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Water neutrality and housing in de Dutch water-metropolis

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Abstract
According to current social theory, global economic, political, social-cultural driving forces are reshaping the way we organize our production and consumption. This would result in the dawn of the era of the New Geography. This might explain that in Western Europe the countryside is changing rapidly into an arena in which many different stakeholders compete for the land and the countryside becomes multifunctional in time and space. In this contribution, we will focus on one challenging aspect of these dynamics: the combination of an attractive developed (pseudo) countryside, housing development and water-retention in the urbanized Netherlands. The challenge is to design an attractive and multifunctional area that is affordable for the state, for developers and the final consumer. Each of these stakeholders makes costs-benefit analyses as a part of a general risk-assessment procedure. This assessment has become important in the Netherlands due to deregulation politics. So, the question becomes: who pays for public amenities with positive and negative spill-over effects?
The National Institute of Public Health and the Environment (RIVM) is a state agency that develops and uses GIS-based evaluation models to assess risks. It noticed that the valuation of housing nearby water was lacking in its models. It commissioned the Research Institute for Housing, Urban and Mobility studies to review literature on the methodological aspects of the assumed relationships and to estimate the part-utility/part-valuation of water nearby housing location. This estimation of the monetarized evaluation (valuation in UK-English and appraisal in USA-English, price) by the final users, the housing consumers, is a necessary step in this risk-assessment since the value must at least be equal to the public and private expenditures.
We discuss a variety of methodological problems. We also suggest a switch from a market price equilibrium to a choice and preference equilibrium perspective. Using expert interviews and trade-offs of preferences in a multi-criteria/dimensional setting may overcome problems with conventional tools such as contingent valuation and revealed preferences methods (hedonic, travel cost and input output approaches). Accepting that the reality is complex and fuzzy may in fact turn into strength, as the analysis becomes more valid. We also question the vitality of present spatial analytical models. The basic weakness of the GIS-models is that they assume spatial objects to act, instead of regarding these objects as elements of an opportunity-set for stakeholders (agents). Multi-agent-models may seem promising means to combine the best of individual choice modeling and system-analytical GIS-models that link the micro-macro perspective.

Key-words:
Dynamics of the countryside, water retention, housing, spatial planning, GIS-models, valuation models.

1 Introduction

Join in with research done by others and ourselves, we will argue that the country-side is changing into an area in which various forms of land use are being combined for various reasons (Hillebrand at al. 1999, Davoudi & Stead 2002). A specific case of multi-functional land use is water neutral housing development planning projects. Water neutrality refers to a minimum availability of land to cope with excessive water (rain, river), a minimum level of subsoil water and finally to look after the minimum quality of water for irrigation (agriculture), human use and nature development. In these projects, water is open water, like lakes, rivers and so forth.

Since housing in the vicinity of 'safe' water has always attracted people and revealed itself in an added value (valuation in UK-English and appraisal in USA-English, price) and or part-utility (subjective evaluation that may not be equal to the price) of a location, the idea is to co-finance the public expenditures for water management and land development by pruning away profits made elsewhere in the project. Since many stakeholders are involved in such new and large scale planning projects risk-assessment for the whole project as well as for every individual stakeholder is vital step in the planning process. The land valuation method will show that a sound estimation of the final demand, the dwellings, is crucial information to determine to which extent the costs for construction, land development and land acquisition are possible.

Spatial planners apply GIS based DSS'. The National Institute of Public Health and the Environment (RIVM) has developed two models. Both models apply spatial (regression) functions derived form of individual (housing) choice models that either can be based on overt behavior or intended behavior (revealed and stated choice models). The RIVM noticed that the functions in both models were suboptimal for these new forms of 'water-enriched' planning schemes. The commissioned the OTB Research Institute for Housing, Urban and Mobility Studies of Delft University of Technology to gain more insight in the added value of various forms of water from the perspective of housing consumers and developers to improve both models.' We applied a literature study as the first step in a possible extended project. This extended project has been defined recently.

This contribution summarizes the results and conclusions. We start with an outline of the broader framework of the case 'water neutrality'. We pay attention to the impact of driving forces that shape and reshape the built environment and planning strategies. The key words are multifunctional land use, multi-stakeholders (financial) assessments and the behavioral foundation of the GIS-based DSS'. We summarize the results of our literature review on the valuation of water and real estate. The emphasis is on the valuation methodologies and on the added value of water. We end with a discussion by returning to our first sections.

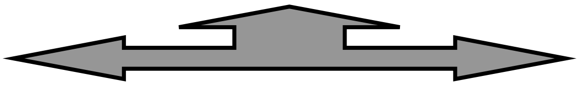
2 A New Geography, New Planning Strategies and New Tools

2.1 The dynamics in society and its impact on the spatial order

The spatial and the social orders are changing rapidly in many countries in western, eastern and southern nation-states due to new organizational structures of consumption and production in relationship to new social-cultural, political and technological developments, often known as driving societal forces. In the recent Dutch WRR report 'Town and countryside in a new geography' (WRR 2002) have set out the relationship between societal and spatial dynamics (figure 1 and 2).

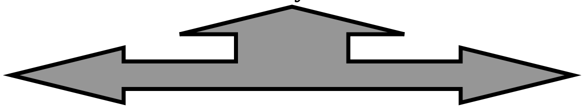
According to many, a New Geography very slowly emerges on the fundaments of the old spatial order. The dynamics induce rearrangements of space to cope with the new emerging opportunity sets for the stakeholders involved. At the same time increases and decreases of the scale of activities in combination with new specialization of places in time and place.

Figure 1 Overview of the societal dynamics

Dynamic with respect to production structures	**Dynamic with respect to consumption patterns**
Increasing (international) labor distribution and competition Strong growth of the service sector (commercial, leisure, communication, media Growing role for ICT Increasing mobility of goods, services, passengers, capital, and knowledge	Creation of new markets Increasing differentiation of consumption according to place and time Growing significance of rapidly changing modes Growing roles of experiential, symbolic and aesthetic consumption
Economic dynamic **Social-cultural dynamic** 	**Political dynamic**
Demographic change Individualization and professionalization Changing role of work Cultural homogenization Differentiation of urban lifestyles	Democratization Changing role of the national state Restructuring of the welfare state Realignment of public versus private sectors New social movements Changing role of citizens, experts, and the media

Source: WRR., 2002: p. 142.

Figure 2 Overview of the spatial dynamics related to the social dynamics

Spatial consequences of the reorganization of production systems	**Spatial consequences of changed consumption patterns**
- Changed location patterns of activities: the creation of innovation centers; of regional economies; concentration of (financial) services; production in low wage countries - Laying of infrastructure (goods and information} - Increasing importance of services and leisure products: tourism, the heritage industry	- Space as consumption space for the middle classes - Growing importance of the visual experience of consumption of the space itself - Re-evaluation of older residential districts: place of residence as identity - The role of the corporate identity of companies in their choice of location
Economic dynamic **Social-cultural dynamic** 	**political dynamic**
- Various requirements related to planning design and use - Revival of land associated identities, and simultaneous uncoupling from cultural characteristics and place - Attention paid to risks and safety: supervised and selected access - New daily mobility patterns	- Withdrawal of the government: privatized housing market, networks, and public space - Rearrangement of government scales - Other governance opportunities for the national state - New arrangements for planning design projects - Issues, diversity, and meanings: radicalization of the space debate

Source: WRR, 2002: p.145

Let us concentrate on rural areas. In Western Europe, they undergo important changes in their economic structure and spatial functions (Davoudi & Stead 2002). Most

important undercurrent in, as well as outcome of this change is the decreasing importance of agriculture although this may often be difficult to discern. For instance in the Netherlands the area for agriculture only diminished by 3 percent in the last 50 years. More than 66 percent of the total area of the Netherlands (34,000 km^2) is mainly used for arable land and dairy farming. However, in economic figures the real dynamics are revealed. The share in the GNP of the agro-complex and employment are 10,5 and 10,7 percent. These figures drop to 2,5 percent just for the primary chain in agro-complex. The lionshare of the added value is found in the industry, distribution, retail and so on. These activities are located in villages and towns. Other statistics show an influx of housing consumers, entrepreneurs, tourists and so on. The added value of these activities in the regional product increases rapidly (CBS 2003, LEI-DLO 2002).
Other competing activities are nature development (Ecological Main Structure) which is responsible for an estimated partial loss of 750.000 ha agricultural land (RIVM 2002), although recently this national policy has been abandoned for budgetary reasons. Not mentioned in WRR-report are the natural dynamics that trigger social-cultural, political and economic dynamics. Especially in the Netherlands, the climatic changes have become our concern. The excess of water by rivers, rainfall, the rising of the sea-level, which has been estimated by 1 meter between 2000 and 2100, and the drop in the level of the land have probably lead to the floods in the last decades in the Netherlands. This has resulted in two main streams of water-management. One stream argues that leveling up the dykes was and will be the best solution. The other stream argues that temporarily water retention lakes in the countryside might be a better solution.
All these new claims in the countryside plus the declining role of the primary agriculture have lead to the revaluation of the countryside into an area of new means of production and consumption. In terms of urban-rural relationships and its impact on the built environment, we even may argue that both concepts have become fuzzy (Asbeek Brusse & Wissink 2002). Davoudi & Stead (2002) argue that new relationships must firstly be understood and addressed in the context of globalization processes, we earlier mentioned, secondly these relationships need to be strengthened for the well-being of the urban and rural populations while the negative impacts of the linkages need to be reduced. This demands for new type of spatial policies as Heins et al (2002), Bengs & Zonneveld (2002) and Asbeek Brusse & Wissink (2002) argue.

An interesting new development is the countryside in the urbanized Netherlands is to combine water retention, nature development, landscape development into (pseudo) country-sides (Heins 2002) and housing into one comprehensive planning designs and planning strategies. The goal is to develop project that are affordable conditional to the necessity that the minimal requirements regarding goals of water-management. These requirements include a minimum availability of land to cope with excessive water (rain, river), a minimum level of subsoil water and finally to look after the minimum quality of water for irrigation (agriculture), human use and nature development. The National Institute of Public Health and the Environment (RIVM) refers to this as Water neutrality. We add extra neutrality: the affordability. This is clearly an example of strategic and complex planning.

2.2 Spatial planning and Decision Support Models

How these social processes will express themselves spatially depends largely on the present land use due to economic inertia of investments. Wissink (1986) uses the concept of spatial order: "the in space distributed and organized activities, their interdependent relations, and the accompanying adapted space and channels of communications.' Needham (1988) argues that the order has three distinctive attributes. First, the order is defined as a reciprocal relationship between the material (physical or spatial) and the societal component. Second, the spatial structure is a pattern that reflects the societal patterns of human behavior of the past and present. Third, the structure changes over time due to societal patterns of human behavior. Hence, on macro-level of analyses societal and the spatial patterns do influence each other over time and space.

Government tries to structure these relationships in such a way that public and private interests are at least safeguarded. Kreukels (1979) argues that 'spatial planning is strategic policy aimed at the allocation of activities in favor of the social-cultural and social-economic order and the living conditions of citizens, while paying attention to the environmental restrictions.'

Hence, in the welfare state spatial planning is a means to optimize the economical, social, ecological and scenic effects on the level of the system in such a way that these effects are distributed as even as possible over the population. Hence, planning implies intervention in the 'recursively organized rules and resources that individuals draw upon and reconstitute in their day to day activities' (Moos & Dear 1986 p. 233). Giddens (1984) defines this as the structure or the set of opportunities and restrictions households, firms and institutions apply in their decisions and refines because of their decisions. Hence, the structure is linking the macro and the micro level. Therefore, Lindenberg argues (1990, p. 736)"in economics and sociology, the main task is to analyze social systems. In other words, the analytical primacy is focused on social systems. In order to explain social systems and related social phenomena, both disciplines have to make use of a theory of action; i.e. the theoretical (or explanatory primacy) is focused on the individual. Thus, the two primacies refer to two different levels. There is analytical interest in the individual but only as an instrument for coming up with explanations on the social systems level." We will apply this perspective to explain the interaction between the various orders.

This implies that the WRR (2002) approach of interdependencies in time and space of different orders is to be understood in a micro-macro perspective. The political, social-cultural, economical and spatial orders are defined as interrelated sets of opportunities and restrictions agents are confronted with if he wants to achieve goals. Arriving at one's goals relates to strategy policy. According to Friend & Jessop (1996, p. 110, cited by Geertman 1996 p. 10) "any process of choice will become a process of planning (or strategic choice) if the selection of current actions is made only after a formulation and comparison of possible solutions over a wider field of decisions relating tot certain anticipated as well as current situations." Strategic planning therefore implies intentional behavior to achieve a better solution in the (nearby) future.

Risk assessment in a multi-stakeholders environment is a complex matter since recursive processes occur as we argued above. System analyses help decisions makers to help them to ex-ante evaluate the (un)intended effects. In spatial planning system analysis boosted by the introduction of Geographical Information Systems. Key-elemnt is that those system-analytical simulation models enable scientists to link micro-behavior and macro-outcomes (Goetgeluk 1997). Many of the spatial models introduced in the early seventies (Batty 1976) were incorporate in GIS-based Decision Support

Models. A GIS is a (automated) system for the collection, filing, use, analysis and presentation of spatial data as a means to create and store information. Information is regarded as interpreted data (Ritsema van Eck 1993). Schotten et al. (2001) define four types:

1. *Planning models that compute the optimal allocation of land to arrive at a maximum value for often one criterion. Linear programming is a version of such a tool. This certainty is not useful for our purpose.*
2. *Individual choice models that describe the (location) preferences of individual stakeholders or homogeneous groups of stakeholders (generalized linear models).*
3. *Artificial Intelligence models such as cellular automata CA that allocate activities to grid cells based on general allocation rules, which can be derived from model type 2*[1]*.*
4. *Equilibrium land use models define land use as a result of a matching between demand and supply as some equilibrium function for many land uses types.*

In the Netherlands we have two important general land use models of type 4: the Spacescanner (Scholten et al. 2001, De Nijs et al. 2001) are available. Both models of the National Institute of Public Health and the Environment (RIVM) have recently been joint into the LUMOS (LandUse MOdeling System). Both models also have the characteristics of the model types 2 and 3. They match demand and supply on the basis of the attraction/utility/ bid-prices, of each grid cell (the Dutch area is divided in grid cells of 500 by 500 meter). The expected utility for each land use type for each grid cell is derived as a regression function or a CA transition rules.

However, these estimated utilities are not directly based on individual choice models, but apply the set of relevant attributes of individual choice models. In the spatial regression functions, these attributes are transferred to spatial objects, like zip codes or land use grid cells. For each location the utility for a type of land use is estimated based on the positive or negative relationships between that land use type and its surrounding set of all possible land use types {1,2..n} given a distance decay function. The resemblance with well-known gravity models or its disaggregated version (logit-model) (Floor & De Jong 1981, Wagtendonk & Rietveld 2000, Goetgeluk et al. 2001) is striking. The similarity does not stop here. In matching demand and supply often a double constrained gravity model is applied (Hilferink & Rietveld 2001).

Irrespective whether this right or wrong, we will discuss this matter in our discussion, the key is that the estimation of the utility-function is a crucial factor in the usefulness of the GIS-based Decision Support Models. In the past, these utility functions were based on expert knowledge. This seemed not to be a problem since both models were applied as scenario instrument in the design phase of the planning process (De Nijs et al. 2001b). However, spatial planner wanted to use the models in a projective sense as well. This demanded for a new type of estimation of the utility-functions with a predictive

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1 A CA is defined as ‘a cellular (cell or grid) based space model consisting of an infinite two-dimensional array of regular polygons (cells), each of which is, at any time, in a state determined by the states of a set neighbor cells according to some location independent rules’ Couclelis 1988). The properties are (Coucelis 1988, 1997, Ligtenberg et al. 1999, De Nijs et al. 2001):

- A regular n-dimensional lattice in which each cell has a discrete state (1 or 0 for each type of land use).
- A neighborhood (a Moore of Von Neumann neighborhood).
- Local rules describing the dynamic behavior of the system. The state of a cell at t+1 depends on the states of the cells in the neighborhood of the cell and the cell itself at t. The rules are often deterministic, but can be stochastic as well. The rules are derived by experts or other social research based in individual choice models and/or physical (ecological models for instance) scientific research.

power. In other words: the utility functions had to based on behavioral sound estimations. This foundation was lacking (Timmermans 1988).

The RIVM noticed a long time ago that the utility function for a number of land use types were not valid. One of the sources was past estimations of the utility functions did not pay attention to the added value of water nearby housing locations. Therefore the RIVM commissioned the OTB Research Institute for Housing, Urban and Mobility Studies of Delft University of Technology to gain more insight in the added value of various forms of water from the perspective of housing consumers and developers.'

3 Valuation of real estate

As we have argued the number of powerful stakeholders has increased due to deregulation policies: more market less government control in short. Comprehensive planning implies that many stakeholders must estimate their cost and benefits in such a process. Since a market-orientation also implies that (un)intended gains and losses are not to be compensated afterwards, an ex-ante risk assessment is a necessary step to plan and implement such large scale and financially risky schemes.
In this planning schemes public and private expenditures are at stake. The central government is responsible by law to minimize the risk of flooding for social and economical reasons. However, the construction of the publicly owned water retention lakes is the risk of the developers. Since the state justly argues that a lake has also positive spill over effects for private home-owners, the logical question is if selling prices of the new stock should not at least partially reflect these effects. If indeed housing consumers are willing to pay more for the amenity water, which is not reflected in the construction costs, this private capital might finance the land development totally or at least partially.

Figure 3 The value of real estate in parts

Value Real -Estate first user
+/- Surplus profits 4
Value of real estate after production
-(Construction costs + finance & transaction costs + normal profits)
Surplus gains 3
Value of real estate after land development
+Location subsidies - (land construction costs + planning costs + finance & transaction costs + normal profits)
Surplus gains 2
Value of real estate after land acquisition
- (Finance & transaction costs + normal profits)
Surplus gains 1
Land value of present land use (often agricultural)

Source: Needham 1999

One of the key factors in a successful public-private partnership, which is the organizational reflection of a multi-stakeholder comprehensive planning scheme, is the estimation of the costs and benefits. A schematic view of this perspective is the residual land valuation scheme of figure 3 (Needham 1999). The scheme shows that the market for real estate is a set of a mix of various markets. Eventually, the final consumer determines the final value: the owner of the real estate who is an owner-occupier, a social or private landlord. Hence, the purchase price is determined by the price-quality ratio within a specific regional housing market housing consumers are willing to pay. Clearly, its is firm interest to know to what extent the quality can be leveled down while

keeping the selling price as high as possible to enlarge the gains. For public organizations who can act a private stakeholder, like municipalities, this is similar, but on the other hand these organizations have also a public goals such as taking care of affordable housing, protecting the landscape and so on.
Priemus argues (in Goetgeluk et al. 2003) that at the present the organizational and legal constructions in the Netherlands are suboptimal. Especially in land development (roads, nature, water retention), where the costs are higher than the revenues, private firms are not eager to invest. Most of the time municipalities, housing corporations or district water board are ‘forced’ to make these expenditures. He advocates project-envelopes in which the surplus gains of one project or a part of a project, is used as a compensate losses in another project or part of projected. The key-factor is that this balancing is done within the project.
The risk assessment can be done within the framework of Needham’s figure 3. An important notion of that in multi-stakeholders comprehensive planning scheme a cost-benefit analysis at least starts with the estimation of final demand. This demand is defined as the product of the number of potential final consumers and the price they want to pay for a specific quality. Developers have the opportunity to choose for a limited of final consumers who want high priced houses or many consumers who have limited budgets.

This figure seems simple, but is reality as simple as this? We doubted that since Needham’s figure is just one interpretation of the concept value: the sum of costs. But which costs are all involved? Is value the same as price of is it something else. In the remainder of this contribution we will discuss these questions based on our project for the RIVM.

4 The data

Given the explorative character of the study and the available budget we applied a literature review. In this review, we wanted a representative sample of all kinds of scientific journals, which had articles referring to water and value in relation to housing and the built environment. Further, we wanted a broad scope of techniques applied in various disciplines. Of course did we want to analyze if the results differed or were alike.
To facilitate our search procedures we used the Internet and electronic journals as a sampling frame. We used various keywords to detect the articles of various scientific journals. The only limitation to the large set of possible journals was the electronic availability. Given the time-budget of the project we stopped at 150 articles that all have been read. We assume that the sample is representative.
Most of the articles were published after 1990. Nearly 90 are quantitative of character. This subset is used to discern regularities in methods and the estimates of the added value of water. The lionshare are revealed choice models. The majority of the literature originates from the North-Americas.

5 Results

We will show that the ‘simple’ and ‘valid’ research question of the RIVM results in a diversity of answers. Why? The diversity in theoretical perspectives and methods & techniques to estimate values is large. We think that insight is necessary in these background of methods before using generalized estimates.

5.1 Diversity 1: Four valuation function rooted in various traditions

Value, based on the generally appreciated attributes of the commodity at the time of assessment, is objective. The economist's and social scientist’s concept utility, in turn, is subjective (Eckert, 1990: p. 40-41).
We define the utility as equal to the attractiveness. This concept may or may not equal the transaction price paid at the market place; the latter is a historical fact, whereas the former is an opinion. Value may nevertheless be derived based on price information. When the value is influenced by the market factors, we obtain a price. Often, these concepts are however mixed. The pure non-market approach dealing with preferences and values is important, when it is assumed that no spatial/other constraints exist. Beside, it is also useful in a more realistic constrained setting, as the policymakers require information of preferences as a part of the demand side analyses.
Benefit-cost calculation is a defined set of techniques for choosing among actions to achieve well-defined goals. This is regardless of whether the project is private, environmental, military or other. In benefit-cost analysis the benefit calculations are considered more controversial than the cost calculations. Market prices of resources are an intuitive basis for costs. Benefit measurements are more problematic, as it is believed that these undervalue/ignore non-economic and non-measurable benefits of government projects. The basic ideas are by Marshall on consumer surplus and Pigou on market failures immediately after World War II (Feenberg & Mills, 1980: 1-3).
A number of factors complicate the analysis. According to Gartner et. al (1996) real property value and price are not necessarily synonymous, and whether one should value an asset by exchange value or by use value is an ancient problem, that is yet pertinent today. Use and exchange value may differ considerable from another. The present owner’s estimate of use value exceeds the exchange value, if he receives a high level of utility of some reason that other potential buyers are unaware of or/and uninterested in. It is assumed that the same attributes in the hedonic function add up to an estimate of both: (1) the market price and (2) the utility generating capacity - the intrinsic worth of the property when in use.
Apart from the cost and market price based calculations/estimations of price, also, a third approach has been put forward; following the multidimensional value concept of the behavioral decision theory and management science. According to Gregory (2000) established survey methods may fail to provide accurate measures for complex environmental amenities, because of the multiple dimensions of value and the task of assigning monetary values to environmental resources not sold in conventional markets. Instead, the multi-criteria and decision analysis methods allow a more apt treatment of such complexity within the elicitation process.
We conclude that a demand for a broader perspective to value formation exists than the equilibrium economic one. Here we use the following categorization of (for our purpose relevant) approaches to property valuation:

- *Value = function (costs) (see basic interpretation figure 3)*
- *Value = paid transaction price in market equilibrium requires finding an*

Exactly similar location (impossible by definition), or a set of reasonably similar locations (in practice difficult)

- *Value* = *function (hedonic shadow prices) based on the assumption in two. This is the Most common approach*
- *Value* = *Paid transaction price +/- a non-monetary element; either consumer surplus or a monopoly pricing or market intervention related (shadow) cost); this is the most realistic model, including the aspect of preference and choice on top of the paid price.*

Given this broad defined set of theoretical perspectives of the concept value, we discern even a greater variety of methods and techniques.

5.2 Diversity 2: methods & techniques

We mentioned earlier the distinction between revealed and stated choice models. We apply this distinction again.

5.2.1 Revealed preference/choice i.e. hedonic modeling

The most frequently applied models in the valuation practice as well as in monitoring the housing market are *hedonic price models*. In these models, the variables are usually of two basic types: internal physical (i.e. house and plot specific, structural) and external locational. On top of that there may be additional variables, most notably some type of inflation control. (e.g. Miller, 1982.)

The main purpose of the development of the hedonic model was to enable econometric analysis of large databases of price and other recorded information describing the nature of the property and its vicinity and possibly some specific (other) circumstances of the transaction. In these studies, the measures of success have been the model fit, whether each independent variable has the anticipated sign of price association and whether each independent variable is statistically significant.

An attractive or unattractive location, determined by a specific combination of locational characteristics, gives the house price an extra element, either a *premium* or a *discount*, when compared to the price of an otherwise similar dwelling situated in an average location. Controlling for the locational effect can be done by operationalizing suitable proxies for location and neighborhood and adding them into the right-hand side of the model.

A standard method is to estimate by means of OLS multiple regression a linear function that connects the prices of apartment or property values with 'shadow prices' or marginal adjustment factors for each locational variable. However, in the empirical hedonic modeling literature locational proxies may be defined in various ways (cf. Ball, 1973; Miller, 1982; Laakso, 1997; Lentz & Wang, 1998).

The methodological aspects to consider when undertaking a hedonic modeling exercise are technical problems. They are related to functional form (i.e. a linear models or transformations), multicollinearity and sample size (Miller, 1982). Other problems emerge as well: subjective evaluations are as good as or even better than exact quantifiable information, whether tax assessments or actual transactions should be used as dependent variable, and whether an element of location is always inherent within the house specific features (See Needham et al., 1998; Orford, 1999).

Local externalities are indeed capitalized in land values and house prices, but what is the *spatial and contextual extent* of it (Orford 2002)? The methodology based on the assumption of a single value model operating on data from one market is not necessary valid, due to multiple equilibria and the various shortcomings highlighted in the theoretical and empirical literature alike. Therefore, marginal adjustment factors might be more feasible to estimate as separate equations for each area, given idiosyncrasies pertaining to a certain area, group of people or both. This would be another approach to deal with location in hedonic models, as a distinction to the more continuous treatment of location discussed so far.

In many situations, exogenous factors or lack of information constrain individuals to participate in segments of a larger market (Michaels & Smith, 1990). Maclennan & Tu (1996) suggest a non- or partly coordinated view as opposed to the dominating 'unitary equilibrium' view, thus claiming that there be no point to model housing markets within an instantaneous equilibrium model. In such a framework, the focus would be in processes of adjustment rather than in what they call 'standard outcome' data. Hence, the assertion for 'persistent localized disequilibrium' caused by both spatial and sectoral factors and either supply or demand side diversification.

Today a variety of advanced spatial techniques add to the possibilities of handling location in the hedonic based house price analysis (Kauko 2002), especially GIS. By using these tools, an attempt is made to solve the problem, how to deal with methodological assumptions of the hedonic regression model being violated. This requires an appropriate routine of handling the non-linearity and dynamics prevailing across space. State of the art methods include multi-level specifications, spatial expansion models, and flexible regression methods (including neural networks, which also could be categorized as input-output simulation).

In *multi-level specifications*, each externality effect is measured at an appropriate level. In order to add some efficiency into the (hedonic) value model, the variation in house prices is decomposed between different spatial scales. In the case of property valuation applications the appropriate levels may be neighborhood, street and property levels. A major advantage of this specification is the ability to differentiate between compositional and contextual effects of location on house prices, in other words of the place in itself and spatial variations in the housing stock. Orford (1999, 2002)

In the *spatial expansion model* the contribution of a housing characteristic to the price is allowed to change over space (spatial autocorrelation). This reflects a series of interrelated submarkets with sliding boundaries. Many applications use such a specification where parameters vary in order to cope with the spatial heterogeneity of a housing market.(E.g. Geoghegan et al., 1997).

Within the statistical paradigm, options to consider are various estimation methods, that make fewer assumptions of the data than a fixed parameter model. The element of non-linearity might prove a decisive improvement of the modeling repertoire, in which case it is relevant to promote the flexible estimation as an alternative to a fixed parametric one. However, an inevitable trade off makes the decision of modeling choice less straightforward: flexible regression is less efficient than fixed parametric regression, but avoids model specification problems (i.e. the problem of parametric methods). It is however to note that *the neural network is only as good as the data you feed it.* And even with the best possible data, a structural prediction is more likely than an exact one using this technique.

We have shown the diversity of hedonic prece models that reflects the need to make them more realistic for our type of questions. The consideration of spatial heterogeneity nd drift may improve results substantially, but the *a priori* nature of analysis remains. In fact, to incorporate spatial autocorrelation or GIS to the hedonic price models does not conceal the drawbacks of the broad regression -based approach to house price analysis. Is there an alternative? Yes, especially we switch from a *market price equilibrium* to a *choice and preference equilibrium* perspective that we propose. We will discuss these type of models below.

5.2.2 Stated preferences/choice

Generally, the stated preference approach has been found to outperform the hedonic approach in estimating the value of welfare changes (Cropper et al., cited in Powe et al., 1995). Yet the community of economists have showed a great deal of aversion towards the use of such a method, while it is based on 'hypothetical' rather than 'actual' behavior (e.g. Vainio, 1995b).

To simply ask from individuals about their willingness to pay for certain property characteristics is an intuitively appealing technique. Aesthetic value, for example, has been quantified by using a bidding game. However, a successful application of the survey method depends on the existence of an *informed populace with market experience* regarding the attributes in question. (Goetgeluk 1997, Lentz & Wang, 1998.)

When deriving a monetary value for negative externality effects, the residents' ranking of neighborhood quality is sometimes used as a dependent variable instead of transaction prices or professional assessments of market value. The reason is that because the latter type of dependent variables may not fully capture the losses due to externalities suffered by current residents (Langdon, 1978; Lindeborg, 1986). Already Ball's (1973) survey of house price models considered in studies more than thirty years ago exceptionally good, precisely because it used environmental variables based on judgements.

Experimental choice design is a method, where the idea is to compare the control group with the affected group with model from the natural sciences. The outcome from such an experiment is an estimate of differences in preferences, and possibly value differences as well. Such behavioral studies aimed at understanding the processes behind value formation and value estimation were inspired by the seminal work of Tversky & Kahneman (1974) on heuristic problem solving (Diaz, 1998).

Contingent valuation (CV) is the most widely used method of monetary evaluation of environmental benefit (Mäntymaa, 1993). Economics estimates, generated by CV and hedonic modeling, have been compared in several contexts. For our purpose, the relevant study is on value increase contributed to waterway proximity in England (see Willis & Garrod, 1993). Usually the hedonic method is considered more reliable, since the analyses are based on actual rather than just hypothetical data. The sensitivity to the rate of discount might prove another problem with contingent valuation if monthly and total expenditures have to be compared (e.g. Vainio, 1995a,b). However, in some cases the prices paid do not reflect all the possible externalities, as they become familiar only with time. For instance, in Vainio's (1995b) comparison of hedonic pricing and CV the questionnaire was sent three years after the transaction, in what time the buyer had perceived the full extent of a disturbance effect from the noise of a nearby motorway. In this case, the hedonic models underestimated the effect.

Gartner et. al (1996) note that in situations were a property possessing certain attributes is not frequently traded at an open market, the owners' own estimates of value provide more useful estimates of economic benefits than those derived from sales transactions. Ready et al. (1997) assert that when non-use values (e.g. altruism toward current residents and preservation of cultural heritage) are large, contingent valuation may be preferred to hedonic methods. The iterative choice approach used by Magat et al. (2000) seems particularly promising in its capability to decompose the various costs and benefit related aspects of the water quality evaluation.

On the other hand, when analyzing housing prices and preferences, situations might occur, where neither of these two established methods, i.e. revealed and stated preference generated WTP (mostly hedonic regression and contingent valuation with extensions), are the most optimal one. We might need very context sensitive insight into how various multidimensional values towards housing and environment are being perceived by the individual. Then, a pure competitive market approach loses validity. Indeed, contingent valuation is a rigorous option, but if one requires estimation of other than monetary benefits, we need another approach.

Analytic *multi-criteria modeling methods* do not in general aim at an estimate for value or aggregate demand, but rather at an estimate for choice behavior in a problem centric setting of discrete alternative decisions. The idea is to transport the method down to the level of the individual problem rather than calculate an estimate that can be used for solving several types of problems. The actual problem that we do not have past information about determines the limits of the method. (see Gregory, 2000)

The prescriptive approaches have been developed, as aids to decision making in complex situation. The multi-attribute value tree (in Anglo-American literature often: utility tree) is one of the best known of them. It provides a formal way of thinking through multidimensional eliciting of peoples' weighted objectives in the context of their expressed values and their selected project alternatives (e.g. Gregory et al. 1997). Tools such as the multi-attribute value tree are suitable for evaluation of other than monetary values when they are mixed with or linked with monetary ones (e.g. Miettinen & Hämäläinen, 1996).

The main weaknesses of conventional survey tools are (1) the possibility to manipulate the outcome by predetermining the nature of response mode; (2) they are incapable of accommodating explicitly the multi-attribute nature of tradeoffs between alternatives. As a result the modern stated preference models have been elaborated. We may distinguish between two basic types: (1) compositional tools, where the researcher combines the part-utilities to arrive at an overall value for each alternative (AHP and the self-explicated multi-attribute utility method belong to this category) (2) decompositional such as conjoint analysis, where respondents have to rank combinations of sets of attributes. (see also Timmermans et al, 1994; and Goetgeluk et al., 1994)

More specifically, the multi-criteria decision making approach include techniques such as the analytic hierarchy process (AHP), the self-explicated utility method and conjoint analysis. The first two are hierarchical models and thus apply the value tree concept, whereas the last one is based on choice profiles. All three are aimed at making choices according to preferences in a multi-attribute problem setting, in contrast to the purely economic WTP-setting of revealed preferences and CV. (e.g. Pöyhönen 1998, Miettinen & Hämäläinen 1996.) All of these techniques contain an assumption about deterministic preferences of the interviewed subjects. In the residential land and built environment context, they are understood as different perceptions of experts or dwellers concerning a given neighborhood from a flexible, problem-specific point of view (e.g. Laakso et al. 1995; Nevalainen et al. 1990).

In these methods the weighting of the preferences becomes a question of elicitation (Ruokolainen & Tempelmans Plat, 1998; Pöyhönen, 1998a). The AHP uses a pair-wise matrix comparison of preferences, especially, when no price-information is available. The combination of weighted attributes obtained could be used to construct a quality-constant geoindex included in the hedonic model (Laakso et al. 1995). With a quality model based on pair-wise comparisons with the AHP one can compare the elicitation of different interest groups for different type of areas or houses. (E.g. Nevalainen et al., 1990). In the self-explicated utility method, in turn the elicitation concerns utility functions for all attributes of a multi-attribute value tree. (Ruokolainen & Tempelmans Plat, 1998; Pöyhönen, 1998a).

Conjoint analysis, in turn, is based on trade-offs of respondents' levels of utility. Recent conjoint applications have been made on school choices (see Borgers, et al. 1999); and on group-based models of family preferences for new residential environments (see Molin, et al. 1999).

Gregory (2000) advocates multi-attribute approaches to elicitation of attributes based on stated preference and choice. These approaches are based on the idea that the values of individuals can be clarified as part of small-group negotiation processes. This is a significantly different setting than the typical contingent valuation study, and has two benefits over the later. First, the ability to clarify both the good and the participants' multiple dimensions of value (according to the 1993 NOAA Panel report, "the validity of responses to environmental survey questions depends on a clear understanding of the commodity to be valued and the scenario used to set context for valuation"). Second, the valuing of amenity environmental goods based on people's experience is not restricted to a rigorous but inconsistent single currency metric. Instead, a new approach: *the value integration survey (VIS),* is developed, and compared *vis-a-vis* contingent valuation.

So, we proposed to switch from a *market price equilibrium* to a *choice and preference equilibrium* perspective that we propose. This implies using expert interviews and trade-offs of preferences in a multi-criteria/dimensional setting are suggested to overcome some problems with more conventional tools such as contingent valuation and revealed preferences methods (hedonic, travel cost and input output approaches). Accepting that the reality is complex and fuzzy, may in fact turn into a strength, as the analysis becomes more valid.

5.3 Diversity 3: generalized estimations on various indicators

The literature can be divided as follows if considers the contents of the valuations:

- *Type of water*
  - Sea/ocean, lakes, rivers/streams and wetlands
- *Added value*
  - Positive
    - Water-quality (safety),
    - Direct located to water (waterfronts),
    - Accessibility and/or vicinity,
    - Location with a view,
    - Size of the water area
  - Negative added value
    - Risk of floods and droughts,
    - Extra financial expenditures due to floods & pollutions

Table 1 Generalized positive effects of water

Indicator	Sea/ocean	Lake (Articfical)	Rivers	Wetlands with restrictive functions for housing, leisure
Water quality (point of reference is clean situation)	+20% .. 30%	+0.1% .. 8.2% (WTP/income: +0.9%)	+5.9% (+0.9%) (rank: 3.57/5)	
Direct located (dummy)	+0.3 .. 30% (42% of response believe in increase value)	+11% .. 12%	+ 2.6 .. 40% (rank: 3.24/5)	+40%
Accessibility (distance decay function) and vicinity	+1.5% .. 30% (83% wants vicinity)	+4% .. 10% (weight 9% .. 12%)	-0.06% .. +20% (rank: 4.25/5)	+0.3% (30% .. 39% accessibility important)
View	+8% .. 60%	+7% .. 25%	3% .. 28% (rank: 3.88/5)	
Size		+2% .. 307%	< +0.02%	+0.02%

Indicator	See/ocean
Seashore development/protection	-19 % opportunity costs + 21,5 % positive effect)

Source: Research Institute OTB TU-Delft

Table 1 shows the generalized positive effects based on the literature review. The effects are either directly (hedonic price models) or indirectly as a percentage of the total value. We used percentages. The Contingent valuation models (Willingness–to-Pay) estimate the value as a part of the households' assets or income (between brackets). The results of the multi-attribute revealed and stated preference and choice models are ranks (italics).
The values in the table are often extremes. Our conservative estimations are: 10-15 percent for the seashore, 5-10 percent for river locations (streams) and 5 percent for lakes.
As we mentioned earlier, these figures are based on revealed choice models. We do have very limited information what these figures might be if supply would be different. As we mentioned in earlier parts of this contribution, the supply of these 'water-enriched' building sites may be larger and therefore trigger new demand and prices developments. Heins (2002) used Decision Plan Nets (Goetgeluk 1997) to determine the relative importance of all kinds of attributes in the housing preference functions of city-dwellers who want to live 'rural'. Water, nature, greenness, forests, garden, quietness are attributes. However, water is not considered as a so-called Reject-Inducing-Dimensions of Trade-Off-Dimension in contrast to forests. This implies that a housing consumer is willing to accept a location without water. In the NVB-OTB survey 'Huizenkopers in Profiel (Housing Buyers in Profile) more than 50 percent of the potential movers who want a garden wants a water nearby. These respondents are willing to pay 10 percent more for the water.
Dutch studies, although they are surprisingly limited, have analyzed if different groups have different behavior. Income does not matter the preference structure, but does influence the rate of failure to realize the preference. Therefore, water is a common shared asset. This implies that that potentially a larger group to pay attention to that presently. Nowadays, policy and firms focus on high-income groups in small-scale projects. Why should we not concentrate on large-scale projects with relatively lower

prices given the other goals of water-management? Have children does not matter, although we had expected that. It seems that people take precautions to minimize the risk of drowning. Age did matter. Elderly are not reluctant. This surprised us since at first site advertisements reveal something else. Starters on the housing market are heterogeneous in their (intended) behavior. The most interested group is households between 30-45 years old. From a marketing point of view, this group is most interesting because it is so large: even a small profit per household may make large-scale investments worthwhile to analyze.

Of course, negative effect exists also. However, the number is rather limited and therefore generalizations are hard to make. Some hedonic models estimate a loss of 18 percent of the land value (not real estate!) in areas with high risks compared to low risk areas. The moment real estate is introduced in a larger scale than scattered farms, the estimate loss is 7 percent. A recent study of Eves & Brown (2002) estimated an added value of 10 percent nearby safe rivers and a loss of 10 percent nearby risky ones. Some studies show that owners and insurance companies overestimate the risk of potential loss of value.

Based on these generalizations, it seems clear that the positive and negative added value of water is in balance. So, (new) technologies to protect the built environment will open new opportunities for housing consumers and suppliers. Especially for the Netherlands this perspective is of interest since new regulations imply more safety by developing artificial water construction like lakes, new river beds and so on.

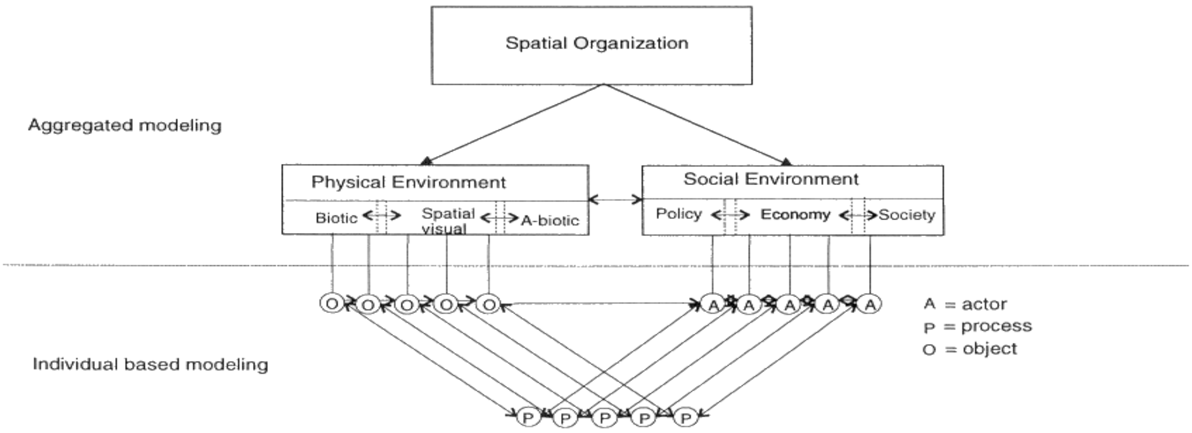
6 Discussion

Irrespective of a New Geography and new planning strategies, cost-benefit analysis has always been a part of a general risk-assessment for investments in the built area. However, the New geography may complicate the risk-assessment since many stakeholders that are more powerful are negotiating. Further, new goals, like quietness, nature-development and so on, are integrated necessities in projects. The question is how these goals are being valued and financed by the various stakeholders. Priemus argued that scope optimization of projects and project-envelopes are the solution, which minimize the risks –but also the profits- of the stakeholders involved. To what extent the state should have a public role in arranging these arrangements is a question of political debate.

Irrespective of this political outcome, the valuation itself is a big problem. We argued that a good starting point was the estimation of the value of a good or service by final demand. Based on a literature review we at least have found four perspectives of thought on the valuation issue independent of the various methods & techniques involved in each perspective. The main combination is the market price equilibrium perspective and hedonic modeling. We have shown in our study and this contribution that the assumptions underlying the price equilibrium and hedonic models are too strict to match reality. Clearly, a model is simplification of reality, but its still must make sense.

We argue in line with many others to put the emphasis on choice *and preference equilibrium.* Using expert interviews and trade-offs of preferences in a multi-criteria/dimensional setting are suggested to overcome some problems with more conventional tools such as contingent valuation and revealed preferences methods (hedonic, travel cost and input output approaches). Accepting that the reality is complex and fuzzy may in fact turn into strength, as the analysis becomes more valid. In general, the problem of (yet) non-capitalized values, like the value of nature, water and in general public amenities, is not solved yet by Welfare Economist. Unfortunately, the number of these studies is limited in economics, regional economics and human geography. This is a pity since policy-makers and their supporting institutes, like the RIVM, need valid estimations. The best practice is to estimate the positive impacts a negative as possible based on the existing literature and our estimations so far. This result is however not very satisfying for all parties, but nevertheless the state-of-the arts considering valuation modeling.

Figure 4 Linking individual and aggregate components in a Land use System



(Source: Ligtenberg at al. 1999)

We recall that stakeholders apply DSS'. Our commissioner, the RIVM, used GIS-based DSS' (LUMOS). Our idea that *choice and preference equilibrium* has consequences for the use of LUMOS in 'forecasts' of the impact of new products, plan and services. We recall the major drawback of most of these models: the assume that spatial objects act like agents instead of assuming the objects a elements in an set of alternatives a real agent can choose from. We apply the concept of agent not in a mathematical way or as a variant of a CA, but as an object of human origin that decides. To be frankly, we do not believe on these kinds of systems on the long run. We do discern more sophisticated tools tot estimate parameters or tools for sensibility analyses. This is still very necessary, but the impact on the explanatory power will be marginal since the estimations lack theoretical foundations. The explanatory power is important since new type of projects develop such as water and housing. New products and services with a spatial and non-spatial (i.e. the impact of ICT!) attributes cannot be estimated by revealed models or spatial analytical models. They will fail.

The explanatory power of individual choice model is far better, but they lack the spatial component. Instead of 'green area within 5 minutes traveling by bike' we need a set of opportunities is a GIS-environment. Given the multi-attribute character of the housing choice, this set will be reduced. It seems at last the time in economics and human geography to combine the best of two model traditions in geography: spatial modeling and individual choice modeling.

Based on an original proposal by Beers, Goetgeluk, Attornaty & Timmermans (1997, unpublished) Ligtenberg et al. (1999) proposed that future land use models should substitute the spatial object based transition rules (CA) or logistics regressions estimations (valuation) by decision rules of real stakeholders. The tool is the multi-agent model (MAS). CA will be applied as well, but for other purposes. The CA are very suitable to model physical effects of specific land uses. These effects are a source of information for the stakeholders.

Multi-Agents-Systems are AI-systems in which agents influence each other in a reactive and proactive manner and their environment (Beer et al. 1999, Brafman et al. 1997, Dowell 1995, Diepenmaat 1997, Ferrand 1996, Green et al. 1997, Hiebeler 1994, Ligtenberg et al. 1999/2001, Nwana 1996, Terna 1998, Sanders et al. 1997). Maes (1998) argues that a MAS tries to fulfill a set of goals in a complex dynamic environment. An agent is situated in the environment: it can sense the environment through its sensors and acts upon the environment using its actuators (Ligtenberg et al. 1999). MAS are developed based artificial intelligence (AI) studies.

The key-issue is how to apply this general framework into a MAS. Brafman et al. (1997) define a MAS in which the agent is a viewed as an individual decision-maker with beliefs (values and expectancies), preferences and a decision strategy. This is called a mental state. Their approach is *'we ground this model in the agent's interaction with the world, namely his, in its actions. This is done constantly by viewing model construction as a constraint satisfaction problem in which we search for a model consistent with the agent's behaviour and with our general knowledge.'*(p. 217). They define a theoretical model that will serve as a starting point for this research project because it may bridge the gap between the AI-knowledge and the individual locational choice models. Further, their model is theory driven instead of computational driven.

Clearly, such a perspective is not only of interest of science to test hypothesis of human (spatial) choice behavior, but for the stakeholders in complex and risky projects it is fruitful as well. First, applying a limited number of decision rules in such a model makes the DSS more understandable. Regression estimates or transition rules are often vague. Second, stakeholders understand that various set of decision rules interact since in reality planning becomes a negotiation with risk-assessment. The spatial impact can be expressed immediately in valid maps and figures. Third, such a model is applied in a real risk-assessment situation and it 'logging' system enables stakeholders and researchers to analyze each other adaptive decision-making due to each other's choices. This is vital in the era of the New Geography as we argued earlier.

References

Asbeek Brusse & B. Wissink (2002), Beyond Town and Countryside? A Dutch perspective on Urban and Rural Policies. In: D. Stead & S. Davoudi (eds); Urban-Rural Relationships. Built Environment vol. 28, No. 4, 2002. pp.290-298.

Ball M.J. (1973), Recent Empirical Work on the Determinants of Relative House Prices. Urban Studies, 10: 213-233.

Batty, M. (1976), Urban Modelling. Cambridge: Cambridge University Press.

Bengs, C. & W. Zonneveld (2002), The European Discourse on Urban-Rural relationships: A New Policy and Research Agenda. In: D. Stead & S. Davoudi (eds); Urban-Rural Relationships. Built Environment vol. 28, No. 4, 2002. pp.278-289.

Borgers A., Oppewal H., Ponjé M and Timmermans H. (1999) Assessing the impact of school marketing: conjoint choice experiments incorporating availability and substitution effects. Environment and Planning A, vol. 31, 1949-1964.

Brafman, R. I. & M. Tennenholtz (1997), Modeling agents as qualitative decision makers. Elsevier Artificial Intelligence 94, pp. 217-268.
Central Bureau of Statistics (2003), Statline. Heerlen: tatline.cbs.nl
Coucelis, H. (1988), Cellular worlds: a framework for modelling micro-macro-dynamics. In: Environment & Planning A vol. 17. pp. 585-596.
Coucelis, H. (1997), From cellular automata to urban models: new principles for model development and implementation. In: Environment & Planning B vol.
Davoudi, S & D. Stead (2002), Urban-Rural Relationships: An Introduction and Brief History. In: D. Stead & S. Davoudi (eds); Urban-Rural Relationships. Built Environment vol. 28, No. 4, 2002. pp.269-277.
Diaz J.:III (1998) The first decade of behavioral research in the discipline of property. 'The Cutting Edge 1998' -conference proceedings, ISBN 0-85406-922-4.
Eckert J. K. (1990), Property Appraisal and Assessment Administration. The International Association of Assessing Officers. Chicago, Illinois.
Eves C. & S. Brown. (2002), The Impact of Flooding on Residential Property Values in England. Paper presented at the 9th ERES conference, Glasgow, Scotland, June 4-7.
Eves C. (2002), The long-term impact of flooding on residential property values. Property Management, 20 (4): 214-227.
Feenberg D. & E.S. Mils (1980), Measuring the Benefits of Water Pollution Abatement. Studies in urban economics. New York: Academic Press.
Floor, H. & T. de Jong (1981), Ontwikkeling en toetsing van een woonallocatiemodel. Utrecht: Utrechtse Ggeografische Studies.
Gartner W.C. & D.E. Chappelle. (1996), The influence of natural resource characteristics on property value: a case study. Journal of Travel Research, 35 (1): 64-71
Geertman, S. (1996), Ruimtelijke planning en geografische informatie; zoektocht naar een Geo-IT methodologie. Assen: Van Gorcum.
Geoghegan J., Wainger L.A. & N.E. Bockstael (1997), Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS. Ecological Economics, 23: 251-264.
Giddens, A. (1984), The constitution of society. Berkeley: University of California Press.
Goetgeluk, R. (1997), Bomen over wonen, woningmarktonderzoek met beslissingsbomen. Utrecht: Faculteit Ruimtelijke Wetenschappen, Universiteit Utrecht.
Goetgeluk, R., P.J. Louter, J.A.M. Borsboom-Van Beurden, M.A.J. Kuijpers-Linde, J.F.M. van der Waals & K.T. Geurs (2000), Wonen en werken ruimtelijk verkend; waar wonen en werken we in 2020 volgens een compacte inrichtingsvariant voor de Vijfde Nota Ruimtelijke Ordening. Bilthoven: RIVM rapport 711 931 001
Goetgeluk, R., T. Kauko, A. Straub & H. Priemus (2003), Wonen met water. Delft: Onderzoeksinstituut OTB, TU-Delft. Onderzoek in opdracht van het RIVM.
Goetgeluk, R.W., A. Goethals, A, Oskamp & H.J.P. Timmermans (1994), Editorial Seminar on Choice Modelling in Housing Market Simulations. Netherlands Journal of Housing and the Built Environment, 9, pp. 209-214.
Gregory R. (2000), Valuing Environmental Policy Options: A Case Study Comparison of Multiattribute and Contingent Valuation Survey Methods. Land Economics, 76 (2): 151-173.
Gregory R. (2000), Valuing Environmental Policy Options: A Case Study Comparison of Multiattribute and Contingent Valuation Survey Methods. Land Economics, 76 (2): 151-173.
Gregory R., Flynn J., Johnson S.M., Satterfield T.A., Slovic P. & R. Wagner (1997), Decision-Pathway Surveys: A Tool for Resource Managers. Land Economics, 73 (2): 240-254.
Gregory, R. (2000) Valuing Environmental Policy Options: A Case Study Comparison of Multiattribute and Contingent Valuation Survey Methods. Land Economics, 76 (2): 151-173.
Heins, S. (2003), Rurale woonmilieus in stad en land; plattelandsbeelden, vraag naar en aanbod van rurale woonmilieus. Utrecht: Faculteit Ruimtelijke Wetenschappen, Universiteit Utrecht.
Heins, S., F. van Dam & R. Goetgeluk (2002), The Pseudo-Countryside as a Compromise between Spatial Planning Goals and Consumers' Preferences. In: D. Stead & S. Davoudi (eds); Urban-Rural Relationships. Built Environment vol. 28, No. 4, 2002. pp.311-318.
Hilferink, M. & P. Rietveld (2001), Nadere uitwerking van het Ruimtescanner model. In: H.J. Scholten, R.J. van de Velde & J.A.M. Borsboom (eds): Ruimtescanner: informatiesysteem voor de lange termijnverkenning van ruimtegebruik. Utrecht/Amsterdam: Koninklijk Nederlands Aardrijkskundig Genootschap/ faculteit der Economische Wetenschappen en Econometrie. Vrije Universiteit Amsterdam. NHS 242. pp. 40-53.
Hillebrand, H., R. Goetgeluk & H. Hetsen (1999), Plurality and Rurality; the role of the countryside in urbanised regions,Den Haag: LEI. Report 4.00.04, volume 1 & II

Kauko, T. (2002), Modelling the Locational Determinats of House Prices. Utrecht: Faculty of geographical Science, Ph.D Dissertation
Kreukels, A.M.J. (1978). Toepassing van strategische planning in de ruimtelijke planning. Delft: Planning; Methodiek en Toepassing 6, pp. 21-32.
Laakso J., Bender A., Din A., Favarger P. & M. Hoesli (1995), An Analysis of Perceptions Concerning the Evironmental Quality of Residential Real Estate in Geneva, 1th IRES Conference, Stockholm 28 June -1 July, 1995.
Laakso S. & H.A. Loikkanen (1997), Asuntomarkkinat ja asumisen taloudellinen ohjaus (in Finnish). In
Laakso S. (1997), Urban Housing Prices and the Demand for Housing Characteristics. The Research Institute of the Finnish Economy (ETLA) A 27, Helsinki.
Langdon F.J. (1978), Monetary evaluation of nuisance from road-traffic noise: an exploratory study. Environment and Planning A, vol. 10, 1015-1034.
LEI (2002), Landbouw-eonomich bericht 2002. Den Haag: Landbouw-Economisch Instituut .
Lentz G.H. & K. Wang (1998), Residential Appraisal and the Lending Process: A Survey of Issues. Journal of Real Estate Research, vol 15, nrs 1/2, 1998, 11-39.
Ligtenberg, A, G. Beers, R. Goetgeluk & J.H. van Rijswijk (1999), The use of multi-agents and cellular automata for modelling a changing countryside. In: Plurality and Rurality; the role of the countryside in urbanised regions, Hillebrand, H., R. Goetgeluk & H. Hetsen (eds.). Den Haag: LEI. Report 4.00.04, volume 1, pp. 125-137.
Lindeborg T. (1986), Icke-monetära nyttors betydelse för innehav av skog och skogsmark (in Swedish). Lantmäteriverket, värderingsenheten, LMV-rapport 1986:11. Gävle.
Lindenberg, S. (1990), Homo Socio-oeconomicus: the emergence of a general model of man in social sciences. Journal of Institutional and Theoretical Economics 146, pp. 727-748.
Maclennan D. and Tu Y. (1996), Economic Perspectives on the Structure of Local Housing Systems. Housing Studies, Vol 11, No. 3, 387-406.
Maes, P. (1998), Modelling adaptive autonomeous agents. Cambridge: MIT press
Magat W., Huber J., & W.K. Viscusi (2000), An Iterative Choice Approach to Valuing Clean Lakes, Rivers, and Streams. Journal of Risk and Uncertainty, 21(1): 7-43.
Mäntymaa E. (1993), Preferenssien paljastamisesta contingent valuation –menetelmällä (in Finnish). Kansantaloudellinen aikakauskirja, 89:2, 213-221.
Michaels R.G. & V.K. Smith (1990), Market Segmentation and Valuing Amenities with Hedonic Models: The Case of Hazardous Waste Sites. Journal of Urban Economics, Vol. 28, 2, Sept., 223-242.
Miettinen P. & R.P. Hämäläinen (1996), Ympäristön arvottaminen B Taloustieteelliset ja monitavoitteiset menetelmät (in Finnish). Helsinki University of Technology, Systems Analysis Laboratory B19, Espoo.
Miettinen P. & R.P. Hämäläinen (1996), Ympäristön arvottaminen B Taloustieteelliset ja monitavoitteiset menetelmät (in Finnish). Helsinki University of Technology, Systems Analysis Laboratory B19, Espoo.
Miller N.G. (1982), Residential Property Hedonic Pricing Models: A Review. In Sirmans C.F. (ed.): Urban Housing Markets and Property Valuation. Research in Real Estate, Vol. 2., Jai Press Inc., Greenwich, Connecticut. 31-56.
Mills, E. S. (1971), The value of urban land. In Perloff, H. S. (ed.): The Quality of the Urban Environment. Essays on A New resources in an Urban Age. 3rd printing, Washington D.C.@: Resources for the future, Inc. pp. 231-253
Molin E., Oppewal H., H. Timmermans (1999), Group-based versus individual-based conjoint preference models of residential preferences: a comparative test. Environment and Planning A, vol. 31, 1935-1947.
Moos, A.I. & M.J. Dear (1986), Structuration theory in urban analysis. London: Allen & Unwin.
Morrison P. S. and McMurray S. (1999) The Inner-city Apartments versus the Suburb: Housing Sub-markets in a New Zealand City. Urban Studies, Vol. 36, No. 2, 377-397.
Needham B., Franke M. & P. Bosma P. (1998), How the city of Amsterdam is using econometric modelling to value real estate. Journal of Property Tax Assessment and Administration, 1998, Vol. 3, 2, 25-46.
Needham, B. (1988), Instruments for achieving desired distributional effects. Planning outlook 31 (2), pp. 89-94.
Needham, B. (1999), Ruimtelijk Ontwikkelingsbeleid en Grondweaardestijging. Nijmegen: STEC Groep/Katholieke Universiteit Nijmegen. Conceptrapport in opdracht van de RPD, Minstrie van VROM.
Nevalainen R., Staffans A. & P. Vuorela (1990), Asumisen laadun arviointi ja tutkiminen. (Evaluating and studying the quality of housing, in Finnish.) YTK B 60, Helsinki.
Nijs, T. de, G. Engelen, R. White, H. van Delden & I. Uljee (2001a), De LeefOmgevingsVerkenner; technische documentatie. Bilthoven: RIVM Report 408505007.

Nijs, T. de, R. de Niet, G. de Hollander, F. Filius, & J. Groen (2001b), De LeefOmgevingsVerkenner:Kaartbeelden van 2030, Een verkenning van de inzet bij beleidsondersteuning. Bilthoven: RIVM. rapport 408505 004.
Orford S. (1999), Valuing the built environment B GIS and house price analysis. Ashgate, UK.
Orford S. (2002), Valuing locational externalities: a GIS and multilevel modelling approach. Environment and Planning B: Planning and Design, 29: 105-127.
Pogodzinsky J.M. & Sass T.R. (1991), Measuring the Effects of Municipal Zoning Regulations: A Survey. Urban Studies, Vol. 28, No. 4, 597-621.
Pöyhönen M. (1998a), On Attribute Weighting in Value Trees. Helsinki University of Technology, Systems Analysis Laboratory A73, Espoo.
Ready R.C., Berger M.C. & G.C. Blomquist (1997), Measuring amenity benefits from farmland: hedonic pricing vs. contingent valuation. Growth and Change, Fall/97.
Ritsema van Eck, J.R. (1993), Analysis of transportation networks in GIS for research in Human Geography. Utrecht: Faculty of Geographical Sciences.
RIVM (2002), Natuurverkenning 2 2000-2030. Bilthoven: RIVM
Ruokolainen A. * H. Tempelmans Plat (1998), A System for Optimizing Private House Owner's Spendin-gs and Benefits. Conference paper. 4th Design and Decision Support Systems in Architecture and Urban Planning Conference, Maastricht, the Netherlands, July 26-29.
Scholten, H.J. , R.J. van de Velde & J.A.M. Borsboom (2001), Ruimtescanner: informatiesysteem voor de lange termijnverkenning van ruimtegebruik. Utrecht/Amsterdam: Koninklijk Nederlands Aardrijkskundig Genootschap/faculteit der Economische Wetenschappen en Econometrie. Vrije Universiteit Amsterdam. NHS 242.
Schotten, K., R. Goetgeluk, M. Hilferink, P. Rietveld & H. Scholten (2001), Residential construction, land use and the environment; simulations for the Netherlands using a GIS-based land use model. In: Kluwer Academic Publishers Environmental modeling and Assesment 6, pp. 133-143.
Timmermans H., Molin E. and van Noortwijk L. (1994), Housing choice processes: stated versus revealed modelling approaches. Netherlands Journal of Housing and the Built Environment, 9 (3): 215-227.
Timmermans, H.J.P. & A. Borgers (1985), Spatial choice models: fundamentals, trends and prospects. Paper voor 'the fourth Colloquium on Theoretical and Quantitative Geography', Veldhoven, 9-13 september 1985,. Eindhoven: Faculteit Bouwkunde, Technische Universiteit Eindhoven.
Tversky A. & D. Kahneman (1974), Judgement under uncertainty: heuristics and biases, Science, Vol. 185, pp. 1124-31.
Vainio M. (1995a), Traffic Noise and Air Pollution. Helsinki School of Economics and Business Administration. A-102, Helsinki.
Vainio M. (1995b), Liikenteen melu ja ilmansaasteet: Ulkoisvaikutusten arvo hedonisten hintojen ja contingent valuation -menetelmillä (in Finnish), Kansantaloudellinen aikakauskirja, 91:2, 240-244.
Vainio M. (1995b), Liikenteen melu ja ilmansaasteet: Ulkoisvaikutusten arvo hedonisten hintojen ja contingent valuation -menetelmillä (in Finnish), Kansantaloudellinen aikakauskirja, 91:2, 240-244.
Wagtendonk, A & P. Rietveld (2000), Ruimtelijke ontwikkelingen woningbouw Nederland 1980-1995; een historisch-kwantitatieve analyse van de ruimtelijke ontwikkelingen in de woningbouw 1980-1995 ter ondersteuning van de Omgevings-effectrapportage Vijfde Nota Ruimtelijke Ordening. Amsterdam: Vrije Universiteit.
Wetenschappelijk Raad voor het Regeringsbeleid (2002), Stad en land in de nieuwe geografie: maatschappelijke veranderingen en ruimtelijke dynamiek. Reports to the Government nr. 53. Den Haag: SDU-Uitgevers.
Willis K.G. & G.D. Garrod G.D. (1993), Not from experience: a comparison of experts' opinions and hedonic price estimates of the incremental value of property attributable to an environmental feature. Journal of Property Research, 10, 193-216.
Wissink, G. (1986), Handelen en ruimte; een beschouwing over de kern van de planologie. Stedebouw en Volkshuisvesting 67, pp. 192-194.