DISTILLATE

Project B: Option Generation

Annexes to the Literature Review

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ANNEX I: IDENTIFYING ISSUES & FRAMING OPTION GENERATION

Policy Delphi

The original Delphi process had the aim of enabling a group of individuals, as a whole, to address a problem and reach a consensus. The Policy Delphi, on the other hand, looks to generate opposing views on the nature of the issues and the potential resolutions of a major policy issue.

The method can potentially be of use both at the problem identification and option generation stages, but the practical examples described below relate more to problem identification and framing. The method operates on the basis that the decision maker does not want the group to agree on the final decision, but to provide an informed group that can identify a wide range of concerns, and later generate a wide range of options and supporting evidence for his or her consideration (Turoff, 2002).

The Policy Delphi is thus often utilized as a tool for the analysis of policy issues, enhancing the effectiveness of the committee approach. Often the decision-maker may even specify a design that inhibits consensus formulation.

The general process used by Policy Delphi is as follows, although it can be modified to suit the context:

1. Formulation of the issues.
2. Exposing the debate and the options.
3. Determining initial positions on the issue: which positions are the most agreed on/polarising? Which should be discarded?
4. Exploring and obtaining the reasons for disagreements: what are the underlying assumptions or examples that people have used to reach their position?
5. Evaluating the underlying reasons.
6. Re-evaluating the generation and assessment of options. (Turoff, 2002)

The Policy Delphi is thus a systematic, multistage process for obtaining, exchanging, and developing informed opinion on an issue, to generate a wide range opinions and options, and develop a range of views both for and against potential policy solutions. The initial gauging of opinions is followed by data analysis, design of a questionnaire, and a second gauging of opinions. The goals of the Policy Delphi method are to outline all the various alternative issues and arguments relating to a policy issue, as well as providing a constructive forum for subsequently reaching a consensus on what should be done (Ravens and Hahn, 2000).

The National Industrial Conference Board, USA, 1968

In 1968 the American National Industrial Conference Board initiated ‘An Experimental Public Affairs Forecast’, in which 70 distinguished and high-ranking stakeholders from a wide variety of backgrounds gathered together to obtain a rank ordered list of ‘National Priorities’ or ‘Areas of Major Concern to the Nation’, areas which could create major public problems and should receive attention by U. S. leadership (Turoff, 2002).

Each item was handled in terms of the following categories of information:

- Description of the item
- Description of public reaction to the item
- Beginning date of maximum impact on U. S.
- Intensity of impact on U. S.
- Opportunity for leadership to change the expected impact.

At the conclusion of the exercise, the top ten priorities were: (1) division in U. S. society; (2) international affairs; (3) education; (4) urban areas; (5) law and order; (6) science, technology, management of change; (7) economy; ($) resources; (9) values; (10) population (Turoff, 2002).

The same approach was soon applied to transport and planning problems, with Schneider (1972) at the University of Washington looking at options for highway development in the Seattle region.

Joel Goodman of the College of Marine Studies, University of Delaware, conducted a Policy Delphi on the Coastal Zone Land Use Planning Issue, involving a large number of stakeholders from government, business and public groups. This exercise explored 'respondent attitudes', 'respondent characteristics', arguments pro and con, general policy and budget items, specific policy issues, specific programmes and strategic issues in different sections of the questionnaires.

The Urban Futures Game

Developed by Cooper and Platt (2004) for the Building Futures initiative, the Urban Futures Game is part of an attempt to involve the local community and other key stakeholder groups in:

"....a meaningful dialogue concerning their ambitions for the future, the opportunities and potential barriers ahead, and their expectations for success".

It is seen as an important part of the process of 'framing requirements' for a local area. The key novelty in the game is the use of playing cards to summarise and prioritise the participants' aspirations and concerns, as a precursor to commenting on potential options developed by the organisers.

The process begins by identifying representatives of key stakeholder groups, including local policy makers, service providers and members of the local community. These people are then interviewed individually, or in small groups, and asked about their present experiences of change, and their Aspirations and Concerns for the future. The latter are then summarised on two sets of playing cards, which form the starting point for a workshop involving similar groups of people (often comprising the same individuals as were originally interviewed).

Participants are first shown the pack of cards that summarises the selection of Aspirations that were generated in the individual interviews, and are asked to choose from these the cards that best reflect their "key aspirations that have to be met, if

towns like theirs and their neighbourhoods are to be effectively regenerated over the next ten to 20 years".

One example of a card sorting exercise is shown in Figure I.1.

Figure I.1: A card sorting exercise during one workshop
Source: Platt and Cooper, 2005)

Their choices are then transferred to 'capture sheets', which group these aspirations under eight broad headings (i.e. people, housing, community, infrastructure, economy, education, process and leadership). Participants' choices are indicated through the use of sticky dots, with each person receiving five dots to indicate their top priorities. Different coloured dots are used for the local community and the service provider/ policy maker groups, to see whether priorities differ between the two groups – which often appears to be the case (see Figure I.2).

Participants are then provided with a second set of playing cards, on which have been marked the main Concerns raised in the preceding interviews. The same mapping process is followed, using the same eight columns and the use of coloured dots for prioritisation. Again, this process can highlight major differences between community groups and the professionals (see Figure I.3).

In a foreword to the report, John Worthington summarises the game as having three unique attributes:

- "It builds on previous experience, by presenting a set of aspirations and concerns which have been raised by previous groups, that can then be used to focus the discussion and speed up the process;

- "It recognises different perspectives and the value of articulating and celebrating diversity; and
- "Issues and opportunities are presented as generic themes and options which can be compared and tested against their ability to adapt to changing future needs."

This then provides a basis for generating policy option packages of solutions.

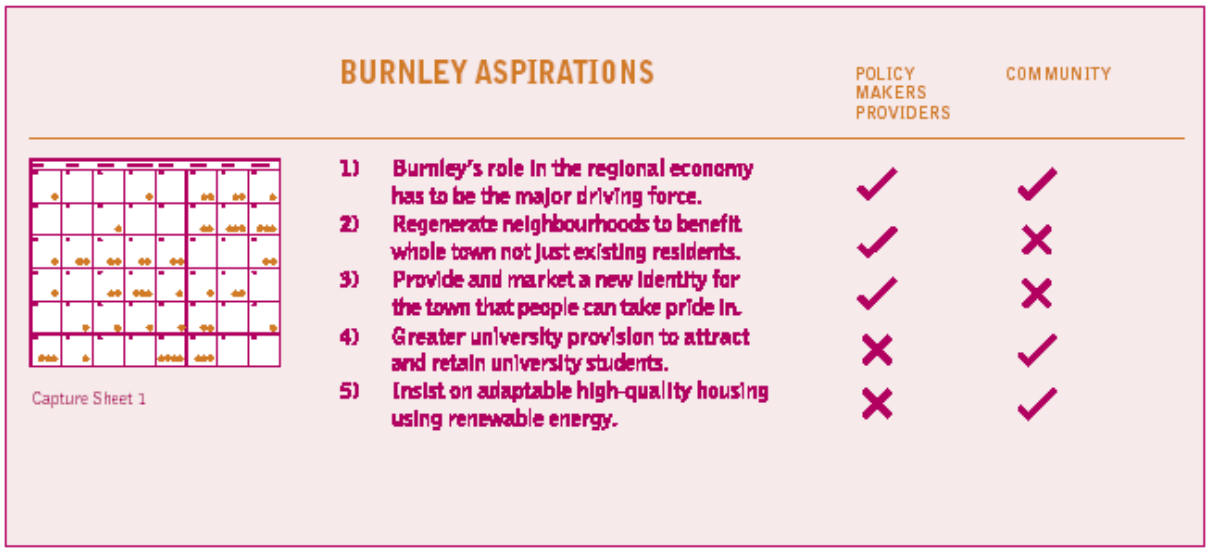


Figure I.2: Capture Sheet showing Aspirations in Burnley
Source: Platt and Cooper, 2005)

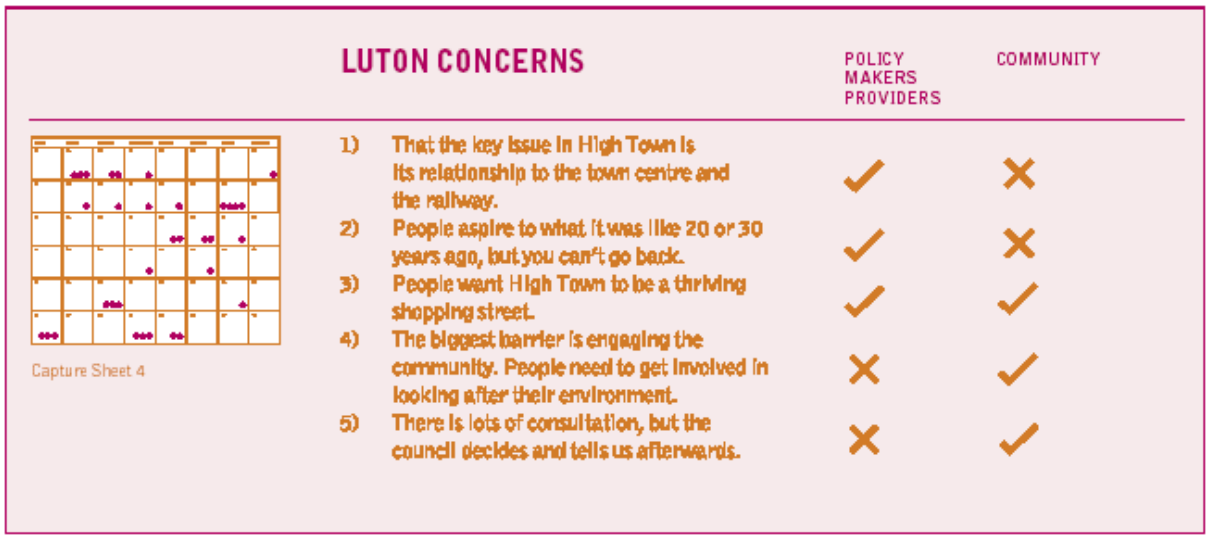


Figure I.3: Capture Sheet showing Concerns in Luton
Source: Platt and Cooper, 2005)

SCUF

SCUF is short for 'Scenarios for Critical Uncertainty Framework'. It has been developed by researchers at the Stockholm Environment Institute (Barrett, 2005), and involves five stages. Phase one begins by asking participants to identify the issues that are important with respect to their area's future. They are asked "If you were to prepare a comprehensive 'history of the future', what topics would you need to discuss?" Thus, in many ways it starts like a visioning exercise. Again, similarly to a visioning exercise, participants are encouraged to define the time horizon, by choosing a length of time that is relevant to the themes they have identified.

In Phase two, the group themselves are asked to bring their knowledge to bear in identifying the key dynamics and relationships that are the overriding determinants of how the future evolves. This is done in the context of the themes that were developed in Phase one. Participants are asked to think about key historical events and trends, and how these have affected the themes in the past. From this, the group can identify driving forces[1], thinking in terms of underlying causes not just descriptions and, for each driving force, map out the range of possible ways it could evolve in the future.

What makes SCUF stand out as a structured question generation method is Phase three, where the outcomes from Phases one and two are then mapped in terms of importance against uncertainty (i.e. in terms of 'critical uncertainty'). This achieves a structured selection of those issues, which are both critical and which have a level of uncertainty in connection with their futures – thus issues into which change cannot be introduced score lowly. Other than for that constraint, the only other factor constraining options is the vision of the participants with respect to the drivers in Phase Two. Critical Uncertainties are selected by those driving forces that are both high impact and have a high uncertainty, as is shown in Figure I.4 below.

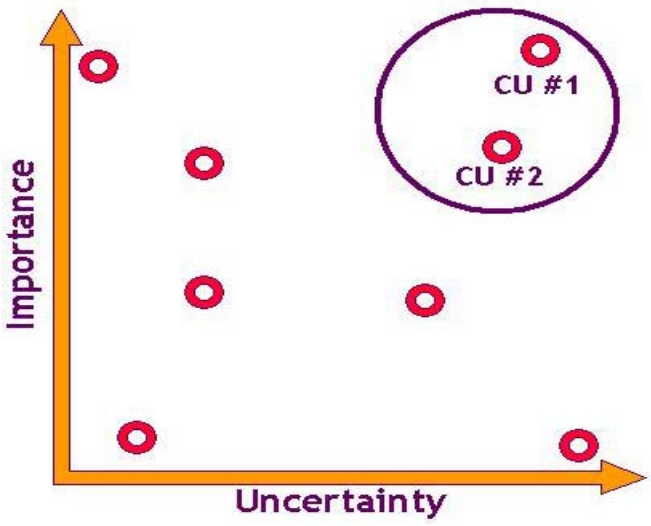


Figure I.4: Mapping Driving Forces on two dimensions

[1] Driving forces can include demographics, economics, social or cultural matters, governance, environmental concerns or technological issues.

The selected critical uncertainties (at least two are required) generate a range of scenarios: two critical uncertainties will give a normal grid of four scenarios, three critical uncertainties will generate a 'grid' of eight scenarios (see Figure I.5), and so on. The scenarios can be elaborated using the participants' own knowledge, or models can also be used to generate possible future trends. Not all scenario options may be modelled or explored in detail.

	Critical Uncertainty #1	Critical Uncertainty #2	Critical Uncertainty #3	Selected to make scenarios
Possible future #1	X	X	X	Scenario A
Possible future #2	X	X		Scenario B
Possible future #3	X		X	
Possible future #4	X			Scenario C
Possible future #5		X	X	
Possible future #6		X		
Possible future #7			X	Scenario D
Possible future #8				

Figure I.5: Grid defining possible scenarios

Typically, around four possible futures are used to define the scenario framework (highlighted in light blue above). In Phase four, the 'scenario narratives' are elaborated by identifying two or three driving forces that are high impact and high uncertainty, and by describing how each driving force and theme would evolve under each scenario.

Finally, Phase five involves the definition of quantitative indicators and estimation (either quantitative or qualitative, as appropriate), of how these will evolve over time.

ANNEX II: LIBRARY-BASED APPROACHES

Library based approaches have been used for presenting relevant information to decision makers for many years. Perhaps the main change recently has been through the utilisation of the Internet to disseminate information. A number of library based approaches in the transport industry, including KonSULT and the VTPI transport demand management encyclopaedia, have developed internet based search facilities for identifying policy instruments that help to achieve given objectives. This Annex first considers some approaches developed in the field of land use and transport planning, and then examine some examples from other policy areas.

Transport examples

KonSULT

KonSULT (**K**nowledgebase **on** **Su**stainable **U**rban **L**and–use and **T**ransport) is an online facility developed by the Institute for Transport Studies[2] at the University of Leeds, providing guidance for decision makers on developing land use and transport policies. At present it contains information on around forty policy instruments, with a plan to extend to this to sixty. This database of information has been developed from a range of sources including the findings from PROSPECTS (May et al, 2003), IHT guidelines (IHT, 1996), surveys of policy instruments (May and Still, 2000) and detailed literature searches which have been used to produce state of the art reports on individual instruments. The content is still being developed along these lines and requires frequent updates as subsequent research findings are released.

The tool has been designed in levels, with level 1 providing the 'getting started' material, level 2 containing the 'transport strategy 'material. Finally level 3 includes specific information on the 'instruments of transport policy' for which the instruments are classified into the six categories of

- Land use measures
- Attitudinal and Behavioural Measures
- Infrastructure Measures
- Management of the Infrastructure
- Information provision
- Pricing

There are multiple ways that this library of information can be used. The first is to consider each individual policy instrument. Here information is available under seven headings, which are:

1. Summary
2. Taxonomy and Description
3. First Principles Assessment
4. Evidence on performance

[2] http://www.konsult.leeds.ac.uk

5. Policy contribution
6. Complementary Instruments
7. References

This information is designed to enable the decision maker to decide whether a particular policy instrument is suitable for a given purpose. For example, by selecting the policy instrument *road user charging* under the category *policy contribution* one of the pieces of information that it provides is the appropriate area types for this policy (Figure II.1). In this case the guidance emphasises that road user charging is more suitable for application in city centres.

Figure II.1: Suitability of road user charging to different area types

Appropriate area-types	
Area type	**Suitability**
City centre	XXXXVVVV
Dense inner suburb	XXXXV
Medium density outer suburb	XXX
Less dense outer suburb	XXXXX
District centre	XXXXVV
Corridor	XXXXVVV
Small town	XXXXV
Tourist town	XXXXVV

Another facility within KonSULT is the 'filter' option, which allows decision makers to select their criteria (see Figure II.2) and then the KonSULT tool ranks the policy instruments according to their suitability for this purpose.

For example, if the options as shown by the ticks in Figure II.2 are selected, the top policy instruments identified for this purpose[3] are:

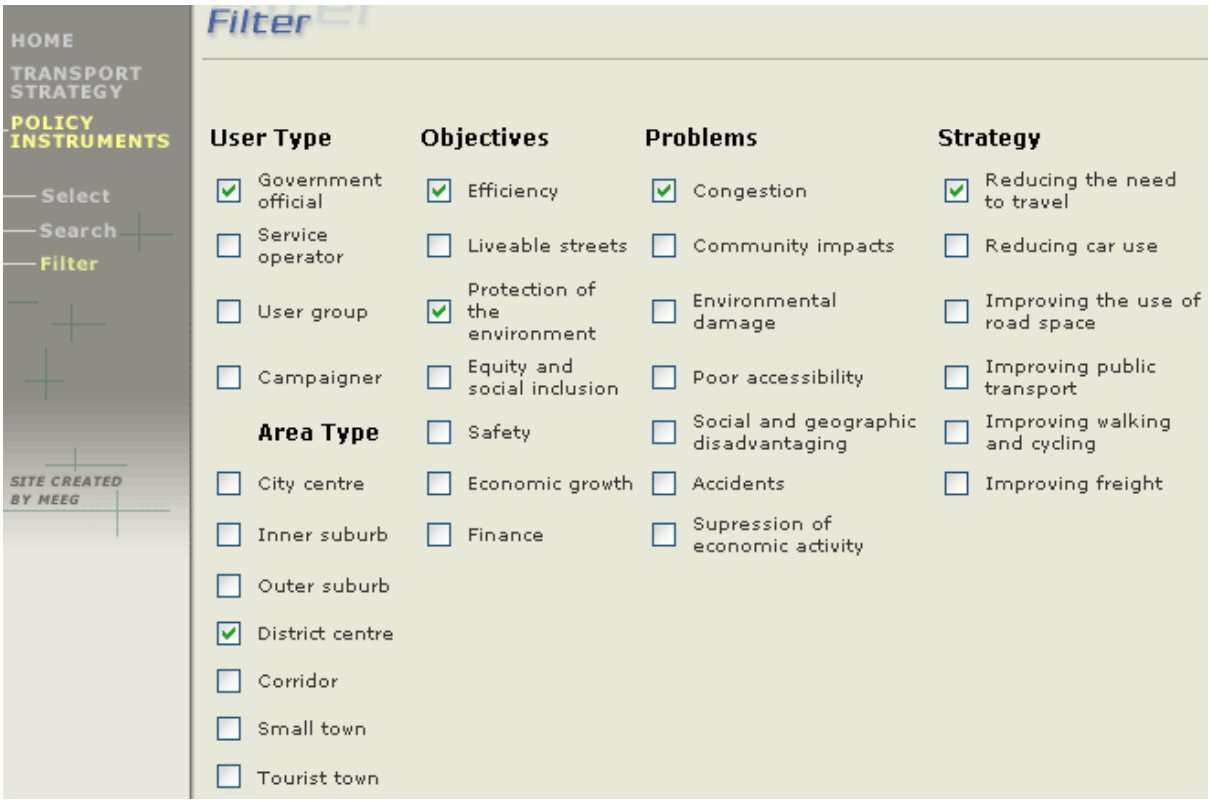
1. Urban Road Charging (26)
2. Guided Bus (19)
3. Company Travel Plans (19)
4. Regulatory Restrictions (19)
5. Ride sharing (18)

Behind the filter page lies a table, in which each policy instrument has been assessed as to whether it contributes positively (represented on a scale from '1' to '5'), negatively ('-1' to '-5'), or does not contribute at all (represented by '0') to the criteria in question. This scoring is then summed to provide each policy instrument with a cumulative score for achieving each of the required criteria.

[3] It should be noted that not all 60 policy instruments are currently active within the tool and this ranking could change once all the instruments are added.

The next stage in the development of KonSULT will be to include the option of directly generating policy instrument packages. This will utilise the current information on complementarity, synergy and additivity between policy instruments, as described in May et al (2005)

Figure II.2: KonSULT page for the specification of relevant criteria



PROSPECTS

A number of research projects have informed the development of the KonSULT database, in particular the European project PROSPECTS. Prior to that project, May and Roberts (1995) had identified from UK case studies three sources of integration between policy instruments that had the potential to increase the benefits of implementing a co-ordinated strategy, compared to a situation where the individual policy instruments were introduced in isolation.

These were:

- Complementary instruments
- Instruments that provide financial support for other instruments being used
- Instruments that make other instruments more publicly acceptable.

Within PROSPECTS a matrix was produced using this classification, which shows how a range of policy instruments work together. Using this matrix, it is possible to select a set of policy instruments that should work well together in a policy package.

One example from this matrix is the potential benefit from combining road pricing with an increase in public transport infrastructure, as the road pricing measure complements the benefits of the increase in transport infrastructure (in terms of boosting ridership) and also has the potential to be able to provide the finance for it, while public transport infrastructure makes road pricing more acceptable.

The PROSPECTS project expanded the categories with which benefits could be achieved from combining instruments into packages. These are:

- Instruments which reinforce the benefits of one another
- Instruments which overcome financial barriers
- Instruments which overcome political barriers
- Instruments which compensate losers.

The matrix describing the different contributions of the main categories of transport instruments is reproduced in Table II.1. This provides an initial source of information from which to determine the categories of instruments that have the potential to create welfare benefits when combined in policy packages. For example, the matrix shows that infrastructure instruments have the potential to combine with land use instruments to reinforce the benefits and also compensate losers. Using these matrices provides a starting point for formalising the option generation process.

Table II.1: Potential for beneficial interaction between groups of transport instruments[1]

	Land use	Infrastructure	Management	Information	Attitudes	Pricing
Land use		∇				∇
Infrastructure	∇ θ		◊			◊
Management	∇ θ	∇ ◊ θ			∇	∇ ◊ θ
Information	∇	∇ ◊	∇ ◊ θ		∇	∇ ◊ θ
Attitudes	∇ ◊	∇ ◊	∇ ◊			◊
Pricing	∇ θ	∇ O θ	∇ O θ	O ◊	∇	
Key:	∇ Benefits reinforced			O Financial barriers reduced		
	◊ Political barriers reduced			θ Compensation for losers		

Source: May et al. (2003)

1(contribution of the measures in the rows to the measures in the columns of the matrix)

On-line Planning Resource

Producing matrices is one way of determining which policy instruments to use in which scenario. Other transport databases have used a different approach to represent the types of policies that transport planners could use in option generation.

In particular, the University of Nottingham[4] hosts an online planning resource facility which contains literature, bibliographies, contact and website details of relevant sources for transport designed by Hugh McClintock. Specialist information is

[3]http://www.nottingham.ac.uk/sbe/planbiblios/

available through 13 bibliographies, which then expand within their section, so that references on specific topics such as *transport and equity* can be identifed.

While this type of approach does not specifically help the decision maker to decide which options to select, as KonSULT does, it does indicate where else they could find additional information on the area that they selected and highlight other potential areas to consider. For example under the heading *transport and equity* it suggests the reader also consider the category of 'traffic calming' among others.

VTPI

The Victoria Transport Policy Institute hosts the Transport Demand Management Encyclopaedia[5] providing sources of information on transport solutions. The website is split into first providing information on strategies to achieve specific objectives, and then providing more detailed information on individual policy instruments.

The specific objectives that are considered in this database are:

- Congestion reduction
- Energy Conservation and Emission reduction
- Parking solutions
- Livability strategies
- Improving Equity
- Health and Fitness
- Rural Community TDM
- Safety Strategies
- Transportation affordability

For each of these objectives, a document has been written that first introduces the problem and then discusses the general approaches used to solve the problem. In some cases (e.g. parking solutions) a summary table has been produced that indicates, on a scale of -3 to +3, how successful each of the general approaches has been in tackling the problem in question, and then how successful it is in terms of: costs, TDM and land use, consumer benefits and equity. It then provides a total score.

Table II.2 shows an example from the VTPI web page dealing with the objective of reducing parking congestion. The highest score was achieved by the solution of 'pedestrian improvements' under the broad category of 'using existing parking capacity more efficiently'. A number of the other potential solutions, while having a positive impact on parking congestion had a severe negative impact on some of the other objectives that a transport planner also want to achieve, for instance increasing equity or keeping costs to a minimum.

Similar to the information provided in KonSULT, expert knowledge and examples from the literature are used to inform the advice given. The VTPI also considers best practice examples and lists the key references and websites for each topic.

[5] http://www.vtpi.org/tdm

The second area of the VTPI database provides documentation on individual transport demand management strategies, which are grouped under the headings of:

- Improved transport options
- Incentives to use alternative modes and reduce driving
- Parking and land use management
- Policy and institutional reforms
- TDM programmes and Programme support
- TDM planning and Evaluation
- Reference information

Table II.2: Options for 'Parking Solutions' in the VTPI Library

Solution	Parking Congestion	Costs	TDM & Land Use	Consumer Benefits	Equity	*Totals*
Increase Parking Supply						
Minimum Parking Requirements	3	-3	-3	2	-3	*-4*
On-Street Parking	3	-3	-3	2	-3	*-4*
Subsidize Off-street Parking	3	-3	-3	2	-3	*-4*
Redesign Existing Facilities	2	-1	0	1	0	*1*
Add Remote Parking	2	-2	-2	1	0	*-1*
Car Stackers	2	-2	-1	2	-1	*0*
Use Existing Parking Capacity More Efficiently						
Provide Parking Information	2	-1	0	3	0	*4*
Encourage Remote Parking Use	2	-1	-1	1	0	*1*
Regulate Parking	2	-1	1	1	0	*3*
Pedestrian Improvements	2	-1	3	3	3	*10*
Shared Parking	2	-1	2	-1	0	*2*
Public Parking	2	-2	2	-1	0	*1*
More Accurate Requirements	0	1	2	2	2	*7*

Source: VTPI (2005) – Parking Solutions.

For each of the policy instruments under these seven categories, a document has been written providing a description of the policy, its impact on travel, benefits and costs and equity impacts (using the -3 to +3 scale) and where it should be applied; any relevant case studies and examples are then listed, concluding with a reference list. For example, Table II.3 shows the traffic impact summary for the TDM policy instrument 'traffic calming'; it indicates that traffic calming has a very beneficial impact on walking conditions, but has no impact on reducing peak period traffic.

The information provided allows decision makers to assess whether a specific policy instrument will meet their requirements and allows them to consider the use of these instruments in other applications.

Table II.3: Traffic impact summary for 'Traffic Calming' in VTPI

Objective	Rating	Comments
Reduces total traffic.	2	Discourages automobile traffic and increases travel alternatives.
Reduces peak period traffic.	0	
Shifts peak to off-peak periods.	0	
Shifts automobile travel to alternative modes.	2	Improves walking and cycling conditions and discourages automobile use.
Improves access, reduces the need for travel.	1	Encourages higher-density, mixed land use.
Increased ridesharing.	0	
Increased public transit.	1	Improves access to transit.
Increased cycling.	2	Improves cycling conditions.
Increased walking.	3	Improves walking conditions.
Increased Telework.	0	
Reduced freight traffic.	0	

Rating from 3 (very beneficial) to –3 (very harmful). A '0' indicates no impact or mixed impacts.

Other library based examples

NHS Direct

One of the best examples of web based library approaches is the NHS Direct website[6]. There are a number of tools within this site to help generate a diagnosis online and suggest treatments for this. In particular, the 'self help' tool and 'best treatments' tools will now be described.

The **Self Help Tool** is designed for members of the public to determine what is wrong with them, based on their symptoms. The first stage is to use the body guide (a clickable picture of a body) to select where the person feels ill (click on that part of a body), or to select the symptom that best represents the illness from an alphabetical list. For example, if the person had a 'Headache' they could either click on the head part of the body or select headache from the alphabetical list.

Once a selection has been made, a number of options are given. For example, under the heading Headache the user is asked to choose between:

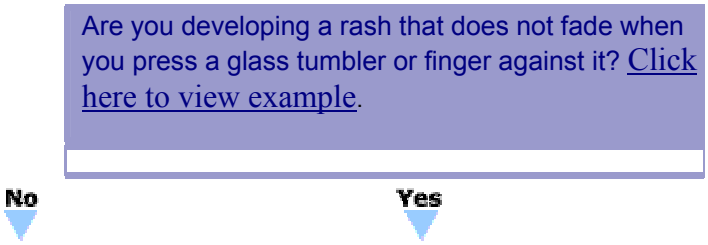
- Head injury in child
- Headache in child
- Headache in Adult
- Rashes
- Toothache

The next stage is to select the symptom from this list that best represents the illness. From this point onwards a series of Yes/ No questions are asked to narrow down the options. For example, if 'headache in adult' is selected, then the following question is asked:

[6] www.nhsdirect.nhs.uk/

If Yes is selected, then the website suggests to ring **999**. If No is selected, then the website goes onto a further question. Wherever Yes is selected then relevant advice (e.g. phone 999) is presented. When No is selected a new question is presented.

For example if No was selected to the above question, then the following question would then be asked:



This process of questions continues until Yes is finally selected. In the example above, a picture is available to aid in the answering of the question. The questions posed and advice given draws on expert knowledge, a database of symptoms, potential illnesses and treatments. There are rules within this that depict that certain symptoms are more critical than others.

The **Best Treatments** website was designed for patients and doctors to have access to evidence from medical research to decide on the best treatments. It is split into options for patients and options for doctors. In the Patients section, patients are first required to select the condition that they have. Once this is selected they can then select from the following headings:

- What treatments work?
- What it is?
- What are the symptoms?
- How it is diagnosed?
- How common is it?
- What will happen?
- Questions to ask?

The Doctors section allows them to select the condition and then provides the answers to patients' questions and advice, based on the headings of:

- Definition
- Incidence/prevalence
- Actiology /risk factors
- Prognosis
- Aims of intervention

- Outcomes
- Methods
- Research papers

Both sections use the same information, the only differences are that the information is presented in a very different way, using different terminology. There is a strict process used to develop the information on each of the conditions that can be accessed, which is:

- The website covers only those conditions included in *Clinical Evidence;*
- 'Best treatments' works with the clinical evidence team, an international team of doctors and patients, to find out what matters most to doctors and patients;
- All information is based on research evidence and high quality medical papers;
- The research evidence for each treatment is studied and summarised by an 'expert' doctor and this is then checked by at least three more doctors.

A classification is then made of the degree to which treatments work, using the guidelines in Table II.4. This classification is very informative and adds some weight to the expert knowledge that is contained within the database, as where it is known that certain treatments do not have a 100% success rate it says this.

Table II.4: Classification of success of treatments in NHS Direct

Treatments that work	There's clear evidence from randomised controlled trials that the treatment works, and the likelihood of problems is small compared with the benefits
Treatments that are likely to work	We can't be as sure that the treatment works as we can for those listed under 'treatments that work'
Treatments that work, but whose harms may outweigh the benefits	Doctors and patients need to weigh up the benefits and risks according to what each person needs and wants
Treatments that need further study	We don't know if the treatments are effective because there is either too little research to tell or the quality of the research is not good enough
Treatments that are unlikely to work	We can't be as sure that the treatments don't work as we can for those in the group 'treatments that are likely to be ineffective or harmful'
Treatments likely to be ineffective or harmful	Clear evidence shows that the treatments don't work or will be harmful.

Design-a-Trial (DaT)

The Design-a-Trial (DaT) tool was developed by researchers to assist clinical practitioners in the design and planning of clinical trials. Before a trial can commence a trial protocol describing the trial must be submitted for approval. This protocol describes the planned trial and practitioners are not allowed to deviate from this protocol, once the trial has been given permission.

This protocol is complex in terms of the information that is required, which includes:

1. The medical interventions that will be administered
2. Sample selection criteria
3. Allocation of medicine to the sample (randomisation)
4. Details of monitoring and analysis of results
5. Information stating how the trial meets ethical requirements

Given the large data requirements that collating this information has involved in the past, this has often meant that protocols have had to be re submitted for approval as critical information had been missed off. Alternatively, there have been instances where, although the proposal was approved, the trial was poorly designed because the full set of research options had not been considered, and so the results were poor, thereby wasting money.

The DaT tool uses "expert rules and multiple knowledge bases to provide a logical intelligent, coherent guidance system (for completing the trial protocol) that not only provides advice to the user but also lets them know the reasoning that led to that advice", Nammuni *et al* (2003).

The design architecture for the DaT (shown in Figure II.3) is described in detail in Nammuni *et al* (2003). The DaT user interface is programmed in Microsoft Visual Basic.Net and WinProlog has been used to code the expert system core. The tool is split into a number of layers, which interact with each other, as shown by Figure II.3. The section titled 'business rules' allows the protocol to be developed in line with known constraints on the trials.

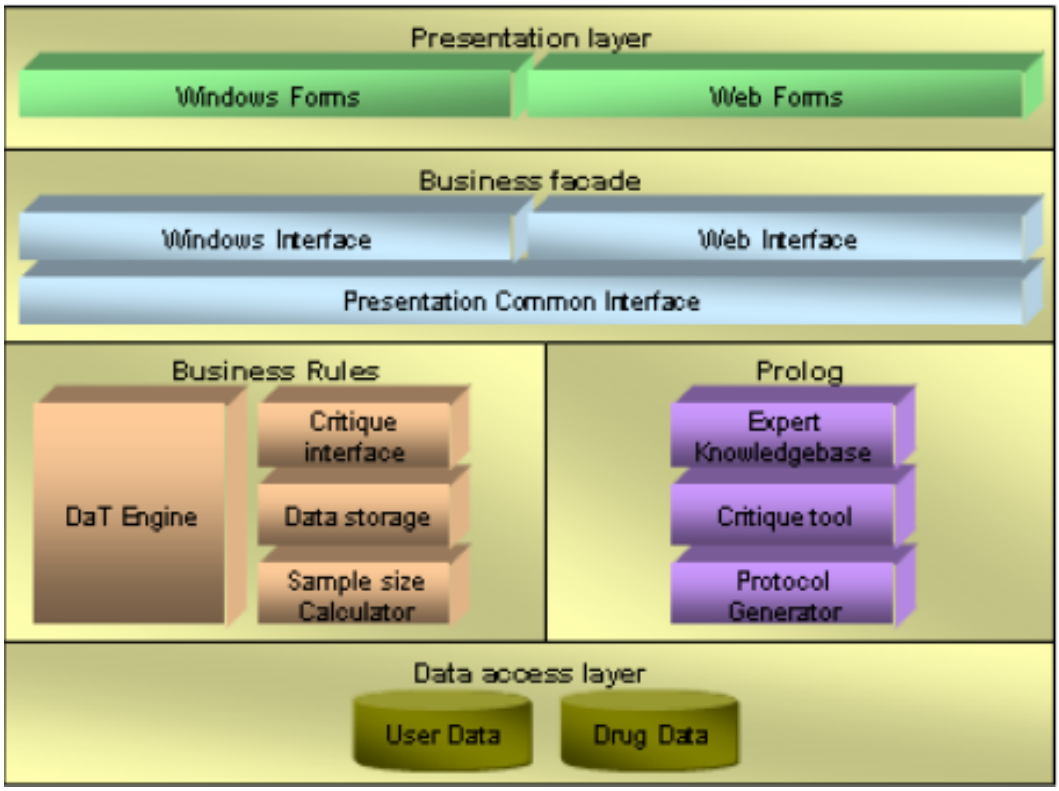
One of the key pieces of information required by the protocol is the sample size of the trial; this tool allows users to input specific data in order to determine the required sample sizes (*sample size calculator*). Statistical support is also available to help with the methodology design and provide more information on the statistical tests that should be used for a specific type of trial. The tool allows direct access to drug databases and an expert knowledgebase.

Built into the tool is a function that queries the validity of the data inputted. In order to advise the designer on "an ethically and sound trial" (ibid) three types of advisory critiques have been included in the *critique tool.* These are:

- Hard constraint violation
- Soft constraint violation
- Data validation error

If in the process of completing the proforma these constraint violations are raised, then this gives the trial designer the opportunity to modify the trial or enter a justification for causing the violation. The key output from this tool is a trial protocol document and ethics application form (*protocol generator*); for the user, they have the reassurance that if all sections have been completed, nothing has been missed from the application form.

Figure II.3: Architectural overview of 'Design-a-trial'



Source: Nammuni et al (2003)

New house/ job selection

The housing industry is also making good use of web-based tools to assist people in searching for and narrowing down their chose of available houses for detailed assessment from the currently available stock. For example, the 'rightmove' website[7] allows potential home buyers to generate options from their database, based on the key information known about the houses in their database. The search categories are:

- Search Location
- Search Area
- Type of property
- Minimum bedrooms
- Minimum price
- Max price
- Newly built/ resale
- Date included in the database
- Sort by price

[7] http:www.rightmove.co.uk

Related to this general approach are the web sites such as 'fish for' jobs/houses/cars[8]. Here, using a similar database system, it is possible to search for jobs, homes and cars. For example, the information required to generate relevant information about available jobs comprises:

- Job title
- Keywords
- Search within (location)
- Working hours
- Job type
- Salary
- Industry sector
- Date posted

The computer then uses the options entered to select the subset of jobs in the database that meet the requirements entered.

Summary

All of these examples of library based option generation systems combine detailed technical information and associated performance criteria. The relevant computer program can then directly search for a solution apply certain rules (e.g. NHS Direct and Fish4), or the decision makers can use the information provided to make their own decisions (e.g. VTPI). KonSULT has features of both approaches. The key to the success of these methods is establishing the rules/criteria and the detailed knowledge base.

[8] http://www.fish4.co.uk/iad

ANNEX III: MORPHOLOGICAL/PERMUTATIONAL APPROACHES

Morphological analysis was first developed by Fritz Zwicky (Zwicky, 1947) as a structure for systematically identifying the complete set of potential permutations for designing a particular system. Current applications of morphological analysis utilize this basic methodology to provide a structure to illustrate the range of choices available for a particular policy or strategy. Once all the choices are identified and input into the matrix (morphological box), and any infeasible options eliminated, it is then easier to consider all the potential combinations that could be used to design a particular policy and also identify where the gaps exist in the current options available. This structured process allows all potential options to be considered.

In this section, five morphological matrix examples are illustrated. Firstly, an application developed to aid transport planners in selecting road user charging options, then three examples outside of the transport planning area considering mobile payment systems, energy conversion, bomb shelter development and new types of electric vehicle. Finally, a hybrid approach, with elements of both library and morphological methods, is presented.

Transport example

Road user charging tool

Kocak *et al* (2005) describe a web based tool that was developed to assist local authorities in investigating first the suitability, and then the possible design, of a road user charging scheme for their local area. The development website for this tool is available at http://www.wmin.ac.uk/ruc.

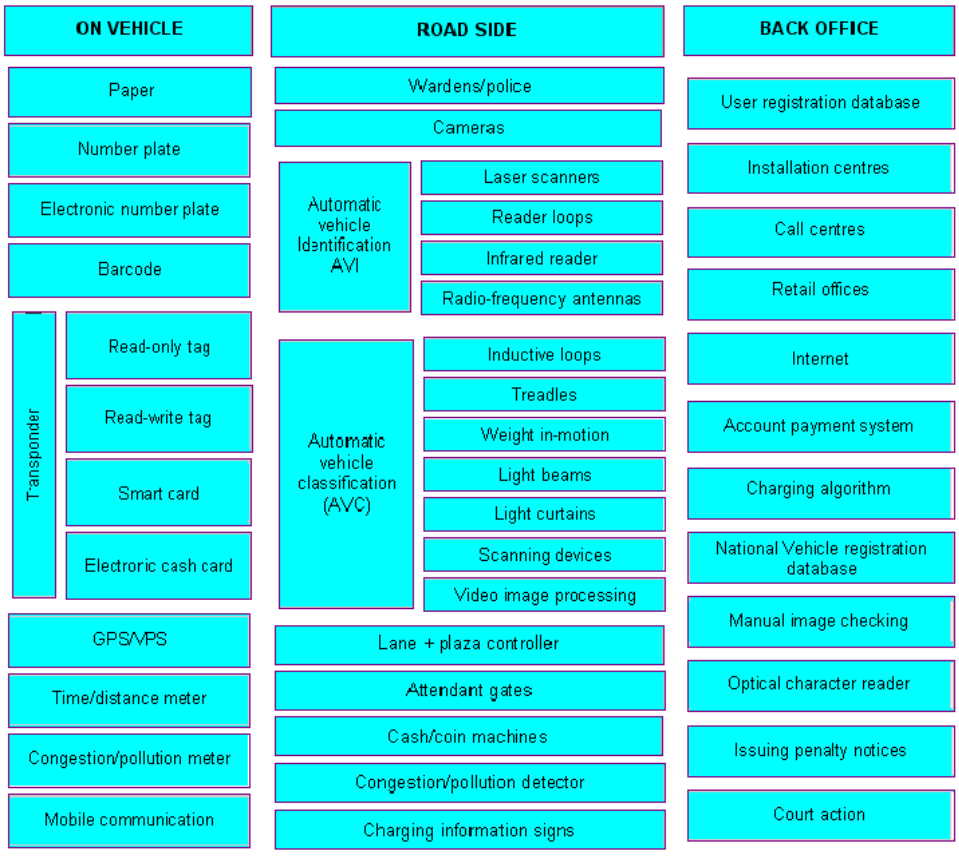
The option generation module is one element of this design process. It is based on a morphological box approach as the basis for mapping out the various options in the general design areas of 'charging principles', 'administration' and 'technology use'. The tool does not directly show all possible combinations of scheme parameters. Rather, it lists all the values for each scheme parameter in a simple-to-read matrix and, as the user builds up a scheme design option on the screen, it blocks out any values for subsequent parameters that are infeasible. For example, it would not be practical to introduce variable charging by time of day, using a London-type of area-based congestion charge.

The matrix developed for the potential choices of technology that could be used for road user charging is shown in Figure III.1. This considers all the main technologies that could be used on the vehicle, at the roadside and in the back controlling offices. It is then possible to consider different combinations of these technologies for use in the road user-charging scheme; again, some combinations are infeasible and are blocked by the software. Similar matrices were produced describing the design parameters for the charging principles and administration issues.

In the case of the charging principles, where the focus is on meeting policy objectives, the design parameters and potential choices are grouped under the headings of (Kocak *et al*, 2005):

- Area to be charged
- Period of time to be covered
- Type/Basis of charging
- Level of charge
- Charging entity/ unit
- Charging variations, according to:
- Time
- Location or network type
- Any variations based on user categories: Vehicles, Occupant, Intensity of use

Figure III.1: Technology Option Generation morphological components matrix



Source: Kocak *et al* (2005)

The value of these three matrices is that they illustrate all the elements of the potential options on one page, enabling all aspects to be viewed at once. Individual options can then be generated systematically, with the program checking for inconsistencies and combinational constraints, within as well as between the three matrices.

Professionals who have used this morphological approach have been reported as saying "…it makes you think about the wider implication of congestion..." and "no one has actually brought all the elements into one package before". This shows the value to UK local authorities of such an approach.

Non transport examples

Mobile payment procedures

Kreyer et al (2002) applied the morphological analysis technique to explore possible mobile payment procedures. The motivation for using this approach was twofold; firstly, to 'identify and characterise any given mobile payment procedure' and secondly, to develop an approach that would generate the maximum public acceptance given the need to make money with a commercial product. The morphological approach allowed all of the potential values of the parameters to be presented on one page. The resulting matrix is shown in Figure III.2

Figure III.2: Morphological components of mobile phone characteristics and options

characteristic		Instances					
strategic	payment scenarios	MC	EC	Stationary merchant	C2C		
	payment heights	picopayments	micropayments	macropayments			
participants	involved parties	customer	merchant	telco	bank/FSP	spec. intermediary	old economy
	receiver of customer data	merchant	telco	bank/FSP	spec. intermediary	none	
	pre-registration needed?	yes	no				
operational	technology required	SMS	WAP	dual-slot/dual-card phone	special payment software		
	basis of payment	account-based	token-based				
	payment frequency	pay per time unit	pay per product unit	subscription			
	deduction time	prepaid	instant-paid	post-paid			
	method for settlement	smart cards/ prepaid cards	electronic cash/ digital wallet	direct debitting	offline payment	credit card	telephone bill

Source: Kreyer et al (2002)

The initial stage in the development of the matrix was to identify the various contexts for using a mobile payments facility, which were: *mobile commerce* (MC), *electronic commerce* (EC), *stationary merchant* and *customer to customer* (C2C). Then to identify how the payment would be made, who the participants in the mobile payment were, and what were the operational issues (e.g. technology required, basis of payment). The research then used the matrix in Figure III.2 to describe the current mobile payment procedures, by highlighting the relevant boxes under each characteristic.

The final stage was to conduct a survey to determine whether an ideal type of mobile payment could be identified. While an ideal type was not identified in this process, the positive outcome was that this approach led to the recognition that an amalgamation of two or more types might reduce some of the negative aspects of mobile payment.

New propulsion systems

One of the key industries that Zwicky first applied his morphological approach to was the aeronautical industry. Figure III.3 illustrates the matrix that was developed to examine the energy forms used in the initial investigation of new propulsive systems. Using this matrix, it is possible to see that from a simple set of three characteristics and five states under each, a large number of possible permutations are possible (5^3), which can be generated and then be tested to see whether they meet the required objectives of the system in question.

Richey (1998) shows that considering the permutations of these five types of energy forms results in some very different outcomes. For example, *initial energy form* Kinetic, with *transmission form* Electrical and *final (storage) form* Chemical, can represent hydroelectric generation that is then stored in a battery. Alternatively, *initial energy form* Electricity with *transmission form* Chemical and *final (storage) form* Thermal represents a refrigerator (ibid).

Figure III.3: Energy Conversion Matrix (Example)

Initial Energy	Transmission Form	Final (storage) form
(K) Kinetic	(K) Kinetic	(K) Kinetic
(E) Electrical	(E) Electrical	(E) Electrical
(C) Chemical	(C) Chemical	(C) Chemical
(T) Thermal	(T) Thermal	(T) Thermal
(N) Nuclear	(N) Nuclear	(N) Nuclear

Source: Zwicky (in Ritchey, 1998)

Swedish bomb shelter program

Figure III.4 shows one of the matrices produced to consider the development of the Swedish bomb shelter program (Richey, 1998). As with the other morphological examples, the first process was to identify the factors (constraints and issues) relating to the scheme in question (e.g. what are the options for 'size' of shelter and the extent of 'cramming' of objects within the available space?).

The next stage was to develop the option levels for each of these key factors. The yellow highlighted boxes in Figure III.4 represent one option. Using this matrix, it is possible to identify and eliminate certain options that would not meet the required objectives, and in this way considerably reduce the potential number of viable combinations.

Figure III.4: An example of a Swedish bomb shelter program component matrix

Geographic Priority	Functional Priorities	Size and Cramming	When to build new shelters	Maintenance levels	General Philosophy
Metropoles	All socio-technical functions	Large, not cramed	With new construction	More frequent maintenance	All get same shelter quality
Cities +50,000	Technical support systems	Large crammed	Compensation where lacking	Current levels	All take same risk
Suburbs and countryside	Humanitarian aims	Small, not crammed	Only for defense build up	Lower or no maintenance	Priority:Key personnel
No geo-priority	Residential	Small crammed			Priority; Needy

Source: Ritchey T (1998)

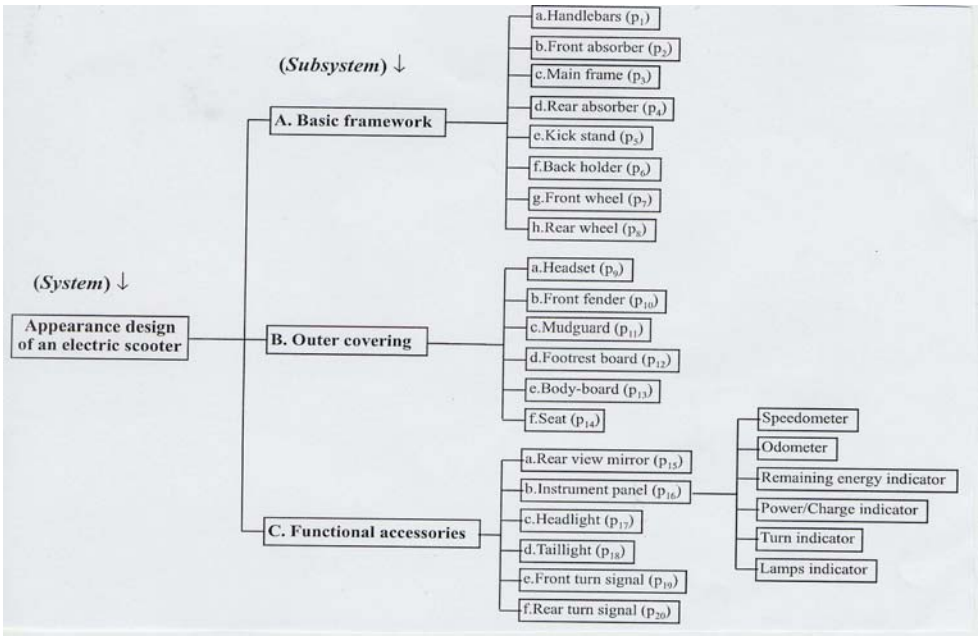
New types of electric scooter

Hsiao and Chou (2004) have applied a version of this technique to consider new types of product design for electric scooters. Firstly, they identify the full range of potential components of an electric scooter – both essential and optional - in a process that they call 'fractionation'(see Figure III.5).

Only a subset of the possible components of an electric scooter is shown here, namely the 'system' dealing with the external appearance of the vehicle. Three general sub-systems come under this broad heading, each of which has a number of components. For each component, there are in turn different ways in which is might be designed, for example, the height and shape of the handlebars (not shown in this figure).

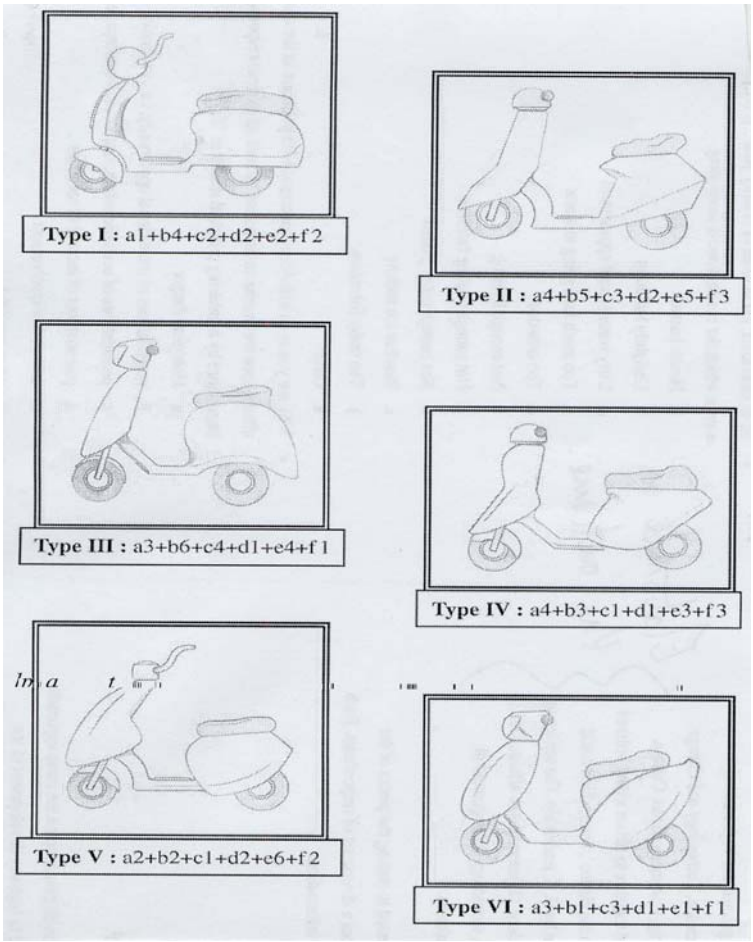
Each component and option is ordered and named and, from this, sets of new designs can be created (see Figure III.6 for some examples).

Figure III.5: 'Fractionation' of an electric scooter



Source: Hsiao and Chou, (2004)

Figure III.6: Some possible new designs



Source: Source: Hsiao and Chou, (2004)

Hybrid Approach: Concept Generator

The concept generator, described in Strawbridge *et al* (2002), is a computational tool that is based around a morphological box type of approach, but directly linked to a library of existing knowledge. In combining threes two approaches, it helps product designers to choose a suitable set of components for a given function in a redesign or original design situation, drawing where possible on existing design knowledge.

The key to the successful operation of the concept generator is the assembly and storage of design knowledge. In the example presented in Strawbridge *et al* (2002), the existing database of knowledge concerning a particular product is generated by producing a matrix which describes the sub-functions of a product in the columns and the components that have been used in the past to fulfil these sub-functions as the rows. The cells of the matrix are then filled in with a zero if the component is not used for that sub function and a positive integer ('1') if it is.

A matrix like this is produced for all the previous products that have potential relevance for the design in question. These separate matrices are then aggregated into a single design matrix containing all the sub functions, which records the number of times a particular component has been used for that sub function (e.g. as shown in Figure III.7).

The next stage is to characterise the new product in terms of the set of sub-functions that it is required to fulfil. These desired sub-functions are then cross referenced against the sub functions in the Design Matrix of existing knowledge, to produce a Filter Matrix (e.g. Figure III.8), which establishes for which of the desired sub-functions there is existing knowledge about possible components that can deliver that sub-function. This matrix displays a '1' on the leading diagonal of the matrix if the particular sub-function is present in both cases (i.e. it is a feature of the new product, and there is relevant existing knowledge).

	Import solid	Secure solid	Transmit force	Export solid	display disp	change disp	measure force	display signal
Cover	2	2	0	2	0	0	0	0
coil spring	0	2	0	0	0	0	0	0
Steel bar/plate	0	0	2	0	0	0	0	0
steel guide plate	0	0	1	0	0	0	0	0
steel channel	0	0	2	0	0	0	0	0
four bar linkage	0	0	1	0	0	0	1	0
Thin steel plate	0	0	1	0	0	0	1	0
Triangular linkage	0	0	2	0	0	0	2	0
Number plate	0	0	0	0	0	0	0	1
Needle cap	0	0	0	0	0	0	0	1
Dial	0	0	0	0	0	0	0	1
View window	0	0	0	0	2	0	0	2
No skid Pads	0	2	0	0	0	0	0	0

Figure III.7: Design Matrix

	Import solid	Secure solid	Transmit force	Export solid	display disp	change disp	measure force	display signal
Import solid	1	0	0	0	0	0	0	0
Secure solid	0	1	0	0	0	0	0	0
Transmit force	0	0	1	0	0	0	0	0
Export solid	0	0	0	1	0	0	0	0
display disp	0	0	0	0	0	0	0	0
change disp	0	0	0	0	0	0	0	0
measure force	0	0	0	0	0	0	0	0
display signal	0	0	0	0	0	0	0	0

Figure III.8: Filter Matrix

The Design Matrix and the Filter Matrix are then multiplied together, to obtain the component Morphological Matrix (e.g. see Figure III.9). The result is a matrix that shows, for each of the sub-functions associated with the new product, which components have been successfully used in the past. This provides a useful starting point for generating design options adopting a morphological box type approach..

	Import solid	Secure solid	Transmit force	Export solid	display disp	change disp	measure force	display signal
Cover	2	2	0	2	0	0	0	0
coil spring	0	2	0	0	0	0	0	0
Steel bar/plate	0	0	2	0	0	0	0	0
steel guide plate	0	0	1	0	0	0	0	0
steel channel	0	0	2	0	0	0	0	0
four bar linkage	0	0	1	0	0	0	0	0
Thin steel plate	0	0	1	0	0	0	0	0
Triangular linkage	0	0	2	0	0	0	0	0
Number plate	0	0	0	0	0	0	0	0
Needle cap	0	0	0	0	0	0	0	0
Dial	0	0	0	0	0	0	0	0
View window	0	0	0	0	0	0	0	0
No skid Pads	0	2	0	0	0	0	0	0

Figure III.9: Morphological Matrix

This method thus represents a combination of the library approach (as existing knowledge is used) and the morphological box approach, which allows designers to systematically select potential options for examination. In effect, it is a version of the morphological box, where the component options are limited to those that are known to have been successful in the past.

The advantage of this hybrid approach is that the various component options with a non-zero value in Figure III.9 have been 'tried and tested' as feasible means of delivering the required sub-function, suggesting a high degree of practicality. On the other hand, the approach cannot generate component options that have not been used before.

Summary

The morphological approach has been found to work well in presenting all the potential component options to decision makers, from which full options can then either be generated manually by professionals (or the public) or automatically. However, it only works well in a practical decision-making context when the full set of component choices is provided in the matrices – since decision makers can only select from among the information that they are given.

In most cases this requires the same kind of expert knowledge to construct the matrices as the library-based approaches use to develop their web databases, but with

two differences. First, much less detail is required as a part of the morphological matrix tool; second, the morphological box approach could contain components – and will certainly generate combinations – that do not currently exist, and so will not be found in library databases.

One of the challenges with the morphological matrix approach is to narrow down the very large number of potential combinations, by rejecting feasible sub-sets of combinations. This, again, requires relevant expert knowledge, and – if done automatically – requires careful thought and programming.

ANNEX IV: CONSTRAINED OPTION SOLUTIONS

Priority Evaluator

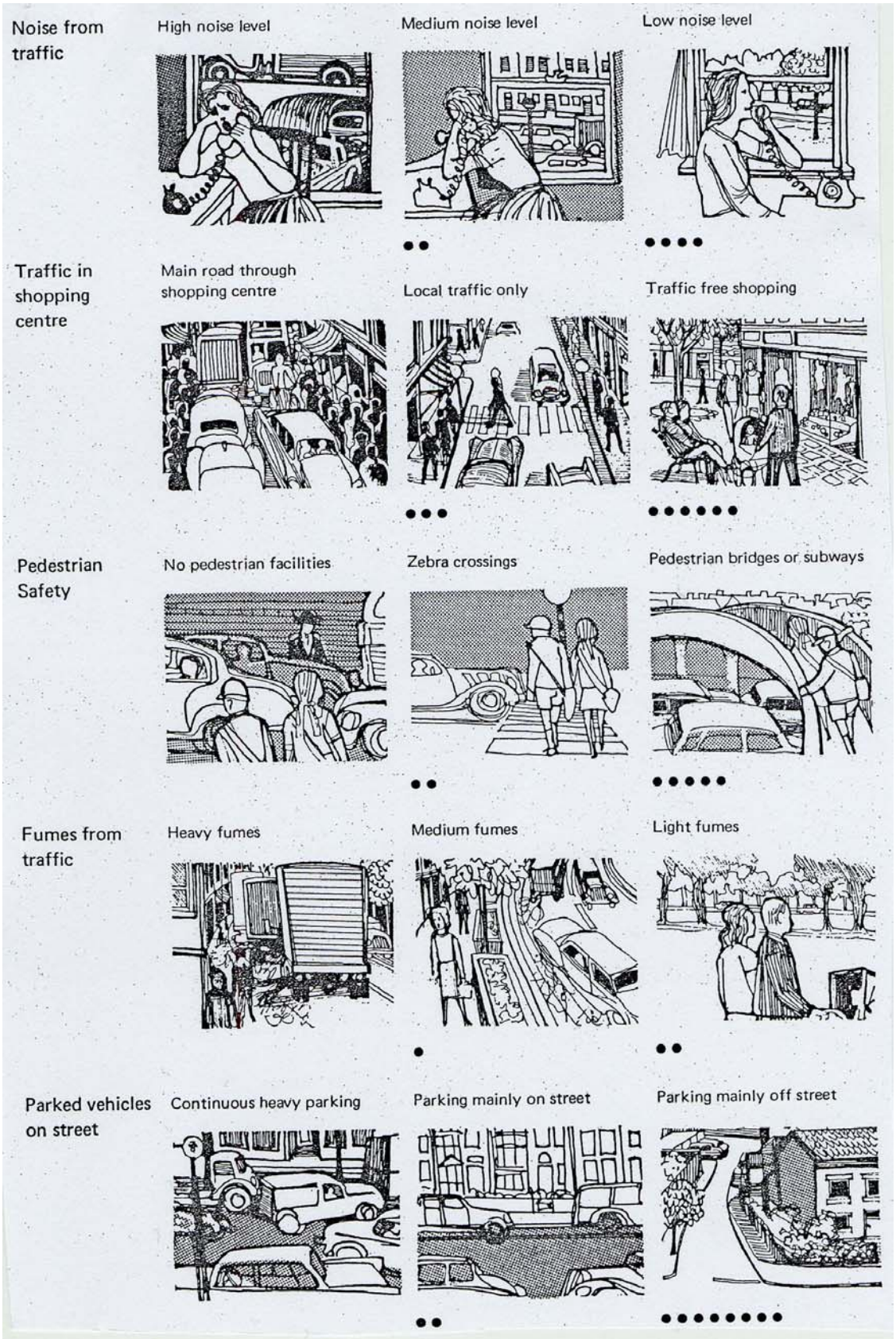
The Priority Evaluator was developed as a way of involving the public in planning decisions. Conceptually, the technique combines an economics-type approach to the allocation of limited resources with social survey techniques, in order to take into account factors such as social capital and community preferences. The method seeks to identify investment priorities in situations where there are limited budgets that require trade-offs among different attributes of potential schemes, and is particularly useful where there are conflicts of interest. The analysis is based on neo-classical microeconomic assumptions about consumer behaviour (e.g. trading marginal utility across all goods), revealing the respondents' ideal preferences within a limited budget, but unconstrained by the vagaries of the market (see the Australian Department of the Environment, Sport and Territories, 2005). A simple grocery basket analogy, giving people enough money to buy half the groceries in the basket, is a crude form of this approach.

The technique has some similarities with the morphological box approach, in that respondents are invited to develop their own 'products' (at the scheme level) or 'packages' (at the strategy level) comprising a series of attributes (or instruments), but their choices are constrained by the fact that there are prices or another measure of 'value' attached to each level of each attribute, and respondents are given a limited budget to spend. Once respondents have chosen their best package, by allocating a given budget, this can be increased, which allows the researcher to examine marginal utilities and identify the relative priority that respondents place on improving the level of service on one attribute compared to another.

Hoinville (1970), based at Community and Planning Research, was one of the pioneers of the approach in the planning field; he described the Priority Evaluator (page 48) as a "*means of communicating with the public in a way that allows us to understand something of the ambivalent nature of their attitudes*". There were many drivers for the creation of the Policy Evaluator method. Conventional participatory methods have been criticised as favouring the middle classes and lobby groups, and are often set up in reaction to specific circumstances, rather than being designed to elicit general, long-term community preferences. The technique goes some way to meeting the need to achieve reconciliation of conflicting preferences as well as the identification of relative priorities.

In the 1970's Social and Community Planning Research used a pictorial illustration of attributes and levels, with pictures tested for comprehension by traditional interview methods. A range of choices was then presented in rows and columns on an electronic board, with each row representing a particular attribute, for example 'fumes from traffic' (see Figure IV.1). Each attribute had a set of increasing levels of utility, running from left to right (i.e. from a poor standard on the left to a good standard on the right); for example: 'Heavy fumes', 'Medium Fumes', 'Light Fumes'. In each case the worst level was 'free' and higher levels had increasing price tags, in this example represented by holes in which the requisite number of pegs could be inserted to 'buy' that level of service. When respondents 'bought' a picture it would then become illuminated; conversely the light would go out if a peg were removed.

Figure IV.1: Part of the SCPR Priority Evaluator Board



Source: Hoinville, (1970)

Respondents were asked to consider themselves in the position of having to buy a house in a new neighbourhood. The cheapest house was in an area with the lowest level on each attribute (i.e. left hand side of the board); there were ten attributes in total and three levels for each. The cost of an attribute level ranged from zero to eight units, and respondents were provided with 15 units; at that time, each unit was notionally worth £100 (Hoinville, 1970). In theory, this gave respondents 3,700 possible sets of neighbourhood conditions, given their budget constraint. Although the technique did not account for interdependence between variables, it did provide an effective and enjoyable platform for the involvement of the public, while avoiding many of the pitfalls of other participatory techniques.

The Priority Evaluator technique was adapted in 1975 by Kitwe City Council in Zambia, to be used at the Copperbelt Agricultural Show, in order to ascertain housing preferences from the public. Just under 100 people took part in the exercise during the three day show (Tipple, 1977). Respondents were asked to devise their ideal home within a given budget, with eight areas of influence; plot size, number of rooms, wall construction, floor finishes, roof construction, power, washing and toilet facilities, and furniture. As with the example above, each area was represented by a row of 'windows' representing varying standards of each facility, again with a switch to illuminate the window. Two key modifications were made to the game. The first was a 'self-help' switch, giving the respondent the option of theoretically building the house themselves and thus cutting costs. The second was the use of three separate budgets, denoting three tiers of the low-cost housing clientele, each player being set a budget based on their monthly income and being placed in either a low-budget, mid-budget or high-budget category.

The game gave some useful and interesting findings. Players were willing to sacrifice plot size in return for more money in their budget to spend on other things. In the tropics, larger plots require considerable maintenance in the wet season and urban dwellers appeared unwilling to make such a commitment, despite the prospect of having land to grow crops on in the curtilage of their house. The low-budget players preferred beaten earth floors and Kimberley bricks, with vinyl tiles and concrete being preferred by high-budget players. No player was satisfied with having outdoor washing and lavatory facilities, regardless of the potential savings. Electricity was also far more preferable to players than authorities had previously expected. At the time Kitwe City Council was building approximately 100 new houses for the rental sector, to a specification at odds with the results of the priority evaluator game, with too much emphasis on the standard of materials and finishes, and too little on the provision of electricity and a larger number of rooms in each dwelling (Tipple, 1977).

Strings and Ribbons:

The Strings and Ribbons Game is a visual approach to decision making and participation that embodies many of the concepts behind the Priority Evaluator mentioned above. It aims to provide as accessible a method of public engagement as possible, and uses budgetary constraints as a framework. It is essentially a consensus building game that encourages cooperation and collaboration among its participants. Participants can play the role of decision makers and explore the necessary trade-offs involved, and generate and contribute ideas that would not come from a committee or public meeting type of forum.

Working in groups around a table, each player is given a sum of money to purchase some transportation improvement projects, with the objective of developing a transportation plan. To assist in this process, participants are provided with a large scale map of the area in question, and an indication of the costs of purchasing units of projects (e.g. miles of cycle lanes). Projects are decided on by the group, then purchased and the appropriate material is then glued to the map. This results in a visual representation of the ideas and projects that participants, after much deliberation, have agreed should be implemented in their area with the available collective budget.

The Volusia County Metropolitan Planning Organizations (MPO) adopted the Strings and Ribbons game during the development of its 2025 Long Range Transportation Plan, in order to create a 'pro-active citizen input process'. Each table was provided with strings (representing bicycle and pedestrian facilities), ribbon (roadway facilities), stickers (other forms of improvement projects), and the equivalent of twenty years of funding, divided equally among the players (VCMPO, 2004).

Figure IV.2 illustrates the game in action, while Figure IV.3 shows some of the completed recommended transportation strategies that were recommended by different groups participating in the sessions.

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Figure IV.2: The Strings and Ribbons game in action

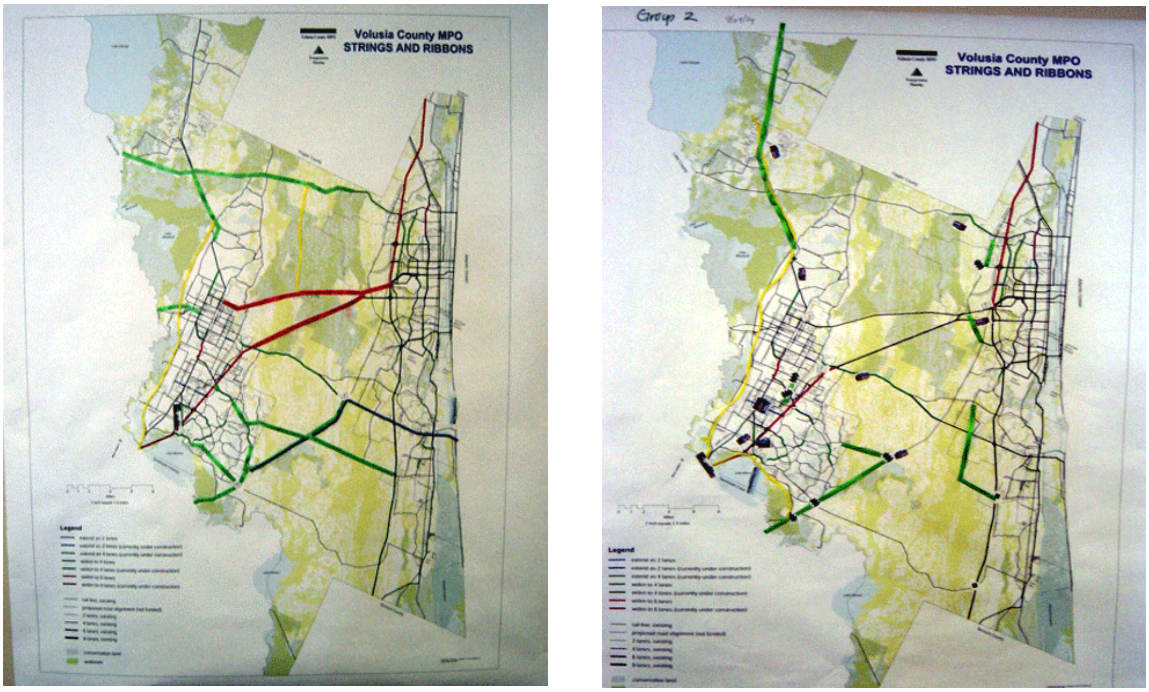
Source: VCMPO, (2004)

When players did not have enough money to complete a project on their own, as was often the case, they were forced to negotiate with other players in order to raise the necessary amount.

The Volusia County MPO feels the process has highlighted both consistencies and inconsistencies between provision of services and public opinion and will continue using the game to enhance their policy options.

Two output maps from their most recent forums are shown in Figure IV.3 (VCMPO, 2004).

Figure IV.3: Two Strings and Ribbons derived recommended strategies for Volusia County



Source: VCMPO, (2004)

ARTISTS Streetscape Design

The 'ARTISTS' project was a three-year project funded by the European Commission, with the aim of seeing how mixed use main roads in urban areas – known as 'Arterial Streets' - could be made more sustainable, in the broadest sense, with the close involvement of local communities. Details of the project can be found at ARTISTS (2004).

One aspect of the study involved developing tools to encourage various stakeholder groups to contribute their detailed ideas to the redesign of local street sections. Three types of streetspace design aids were developed by the project team:

1. **Posters**: these were used to display a breadth of options – including good practice examples from a range of countries – to assist participants in the generation of ideas for design options. Some posters were in the form of montages of street elements, while others showed 'before' and 'after' conditions on arterial streets that had been treated in cities represented by the project partners.

2. A **Street Elements Information Pack** (SEIP), which was provided in the form of a folder containing information about 39 street elements, from cycle lanes to street furniture and loading provision. Each sheet was double sided, and provided basic information about the element, what it does, any design considerations, and what it looks like when implemented in different settings.

3. A set of **Transparent Overlays**, drawn at a scale of 1:200, to enable workshop participants to see what the space requirements would be of many of the design elements provided in the folder and illustrated on the posters.

The Transparent Overlays represent an unusual form of constrained option generation, with the constraint being the space between the building lines[9]. Two types of transparent overlays were provided:

- Longitudinal ones, to be laid in parallel along sections of the street; and
- Cross sectional ones, to enable participants to focus on space constraints at particular pinch points.

Photographs of some of the overlays being used in workshops in Spain and Sweden are shown in Figure IV.4, while details and examples of the overlays themselves are provided in Figure IV.5.

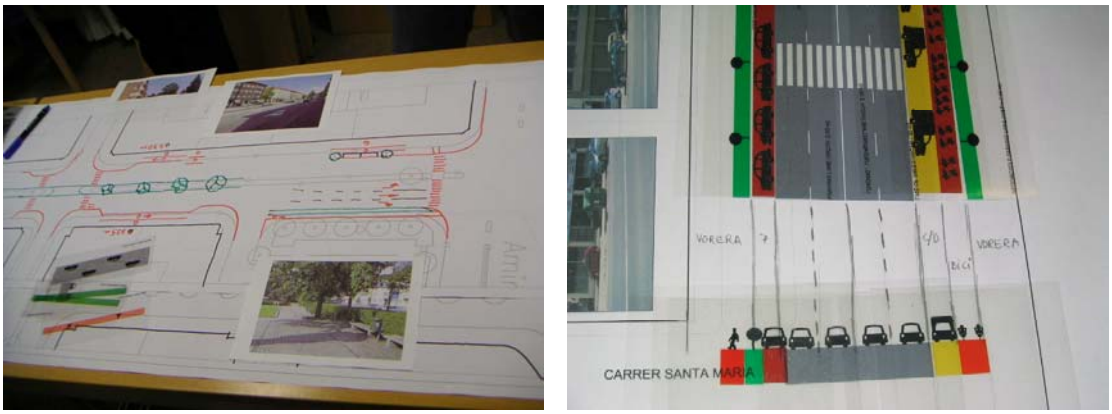


Figure IV.4: Use of overlays in street redesign exercises in Malmo (left) and Girona (right)

The approach was applied in several European cities, and generally worked well. In particular:

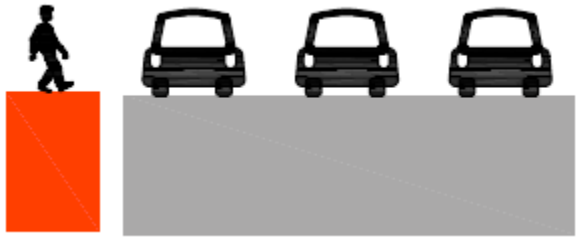
- It enabled people to generate and experiment with a wide range of possible combinations; and
- Acted as a stimulus for thinking of new solutions.

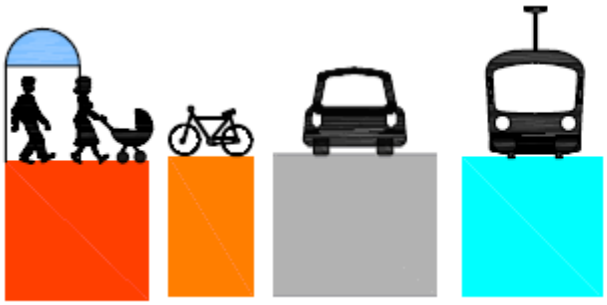
While it was developed primarily to work with non-professional stakeholders (i.e. local residents and businesses), some city partners saw potential for using the materials in training sessions for more junior professional staff.

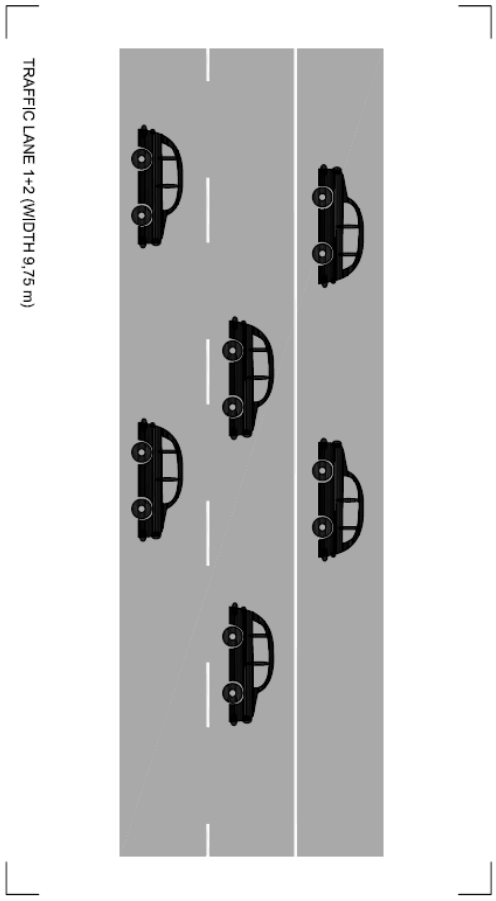
[9] It would be possible to go further, and introduce a second, cost constraint – conditional on the space requirements constraint having been met - but this was not done within ARTISTS.

FIGURE IV.5:
Transparent Overlays USED TO GENERATE CONSTRAINED OPTIONS

1. *Pedestrians*
   Footway
   Non-signalised pedestrian crossing
   Signalised pedestrian crossing
2. *Cyclists*
   Marked one-way cycle lane (on-street)
   One-way cycle path (cycle track)
   Two-way cycle path
   Bicycle parking
3. *Bus users*
   One-way bus lane
   Bus stop with shelter
4. *Tram users*
   Two-way tram tracks (two tracks)
   One-way tram track
   Tram stop with shelter
5. *Van and truck drivers*
   Loading / unloading
6. *General traffic*
   Two-way traffic lanes (two lanes)
   Two-way traffic lanes (three lanes)
   Two-way traffic lanes (four lanes)
   Parking lane
   Motorcycle parking
7. *Junctions*
   Roundabout
8. *Street furniture*
   Line of trees / greenery







Note: overlays can be reversed and so may be used whether vehicles drive on the right or on the left.

Overlays are provided in plan and cross-sectional views. The varied shapes of junctions have meant that standard overlays are not provided for junctions (except a roundabout). Instead, participants and facilitators of design workshops are encouraged to draw their junction designs directly on blank overlays or base plans.

Most of the design elements included in the street elements information pack (SEIP) have corresponding transparent overlays. The full set of overlays is available from the ARTISTS website.

ANNEX V: STRUCTURED APPROACHES

Mind Mapping

Mind mapping is based on research that suggests our thought processes begin with a central focal point and then work outwards in an organised fashion, as opposed to the left-to-right, up-and-down way we visually organise information on paper (Higgins, 1996). There are several forms of Mind Mapping, though all forms are fundamentally a graphical illustration of the structure of knowledge; and provide strategies designed to show the relationship between words or concepts, all through graphic representation (Intraspec, 2005).

Mind mapping was developed as a method for externalising new ideas quickly and easily, and is an advance on a commonly applied tool for problem analysis known as a spider chart, in which ideas radiate out from a starting issue or concept, and. With mind mapping a large piece of paper is used to record all the ideas around a central topic (as in a spider chart), but with connecting lines being drawn between linked ideas - to form a map of the mind or current state of knowledge.

The SODA study

The mind mapping method formed a key part of the SODA study (Hjortso, 2003). SODA (Strategic option development and analysis) was developed for the management of situations involving group decision-making. Strictly speaking, it is a tool for identifying, validating and embracing the potentially conflicting pre-conceived ideas of previously excluded stakeholders, rather than for generating new ideas. However, because these pre-existing ideas may not have previously been in the public domain, the tool has the effect of changing the action strategies of professional decision-makers.

For each participant, a cognitive map is produced describing his or her thought processes on the subject under discussion. These maps are then merged by the facilitator to form a single map, described by the authors as a 'facilitation device', with the objective of comprehensively describing all aspects of the issue under consideration, including suggested options and their positive and negative consequences.

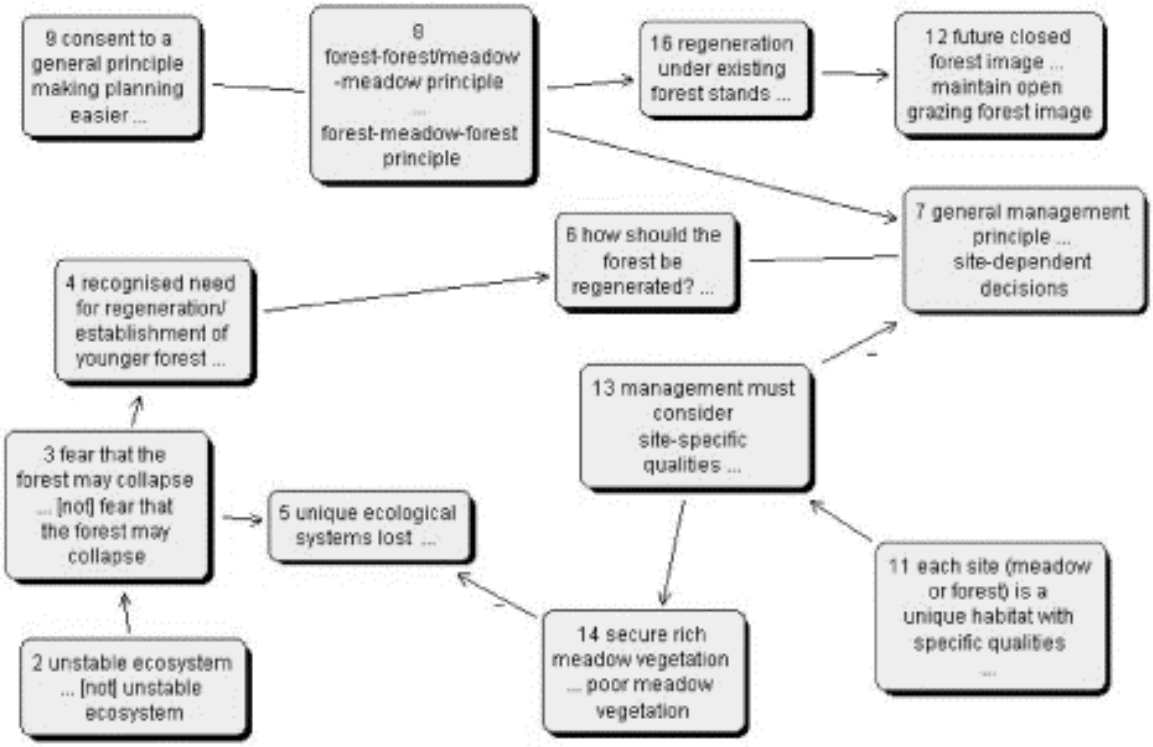
Hjortso disseminated the 'facilitation device', which included over 500 concepts and 17 themes, in 'an idea and debate catalogue' and distributed this amongst all council members and forestry planning staff. They were asked to evaluate the usefulness of the catalogue in a questionnaire and two group interview sessions. The questionnaire included 17 questions with options for quantitative ranking and two qualitative questions. Of the 108 ideas for action that emerged from the facilitation device, councillors evaluated that 20 were considered 'new and meaningful'.

In the case study that Hjortso carried out a problem was identified amongst stakeholders formulating ideas around the regeneration of grazing forest. Mind mapping was used as a facilitative device to highlight conflicting views from environmental NGO's and the Danish Forest and Nature Agency regarding the application of general forest management principles. There was a conflict between

those who favoured the planting of new forest on present meadows (the forest-meadow-forest principle in the figure below) and those who favoured planting new forest under existing forest (the forest-forest and meadow-meadow principle). Given that the environmental qualities of different habitats vary differently these two approaches were limited, especially when applied to the regeneration of forests on a case-by-case basis.

A map was used to highlight the inadequacies of the two approaches, helping to achieve an acceptance between the two opposing groups and create a new framework for tackling forestry problems (see Figure V.1).

Figure V.1: Regeneration of forests mind map

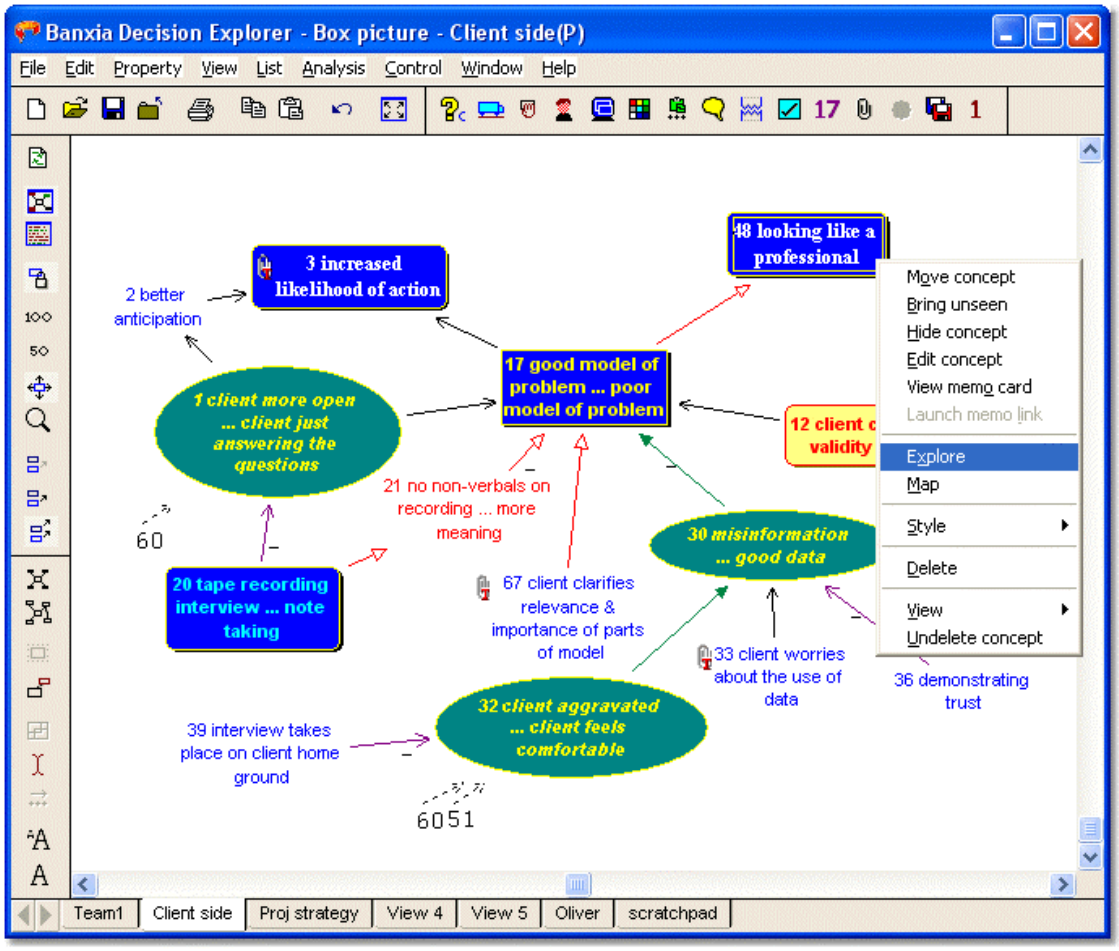


Source: Hjortso (2003)

Decision Explorer

Decision Explorer is a software package for managing the information that arises from examining complex situations. Thoughts and ideas can be captured and explored in detail, giving a fresh perspective. The technique used by Decision Explorer adapts the mind mapping technique, with the links between ideas providing structure to the model and highlighting the inter-relationships of different elements. Decision Explorer maps are not static pages, unlike conventional mind mapping, allowing for a more dynamic view of much larger models. The size of the mind map is potentially limitless, allowing the participant(s) to keep working with and adding to a model over time. Figure V.2 provides one example.

Figure V.2: Example of a Decision Explorer Map



Source: Banxia Software (2005)

A version of this kind of approach has been embodied in the ThinkMap Visual Thesaurus (Figure V.3), an on-line thesaurus that utilises semantic mapping, allowing the user to input a particular word to create a semantic map of possible associated meanings (Visual Thesaurus, 2005). Although not designed primarily as an option generation method, it clearly has some potential in this regard.

Figure V.3: The Visual Thesaurus

Source: Visual Thesaurus, (2005)

Six Thinking Hats:

Six Thinking Hats is a group-based approach designed as an alternative to adversarial approaches to discussion, utilising lateral thinking and our ability to empathise. With this tool there are six different coloured, imaginary/metaphorical hats that can be put on or taken off, with each hat representing a different mode of thinking. The whole group wears the same colour hat at the same time for a limited time period and all participants change hats at the same time.

The technique aims to improve productivity, enable thorough but quick evaluation of ideas, challenge current thinking, develop a cooperative culture and enable team-working. The game allows all team members to make a firm contribution and encourages otherwise reticent people to become involved in option generation (Six Thinking Hats, 2005). It can also be useful in overcoming cultural differences, as is shown in the example below.

Six Hat Thinking - a tool for participation in development

The ABCD programme (Achieving Better Community Development) is an integrated community development scheme promoting inclusive agricultural activities and the use of appropriate technologies. In this example, Christian Outreach, in partnership with World Concern, promoted the use of three types of human-powered pumps across four communes centred around the town of Prey Veng.

The project started in 1993 and continued into 1996 by which time, 2,480 pumps had been installed. The project was deemed successful as local manufacturers readily made the pumps and added their own improvements. The Six Thinking Hats technique was used as part of the process. After use of the hat thinking in training sessions, the staff were encouraged to use it in their work with local farmers.

A typical discussion is given below, concerning water supplies in a village (Batchelor, 2000):

White hat

The White hat deals with hard ‘facts’. It was used to ask questions like ‘Where does the water come from?’ ‘What do we know about its source?’ ‘Who collects the water?’ ‘Who uses it, how much is used?’ and ‘Who drills for water?’. By focusing on the facts of the situation, it avoids any assumptions that people might have, for example that ‘there is enough water below ground, it’s simply that there aren’t the means to dig for it’. It exposes whether there is actual knowledge to support this assumption, and encourages the participants to discuss how to obtain that knowledge or skills set.

Red hat

The Red hat asks for feelings, intuitions and instincts, and serves to legitimise these

feelings that are often suppressed, on the grounds of being irrational – even though they may play an important 'hidden' role in decision making. People would say that they need more water, that it would make life easier and stop their children from becoming sicker. One participant said that they didn't 'like' hand pumps and wanted an open well.

Black hat

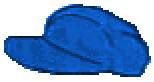
The Black had represents caution and is used to identify any potential problems. With water supplies, likely key problems are skills shortages and lack of money. Participants decided to work together to dig a well, or to fund a community supply in order to pay for a professional driller.

Yellow hat

The Yellow hat encourages positive thinking, looking for benefits and good aspects. For example, a new water point would allow for the growing of vegetables, benefiting the economy of the village.

Green hat

Wearing the Green hat asks the group for creativity and new perceptions or concepts that might not have been considered. For example, 'what else, other than a well, can be purchased for $250? - several hundred hand-pumps?. One village proposed sacrificing some money for hand-pumps and purchasing instead some drilling equipment. They acted on this idea, drilling their own wells for free, before setting up a business providing a drilling service to other villages, with the profits going back into the village fund. This village now has the most hand-pumps of all the villages. A variety of lateral thinking techniques may be employed to assist at this stage (see Annex VI).



Blue hat

The Blue hat manages the overall process and draws the discussion back to its original purpose, should it become distracted. Unlike the other hats, it is usually worn by just one person in the group. The participant wearing the blue hat might ask why they are discussing the water supply in the first place, or stopping the group becoming fixated on the need for an open well. The actual aim may not be simply to get more water, but to help the village develop and prosper. Alternatively, the Blue hat could widen the discussion to include relationships, stimulating discussion on the wider issues: a good way of obtaining water might not be the most constructive way of encouraging community spirit.

Exploring Local Environmental Issues

In 2003 and 2004, research was undertaken into local environmental issues for the Joseph Rowntree Foundation by the Centre for Sustainable Development, University of Westminster, looking at the extent to which Local Strategic Partnerships recognised the concerns of the local neighbourhoods they represent and their efficacy as a participatory process (Lucas *et al*, 2004). Two case studies were examined in Tameside and Wolverhampton, six local neighbourhoods in total. The Six Thinking Hats technique was used to ascertain the key issues and priorities that concerned local people in their respective areas, as a starting point for generating solutions.

A range of statements was devised, based on the priorities identified by a puzzle game and a structured discussion previous to the Six Hats exercise. One example was "All poor-quality houses in this neighbourhood should be demolished". Areas looked at included: Young People and Anti-Social Behaviour, Litter and Street Cleaning, Pest Control, Dog Fouling, Fly-Tipping, Parks and Safe Outdoor Play Spaces, General Maintenance Issues, Local Air Quality, Traffic Noise, Dangerous Roads, Building Community Spirit and Access to Information. Each statement would be addressed using the six hats.

The feedback from the first example of Young People and Anti-Social Behaviour shows the effectiveness of the Six Hats method. Participants begin by talking of people in their area being scared to leave their house because of 'gangs' of youths hanging around, and related problems like vandalism and the shop closing early. However, there was also general agreement from the groups that there was too little for young people to do in the area, one participant noting, "Who wants to stand outside a shop all day long, it would do your head in wouldn't it?"

And so solutions moved on from a simple emphasis on better policing, to addressing some of the underlying factors that contributed to youth disaffection.

Creative Thinking Training for Transport for London

Between 2000 and 2002, the Transport Studies Group at Westminster carried out an extensive training programme for the Street Management arm of Transport for London, in all involving around 1,000 staff at all levels of seniority.

The purpose of the exercise was to introduce staff to the Mayor's Transport Strategy and the associated programme for implementation, and to encourage innovation and 'out-of-the-box' thinking about ways to address the various challenges. In several areas – for example, walking - the Mayor wanted London to become world leading, and so simply copying and adapting solutions from elsewhere would not be sufficient.

After a serious of lectures about the Strategy and the Business plan, staff were split into workshop groups of around 10-12 people, and used the Six Thinking hats approach to come up with innovative solutions to one of four general, pre-defined problems. At the end of the day, groups presented and compared their findings.

Preliminary results are summarised in Jones *et al* (2001). The exercise was very successful at team building, and at encouraging people to think more openly and

creatively, in a non-threatening environment. Some suggestions were quite radical and exciting. For example, under 'Making better use of the River Thames', suggestions included:

- Building a floating island in the area of the City of London, to provide public space and help to unite both sides of the river;
- Build more pedestrian links across the Thames, with a suggestion to build a transparent tunnel on the riverbed, so that pedestrians could view the river from below; and
- Reintroducing shops and services on the Thames bridges (e.g. on the wide London Bridge).

Laddering:

Laddering uses structured questions to create a hierarchy of concepts, from which new solutions can emerge (Corbridge *et al*, 2005). Beginning with the 'seed item' – the original concept or problem, or sometimes a random word - a series of questions are asked in order to place the original concept or problem in a broader conceptual framework. These questions, or 'probes', can move the concept or problem in various directions. The technique thus allows a problem or concept to be approached from several viewpoints.

Rugg *et al* (2002) use the example of Linnean taxonomy. Pine martens and sea otters are both mustelids and would be located near to one another on a taxonomy grid. If the probes concern habitat, however, the two species are located far apart, sea otters living in the sea and pine martins in tree tops.

Laddering will encourage the participant to think both laterally and literally, by moving 'up the ladder' from a specific position to an abstract one and then working back down the ladder again. The participant can add, delete, rename or re-classify each rung of the ladder, as appropriate (Epistemics, 2005).

This can easily be applied to a planning issue, utilising predefined probing questions such as 'why?' on the way up and 'so what?' on the way down. For example, exploring the existential imperative of pavements, as shown in Figure V.4.

Figure VI.4: A Laddering Example

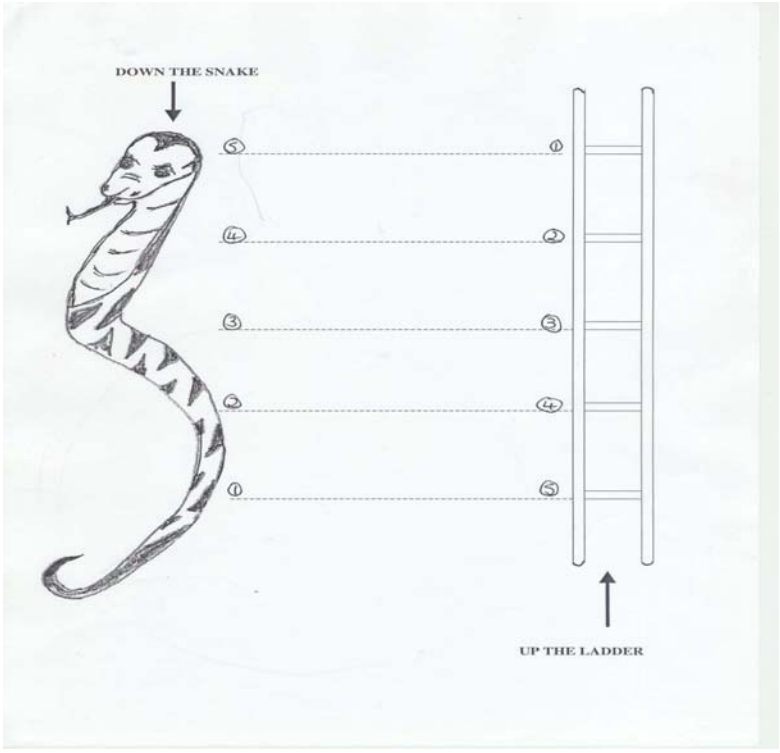
WHY?	↑	6. Enjoy life	**SO WHAT?**	↓	7. Fulfilment
		5. Survival			8. Procreation
		4. Meet our needs			9. Children
		3. Mobility			10. Safety
		2. Walking area			11. Safe upbringing
		1. Pavements			12. Safe pavements, less accidents and lower infant mortality rates

The 'Snakes and Ladders' game

The Snakes and Ladders game was designed for use at a workshop on addressing environmental inequalities. It was run on behalf of the Environment Agency for a group of policy makers and practitioners from a variety of governmental and non-governmental organisations (Lucas and Psaila, 2005). It is a modified form of laddering. The aim of the exercise was, firstly, to get the participants to explore the meaning of 'cumulative environmental impacts' (CEI) and when, where and why they might need to understand and assess these in relation to deprived communities. Secondly, to prompt them to consider and evaluate different potential approaches to, and methods for, assessing cumulative environmental impacts in deprived communities. The game was only one in a raft of techniques used to achieve this outcome. It was introduced after an initial brainstorming session with the group and was followed by other exercises to expand and refine their understandings.

The participants were asked to work in pairs to complete a worksheet (see Figure VI.5). Each pair was asked to select an environmental impact or risk and to use the snake to identify five stages in a spiral of environmental decline as a result of this. They were asked to particularly focus on the effects of this decline on vulnerable groups and communities living in the affected area. Concentrating on the needs and concerns of these people, they were asked to use the ladder to describe a five-staged policy response to address the cumulative environmental impacts they had experienced. In addition, they were required to consider whether there might be points of 'critical impact loads' and 'critical mass' in effectiveness of the policy responses. Each pair reported back to the whole group, including the mention of any particular difficulties they had experienced in undertaking the exercise.

Figure VI.5: Snakes and ladders worksheet



Source: Lucas and Psaila, (2005)

The output from this exercise is well illustrated by the example of a community living in close proximity to a landfill. The five key issues identified as part of the 'snake of decline' and the subsequent 'ladder of success' are summarised below:

5 steps of decline:

1. Loss of land, smells, lorry movements
2. Pollution, air quality, water quality, contamination
3. Road safety, asthma, house price reductions
4. Play areas, basic enjoyment of property, lost leading
5. Isolation – those who move away do leaving a higher proportion of vulnerable groups

5 steps out of improvement:

1. Securing better conditions on licenses, methane use
2. Providing more recycling facilities to reduce overall quantity of waste
3. Secure improvement in operation, e.g. movement of trucks
4. Form action group and challenge planning decisions
5. Recognition and desire to do something – community take control of facility and have an active role in its management

Participants reported a number of difficulties in completing the exercise, including the non-linear and layered nature of the impacts; overlaps between social and environmental impacts and identifying appropriate solutions. This was the intended outcome of the exercise, as it brought participants to a relatively quick understanding of the complexity of the issue, the interconnectivity of environmental, economic and social disadvantage and the need for integrated policy solutions to address the environmental decline of poor areas.

ANNEX VI: UNSTRUCTURED APPROACHES

Lateral/Creative Thinking

The Oxford English Dictionary describes lateral thinking as "a noun (chiefly British) the solving of problems by an indirect and creative approach" (OED, 2005), a process that encourages the thinker to move sideways when working on a problem to find different perceptions and points of entry. Lateral/Creative thinking covers a variety of techniques that encourage the thinker to move away from the usual line of thought, cutting across patterns in a self-organising system (MyCoted, 2005a). The term can be used specifically to describe a set of techniques that change concepts and perceptions and generate new ideas, and more generally when exploring multiple possibilities and approaches rather than pursuing one single approach (MyCoted, 2005b).

Edward de Bono describes lateral thinking and lateral creativity as a "way of thinking that seeks a solution to an intractable problem through unorthodox methods or elements that would normally be ignored by logical thinking" (De Bono Homepage, 2005). De Bono divides thinking into two distinct approaches, 'vertical thinking', using the traditional processes of logic, and 'lateral thinking', disrupting a logical sequence and finding a solution from a different angle (De Bono, 1970).

De Bono suggests, for example, taking a newspaper story and deliberately making a favourable story unfavourable, or approaching it from a different angle. For instance, a newspaper story of an eagle that has escaped from the zoo and is perched on a high branch and difficult to capture. From the keeper's point of view, the bird may fly away and never be seen again, resulting in the keeper getting the sack. From a newspaperman's point of view, the longer the bird stays there the better the newspaper story. The onlooker is bemused by all the fuss, but enjoying the spectacle. The Eagle is getting hungry and happy not to be in a cage (De Bono, 1970: 76-77).

De Bono argues that, if you give a child a dolls house with all the pieces in place, they have no choice but to use it as it is. If, however, you give a child building blocks they can make as many different houses as they like (De Bono, 1970: 116-7). The process of 'fractionation', breaking something down into as many parts as possible, is one technique in lateral thinking. De Bono suggests taking a situation where a problem exists, for example apple picking, and fractioning the problem into, for example, 'reaching', 'finding', 'picking', 'transport to the ground', 'undamaged apples'. These fractions can then be reassembled putting 'reaching-finding-picking' together, then substituted by shaking the tree as a solution. The fractions could be reassembled as 'reaching-undamaged' 'apples-transport to the ground' (1970: 118-9). Either way, the situation will be viewed from a new angle.

The Six Hats method mentioned in Section V has elements of lateral thinking, particularly in the way the participant is encouraged to see a particular problem or scenario from a different perspective, with a participative approach. However, the techniques below are more essentially lateral in that they seek to generate options that the participant will not have considered, approaching a problem or situation from a perspective the participant will not have previously thought of using, subverting our usual thought processes.

For example, De Bono suggests a simple, self regulating solution for a factory that uses water from a river and then pollutes the river through discharges at the end of the industrial process: place the inlet pipe upstream of the outlet pipe, so the factory has to deal with its own pollution.

The Concept Fan

The concept fan is one lateral creativity technique that looks to create a range of new options that otherwise might not have been considered. As the brain immediately jumps to the most practical solution when faced with a problem (for example 'needing to reach up high' the brain leaps to 'find a ladder'), De Bono has created the 'concept fan' as a way of avoiding this mental pitfall. De Bono uses the classifications of 'directions', the broadest possible concept, 'concepts', general methods or ways of doing something, and 'ideas', specific concrete ways of implementing an idea (De Bono, 1992).

Taking the problem of a water shortage, some approaches or directions to solving this problem might be 'reduce consumption', 'increase supply' or 'do without'. These directions can then be developed into concepts, a way of achieving the direction. In the case of 'reducing consumption' this could be 'increased efficiency use', 'discourage use', 'education'. For increase supply we might have 'new sources', 'recycling'. For the direction of 'do without' we might have 'substitute other substances'. These concepts can then be developed into ideas. With, for example, 'discourage use' we might find ideas like 'charge for water', 'meter the water', 'water only at certain times', 'publish names of heavy users', 'threaten users with rationing', even 'put a harmless bad smell into the water' (De Bono, 1992).

The emphasis is very much on achievement, on overcoming a particular problem, rather than merely on description or analysis. De Bono uses the example of traffic congestion (De Bono, 1992). If you think of an idea you can move 'upstream' – towards the left in the diagram below - by asking 'how does this help?' If you think of a direction or concept you can move downstream – right in the diagram - by asking 'how can this be carried through?'

Figure VI.1: Example of De Bono's 'Concept Fan'

Ideas	Concepts	Directions	Object/Purpose
Working at home	Reducing the need to travel	Reducing the traffic load	
Car pooling	Increasing the density of people per vehicle	Public transport	Decrease traffic congestion
Staggering working hours	Reducing the peak load	Improving flow along existing road	

Source: de Bono (1992)

The Random Input

Random input is a systematic technique for using provocation in a deliberate way. De Bono suggests finding a random word, from a dictionary, newspaper or other random stimulus that will have no connection with the identified problem or situation and then force a solution (De Bono, 1992). De Bono uses the abbreviation 'Po' for provocation and places it as a bridge between two words.

One example is 'Office Copier Po Nose', looking at ways to increase the effectiveness of a photocopier with the random word 'nose'. The brain immediately associates nose with smell and new options can be generated from this. For example, smells could be used to signal when a copier is out of paper, perhaps a lavender smell, or out of ink, a camphor smell. This would allow people in the office to change the paper and ink in response to a smell, rather than when they need to copy something for a deadline at the last minute only to find out they cannot because there is no ink.

Another example De Bone cites is 'Cigarette Po traffic light'. This led to the idea of placing a red line around the end of a cigarette to alarm the smoker that they were reaching the more dangerous end of the cigarette. 'Cigarette Po Flower' led to the idea of placing seeds in the end of cigarettes so that when cigarette butts were thrown to the ground they would lead to the growing of flowers and trees, creating a different world to the smoky one of the smoker.

The Creative Charter

David Hall notes how at one organization a group of managers would meet for one hour per week, locked away from the outside world, and practice a wide range of creative techniques focused on specific business problems. Employees were able to play around with ideas that seemingly had no specific application to the work they were doing, but could in turn become effective creative solutions (Hall, 1996). The group of managers drew up the 'creative charter' to legitimize the behaviour of all the participants.

The Creative Charter;

1. We shall collectively work to produce atmosphere.
2. Thou shalt not pass premature judgment on any suggestions.
3. Thou shalt look positively on all suggestions, finding the good rather than the bad.
4. We all reserve the right to make complete fools of ourselves in a completely safe environment, without fear of later comeback.
5. We are all completely equal, irrespective of position or function.
6. No-one shall opt out.
7. We shall have fun (Hall, 1996).

Formalizing and legitimizing the use of techniques in the workplace, and the often zany behaviour of participants, has been proved to give significant results for a workplace. Perhaps the most classic example being the company 3M, who used this approach to lateral/creativity techniques when creating the 'post-it note' (Nayak and Ketteringham, 1987).

Eureka and Force-Fit

The techniques Eureka and Force-Fit are both creativity techniques and can be applied to generate transport and land use planning options. Both techniques work around a framework that forces seemingly unrealistic solutions or irrelevant and polarised ideas into a realistic suggestion.

The **Force-Fit** approach operates as follows (MyCoted, 2005a):

- Two groups are formed, with 2 – 8 individuals in each.
- A problem statement is read out.
- The first group proposes a seemingly irrelevant idea.
- The second group develops a realistic solution, based on this irrelevant idea.
- If the solution is plausible, the second group gains a point, if not the point goes to the first group.
- The game ends after a pre-agreed number of rounds and the ideas generated are analysed and appraised.

With the **Eureka** technique the identified problem is initially forgotten. Randomly selected images are presented to participants, who are firstly asked to list words or attributes they would associate with each image, and then find a solution to the original problem through the combination of these images (Townsend and Faviour, 1991).

The process is as follows:

- Forget the problem altogether.
- Present three randomly chosen images that have nothing to do with the problem or decision to be made.
- Participants are asked what words or attributes they would associate with each image, which are then listed.
- Group members take it in turn to make contributions.
- The attributes from each column are then 'force fitted' together to make a viable solution.
- Visual stimuli are generated, and ideas are generated and recorded.

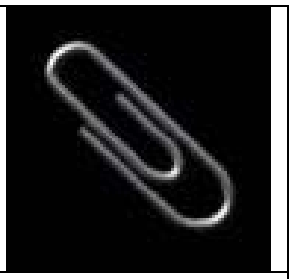
For example:

The problem - traffic flow around a small town in Lancashire.

1. The problem is forgotten.
2. Three randomly chosen images are displayed; in this case a disabled sign, a smiley face and a paper clip (see Figure VI.2 below).
3. A list of attributes or associations is made below each image. In this example the word 'Disabled' is associated with a disabled sign, 'Alien' with the smiley face and 'Thin' with the paper clip.
4. This can then be repeated, with each participant taking it in turn to make a contribution.

5. With the original problem now back in the process, the participants are then asked to 'force fit' words from each list into a viable solution. In this example the words 'Disabled', 'Alien' and 'Thin' became 'Disable thin streets'.
6. Widening bottlenecks in the road system around the town, thus 'disabling' the 'thin' streets was put forward as a solution to the problems with traffic flow around the town in Lancashire.

Figure VI.2: Eureka example

			
Associated words	Disabled	Alien	Thin
Force fit	Disable	Thin	Streets
Suggested solution	Widen bottlenecks in the road system around the town		

Source: Proctor (1997)

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