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Interdisciplinarity, Problem Focused Research and Normativity

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Interdisciplinarity, Problem Focused Research and Normativity

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Contents

Abstract

The rationale for adopting an interdisciplinary approach to investigate a certain problem has been discussed at length in scientific literature and in policy documents. Interdisciplinary research is often motivated by 'societal' problems. As society is not homogenous, this means that multiple perspectives exist on the problem. Societal problems often require interdisciplinary approaches, so multiple disciplines are relevant. Both aspects introduce the need to make normative choices. This paper will show that the selection of 'societal' objectives introduces the first layer of normativity. The second layer originates from the amalgamation of disciplinary insights into a new integrated outcome. This process of integration requires the exercise of value judgment as well as the professional judgment implied in the delivery of any expertise. Rather than denying this normativity as something to be avoided, which is the approach generally favoured in science, it should be acknowledged explicitly as an essential ingredient to interdisciplinary research. This opens up the possibility for inquiry into the validity of the values that were employed. Last, it will be shown that selection of a boundary object as objective facilitates interdisciplinary research, both because it can be shared amongst disciplines and because it enables the emergence of shared solutions.

Key words: interdisciplinarity, boundary object, emergence, normativity, Meuse

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About the Author

Anna Wesselink trained as a tropical land and water management engineer before moving into water resources research. This has taken her to the UK, the Central African Republic, and Madagascar. In order to reflect on her professional practice, she started a PhD on the decision-making processes in water management, with particular attention to the integration of expertise, the participation of relevant social groups, the ways integrated assessment is framed, and processes of (social) learning and negotiation. She now works as Marie Curie research fellow at SRI on multi-level governance of natural resources. Her special interest is understanding interdisciplinarity.

1 Introduction

In this paper I want to explore how normative choices play a role in interdisciplinary research on the governance of natural resources. I am looking specifically at research in natural sciences-based fields, such as environmental management, integrated water management or land use. This research tends to deliver specific recommendations for policy and practice on the basis of natural science outputs. These recommendations often imply a specific view on desirable management options, namely where the environmental protection or improvement is seen as the most important goal above economic or political motivations. In addition, implementing the recommendations often implies large societal impacts. This means that no a priori assumptions should be made that the environmental goals implicit in the recommendations will be politically acceptable, even if the political discourse may give the impression that it is. Typically, the research projects I am focussing on aim to contribute to achieving goals such as sustainable land use, integrated water management, resilient ecosystems, etc. An example is current research on adaptation to and mitigation of climate change impacts. The message from the natural science-led research is very clear: we can expect significant impacts, we need to implement severe restrictions if we are to mitigate CO2 level rises, and adapting to the new conditions will cost a lot, both in monetary but even more in human terms (IPCC 2007a; IPCC 2007b). Despite the political rhetoric of the moment, there is little real action towards achieving mitigation or adaptation, which would mean a significant cut in fossil fuel consumption.

Because of the political controversies related to these topics, the large uncertainties in the predictions and the multiple possible interpretations of goals like sustainability or resilience, this kind of interdisciplinary research is loaded with normative choices. However, in practice these are rarely made explicit in the research process. Also, the range of solutions that is investigated and the choices that are made on how to evaluate them are choices usually made by the researchers, not by is the participating public. I would argue that the responsibility for methodological choices should indeed for a large part be the researchers' (and whoever funds them): this is part of professional responsibility. It is therefore also the researchers' responsibility to be aware of the normativity involved in their work. I would not want to dismiss that greater stakeholder participation can contribute to solving a legitimacy problem and add expertise to the process. I have shown that participation can be a way to integrate values, interests and power relations into research outcomes (Wesselink 2007). However, even if stakeholder participation is employed to expose the normative goals and assumptions of the researchers and to negotiate shared goals and jointly examined assumptions, the choice of purpose of a such a research project normative, even when shared by stakeholders. I will return to this argument when I discuss the example of the RELU programme below. For a more general and more extensive treatment of the same argument, see e.g. Guba & Lincoln (2005, 197-200).

In theories about interdisciplinary research as well as in interdisciplinary practice, the focus is usually on the creation of knowledge as the central objective, thereby ignoring the dimensions of values, interests and power. My aim is to understand how normative choices are a part of interdisciplinary practice and to which problems this might lead. First, I will offer a way to systemise the different types of interdisciplinary work. This systemisation indicates two different types of normative choices potentially

implied in interdisciplinary projects. I then examine the character and pitfalls of these normative choices, and conclude with a plea for explicit attention to normativity in order to make interdisciplinary research more robust and more effective.

2 Interdisciplinarity: Definitions and Practices

There are many different interpretations and definitions of interdisciplinarity and its close cousins, multi- and transdisciplinarity. Overviews are presented by Klein (1996), Weingart and Stehr (2000) and Aram (2004) amongst others. While definitions of interdisciplinary research disagree on details, they do agree that the participating scientists work together on a common question by somehow exchanging concepts and tools in order to formulate one collective conclusion, while in multi-disciplinary research each discipline produces a separate report. Paxton (1996) identifies four levels on interaction among disciplines: notice-taking of one discipline toward another, modifying one discipline as a result of contact with another, building at the interface of two or more disciplines, and connections among the disciplines as such. All of these typologies share a movement from less to more knowledge integration; they also make evident a lack of a standard nomenclature in this area. In this paper I will not evaluate whether a project is interdisciplinary according to one of these definitions, but I will assume it is interdisciplinary when the researchers involved consider it to be so.

From his interviews with scholars leading interdisciplinary courses, Aram (2004) proposes a systematisation of concepts of interdisciplinarity. First, they can be distinguished according to the degree in which knowledge from different disciplines is integrated. Aram classifies them into two groups: where new ways of producing knowledge are explored, and where, less radically, new perspectives are exchanged across disciplinary boundaries. This is the vertical axis in Table 1. Second, concepts of interdisciplinarity differ in the overarching purpose of the research. Is the unification of disparate knowledge its goal, or is it the usefulness to society? Klein (1996) calls these endogenous and exogenous purposes; this is the horizontal axis in Table 1.

Combining these two criteria, interdisciplinary research can be classified into four categories (Table 1). In box 1, the aim of the research is to introduce new perspectives into each other's research in order to produce academic knowledge. In box 2, perspectives are exchanged in order to produce knowledge in a societal context. In box 3, the aim is to produce new knowledge in an academic context, and in box 4 the new knowledge serves a societal purpose. I propose that the new knowledge in box 3 and 4 can be understood in the sense of Angyal's definition as 'a synergy of the contributing parts that are not visible any more' (Angyal 1939): it is an integrated whole. Its characteristics result from the interactions between the parts, and are emergent properties of the system as a whole (Ablowitz 1939). The emergence of new characteristics is a phenomenon associated with complex systems (von Bertalanffy 1968; Holland 1998; Harrison et al. 2006). I will show in Section 4 how emergence of new properties occurs in land use planning.

Table 1: Interdisciplinary Research Classified

		Intellectual purposes addressed	
		Academic context (endogenous)	Social context (exogenous)
Definition of interdisciplinarity	New perspective	1	2
	New knowledge	3	4

Note: the figures do not indicate numerical values
Source: After Aram (2004)

I also propose in this paper that interdisciplinary research is facilitated when the shared objective is a boundary object. A boundary object is defined as 'an analytic concept of those scientific objects which both inhabit several intersecting social worlds [..] and satisfy the informational requirements of each of them. [..] They are weakly structured in common use, and become strongly structured in individual-site use. [..] They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation' (Star and Griesemer 1989, 393). Boundary objects allow negotiation amongst stakeholders (including scientists) settings and site-specific interpretation, which are useful characteristics in an interdisciplinary setting of multiple values and multiple disciplines.

A similar table to Table 1 can be applied to definitions of transdisciplinarity found in the literature, the only difference being the involvement of non-academic stakeholders in the research process. While in many definitions of transdisciplinarity 'cooperation by diverse academic experts and practitioners to address real-world problems' is emphasised (Aram 2004), a new way of knowledge production is simultaneously advocated by many authors, placing the research to box 4. For example, Haberli et al. (2001) define transdisciplinarity as 'a new form of learning and problem-solving', and Klein (2003) describes transdisciplinary approaches as 'comprehensive frameworks that transcend the narrow scope of disciplinary worldviews through an overarching synthesis [..] a new mode of knowledge production that fosters a synthetic reconfiguration and re-contextualization of available knowledge' (Klein 2003, 4).

All definitions of multi-, inter- and transdisciplinarity mentioned above, including Table 1, focus on the creation of knowledge as the central objective. They thereby ignore the dimensions of values, interests and power present in interdisciplinary research. These play an important role in any collaborative project, first of all on the personal level of influence and authority but also shaped by disciplinary status and reputation: whose knowledge counts, which purpose are we pursuing, what should solutions look like. Indeed, it can be argued that values, interests and power play a role in any knowledge pursuit, including those taking lace within disciplinary

boundaries. Many scholars describe (disciplinary) knowledge as a social construction, where views of 'reality' are susceptible to a variety of historical and cultural forces, and 'truth' claims are interdependent with the nature and exercise of power (e.g. Knorr-Cetina and Mulkay 1983). This implies that cultural values and political interests are integrated into the knowledge produced at a certain time by a certain group of people by the normative choices they make.

Whether the reader buys into this view of knowledge production or not, I will show below how (an additional round of) value-integration is necessary to achieve new knowledge, based on my analysis of a land use planning project in the Netherlands. These are the normative choices associated with doing interdisciplinary work in the bottom row in Table 1. In other cases, the need for value-integration results from the choice to help solve a 'societal problem'. These normative choices are associated with doing interdisciplinary work in the right column in Table 1. I will briefly explore this kind of interdisciplinary research in the next Section 3 before returning to the interdisciplinary production of new knowledge in Section 4.

3 Normative Choices and Societal Objectives: The RELU Example

In the Rural Economy and Land Use (RELU) programme, 'scientists are collaborating on wide ranging interdisciplinary research projects grouped around four research themes and six societal challenges' (RELU 2008). RELU 'was launched in 2003 to carry out interdisciplinary research on the multiple challenges facing rural areas. Interdisciplinary research is being funded from 2004-2010 to inform future policy and practice with choices on how to manage the countryside and rural economies' (RELU 2007; RELU 2008). The RELU projects are only one example of many such projects; others are EU 6th Framework projects such as GoverNat, NeWater, HarmoniCop and others. It appears that interdisciplinarity has been successfully presented as the answer both to fragmentation between the disciplines and to a perceived lack of usefulness of scientific research to society as a whole. Whether it will deliver these promises remains to be seen, and I hope to show that the recognition of normative choices may help to achieve these goals. I am using the RELU programme as an example to show how normativity is necessarily a part of such projects, not in order to criticise the way the RELU projects have or have not dealt explicitly with normative choices. In fact, it appears than more attention than usual was paid to normativity here than usual. Second, my purpose is to raise awareness, not to propose solutions, hereby following Wickson et al. (2006) who 'view these quandaries as exciting new challenges for the research community' (Wickson et al. 2006, 1052).

If the purpose is to do policy-led research, normativity will be a significant issue because the research will be framed in relation to 'the problem', or 'challenges' as RELU names them. Since RELU is funded by UK government and aims to inform future policy, it may be assumed that 'the multiple challenges facing rural areas' are considered of interest to policy makers. However, different groups in society have different priorities, possibly other than those defined by the political process. To define a problem as 'societal challenge' as if it would apply to the whole of society is therefore problematic, as some actors are better represented in the political process than others. By their choice of 'societal challenges' the RELU projects are therefore necessarily normative, even when, as is the case in most RELU projects, stakeholders are extensively involved in setting the projects' objectives. In addition,

there will always be different opinions on desirable solutions because people have fundamentally different outlooks on how society should be managed (e.g. Thompson et al. 1990). Donaldson et al. (2005, 4) in their RELU working paper in effect acknowledge that 'catchment management is unavoidably controversial' with different actors 'competing to realise different visions'. When they frame the controversy as 'different knowledge claims and practices' they implicitly acknowledge the essentially political character of such decisions. Even if a project manages to explicitly deal with local political issues, such as in the RELU Sustainable Uplands project (2008) approach, there is still the wider societal priority setting process and the subsequent allocation of funds to be considered when implementation of recommendations is at stake. Should the political process decide? However this is viewed, it is clear that dealing with 'societal challenges' involves normative choices, and I will argue below that it is in academia's own interest to make this explicit.

Table 2: RELU Research Themes and Societal Challenges

THEME
A. The Integration of Land and Water Use
B. The Environmental Basis of Rural Development
C. Sustainable Food Chains
D. Economic and Social Interactions with the Rural Environment
CHALLENGE
1. Public Trust in Food Chains
2. Tackling Animal and Plant Disease
3. Sustainable Farming in the New Europe
4. Robust Rural Economies
5. Land Management Techniques to Deal with Climate Change and Invasive Species
6. Managing Land and Water Use for Sustainable Water Catchments

Source: RELU (2008)

In the RELU 'themes and challenges' (Table 2) normative choices are also visible in the choice of what to study, and therefore what not to study. For example, choosing 'integration of land and water use' explicitly as one of the four themes means that the programme instigators believe it is important that land and water are managed together. Of course, such normative choices do not make the results of the research any less well-founded or less useful, on the contrary. However, it is important to acknowledge that there are a normative choice in problem definition, methodology, etc. for the following reason. There is a significant risk that the initial enthusiasm, with scientists and policy makers alike, for new and apparently useful concepts, such as integrated land and water management, leads to frustration and eventually rejection of the concept itself if the implementation of research recommendations is found to stagnate. In these cases it is often concluded that the concept itself is flawed. A new miracle solution is then sought, instead of giving proper thought to why the policy objectives informed by the concept were not achieved: was it lack of understanding and flawed research recommendations or lack of political clout and institutional support? With Carter (2007) I think the latter is often the case. He argues that plans

produced by local authorities and other bodies in the UK have always had an overriding concern for economic development and that environmental objectives cannot easily be accommodated within existing planning practices and organisational cultures.

One example of this is happening in integrated water management research. At the recent CAIWA conference (2007) it appeared that several researchers are now rejecting the integrated water management (IWM) concept, saying 'it does not work' (e.g. Jeffrey & Gearey 2006). This assessment seems to be based on the view that it is possible for scientists to design solutions for policy goals, such as IWM projects, assuming they would then be implemented irrespective of political processes. In reality, implementation of any solution is problematic, because this requires political negotiation. Now the usefulness of IWM as a concept itself rather than a learning process where 'failed' implementation is taken to indicate a need to improve arguments, knowledge and practice. Embarking on a new path, such as 'adaptive water management' (CAIWA 2007), presenting this as the new miracle solution, hampers serious evaluation of lessons learnt. A more productive position is to acknowledge that 'overall, it is not altogether clear at the present time precisely what kinds of competencies, in the form of institutional and policy approaches, are required in order to successfully implement IWM in the 'messy' and 'turbulent' conditions that are increasingly evident in river basin systems around the world. These kinds of arguments have major implications for research and raise important questions about how IWM should be conceptualized and the sorts of analytical frameworks that are required in order to improve our understanding' (Watson et al. 2007).

There is a risk that interdisciplinarity will also go this route of a useful concept that is rejected because its solutions for policy problems are not implemented. The relationship between research and policy making and implementation should be given more careful consideration in the evaluation of the success of interdisciplinary projects. I join Beaumont et al. to say that 'we argue that [interdisciplinary researchers] should be aware of the possibilities and constraints for critical engagement in the context of policy-oriented research' (Beaumont et al. 2005, 118). After all, interdisciplinarity 'is a practice, not an institution, and the more flexible, adaptable and open it remains, the greater will be its contribution' (Russell et al. in press). Explicit attention to normative assumptions and choice and their effect on uptake of results by the policy area is an essential ingredient in this reflexive exercise, which was also identified by Wickson et al. (2006): 'When researchers become engaged in the problem they are investigating assumptions of objectivity will inevitably come into question. This means that it becomes important for the researcher to reflect on how their own frames of reference, values, beliefs, assumptions etc have shaped the conceptualisation of the problem, as well as the development of the method of investigation and the solution' (Wickson et al. 2006, 1053).

4 Normative choices and the production of new knowledge: landscape quality

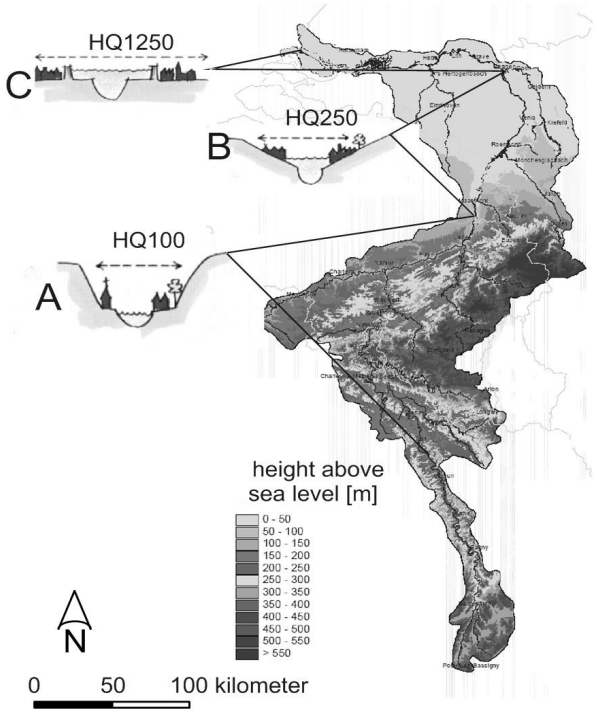
The need to pay attention to normativity in interdisciplinary research does not just arise from the relatively obvious value-related choice of objective, method and solutions that was explored above through the example of RELU. There is also a

more hidden aspect of interdisciplinary research that requires value-integration and that is related to the production of new knowledge. While it was not their explicit intention to do interdisciplinary research, the landscape experts in the case study I describe below managed to produce a new kind of knowledge, with integrated separate knowledge from different disciplines into a new, synthesising result. The synthesis required their judgement of aesthetic values as well as the evaluation of relative importance of landscape functions. They were effectively doing research in box 4 of Table 1: the production of new knowledge in a societal context. First I briefly summarize the project used as case study.

4.1 Flood management: a spatial problem

The Netherlands is the most densely populated country in the European Community. The pressure on available space is correspondingly high and has been increasing with economic growth. Most of The Netherlands is protected from flooding by dikes along the major rivers – Rhine and Meuse – and by dunes along the North Sea coast. This system of flood protection has developed over the last millennium (e.g. Bijker 1993; TeBrake 2002) and there is little real prospect of changing it (Wesselink et al. 2007). An exception to this old system of protection is found in the southern part of the Meuse, where no dikes are present along the first 150 km (Figure 1).

Figure 1: Catchment Area of the River Meuse with Tributaries, Topography and Typical Cross Sections



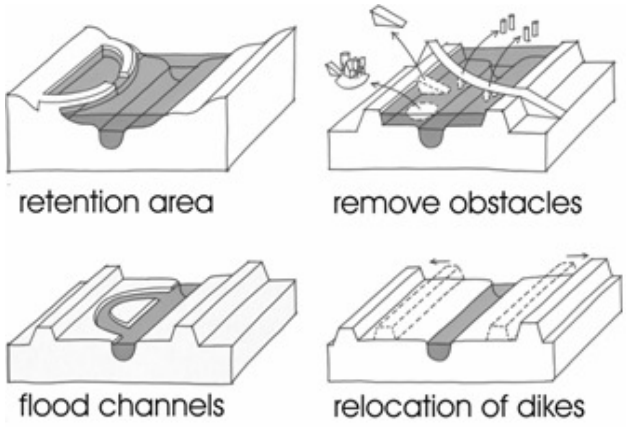
NB: Return periods for flood defence design are indicated by 'HQ' (Reuber et al. 2005)

In the second half of the 1990's climate change predictions triggered the Ministry for Transport, Public Works and Water Management to investigate how increased probabilities of flooding could be planned for. National policy now aims to

accommodate any increased discharge by spatial measures in the flood plain instead of dike enlargement as this is estimated to be more robust. This principle was named 'Room for the River' (Bruijn and Klijn 2001; Reuss 2002). Suitable measures are e.g. retention reservoirs, parallel rivers, deepening or widening of the river bed and/or flood plain, removal of obstacles or relocation of dikes and levees (Figure 2). All of these require the reservation of land for flood protection measures, while a simple increase in dike heights hardly requires any extra space. Especially in the southern part of the Meuse valley, where people are accustomed to having no such restrictions on land use, this is proving difficult to swallow.

In this context of resistance, it was the task of the project 'Integrated Assessment of the river Meuse' to propose a selection of politically acceptable flood management measures that would ensure the legal level of flood protection. The required space for the selected measures would have to be set aside and protected from future investments. This study followed a similar investigation for the Rhine and its branches (Kors 2004). Various ministries and administrative and political bodies were involved in the project. Through the discussions in the project group and the working groups, civil servants working for local and regional administrations were kept informed of experts' investigations. To some extent they influenced the choices that were made, but mostly they followed the proposals made by the experts. This makes the IVM project more interdisciplinary than transdisciplinary.

Figure 2 Room for the River Measures - Examples



Source: Ministerie van V&W (2003)

At the start of the project, a total of 160 individual measures were identified on the 230 km stretch of the Dutch Meuse (Reuber et al. 2005). The hydraulic model showed that these measures together would more than compensate the expected water level rise, and a selection would therefore have to be made. Two selection methods were employed during the course of IVM. In the first phase of the project factual studies into the effect of climate change on different interests were prepared. It was implicitly assumed that these would provide sufficient information for the steering group to formulate a solution: in this way expertise and interests were kept almost separate. The project set out to do a multi-criteria analysis. A 'wish lists' for future development were identified for the main spatial demands in the region (agriculture, housing, industry, recreation, ecology). All individual measures were scored qualitatively for their effect on these functions. It would then have been

possible to choose a set of measures that fulfilled the flood protection criterion and scored best on the individual ratings for spatial demands. If necessary, weights could be applied if one aspect was considered more important than another. However, the advisory board felt that this approach did not do justice the need to provide an integrated solution: they felt it was impossible to compare the different entities in the multi-criteria analysis. The experts proposed to look at the landscape as a unifying concept that could be used to assess whether integration had been achieved.

4.2 Landscape Quality Framework

While IVM was proceeding, the concept of landscape quality had become accepted as an important objective for any spatial plan. The aim of IVM was reformulated accordingly: 'to assess in which ways flood management objectives can be achieved [..] while maintaining or enhancing the quality of the landscape' (Ministerie van V&W 2006). Landscape experts identified eight sections in the Meuse valley with distinctly different characteristics. They then produced pictures and a textual description of the spatial qualities of each of these sections. In Figure 3, two examples of the characterisations are shown. The text presented here is the summary version; the more comprehensive assessment for each river stretch amounts to several pages, describing existing qualities and potential, the socio-economical developments expected in 2000-2050, challenges and assessment criteria. Together these descriptions and pictures constitute the landscape quality framework.

Parallel to this work on the landscape, the technical and political feasibility of the proposed measures had also been examined in more detail. Many were rejected, and many were reduced in size and therefore effectiveness. It turned out that all remaining measures were required if the flood reduction target was to be achieved. No selection was needed any more, and the landscape quality framework was not used for this purpose in the end. However, the fact that this was a politically as well as professionally acceptable selection method presents important lessons for the way in which knowledge can be integrated with values and interests to provide results that are useful in a land use planning context where multiple interests are at stake and where people have different values systems. To explain why, I need to explore the character of landscape quality.

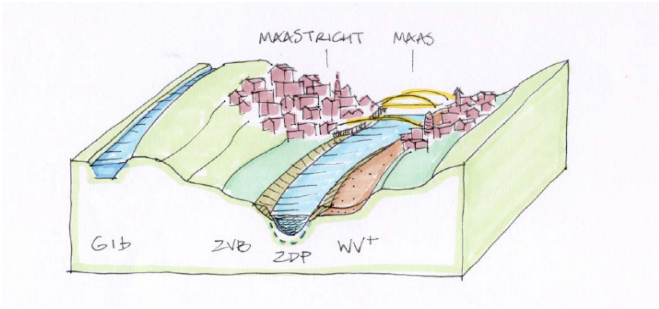
4.3 The essential characteristics of landscape quality

The particular interpretation and implementation of landscape quality used in IVM was developed by Dutch landscape experts in interaction with water management professionals (Musters et al. 2003). They both find it to be a useful tool in land use planning for water management. It is the result of nearly a decade of development and reflection, which swung between the extremes of 'landscape quality as an optimum allocation of land use functions' to 'landscape quality as a purely individual esthetical appreciation'. Guidelines for its implementation have recently been published (Ministerie van V&W 2007). According to the guidelines, landscape quality includes, at least in the rhetoric, both reductionist and holistic elements. Landscape quality takes the multiple land use objectives as expressed by local, regional and national policies and politics into account. It also includes an assessment of the needs of primary functions of the river in the future, similar to the multi-criteria table produced in IVM. In addition it appeals to esthetical imagination to sketch an ideal

picture of the landscape, taking account of 'regional location specific characteristics, the assessment of which is partly subjective'. The aim is to achieve 'quality in the whole' (Ministerie van V&W 2007, 58). While this is a specifically Dutch development, it reflects a more general change in thinking about landscape: 'The perspectives of more than half a century ago still affect the geographical treatment of landscape and endure in the ambiguity between objective and subjective attitudes towards landscape, while in late twentieth century geography, the subjective approaches are ascendant' (Muir 1998, 263).

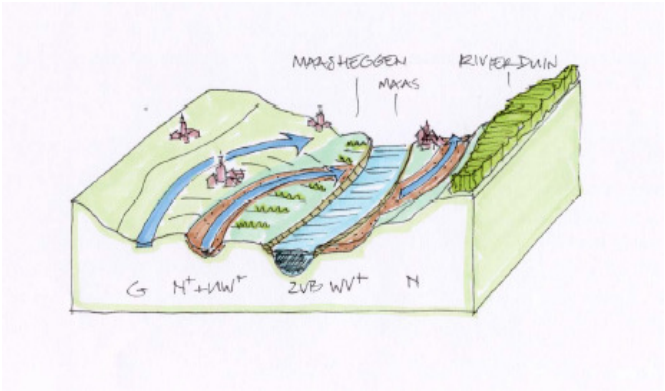
Figure 3: Characterisations of Two of the Eight River Stretches Using Sketches and Text

Upper Meuse



Vision: To develop a sustainable alliance between city and river. The need to interweave the increasing urbanisation and space for the river demands intelligent and creative solutions that provide the optimum of multiple land use and contribute to positioning Maastricht as a compact and complete city with a European cachet.

Meuse north of Venlo



Vision: The geomorphological underground indicates a slow sustainable development of the unspoilt countryside north of Venlo.

Source: Ministerie van V&W (2006)

This particular interpretation of landscape quality, combing holistic as well as reductionist elements, features two characteristics that make it such a useful concept for land use planning: it acts as a boundary object, and it is an emergent property. Both characteristics allow different disciplinary knowledges to be synthesised into one result through normative choices.

Landscape quality as negotiable boundary object

Setting landscape quality as an objective for land use planning clearly presents a number of advantages. Envisaging future developments for the location under scrutiny gives ample opportunities for involvement of stakeholders, by whom I mean

all parties that have a possible stake in the outcomes except the project initiator. In fact, the Dutch guidelines state clearly that 'the plan should be a collective plan of landscape designers, politicians and inhabitants in the region. [..] It is important that the project initiators and the region should reach agreement about the appreciation of present and future qualities of the area as well as the desired design of a measure' (Ministerie van V&W 2007, 58). Obviously, a lot of negotiation will be needed to arrive at a solution acceptable to all. Although in IVM stakeholders have not been involved directly in the development of the landscape quality framework, the end result is sufficiently 'sketchy', both as picture and as text, to leave room for interpretation should it be used in subsequent participatory process. It is also sufficiently appealing as a policy or project objective to motivate stakeholders to participate in its elaboration in the region where they live: its implementation is linked to a particular space and time.

These characteristics make it a boundary object (see Section 2). Negotiation between stakeholders and project initiator is the way in which the translation between different social worlds and the structuring in individual-site use take place in the setting of projects such as IVM. Landscape quality can act as a boundary object in spatial planning because it is open for negotiation; it has potential to include local and regional priorities and preferences. With its definition that includes multi-interpretable images there is great potential for visionary workshops to develop common views. However, in this project the landscape quality assessment framework was defined mostly by landscape experts, using their own preferences and persuasive texts and images formulated in professional jargon and thereby fencing off their expertise from questioning by others. In spite of this, nor the expert-driven method or the results were contested by the participants because in this particular setting it did not limit the choice of flood management measures.

Landscape quality as emergent property

The IVM landscape quality framework presents an amalgamation of the different inputs in which the contributing parts are not visible any more. To achieve this, experts started from information about land use functions but used their esthetical judgement of the landscape to arrive at one overall picture. Put differently: they integrated their values with factual information to produce a result which is 'original, new, on a different level and enriching' (Hoppe 1983). This integration of facts and values has therefore lead to 'new knowledge' and the emergent property 'landscape quality'. 'Integrated water management' has similarly been described as emergent property of the local and context specific outcome of integrated water management projects by Collins and Ison (2007) and Robinson (2008).

4.4 Facilitating the interdisciplinary production of new knowledge

Other examples of potential boundary objects that can be used as policy objective are sustainability, safety, social justice, robustness or resilience. Turnhout et al. (2007) have shown that even seemingly non-integrated concepts like quantitative ecological indicators often play a role as boundary object in practical settings, because they have to be made flexible where the implementation of ecological goals has to be negotiated with stakeholders. I maintain that it is no coincidence that the use of boundary objects as policy goals gives rise to emergent properties: their

evaluation is not wholly objective and can only be made specific in relation to a particular site. Again, in some way or another, a value judgement has to be made to assess whether such an objective has been achieved. If the explicit purpose of interdisciplinary research is the creation of new knowledge, these boundary objects are suitable objectives, too, because they allow this emergence of new knowledge through the synthesis of existing knowledge into something else.

In other settings of interdisciplinary research this is likely to involve judgement of one kind or another, too. Where several people work together on one question, they will have to give priorities, hence value certain aspects higher than others. For them to be able to work together towards one purpose, this objective will have to be sitting on the boundary between the disciplines: be shared by all contributors but specifically interpretable in each discipline. This is exactly the purpose of a boundary object as described first by Star and Griesemer (1989). It can therefore be concluded that the choice of a boundary object facilitates interdisciplinary research, whether it is aimed at producing new knowledge and/or at a specific social context. It does not guarantee success however, because this depends also on the researchers' ability to communicate across borders (Bracken and Oughton 2006; Jones & Macdonald 2007). When the purpose of interdisciplinary research is less ambitious and aimed at learning about new perspectives by exchange across disciplinary boundaries (top row in Table 1), there is no such need for one shared purpose and the selection of boundary objects as objective, although it will still help to focus the exchange.

5 Conclusion

In this paper I wanted to explore how normative choices play a role in interdisciplinary research on governance of natural resources. I have shown that interdisciplinary research on the whole is a normative exercise. This normativity originates in both characteristics usually identified with interdisciplinary research, namely a 'societal' objective and the production of new knowledge. Setting a 'societal' objective means to accept the outcome of a political process, or alternatively to not accept a mainstream political choice and work for the benefit of minority interests. Both choices are inherently normative. The production of new knowledge implies selection and combination of available knowledges to lead to emergent properties. This also requires the exercise of value judgement both in choosing the combination of knowledges and in judging whether the result is satisfactory.

Even though the conclusion that interdisciplinary research is inherently normative sits uncomfortably with the dominant view of science as a value-free exercise, it is important to recognise this normativity if interdisciplinary research is to fulfil its promise of helping to solve 'societal' problems. The risk of not doing so is to be rejected as a useful way of knowing, while it is in fact exactly this opportunity to include values which makes interdisciplinary research so suitable for solving 'societal' problems. This opportunity is greatly increased if the objective of research and policy is a boundary object, as this is a concept which sits on the boundary between different social worlds, each with their own values and interests. Choosing such a boundary object also increases the possibilities for achieving value-integration in results and emergent properties. It important to recognise that this new, integrated knowledge is site-specific and context dependent.

If these challenges are not given due attention, interdisciplinarity 'like concepts such as sustainability and progress, is presented as a one-size-fits-all solution, which will boost the economy, save the environment and empower the community [..] leaving it in danger of being ignored as a buzz word [while] interdisciplinarity has considerable potential to provide knowledge production that is problem-oriented, responsive and open to external knowledge producers, contextualized and systems-based, adaptable, consultative and socially robust' (Russell et al. in press).

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