gedeelte van) de zogenaamde *perspectievenkaart*. In de linker kolom staan de vragen/ stellingen, onder de kolommen A t/m D de antwoordopties. U kunt per vraag/ stelling steeds 0 tot 4 antwoordopties aanvinken. Indien u nul antwoordopties aanvinkt, betekent dit dat u geen mening over de betreffende vraag/ stelling heeft. Het aanvinken van **meerdere antwoordopties** (2 t/m 4) betekent dat u zich kunt vinden in meerdere categorieën. Indien uw visie niet in een antwoordcategorie naar voor komt, heeft u aan het eind van de vragenlijst de mogelijkheid uw visie weer te geven.

Vraag	A	B	C	D
De Waarde van water is voor mij	**Een betrouwbare bron voor diverse functies** H	Dat het **mijn leven** kan veraangenamen. F	Een bron van materiële **welvaart en zelfontplooing;** I Belangrijk voor Nederlands imago	Een bron van **rust en ruimte** E
De Nederlandse waterproblematiek is op dit moment	**Serieus, en haast niet beheersbaar** E	**Serieus, maar wel beheersbaar** H	Iets waarover we ons **geen zorgen** hoeven te maken I	**Het is compleet nutteloos** om problemen proberen te voorkomen of de gevolgen te beperken F
Bij klimaatverandering ga ik uit van	**Gemiddelde** trends, zoals voorspeld door experts H	**Minimale** trends; ik denk niet dat het klimaat duidelijk zal veranderen E	**Geen trend.** Vandaag kan het A zijn, morgen B F	**Extreme** trends; ik denk dat het klimaat nog sterker veranderd dan nu gedacht wordt. We moeten alle opties open houden. I
Mijn vertrouwen in technologie is	**Redelijk,** maar ik vind het wel belangrijk dat eventuele gevolgen nauwgezet onderzocht worden en de toepassing niet te grootschalig is. H	**Groot.** Ik zie vooral kansen in het gebruik van innovatieve technologieën. We moeten beschikbare technologieën snel en grootschalig inzetten I	Onduidelijk. F Technologie **veraangenaamt** mijn leven, maar in het verleden behaalde resultaten bieden geen garantie voor de toekomst.	**Laag.** De risico's zijn te groot. We moeten heel voorzichtig met technologie omgaan. Ik zie liever gedragsaanpassingen dan gebruik van technologie. E
Belangrijke waarden	Structuur en stabiliteit H	Harmonie en solidariteit E	Vrijheid en onafhankelijkheid I	Comfort en plezier vooral op korte termijn F

Lokale gebieden in Nederland kunnen op verschillende manieren ingericht worden. Welke afbeelding spreekt u het meest aan (1 antwoordoptie mogelijk)?

☐ Fat   ☐ Hie   ☐ Ind   ☐ Ega

Waarom heeft u voor deze afbeelding(en) gekozen?

....

....

....

Nu volgen een aantal stellingen. Gelieve voor iedere stelling aan te geven in hoeverre u het eens bent met de stelling (1 antwoordoptie mogelijk).

		2	1	1	2		
I	Ik vertrouw op mijn competenties en vaardigheden	☐	☐	☐	☐	Ik vertrouw op intuïtie en gevoel	E
E	Ik heb groot vertrouwen in de mens	☐	☐	☐	☐	Ik heb weinig vertrouwen in de mens	F H
I	Doorontwikkelen wat we hebben	☐	☐	☐	☐	Behouden wat we hebben	
F	Ik verveel me **snel**	☐	☐	☐	☐	Ik verveel me **amper**	I
H	Ik koop graag praktische kwaliteitsproducten	☐	☐	☐	☐	Ik koop graag de nieuwste producten die op de markt verschijnen	F
H	Ik denk dat overheidscontrole het meest effectief is	☐	☐	☐	☐	Ik denk dat sociale controle (buurtcontrole) het meest effectief is	E

Maximum score per perspective = 6

De omgeving kan op verschillende manieren worden ingericht en er zijn meerdere manieren waarop we met water om kunnen gaan. Welke afbeelding spreekt u het meest aan (1 antwoord mogelijk)?

☐ Fat   ☐ Ind   ☐ Ega   ☐ Hie

Waarom heeft u voor deze afbeelding gekozen?

....

Vraag	A	B	C	D
Prioriteiten in waterfuncties zijn idealiter	**Economische functies** en zelf-ontplooiing. Innovatief omgaan met water is goed voor imago NL I	**Ecologisch herstel**, compensatie en natuur(ontwikkeling) E	**Behoud** van bestaande functies: win-win H	**Comfort.** Mij momenteel van voldoende water voorzien (bv voor drink-water, auto wassen etc). F
Veiligheid moet worden bewerkstelligd door	**Overstromings-preventie en controle** van de afvoer H	**Ingrijpen is zinloos**; we kunnen het lot niet keren. F	**Aanpassing** aan het water door kansen te benutten. I	**Overstromings-gevoelige gebieden** te **mijden** en acceptatie van water. Risico's uit de weg gaan. E
De reactie op droogte is idealiter	Het strikt volgen van richtlijnen uit de H **verdringingsreeks**	Het eerlijk verdelen E van beschikbaar water tussen **natuur** en con-sumptie voor de **mens**	De marktwerking. Op het moment dat water schaarser wordt, moet de **prijs** omhoog. I	Weet ik niet. Daar hoeven we **niet over na te denken**. Uiteindelijk komt het heus wel in orde.
Idealiter is de watervoorziening	**Vraag gestuurd** ook als de vraag hoog is. Watervoorziening moet aan de vraag H voldoen.	**Aanbod gestuurd**, ook als het aanbod laag is. Mensen E moeten hun vraag aanpassen aan beschikbaarheid.	**Hetzelfde als momenteel.** Het is zinloos na te denken over de toekomst F	**Markt gestuurd.** In geval van schaarste, wordt water duurder waardoor de vraag vanzelf afneemt.Vraag en aanbod via de markt in I balans
De ideale inrichting van het watersysteem is gebaseerd op	**Passiviteit** ledere vorm van ingrijpen of actief beleid is zinloos. Het verloop van omstandigheden is voorbestemd	**Natuurlijke** E **inrichting**: natuurlijke berging en veerkracht. Bv door het geven van ruimte aan de rivier, herstel brakke estuaria	**Opportunisme**, marktgericht en mbv hoogstaande technolo-gieën. BV amfibisch/ drijvend wonen. I	**Controle**: waterkering en regulering, BV door dijkenbouw, zandsuppletie en kanalisatie H
In de Ruimtelijke ordening	**Biedt water kansen**. Functie benut peil. I Creëren van ruimte op en om het water	**Zou water sturend moeten zijn**, functie volgt peil, opgeven E ruimte indien nodig.	**Zou water volgend moeten zijn** peil volgt functie, behoud bestaande ruimte H	Moet water **gebruikt worden** om plezier en lol te maken F
Schade als gevolg van overstromingen	Is het een kwestie van **solidariteit**: schade treft ons allemaal: E iedere burger is financieel verantwoor-delijk voor gevolgen en vergoeden kosten	Moet voorkomen worden, maar als het toch gebeurd, is de **overheid** verantwoordelijk voor gevolgen en vergoeden kosten	**Daarop ga ik niet vooruit lopen.** F	**Is onderwerp van eigen verantwoordelijkheid.** I Wonen in risicovol gebied is eigen afweging. Zelf be-talen van schade eventueel gecombineerd met verzeke-ring tegen schade
De verantwoor-delijkheid voor water(beheer) ligt wat mij betreft bij	**Nationale** overheid H	**Regionale** overheden, NGO's, en in feite E draagt iedereen een steentje bij. Collectief	**Marktpartijen** en in risicovol gebied (bv buitendijks) individuen I	**Maakt mij weinig uit**, zo lang ik maar water genoeg heb. Verder bepaal ik zelf wel wat goed voor me is. F
Besluitvorming moet wat mij betreft geschieden op basis van:	**Participatieve** processen met ruimte en input voor alle E betrokkenen	**De werking van de vrije markt** en I **privatisering.** Kosten-baten analyses deter-mineren beste keuzes	**Onderzoek, normenstellingen, en expertkennis** H	**Niet van toepassing.** F Besluitvorming heeft geen enkele zin omdat het geen effect op de toekomst heeft.
Water en de manier waarop water beheerd wordt, draagt met name bij aan	**Internationale identiteit**. We hebben als Nederland zijnde een imago hoog te houden van innovatieve I waterbeheerders	**Nationale identiteit**, waterkennis is een traditioneel export product. We moeten trots zijn op onze va-derlandse geschiede-nis: de strijd tegen H water is daarbij van groot belang	**Stroomgebied identiteit**, waterkennis onderbrengen bij lokale beheerders. Solidariteit aan elkaar en mensen in andere landen E	**Mijn eigen identiteit.** Genot, plezier en een aangenaam, leven. Wat levert op korte termijn het meeste plezier op. F

Hieronder ziet u twee afbeeldingen met verschillende soorten kranen. Welke afbeelding spreekt u het meest aan? Laat u hierbij vooral leiden door de vormgeving van kranen en achtergrond en niet door de dikte van de straal.

☐ 1

☐ 2

Hier ziet u twee afbeeldingen die water uitbeelden. De eerste betreft een abstract werk, de tweede afbeelding is een foto. Welke afbeelding spreekt u het meest aan?

☐ 3
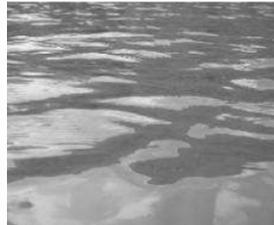
☐ 4

Mijn leeftijd is
☐ Jonger dan 25
☐ 25-40
☐ 41-55
☐ 56- 65
☐ 66-70
☐ Ouder dan 70

Mijn hoogst voltooide opleiding is:
☐ Basisonderwijs
☐ Middelbaar onderwijs
☐ MBO middelbaar beroepsonderwijs
☐ HBO hoger beroepsonderwijs
☐ WO Wetenschappelijk onderwijs - Universiteit
☐ Doctoraal
☐ Anders, namelijk

Picture 1 and 3= Ind
Picture 1 and 4= Hie
Picture 2 and 3= Ega
Picture 2 and 4=Fat

(following mood consumption)

Ik ben
☐ Man
☐ Vrouw

Ik ben momenteel werkzaam of betrokken bij:
☐ Waterschap
☐ Rijkswaterstaat
☐ Onderzoeksbureau (aan universiteit verbonden)
☐ Onderzoeksbureau (niet aan universiteit verbonden)
☐ Overheid
☐ Ik ben werkloos
☐ Anders, namelijk:

Mijn postcode is:
………

Dit is het einde van de vragenlijst. Hartelijk dank voor het invullen! Hier heeft u de mogelijkheid om opmerkingen, suggesties en aanvullingen aan ons mede te delen.

Wij verzoeken u, indien u gebruikt maakt van vragen of antwoordcategorieën uit de tabellen, te verwijzen naar de door ons ontwikkelende perspectievenkaart. Zie: Valkering, P., A. Offermans, M. van Lieshout, R. van der Brugge, M. Haasnoot, H. Middelkoop, W. van Deursen, J. Beersma, H. Buiteveld, K. Volleberg (2008). Inspelen op verandering; naar een robuuste en flexibele strategie voor waterbeheer. Eindrapportage van de pilotstudie Perspectieven in Integraal Waterbeheer. Maastricht: ICIS

APPENDIX 3: THE SOCIAL SUPPORT MAP

1	Principle 1 Priority objective	Safety with attention to ecology	Safety	Safety with attention to agriculture and navigation
	No support for	9, 11 until 16, 18, 24	22	1,2, 4
2	Principle 2 Technology	No measures with a high technological content	All measures possible	Only measures with a low technological content
	No support for	-	-	21, 25
3	Principle 3 Climate change	Assume no or minimal climate change in planning/ policy activities	Assume extreme climate change in planning/ policy activities	Assume average climate change in planning/ policy activities
	No support for	1, 15, 16, 18, 27		18
4	Principle 4 Spatial pressure	Assume average spatial pressure in planning/ policy activities	Assume a low spatial pressure in planning/ policy activities	Assume high spatial pressure in planning/ policy activities
	No support for	1 unless combined with 22	-	1 unless combined with 22
5	Principle 5 Safety by means of...	Adaptation to the water	Avoidance of flood prone areas, space for the river	Control and regulation of the discharge
	No support for	15, 16, 18, 1 unless combined with 22	10, 14, 15, 16, 18	1
6	Principle 6 Construction in flood plains	Building in floodplains only under strict conditions	Building restrictions in flood prone areas	(Adjusted) building is possible everywhere
	No support for	-	19,21,22	-
7	Principle 7 Responsibility	Regional	National government	Private parties
	No support for	-	-	5,6,7
8	Principle 8 Decision making based on	Expert knowledge and research	Cost- benefit analysis	Participatory stakeholder processes
	No support for	-	-	-

The social support map. Depending on the interpretation of beliefs according to the dominant citizen perspective, some measures may not be supported by the citizens, making it impossible for policy makers to implement these measures straight away.

APPENDIX 4: OVERVIEW OF INFORMATION IN THE SPSS FILE

Name tag	Categories	variable[61]	Description
RunNumber	None	S	Game session
Date	None	N	Date of game session
RUN	None	N	Where was the game played
Coalition_name	None	N	Coalition name (2 per session)
Period_in_run	None	S	Time step in the game (1-5)
Climate_scenario	{1, No Climate change}	N	Chosen climate scenario (1-3)
Climate_realisation	None	N	Which climate run
FloodEvent	{0, no event}...	O	No,almost,small or large flood
DroughtEvent	{0, no event}...	O	No, very small, small and large
SocialEvent	{0, no}...	N	No, hie, ega, ind or fat
Citizen	{0, no}...	N	No, hie, ega, ind or fat
ProposedM1	{0, no measure}...	N	29 options, first proposed measure
ProposedM2	0, no measure}...	N	29 options, second proposed measure
ImplementedlM1	0, no measure}...	N	First measure implemented after negotiation, 29 options
ImplementedM2	0, no measure}...	N	Second measure implemented after negotiation, 29 options
Strategy	0, no measure}...	N	First implemented measure, 16 options (eg no distinction in dike related measures)
type_of_strategy	{1, wet}...	N	Wet or dry
perspective_strategy	{1, hie}...	N	Perspective inherent to first implemented measure
Strategy2	0, no measure}...	N	Second implemented measure, 16 options (eg no distinction in dike related measures)
type_of_strategy2	{1.00, wet}...	N	Wet or dry
Perspectve_Strategy2	{1, hie}...	N	Perspective inherent to second implemented measure
BeliefchangeT1	None	N	Which belief changed in the perspectives map (1-8)
BeliefchangeT2	None	N	Which belief changed in the perspectives map (1-8)
BeliefchangeT3	None	N	Which belief changed in the perspectives map (1-8)
BeliefchangeT4	None	N	Which belief changed in the perspectives map (1-8)
BeliefchangeT5	None	N	Which belief changed in the perspectives map (1-8); maximum number of 5 changes per time slot could be accommodate

[61] S= Scale variable, O= Ordinal variable and N= Nominal variable

number_beliefs_changed	None	S	How many beliefs did change per coalition and time step
Into_Direction	{1.00, hie}...	N	Into what direction did the coalition change (hie, ega, ind)
Away_from	{1.00, hie}...	N	In case of change, from what perspective did the coalition move away (hie, ega, ind)
MissedFloods	None	S	How many missed floods took place
Dike_rings_flooded	None	S	How many dike rings were flooded
FalseAlarms	None	S	How many false alarms have been given
urbanarea	None	S	How much square meters of urban area was flooded
casualties	None	S	How many flood induced casualties occurred
damage	None	S	What was the total damage (in million Euros)
AgriculturalDamage	None	S	What was the total agricultural damage (in million Euros)
navigation	None	S	How much percent of the time could ships navigate unhindered
nature	None	S	What was the total nature area (in square kilometers)
Diversity	None	S	What was the ecological diversity (0-3)
AgreementStart	None	S	What was the overlap between (un)marked beliefs in the perspectives map between coalitions (in %) at the start
AgreementEnd	None	S	What was the overlap between (un)marked beliefs in the perspectives map between coalitions (in %) at the end
MatchWbMsexclconsensus	None	S	How often did worldview (perspective) and proposed measure (management style) match (in %)
MatchWbMsinclconsensus	None	S	How often did worldview (perspective) and implemented measure (management style) match (in %)
Evaluatie	None	N	What was mentioned as motivation for the choice for measures
pattern_of_change1	{1, from left to right}...	N	How did coalitions shift throughout the triangle (horizontally)
Pattern_of_change2	{1, from above to below}...	N	How did coalitions shift throughout the triangle (vertically)
Tracking_persp_change	{1.00, astrid}...	N	Who kept track on perspective change (researcher of coalitions themselves)
Target_Group	{1, students}...	N	With whom did we play (students, water managers, scientists or mixed group)
Target_Group2	{1, National}...	N	With whom did we play (national group, international group)

APPENDIX 5: OVERVIEW OF MEASURES AND THEIR CORRESPONDING PERSPECTIVE

Measure	Perspective
Cooperation with upstream areas	Hierarchical, sometimes egalitarian*
Room for the river	Egalitarian
Dike raising	Hierarchical
No measure chosen	
Dredging	Individualistic
Climate dike	Hierarchical
Increase nature area	Egalitarian
Adaptation of the trigger for alarm	Hierarchical
Medium boats	Hierarchical or egalitarian*
Houses on artificial mounds	Hierarchical
Small boats	Egalitarian
Elevated houses	Individualistic
Floating houses	Individualistic
Dike ring around the cities	Hierarchical
Large boats	Individualistic or hierarchical*
Educating people about water	Egalitarian or hierarchical*
Wave overtopping resistant dikes (asphalt coverage)	Hierarchical
Dikes with grass coverage (current situation)	Hierarchical

Sometimes, previous research does not offer enough information to judge to which perspective a strategy ideally fits. In all situations, motivations behind a choice for a strategy, offer more information on this issue. For 'Upstream cooperation' for example, it is decisive why people chose this option: to approach high water levels from a river catchment point of view (egalitarian) or to lower discharges with low costs and high governmental responsibilities (hierarchical). Given the results from our analysis regarding the match between worldview and management style, we suggest to let the motivation be decisive to conclude whether the choice for a measure fits within a hierarchical, egalitarian or individualistic perspective. Even measures that instinctively fit nicely within one perspective, can than be in line with another perspective. For example, 'Room for the river' is oftentimes approach as an egalitarian measure as nature receives more space and building activities in the winter bed will be limited. However, the motivation behind 'Room for the river' can also be different: to let the river discharge flood in a controlled way, making it a more hierarchical instead of egalitarian measure.

APPENDIX 6: MEASURES BELONGING TO THE NUMBERS USED IN FIGURE 39

Measures belonging to the numbers in Figure 39. The bars in the Figure are based on average, minimum and maximum scores for the indicators flooded dike rings, flooded urban area and damage due to flooding. These bars have subsequently been adapted based on low, medium and high acceptability levels as indicated in table 23. These acceptability levels are assumed values and not empirically tested, neither the adaptation of the initial bars have been empirically tested.

No policy on floods	1	8 Plus floating houses	12
Dike raising 1:500	2	8 Plus dike rings	13
2 plus cooperation upstream	3	8 Plus artificial mounds	14
2 plus artificial mounds	4	Dike raising 1.5 times	15
2 plus floating houses	5	Room for the river large	16
2 plus Room for the river	6	16 plus cooperation	17
2 plus Dike rings	7	No policy on drought	18
Dike raising 1:1000	8	Small Ship	19
8 plus cooperation	9	Medium Ship	20
8 plus Room for the river large	10	Dredging small	21
8 Plus Room for the river medium	11	Large Dredge	22

SUMMARY

Changing social perceptions effect the way the water system will be arranged and the type of strategies that will be preferred or rejected. The central aim of this thesis was to further understand the interaction between society and the water system, perspective dynamics and to explore the sustainability of water management strategies under an uncertain future. We defined a sustainable strategy as a strategy that (including its effects on a multitude of indicators) is evaluated as acceptable under a wide range of perspectivistic futures.

In chapter two we explained that a sustainable strategy involves the interaction between society and the water system that often co-evolve in a non-linear way. This interaction can be understood by the Pressure (P)- State (S) – Impact (I)- Response (R) framework. The Response part within this framework can subsequently be better understood by making use of Perspectives derived from Cultural Theory. Chapter two can be seen as a chapter reporting on the main results from a pilot study we performed before the research underlying this thesis was funded. We describe the red line of the thesis by touching upon past, present and future perspectives and perspective changes. As the pilot study had to be carried out within a limited time frame of one year, the use and application of Cultural Theory for and to water has not been (empirically) tested.

In chapter three we therefore started with a comparison of the position of Cultural Theory within other typologies and the extent to which the perspectives as described in Cultural theory could be recognized in other typologies. Although Cultural Theory has been applied to multiple topics -amongst which water- this application never seems to be explored in an empirically satisfying way. Before using Cultural Theory as a framework to analyze perspective changes regarding water management, we wanted to be sure about its suitability and completeness to do so. To that end, we identified criteria for a proper typology (see chapter three) and compared how Cultural Theory and six other typologies scored on them. Resulting from this, we concluded that Cultural Theory scored well (both absolutely and relatively) on these criteria, it can be considered complete and all perspectives (including the Fatalist) can be recognized in other typologies. The determining role of the grid- and group axes however, could hardly be recognized in other typologies. This is also true for Cultural Theory's discrepancy between Hierarchists and Individualists on the one hand, and Fatalists and Egalitarians on the other as they supposedly do not share a position on the grid- or group axis. Besides, Cultural Theory's discrepancy between government regulation (as characteristic for the Hierarchist) and the free market (Individualist) could not be recognized equally strong in other typologies. Finally, the possibly determining role of characteristics like sex, age and education needs to be kept in mind. However, in our questionnaire we could not find any significant differences based on sex, age or education. We can thus conclude that Cultural Theory relates well to other typologies and that it -taken some attention points into account- may function well as a

framework to be applied to water and to explore perspectives on water, perspective change and social robustness of different water management strategies in an uncertain and changeable future.

As chapter three confirmed Cultural Theory's suitability as a typology, chapter four elaborates on the Theory as such and on its application to water and socially robust river management. The Perspectives Method allows analyzing different and changing perceptions on water. It refers to the process of applying Cultural Theory perspectives to water management while acknowledging the non-stereotypical and dynamic nature of perspectives and simultaneously offering a method to operationalize and measure perspectives on water in order to gain more knowledge on future perspective changes and socially robust water management strategies. In paragraph 2.2.1 and 4.6 the reader finds an extensive and qualitative description of every perspective on water. In a nutshell, the Hierarchist focuses on control, meeting demands by controlling the supply, government responsibilities and expert knowledge. The Egalitarian prefers natural development, adapting human behavior to available water resources taking water needs from non-human users of water into account, providing space for the river and shared responsibilities with input from various stakeholders. The Individualist argues that water offers opportunities and innovative technologies will enable to adapt to changing water levels and the integration of water into spatial planning. Self development is important and decisions should be based upon expected costs and opportunities. The Fatalist adopts a more passive attitude towards water. Floods and water scarcity are predetermined and therefore not preventable. *Carpe diem* is the best and most clever way to deal with water and besides, water can contribute largely to enjoyment and pleasure. Chapter four summarizes starting points inherent to the Perspectives Method. In a nutshell, real life perspectives are never stereotypical and therefore tend to exist of combinations of interpretations from two or more perspectives. These perspectives explain differences in preferences and support for water management strategies. Perspectives are also dynamic and may change due to surprises and a lack of reproduction mechanisms, possibly also effecting support for water management strategies. Lacking support for strategies may make it impossible to implement or continue strategies on the short term. A socially robust water management strategy is however able to cope with such uncertainties in our social system (perspective change). Within every level of analysis, a dominant perspective (referring to interpretations were the majority of people in a group adhere to) and one or more undercurrents (non-dominant but significant interpretations of beliefs) can be distinguished. Due to surprises and or reproduction mechanisms, the distribution between dominant perspective and undercurrent may change, for example because the popularity of the undercurrent increases and eventually takes over the dominant perspective. A changing dominant perspective may alter support for strategies to such an extent that policy makers may be forced into sudden en sometimes expensive measure changes.

Chapter 5 focused on the possible theoretical and practical lessons resulting from the application of the Perspectives Method to Dutch water management history. It was concluded that the application of the Perspectives Method to Dutch water management history offered relevant lessons regarding the dynamic nature of perspectives, changing social support and the utility of the method for policy and science. Content wise we have learned that changes in the dominant perspective can both be initiated by stakeholders and policymakers. Events and developments inside and outside the chosen study area, notably those with a visible or sensory (smell, taste) character in combination with appealing icons, people or a group of people may contribute to the initiation and intensification of perspective change. Additionally, the availability of alternative ways to deal with nature and water and media attention can further catalyze perspective change. Regarding the direction of change, we have learned that this depends on present undercurrents and the type of event occurring. Besides, the dominant perspective needs to be susceptible for being surprised (e.g. an Egalitarian won't be very much surprised by technological disasters as they did not have trust in technology anyway). Further, we have seen that perspectives may change in different velocities for different domains (for example the water quality- and water quantity domain). In our historical case study, it took around 50 years between the rise of an (Egalitarian) undercurrent and the growth of this undercurrent into a new, dominant perspective. Next, the timing and sequential occurrence of surprises are essential. Usually people have the tendency to explain a surprise away or explain it in such a way that it still fits within their perspective. However, this resistance is only tenable up to a certain point. More surprises in a relatively short time frame cannot be denied and will therefore function as surprise, changing the dominant perspective. Retrospectively we can identify historical decisions that helped to increase the popularity of the Egalitarian undercurrent and decrease support for the dominant Hierarchical perspective, like the removal of natural area 'the Beer' for the expansion of the Rotterdam harbor. Adapting to concerns stemming from the undercurrent (for example by appointing compensation areas with protected nature) may have prevented the severe loss of public support for intensified 'Dike raising' measures and may have increased the social robustness of the 'Dike raising strategy' in those times. For policy makers it is thus important to analyze the social robustness of a strategy in advance, not only to closely monitor events and developments that may impact the support for the strategy, but also to proactively think about how to adapt the strategy in case it is no longer durable (socially acceptable). The Perspectives Method may help policy makers herein.

Chapter 6 reports on the present dominant perspective among Dutch water professionals that was measured via a perspective-based questionnaire. This perspective was compared to the perspective inherent to one of the more recent policy reports for long-term Dutch water management. Results of both exercises were depicted on the perspectives map and perspectives pyramid, visualizing similarities and differences between the policy- and professional perspective. On a worldview level,

the policy- and professional perspective on water resemble to a large extent. This means that policy makers can count on public support for goals they now want to achieve. However, the beliefs on 'trust in technology' and 'important values' as well as beliefs on a management style level deserve input from more perspectives than only Hierarchism to make it (more) acceptable for the current dominant perspective. The present undercurrent is relatively comparable to the dominant perspective, but slightly more Fatalistic and less Egalitarian. To guarantee enough future support for measures suggested in the report, it is advisable to also pay attention to Individualistic and Fatalistic values. Individualistic and particularly Fatalistic values are underrepresented in the Delta report. Especially as the undercurrent (which may grow in the future) already has Fatalistic characteristics, it is advisable to include these values into the report to also guarantee longer term support for suggested measures. Following the results of chapter 6, we can conclude that the Delta report may face difficulties in finding enough support on the short term as it mainly focuses on Hierarchism, whereas the dominant Perspective also has strong Egalitarian characteristics. As the report is rather Hierarchical, support will probably be guaranteed in Hierarchical futures. However, strategies may experience support difficulties in Egalitarian and notably Individualistic and Fatalistic futures. The Delta report strategies are thus lacking social robustness. In Fatalistic or Individualistic futures, policy makers may be forced into sudden and expensive decisions, unless the suggested strategies prove to be very flexible and easy adaptable to changing dominant perspectives. Fortunately, the perspectives map provides a first framework for discussion, as it becomes clearer on which beliefs present support may be lacking. Discussion on these specific topics may contribute to meaningful negotiations to find synergistic and therefore multi-perspectivistic solutions.

Chapter seven shows that combining the Perspectives Method with an Integrated Assessment Meta Model offers useful insights in the physical and social effects of strategies under uncertain futures. Players of participatory game have to manage a river stretch sustainably for the next 100 years. They can choose water management measures, negotiate and agree with other coalitions on the measures that will be implemented while taking the citizen's opinion into account. After implementation players will be confronted with the effects of their measures on indicators like floods, damage, nature, shipping suitability etcetera. Of course these consequences depend on the randomly chosen climate realization and socio-economic developments. After each run, the choice and negotiation for measures starts again and coalition will reflect upon their perspective. One play session usually encompasses 100 years of river management and comes together in a storyline reporting on perspective changes, developments in the river system and responses from players. Analyzing a large amount of storylines provides information on possible future perspective changes, causes for change and the effects of changes on the choice for measures. Besides, it may increase knowledge on the relation between worldview and management style. However, to increase the game's ability to explore social robustness and perspective

change in a very broad variety of climatic, perspectivistic and socio-economic scenarios it is advisable to adapt the simulation game on some aspects. In chapter seven we argued that a broader range of demographic, land-use- and economic scenarios, measures and decision making processes is needed. Also the way information is presented to participants (both content- and process wise) should be adapted to better fit to other perspectives except Hierarchism. Next, the damage indicator should ideally include other types of damage than only harm caused by floods, for example costs resulting from drought (navigation or nature). Also the Fatalistic perspective should be included (at least as possible citizen perspective) into the game.

Chapter 8 can be seen as an outlook wherein we show the importance of taking perspective-based acceptability thresholds into account when analyzing the social robustness of river management strategies. To this end, retrospective evaluations can be added to the participatory simulation game and we need to analyze the minimum, maximum and average tenability of different strategies under various climatic and perspectivistic futures. This provides insight in different gradations of robustness. Chapter eight provides the reader with first ideas on how perspective dependent acceptability thresholds can be defined. Chapter 9, finally, answers and reflects upon the questions raised in chapter 1.

SAMENVATTING - DE PERSPECTIEVEN METHODE: OP WEG NAAR SOCIAAL ROBUUST RIVIERBEHEER

De manier waarop wij water en waterbeheer waarderen, beïnvloedt ook de wijze waarop wij het watersysteem idealiter zouden willen inrichten en welk type maatregelen wij daarbij prefereren dan wel verwerpen. De centrale doelstelling van dit proefschrift was het beter begrijpen van de interactie tussen het watersysteem en de maatschappij, het vergroten van inzicht in perspectiefverandering en het verkennen van de duurzaamheid van strategieën gegeven een onzekere toekomst. We gaan ervan uit dat een duurzame strategie (evenals diens gevolgen en effecten) acceptabel wordt bevonden door een diversiteit aan personen en onder een diversiteit aan mogelijke toekomsten.

In hoofdstuk 2 leggen we uit dat het analyseren van de duurzaamheid van een strategie onlosmakelijk verbonden is met het bekijken van de interactie tussen riviersysteem en maatschappij. Watersysteem en maatschappij blijken vaak op non-lineaire wijze te co-evolueren. Deze interactie kan beter begrepen worden door gebruik te maken van het zogenaamde Pressie (P)- Systeem Status (S)- Impact (I)- en Response (R) kader. In dit proefschrift staat het response deel –ofwel de vraag hoe mensen reageren op datgene wat zij om zich heen zien gebeuren- centraal. De menselijke response is moeilijk te doorgronden, maar kan beter begrepen worden door gebruik te maken van Perspectieven vanuit Culturele Theorie. Hoofdstuk 2 beschrijft verder de resultaten van een eerder verrichte experimentele studie, die plaatsvond voordat het onderzoek dat ten grondslag ligt aan dit proefschrift gefinancierd werd. Het beschrijft feitelijk de rode draad van dit proefschrift waarbij de lezer wordt meegenomen op een perspectivistische reis naar het verleden, heden en de toekomst van het Nederlands rivierbeheer. Aangezien de experimentele studie binnen een jaar uitgevoerd diende te worden, is Culturele Theorie destijds vanuit pragmatische beweegredenen als uitgangspunt genomen, waardoor deze toepassing dus niet aan een empirische toetsing is onderworpen.

In hoofdstuk 3 gaan we daarom in op de positie van Culturele Theorie vergeleken met zes andere typologieën. We onderzochten hoe herkenbaar en compleet de perspectieven van Culturele Theorie zijn in verhouding tot deze andere typologieën. Hiertoe hebben we gebruik gemaakt van een aantal criteria waaraan volgens de literatuur voldaan moet zijn om te kunnen spreken van een goede typologie. We concluderen dat Culturele Theorie zowel absoluut als relatief goed scoort op de geformuleerde criteria, dat het compleet bevonden kan worden en dat alle perspectieven (inclusief de Fatalist) herkend worden in andere typologieën. De leidende rol die de netwerk- en groep dimensies (grid en group) echter spelen, kon niet evenredig sterk herkend worden in andere typologieën. Hetzelfde geldt voor de ogenschijnlijke tegenstellingen tussen Hierarchisten en Individualisten of tussen Fatalisten en Egalitairen aangezien zij binnen Culturele Theorie geen groep, noch een

netwerk-dimensie met elkaar gemeen hebben. Daarnaast kon ook de discrepantie tussen overheidsregulering (kenmerkend voor de Hierarchist) en de vrije markt (Individualist) niet vergelijkbaar krachtig herkend worden. Tenslotte gingen sommige typologieën ervan uit dat karakteristieken als geslacht, leeftijd en opleidingsniveau bepalend kunnen zijn voor iemands perspectief. Dit aspect hebben we meegenomen in onze vragenlijst, maar konden hieromtrent geen significante verschillen identificeren. Concluderend stellen we dat Culturele Theorie zich goed verhoudt tot andere typologieën en dat het -met inachtneming van enkele aandachtspunten- goed zal kunnen functioneren in de toepassing op water, het verkennen van perspectiefverandering en de analyse van sociaal robuuste rivierbeheer strategieën.

Nadat hoofdstuk 3 het gebruik van Culturele theorie rechtvaardigt, gaan we in hoofdstuk 4 in op de theorie zelf en diens toepassing op water en sociaal robuust rivierbeheer. De door ons ontwikkelde Perspectieven Methode stelt in staat om verschillende en veranderende perspectieven op water vast te stellen. Het verwijst naar het toepassen van de perspectieven vanuit Culturele Theorie op rivierbeheer waarin het niet-stereotype en dynamische karakter van perspectieven erkend wordt. Het biedt een methode om perspectieven op water -evenals perspectiefverandering- te operationaliseren en meetbaar te maken om zo ook meer kennis te vergaren omtrent sociaal robuust rivierbeheer. In paragraaf 2.2.1 en 4.6 wordt een uitgebreide kwalitatieve beschrijving van ieder perspectief gegeven. Kort samengevat richt de *Hierarchist* zich op controle van het riviersysteem, het kunnen voldoen aan de watervraag door het aanbod te beheersen, overheidsverantwoordelijkheid en de belangrijke rol van expertkennis. De *Egalitair* prefereert een natuurgerichte insteek waarin de menselijke watervraag wordt aangepast aan beschikbaar water met inachtneming van de behoeften van flora en fauna. Daarnaast richt deze zich op het verschaffen van meer ruimte voor water en natuur en gedeelde verantwoordelijkheden waarin een zo breed mogelijk palet aan stakeholders betrokken wordt. De *Individualist* stelt dat water vooral kansen biedt waardoor wij ons -dankzij gebruikmaking van innovatieve technologieën- kunnen aanpassen aan het water. Het integreren van water in de ruimtelijke ordening, zelfontplooiing en het baseren van keuzes op verwachte kosten, baten en opportuniteiten heeft de voorkeur. De *Fatalist* verkiest een meer passieve houding ten opzichte van water. Overstromingen en droogten zijn voorbestemd en niet te voorkomen. Een houding van *pluk de dag* is de beste en meest slimme wijze om met water om te gaan waarbij de plezierfunctie van water niet ondergesneeuwd mag raken. Voorts onderstreept hoofdstuk 4 enkele uitgangspunten van de Perspectieven Methode. Zo zijn werkelijke perspectieven nooit stereotype waardoor zij bestaan uit interpretaties vanuit meerdere perspectieven. Perspectiefverschillen verklaren (in ieder geval ten dele) verschillen in voorkeuren en draagvlak voor rivierbeheer. Perspectieven zijn ook dynamisch en kunnen veranderen door verrassingen of het uitblijven van reproductiemechanismen. Een dergelijke verandering heeft mogelijk effect op het draagvlak voor verschillende rivierbeheeropties. Verlies van draagvlak kan ertoe leiden

dat strategieën op de korte termijn niet geïmplementeerd of voortgezet kunnen worden. Robuuste strategieën daarentegen, kunnen omgaan met perspectiefveranderingen en onzekerheden in de maatschappij. Op verschillende niveaus kan onderscheid worden gemaakt in een dominant perspectief en een onderstroom. Het dominante perspectief verwijst naar datgene wat door de meerderheid van personen onderstreept wordt, de onderstroom betreft een coherente minderheidsgroep. Verrassingen en reproductie mechanismen kunnen de balans tussen dominant perspectief en onderstroom veranderen. Zo kan de onderstroom aan populariteit winnen ten koste van het dominante perspectief. Een nieuw dominant perspectief kan gevolgen hebben voor draagvlak voor strategieën waardoor beleidsmakers –na een verandering van het dominante perspectief- vaak abrupt maatregelen moeten treffen om draagvlak te herstellen.

Hoofdstuk 5 richt zich op theoretische en praktische lessen volgend uit het toepassen van de Perspectieven Methode op historische ontwikkelingen in het Nederlandse waterbeheer. We concluderen dat deze toepassing waardevolle lessen oplevert omtrent perspectiefverandering, veranderend draagvlak voor strategieën en de bruikbaarheid van de methode voor beleid en wetenschap. Inhoudelijk hebben we geleerd dat een veranderend dominant perspectief geïnitieerd kan worden door zowel beleidsmakers als stakeholders. Gebeurtenissen en ontwikkelingen binnen, maar ook buiten het studiegebied kunnen verandering katalyseren, met name indien zij een sterk waarneembaar (zicht, reuk, smaak) karakter hebben of uitgedragen worden door aansprekende iconen, personen of groeperingen. Daarnaast kan ook de beschikbaarheid van alternatieve manieren van omgang met water alsmede media-aandacht een rol spelen in het verder katalyseren van perspectiefverandering. De richting van verandering hangt ondermeer af van aanwezige onderstromen en het type gebeurtenis dat plaatsvindt. Daarnaast moet het dominante perspectief ontvankelijk zijn om verrast te worden (zo zal een Egalitair niet vlug verrast raken door een technologische ramp aangezien deze toch al weinig vertrouwen in technologie had). Tevens hebben we gezien dat perspectieven in verschillende tijdsspannen kunnen veranderen binnen verschillende domeinen (bijvoorbeeld in het water kwaliteit- en kwantiteitdomein). In onze historische case studie zat er ongeveer 50 jaar tussen het ontstaan van een (Egalitaire) onderstroom en de groei van deze onderstroom tot een nieuw, dominant perspectief. Met betrekking tot perspectiefverandering zijn vervolgens de timing en sequentie waarop en waarin gebeurtenissen en ontwikkelingen plaatsvinden essentieel. Gewoonlijk zijn mensen namelijk geneigd verrassingen te negeren of op zo een manier uit te leggen dat het mooi binnen hun perspectivistische straatje past. Echter, deze resistentie is slechts beperkt houdbaar; meerdere onverwachte gebeurtenissen in relatief korte tijd kunnen niet meer genegeerd worden. Zij zullen dan functioneren als verrassing en bijdragen aan verandering van het (dominante) perspectief. Vaak kan er echter ook worden ingespeeld op de inwerking van verrassingen en naderend verlies aan draagvlak. In retrospectief kunnen we bijvoorbeeld beslissingen aanwijzen die de Egalitaire

onderstroom destijds gevoed -en het Hierarchistisch dominante perspectief verzwakt-hebben (bijvoorbeeld het verwijderen van natuurgebied 'De Beer' ten behoeve van de uitbereiding van de Rotterdamse haven). Het significant verlies aan draagvlak voor verdere dijkverhogingen dat hierop volgde, had verkomen kunnen worden door in te spelen op zorgen en geluiden in de onderstroom (bijvoorbeeld door compensatie gebieden met beschermde natuur aan te wijzen). Beleidsmakers zouden de sociale robuustheid van een strategie dus eigenlijk van tevoren moeten testen en gebeurtenissen en ontwikkelingen die het draagvlak voor de strategie mogelijk kunnen aantasten, nauwgezet monitoren. Ook het proactief nadenken over hoe de strategie aangepast of aangevuld kan worden in situaties waarin draagvlak verloren raakt, is aanbevelenswaardig. De perspectieven Methode biedt hiertoe handvatten.

Hoofdstuk 6 presenteert het huidige perspectief op water onder Nederlandse waterprofessionals dat gemeten is aan de hand van een perspectievenvragenlijst. Dit perspectief is vervolgens vergeleken met het perspectief dat inherent is aan een van de meest recente lange termijn waterbeleidsdocumenten: het nieuwe Deltaplan. Centraal stond de vraag hoe robuust het Deltaplan is gegeven het huidig dominante perspectief op water en gegeven mogelijke toekomstige ontwikkelingen. Hiertoe zijn beide perspectieven (van de professionals en het Deltaplan) weergegeven op de perspectievenkaart en -piramide zodat verschillen en overeenkomsten gevisualiseerd werden. Het professionele- en beleidsperspectief komen goed overeen op wereldbeeld niveau, hetgeen betekent dat beleidsmakers op huidig draagvlak kunnen rekenen betreffende de doelen die zij momenteel na willen streven. Echter, op een managementstijl niveau bestaan grote verschillen tussen het hoofdzakelijk Hierarchistisch georiënteerde beleidsrapport en de professionals die ook sterke Egalitaire kenmerken hebben. De huidige onderstroom is voorts erg vergelijkbaar met het dominante perspectief, maar significant iets minder Egalitair en meer Fatalistisch. Ten behoeve van het huidig draagvlak, is het raadzaam meer nadruk te leggen op perspectieven anders dan Hierarchisme (met name Egalitarisme omdat het dominante perspectief reeds een groot aantal Egalitaire kenmerken heeft). Behalve het huidig draagvlak, lijkt ook toekomstig draagvlak mogelijk in het gedrang. Gezien het sterk Hierarchistische karakter van het beleidsplan, kan draagvlak in een Hierarchistische toekomst naar verwachting behouden blijven. Echter, voorgestelde maatregelen lopen mogelijk tegen problemen betreffende draagvlak aan, wanneer het perspectief zich in de toekomst richting Individualisme, Egalitarisme of Fatalisme beweegt. Vooral bewegingen richting Individualisme en Fatalisme zijn niet ondenkbaar aangezien de onderstroom al dergelijke kenmerken bevat. We concluderen dat de in het Deltaplan voorgestelde maatregelen niet afdoende sociaal robuust zijn. In bijvoorbeeld Individualistische toekomsten kunnen beleidsmakers gedwongen worden tot ad hoc veranderingen, tenzij de maatregelen flexibel zijn en dus eenvoudig aangepast kunnen worden aan het nieuwe dominante perspectief. De perspectievenkaart vormt een eerste discussiekader omdat het aangeeft over welke overtuigingen onenigheid (of een gebrek aan draagvlak) bestaat. Het expliciteren en bediscussiëren van deze

overtuigingen vormt een eerste aanzet tot een meer constructieve dialoog. Deze dialoog kan vervolgens een eerste stap naar het vinden van synergetische, multi-perspectivistische oplossingsrichtingen vormen.

Hoofdstuk 7 laat zien hoe de Perspectieven Methode geïntegreerd kan worden in een simulatie computermodel (IAMM) en welk type resultaten dit oplevert met betrekking tot perspectiefverandering en sociaal robuust rivierbeheer. Het computer model is onderdeel van een participatieve spelsetting waarin spelers de opdracht krijgen om een stuk rivier op duurzame wijze te beheren voor de komende 100 jaar. Binnen een groep perspectivistisch gelijkgezinden (dit wordt vooraf gemeten middels de zogenaamde perspectievenkaart) kunnen maatregelen worden gekozen om het riviergebied te beheren. Vervolgens dienen de verschillende coalities het eens te worden over uit te voeren maatregelen waarbij rekening gehouden dient te worden met het burgerperspectief en daaruit resulterend (gebrek aan) draagvlak. Na implementatie berekent het model de effecten van maatregelen op indicatoren als overstromingen, schade, natuur, beperkingen voor de scheepvaart enzovoorts. Deze gevolgen hangen ondermeer af van de random gekozen klimaatrealisatie en ontwikkelingen in de socio-economische context. Na elke run kunnen opnieuw maatregelen worden gekozen en wordt er weer onderhandeld. Normaliter omvat een spelsessie 100 jaar rivierbeheer hetgeen wordt samengevat in een zogenaamde verhaallijn. Elke verhaallijn geeft aan wat er in het riviersysteem gebeurd is, welke besluiten coalities genomen hebben en hoe het coalitie perspectief al dan niet veranderd is gedurende het spel. Het analyseren van een groot aantal verhaallijnen geeft inzicht in mogelijke toekomstige perspectiefveranderingen, aanleidingen tot verandering en de effecten van perspectiefverandering op de keuzes van maatregelen. Hoofdstuk 7 laat zien dat het huidige spelconcept al bruikbare resultaten oplevert, maar om de sociale robuustheid van strategieën onder een breder palet aan klimatologische, socio-economische en perspectivistische toekomst te verkennen, zijn enkele aanpassingen noodzakelijk. Deze aanpassingen (zoals variatie in de manier waarop besluiten worden genomen en de wijze waarop informatie gepresenteerd wordt, evenals het meenemen van het Fatalistische perspectief) worden in hoofdstuk 7 besproken.

Hoofdstuk 8 gaat in op perspectief afhankelijke drempelwaarden voor acceptabelheid. Deze drempelwaarden bepalen wanneer een strategie (en diens effecten onder toekomstige ontwikkelingen) niet meer langer acceptabel worden gevonden, of in andere woorden: wanneer de strategie draagvlak dreigt te verliezen. Dit moment is verschillend voor elk perspectief en hangt bovendien af van ontwikkelingen in het klimaat en de socio-economische omgeving. Wij laten zien hoe informatie over minimum, maximum en gemiddelde houdbaarheid van strategieën helpt in het definiëren van robuuste waterbeheerstrategieën en hoe dergelijke waarden geformuleerd zouden kunnen worden. Hoofdstuk 9 ten slotte, beantwoordt de vragen die in hoofdstuk 1 uiteengezet zijn.

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LIST OF ABBREVIATIONS

ACF   Advocacy Coalition Framework
ANOVA   Analysis Of Variance
BSIK   Besluit subsidies Investeringen Kennisinfrastructuur
CIESIN   The Center for International Earth Science Information Network
CopU   Cooperation with Upstream areas
CT   Cultural Theory
DH1.5   Dike raising to 1.5 times the second highest discharge ever
DH500   Dike raising to a norm of once in 500 years
DH1000   Dike raising to a norm of once in 1000 years
DIKTI   Indonesian Ministry of Education and Culture
EGA/Ega   Egalitarian
Et at.   And others
EU   European Union
FaC   Dike rings around the cities
FAT/Fat   Fatalism
FloatH   Floating houses
GIS   Geographic Information System
HERM   Hermit
HIE/ Hie   Hierarchism
IAHS   International Association of Hydrological Sciences
IAMM   Integrated Assessment Meta Model
ICIS   International Centre for Integrated assessment and Sustainable
                development
IND/Ind   Individualism
INSPIRATOR   Integrated Analysis of the Science-Policy Interface in research
                projects on global change and sustainability
IPCC   International Panal on Climate Change
IRMA   Interreg Rhine-Meuse Activities
KM   Kilometres
KNAW   Koninklijke Nederlandse Akademie van Wetenschappen
KNMI   Koninklijk Nederlands Meteorologisch Instituut
MATISSE   Methods And Tools for Integrated Sustainability aSsEssment (EU
                project)
MEuro(s)   Million Euros
MNP   Milieu Natuur planbureau
MS   Management Style
MUST   Maastricht University Graduate School of sustainability Science
N   Number
NHV   Nederlandse Hydrologische Vereniging
NIPO   Nederlands Instituut voor Publieke Opinie
NOP   Nationaal Onderzoeks Programma

NWO	De Nederlandse Organisatie voor Wetenschappelijk Onderzoek
N.Y.	No Year
OECD	Organisation for Economic Cooperation and Development
P	Page
PBL	Planbureau voor de leefomgeving
PP	Pages
PRIMA	Pluralistic framework for integrated uncertainty management and risk analysis
PSI	Pressure-State-Impact
PSIR	Pressure-State-Impact-Response
RfRlarge	Room for the river large scale
RfRsmall	Room for the river small scale
RIVM	Rijksinstituut voor Volkgezondheid en Milieu
SPIN	Scientific Programme Indonesia-Netherlands
SPSS	Statistical Package for the Social Sciences
Std. Deviation	Standard Deviation
TARGETS	Tool to Assess Regional and Global Environmental and health Targets for Sustainability
TIAS	The integrated Assessment Society
TNS	Taylor Nelson Sofres
T1, T2, Tx	Time (step) one, Time (step) 2, Time (step x)
UCM	University College Maastricht
WCED	The World Commission on Environment and Development
WIN	Waardensegmenten in Nederland
WRR	Wetenschappelijke Raad voor het Regeringsbeleid
#	Number
σ	Standard deviation
μ	Average

ABOUT THE AUTHOR

Astrid Offermans was born on February 16th, 1984 in Sittard, the Netherlands. In 2002 Astrid started her bachelor program 'Interdisicplinairy Social Sciences' at Utrecht University. During her bachelor she successfully attended four anthropology courses and in September 2005 she started the Master program "Social interventions and policy", also at Utrecht University. In June 2006 she completed this master Cum Laude and with clear pass.

In December 2006 Astrid started working as a junior-researcher at the International Centre for Integrated assessment and Sustainable development (ICIS) at Maastricht University. She worked on the BSIK project 'Perspectives in Integrated Water Management' on the integration of research results from different academic disciplines and the development of integrated scenarios for water management in the Netherlands. In June 2008 Astrid started her PhD on integrating social Perspectives into a method to assess the sustainability of different water management strategies. Besides, Astrid was involved in the EU- MATISSE project where she worked on the integration of social and cultural values in (agent based) models for integrated sustainability assessments. In 2007 and 2008 she also co-organized 'sustainable Tuesday' in the province of Limburg, the Netherlands. As from 2010 she is a member of the Educational Committee for the MUST PhD program 'Sustainability Science, Policy and Practice'. In 2012, she started working on the NWO funded project 'INSPIRATOR' that investigates joint knowledge production in science-policy interfaces. Next to her experience in research projects, she has experience in organizing workshops, special sessions during conferences, and presenting. As from January 2013 she will be working as a post-doc researcher on the SPIN (Scientific Programme Indonesia-Netherlands) project 'Social and economic effects of partnering for sustainable change in agricultural commodity chains – A Southern perspective', funded by KNAW/DIKTI. The project is an initiative of Maastricht University (ICIS) and the University of Lampung (Sumatra, Indonesia), and embedded in the SPIN- theme Social and Economic Development.

Finally, she was a teacher of the course 'Sustainable development, an introduction' and teaches and coordinates the UCM bachelor course 'Globalization, environmental change and society' at University College Maastricht. She also co-developed and teaches in the Master skills course 'Participatory methods'.

Maastricht University

International Centre for
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On behalf of Maastricht University, the International Centre for Integrated assessment and Sustainable development (ICIS) - Maastricht University graduate school of SusTainability science (MUST) declares that

Astrid Gertruda Elisabeth Offermans

born   *in*
16 February 1984   *Sittard, The Netherlands*

has successfully fulfilled all requirements of the MUST PhD programme.

Maastricht, 19 December 2012

Dr. R.J.M. Cörvers
Chair education committee MUST

Prof. Dr. P. Martens
Scientific Director ICIS

Maastricht University

International Centre for
Integrated assessment and
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COURSES

PhD Courses

- MUST PhD course "Knowledge production for sustainable development" 12-13 April 2012, Maastricht University, Maastricht, the Netherlands
- MUST PhD course "Global Change, Complexity and Sustainability" 19-20 October 2011, Maastricht University, Maastricht, the Netherlands
- TIAS PhD course "Cognitive mapping & interactive stakeholder collaboration", 15-16 February 2007, Osnabrück, Germany

Other courses

- Maastricht University in collaboration with Tijdwinst.com "Brain training and speed reading" 21 September 2010, Maastricht, the Netherlands
- Maastricht University "Self management for PhD trajectories" 5 and 19 February 2009, Maastricht, the Netherlands
- Maastricht University "Project matig werken" in collaboration with Twynstra & Gudde, 2009 (3 days) Maastricht, the Netherlands
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- Tutoring: UCM (University College Maastricht) bachelor course: PEERS undergraduate Research (2009)
- Tutoring: Sustainability Science, Policy and Practice Master skills course: Participatory methods (2012 - present)
- Lecturing: Offermans, A. (9 February 2012) Lecture for the course: Globalization, environmental change and society. An introduction to Globalization and environmental changes. University College Maastricht, Maastricht, the Netherlands

Other

- Course coordination: UCM (University College Maastricht) bachelor course: Globalization, environmental change and society (2009 - present)
- Course coordination: Master Sustainability Science, Policy and Practice skills course: Participatory methods (2012 - present)
- Co-organization of 'sustainable Tuesday in the province of Limburg' in collaboration with IVN (2007 and 2008)
- Co-organization of 4 workshops related to the Dutch BSIK project 'Perspectieven in Integraal waterbeheer' in 2007 and 2008
- Co-organizer of the special session P FR5: Preparing for an uncertain future. During the conference 'Deltas in times of climate change'. 29 September - 1 October 2010, Rotterdam, the Netherlands
- Special session organizer within the sixth Dubrovnik conference on Sustainable Development of Energy, Water and Environment Systems. Session title: Understanding environment-society interactions for sustainable development. 25-29 September 2011, Dubrovnik, Croatia
- Chair of the session 'Water resources II' at the sixth Dubrovnik conference on Sustainable Development of Energy, Water and Environment Systems. 25-29 September 2011, Dubrovnik, Croatia
- Member of the scientific advisory board Dubrovnik conferences SDEWES (2009 - present)
- Member of the educational committee MUST PhD program Sustainability Science, Policy and Practice (2010 - present)

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