

# Sustainable behaviour modelling

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“Freedom in a commons  
brings ruin to all”  
Lloyd, W.F., 1833



# About this presentation

- This presentation is a synthesis of Wander Jager's PhD thesis: Jager, W., 2000. Modelling consumer behaviour. University of Groningen, Groningen. It gives a good understanding of the essence of behavioural modelling.
- This presentation will hopefully generate some discussion and it will provide some ground to formalise concepts and potential applications of behavioural modelling.
- It also provides with plenty of jargon!
- It contains general and technical detail, some people might want to read only the first 6 slides and the conclusion.

# Human behaviour and sustainability

- People often do not change to more sustainable behaviour because:
  - People may be unaware of the environmental problem.
  - They might be uncertain or underestimate the consequences of the environmental problem.
  - They might be incapable of changing behaviour due to a lack of abilities.
  - Changing behaviour may seriously impair their quality of life.
  - They perceive that their individual behaviour change will hardly have an effect on the collective environmental problem.
  - They may be inclined to wait until other persons change their behaviour first (avoid being the “sucker”).

# Cognitive processing (reasoning)

- The introduction of a psychological perspective to sustainability studies might add to the understanding of behavioural determinants:
  - Habits
  - Needs
  - Personal restraint, personal responsibility
  - Uncertainty
  - Expectation of other persons' behaviour
  - Trust
  - Social value orientation:
    - Cooperation, individualism, competition
  - Morality

# Integrated modelling

## Crème de la crème

- systems dynamics
- environmental economics
- industry ecology
- ecological economics
- systems ecology
- integrated assessment modelling

They all share one essential property:

**The inherent impossibility to make accurate predictions for long-term future developments**

# Why modelling then?

- The complexity of systems involving ecology and humans confront us with the fundamental limits of predicting future systems behaviour.

## However

- Models can be used to illustrate interdependence of human activities and their consequences in **time, place and space**.
- They can also be used to communicate knowledge on relevant systems dynamics to policy makers and stakeholders.

# Economics and social psychology

- Economics – normative science
  - Optimal way of allocating scarce resources
- Social psychology – descriptive science
  - Actual decision-making of human actors
- The combination applied to sustainable resource management might add to the understanding of:  
**discrepancies between optimal and actual behaviour**

# Two main directions in behaviour simulation models:

- Increase the realism of natural resources systems and economic models by developing computer simulations of more complex systems.
- Simulations of behaviour itself, operationalising agents via algorithms that represent certain decision processes – testing algorithms against each other.



# Behavioural models

- Theoretical model describing the dynamics between individual decision-making and the characteristics of a social group to improve understanding of:
  - The rules that people apply in social dilemma situations
  - How the combination of individual rules leads towards certain collective outcomes
  - How individual rules are apt to change as a result of a changing situation

# Conceptual meta-model of human behaviour

W. Jager (2000)

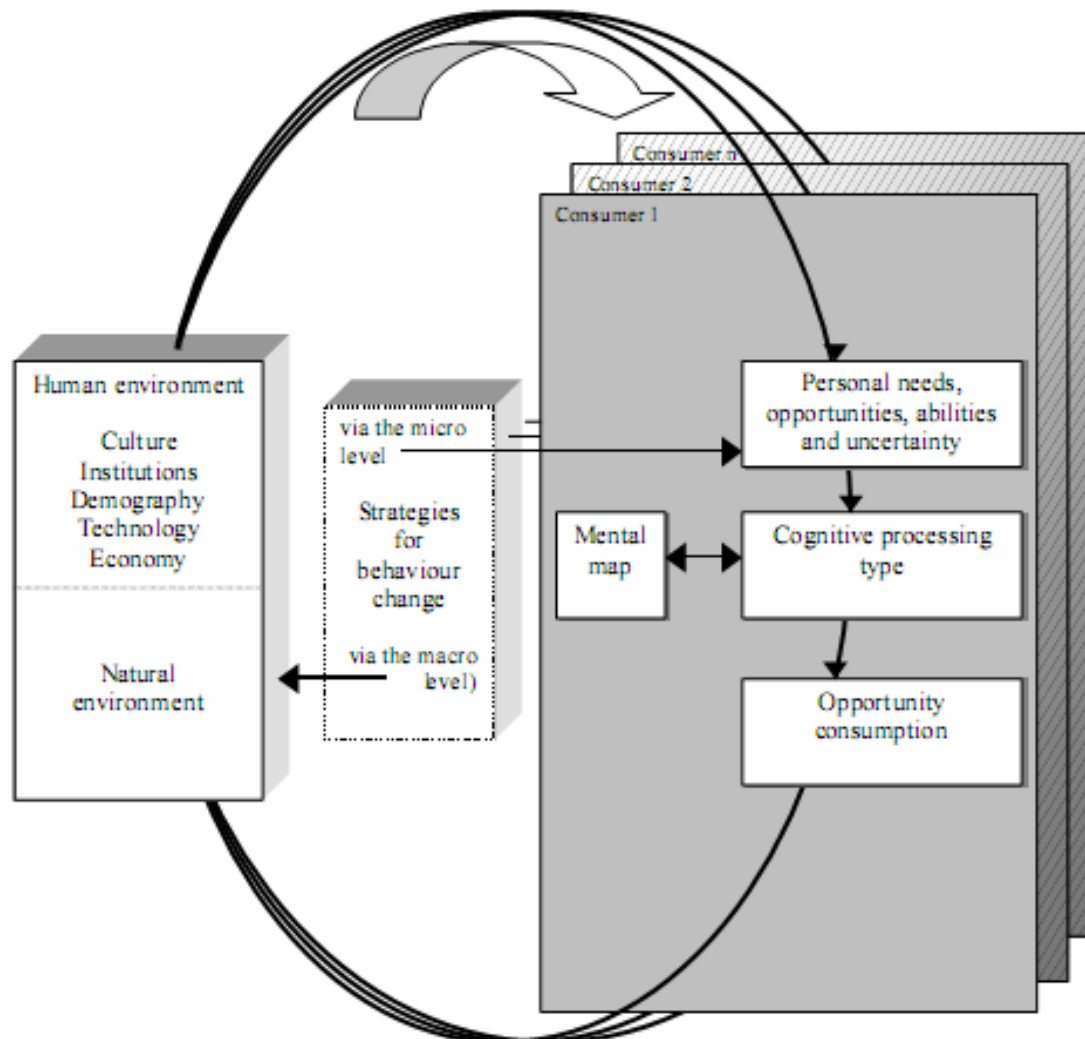


Figure 5.1: The cyclical pattern of micro-level behaviour and macro-level changes

# Macro-level driving factors

- Refer to the environment a person lives in, determining behavioural options:
  - Technological developments (e.g. washing machine)
  - Economic developments (e.g. purchasing power)
  - Demographic developments (multiplier)
  - Institutional developments (e.g. free-market system)
  - Cultural developments (e.g. consumerism)

# Micro-level driving factors

- Refer to individual factors that determine the type of cognitive processing people are most likely to engage in.

**Human needs and values**  
**Behavioural opportunities**

**Consumer abilities**  
**Consumer uncertainty**

- Combining needs with opportunity consumption results in a **level of need satisfaction**, which determines their motivation to consume.
- Combining consumer abilities with uncertainty results in **behavioural control**, indicating the feasibility of opportunity consumption

# Human needs

- If a need is not satisfied, the related negative feeling will arouse a drive to satisfy this need. People are able to build a 'stock' that satisfies each need. For example, a self-sustaining farmer will store the harvest of this year in the barn, and households generally have a fridge to store food.
- For all types of needs such a 'stock' is imaginable.

# Human needs cont.

- When satisfaction is guaranteed, the actor's motivation to further increase the stock level will be low.
- The need satisfying capacity of an opportunity (consumption) follows a diminishing marginal utility function along with increasing stock level.

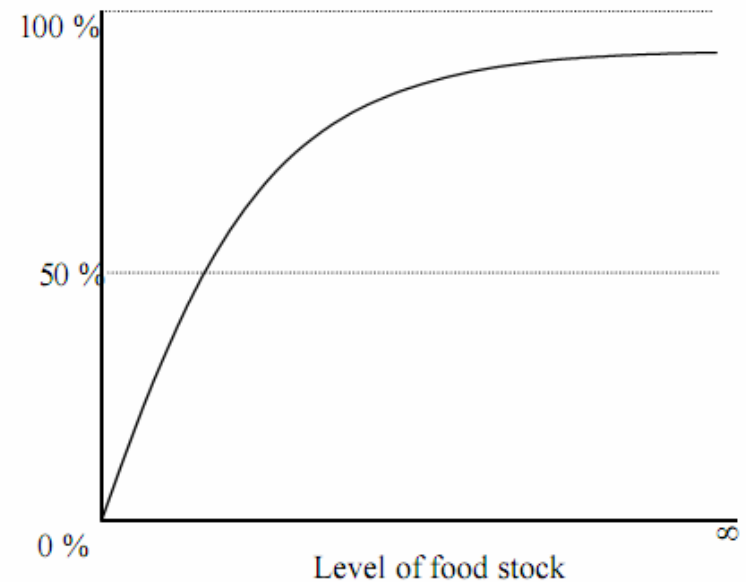


Figure 5.3: The need-satisfying capacity of food as a function of the stock level

# Human values

- Whereas some people attach great value to comfortable living, adhering to a materialistic lifestyle, other people are more concerned with the environment and adhere to a more non-materialistic lifestyle.
- There is a number of archetypes of cultural perspectives that can be used for modelling behaviour (next page)
- Although deterministic, these cultural perspectives can be used to infer the way in which people perceive the world and behave in it.

# Human values cont.

W. Jager (2000)

Cultural perspective (Thompson <i>et al.</i> , 1990, extended by Bossel, 1996)	Basic orientors/values (Bossel, 1977)	Personal + social needs (Max-Neef, 1992)
Fatalist	Existence Subsistence	Subsistence
Organiser	Effectiveness	Understanding Leisure
Individualist	Freedom of action	Freedom
Hierarchist	Security	Protection
Innovator	Adaptability	Creation
Egalitarian	Coexistence	Participation
All perspectives	Psychological needs	Affection Identity

Table 5.3: Cultural perspectives, basic orientors/ values and focal needs. Based on Bossel (1996).



# Opportunities

- Products and services (commodities) that one can use and that have a certain capacity to satisfy one's needs.
- The relationship between opportunities and needs is complex, as some opportunities may, in fulfilling one need, either fulfil or impair other needs.
  - Eating caviar may fulfil the need to eat (Subsistence), to relax (Leisure) and to demonstrate one's prosperity (Identity).
  - A need of leisure might be fulfilled by playing, taking a holiday, knitting and so forth.

# Opportunities cont.

- There are five types of satisfiers:
  - **Singular satisfiers** – satisfies one need without interfering with others. E.g. insurance systems (need for protection)
  - **Synergic satisfiers** – satisfies multiple needs. Education improves living conditions (protection), enhance social participation and self confidence (identity).
  - **Pseudo-satisfiers** – e.g. status symbols (need of identity).
  - **Inhibiting satisfiers** – obsessive economic competitiveness satisfies the need for (economic) freedom, but inhibits time with family (affection), environment (subsistence) and time to relax (leisure) needs.
  - **Violators or destructors** – supposedly satisfy a given need but in fact often annihilate the possibility of satisfying it. Government bureaucratic procedures.

# Abilities

- Refer to the set of capacities or skills an actor (individual or household) has for actually using or acquiring an opportunity.
  - **Physical resources** – one's health, fitness, tools (owning a car)
  - **Permitted and licensed resources** – permits to use opportunities (having a driver's license)
  - **Financial resources** – 'Can't buy me love'
  - **Social and cognitive resources** – one's knowledge, values, norms, social status.

# Uncertainty

- Refers to the stability of the environment people live in and of the stock of resources they use. Unexpected outcomes make people uncertain about how to behave.
- Uncertainty tolerance indicates how sensitive people are to uncertain outcomes.

# Cognitive processes

- Refers to the strategies a person might employ in determining which behaviour to perform.
  - Deliberation
  - Social comparison
  - Imitation
  - Habit formation
- There are certain conditions that determine the type of cognitive process most likely to be used by people:
  - Reasoned vs. automated processing
  - Individually vs. socially determined processing

# Reasoned vs. Automated processing

- Reasoned processing is focused on optimisation of possible outcomes.
- Because of limited cognitive resources, mainly of the daily routines are automated.
- People often repeat behaviour as long as the outcomes are satisfying.
- Reasoned processing is triggered when a need satisfaction is seriously impaired.

# Individual vs. Social processing

- If an actor is observing the behaviour of other actors as a means to get information to assess opportunities, we speak of social processing.
- Individual processing is commonly used under certainty.
- Social processing is mainly triggered under uncertainty (next page).

# Cognitive processing styles

	<b>Automated</b> <i>(high LNS, high BC)</i>	<b>Reasoned</b> <i>(low LNS, low BC)</i>
<b>Individually determined</b> <i>(certainty, private, individualist CP, personal needs)</i>	<b>Repetition</b> (1) - Classical conditioning theory - Operant conditioning theory	<b>Deliberation</b> (2) - Decision and choice theory - Theory of reasoned/planned behaviour (attitude and perceived control)
<b>Social determined</b> <i>(uncertainty, public visibility, egalitarian CP, social needs)</i>	<b>Imitation</b> (3) - Social learning theory - Theory of normative conduct	<b>Social comparison</b> (4) - Social comparison theory - Relative deprivation theory - Theory of reasoned/planned behaviour (social norm)

Table 5.4: A classification of eight major theories on human behaviour. LNS = level of need satisfaction, BC = Behavioural Control and CP = Cultural Perspective (based on Jager et al., 1997)



# How does behavioural models relate to environmental and economic models?

- A behavioural model can assess consumption volumes that can be used as inputs in economic models.
- Economic model also provide inputs to assess changes on the macro-economic environment that affect availability of opportunities.
- Environmental models provide the inputs to assess changes in the natural environment as a determinant of human behaviour.

# Strategies for behavioural change

- Behavioural models could be applied to evaluate strategies employed by individuals, government, interests groups to influence consumer behaviour:
  - Changing need-satisfying capacities of opportunities – product improvement, new products or services.
  - Changing the resource demands of opportunities – laws, prices, information.
  - Changing the abilities of consumers – income taxes, education.
  - Changing the perspective people have on need satisfaction – influencing motivation to consume.

# Policy Instruments evaluation

- The link between cognitive processes and strategies for behavioural change could be used to design and evaluate more effective government policy instruments by using a combination of the following:
  - Provision of physical alternatives and rearrangements
  - Regulation and enforcement
  - Financial-economic stimulation
  - Social and cognitive stimulation
  - Changing values and morality

These are explained in the following slides.

# Provision of physical alternatives and rearrangements

- The basic assumption is that changing the physical environment can shape behaviour. These instruments deal with:
  - Optimisation of existing technology – more energy-efficient burners, better public transport.
  - Innovation and development of new technology – small-scale windmills, electric cars.
  - Infrastructural changes – new railways, broadband.

# Regulation and enforcement

- Regulations change opportunity demands and consumer abilities. This instrument deals with:
  - Rules for commercial transactions
  - Product characteristics (food additives, residues, etc.)
  - Speed limits
  - International compliance
  - International travel

# Financial-economic stimulation

- Aimed at changing the pay-off structure of a series of opportunities. Preferred behaviours may be financially rewarded (subsidies and discounts), while undesirable behaviours may be financially punished (taxes and fines). The basic assumption is that people are susceptible to the price mechanism and the demand-price elasticities involved are reasonably high.
  - Micro-economic measures – taxing luxury goods, tobacco.
  - Macro-economic measures – changes in interest rates, budgetary deficits.

# Social and cognitive stimulation

- Increasing public problem awareness and altering problem perception, motivating people towards preferred behaviour.
  - Informing consumers about advantages or disadvantages of certain opportunities.
  - Using influential people – role models to alter perceptions of opportunities as status-increasing (need for identity).

# Changing values and morality

- Appeals to the conscience of the consumers. Attempts to enhance 'altruism' or 'cooperativeness' toward other actors and future generations.
  - People conception of 'quality of life'
  - Educational system
  - Media campaigns



# Conclusion

- The work by Wander Jager can provide with a ‘stand-alone’ theoretical model of human behaviour independent of any software platform.
- Ultimately, the aim of this theory is the possibility of creating a model of some elements of human or institutional behaviour on which experiments can be run.
- There are fragmented behavioural theories that could ‘validate’ such model.

# Conclusion cont.

- Once established, the behavioural model can be used to model decision makers (agents) and their interaction with an economic and environmental context relevant to a research question, in collaboration with economists and environmentalists.
- The model could then be customised to a particular case study or research question, in collaboration with social scientists.
- Policy instruments then can be then designed and tested.
- Results could also be plugged-in on an existing economic or environmental model.