SYSTEMS PLANNER №2 (2011)

Application manual for the 'Systems Thinking' book[a]

Anastássios Perdicoúlis
Assistant Professor, ECT, UTAD (http://www.tasso.utad.pt)
Affiliate Researcher, CITTA, FEUP (http://www.fe.up.pt/~tasso)

Abstract

A set of methods and techniques have been designed to promote efficiency in urban and environmental planning through systems thinking.

1 Explicative Causal Thinking (ECT)

ECT is a method (or normative process protocol) to efficiently create new plans, based on systems thinking. The ECT planning method is quite long and complex, so it involves a number of auxiliary methods and techniques — Figure 1.

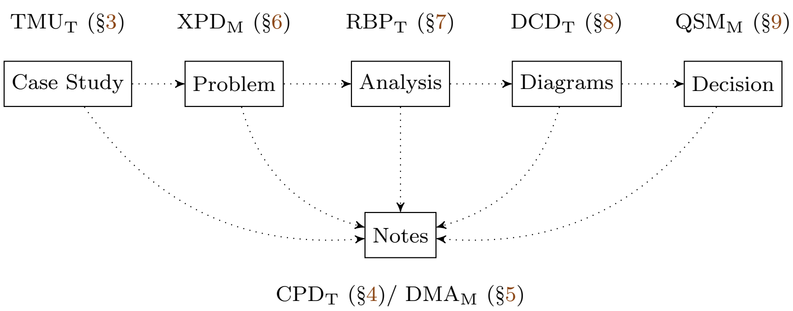

FIGURE 1 Process protocol of the ECT, for planning 'from scratch'

OBSERVATION The efficiency of planning with the ECT method increases as the user becomes familiar with the associated methods and techniques.

SUGGESTION Before attempting a full planning operation with the ECT, it is a good idea to familiarise with the associated methods and techniques through individual planning tasks — for instance, see the 'Building Competences' book (Perdicoúlis, 2011).

[a] This is a supplement to the 'Systems Thinking' book (Perdicoúlis, 2010), prepared with the permission of the publisher and intended to facilitate applications in practice. User feedback is particularly appreciated.

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2 Diagrammatic Causal Analysis (DCA)

DCA is a method (or normative process protocol) to transform existing plans from their typical text form to appropriate diagrams, with the intent to facilitate the revision or simulation of these plans. Being a relatively complex method, DCA involves a number of auxiliary methods and techniques — Figure 2.

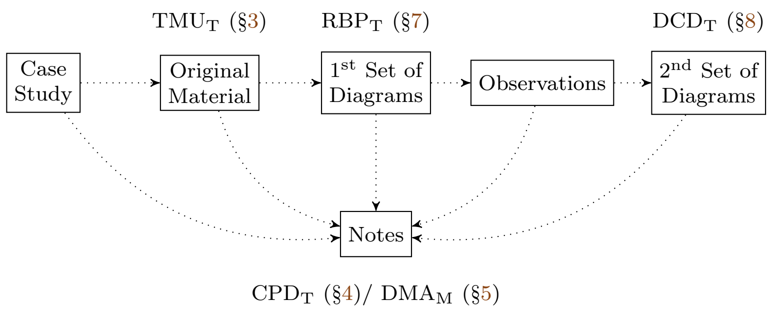


FIGURE 2 DCA process protocol for dealing with existing planning material

OBSERVATION DCA is not as thorough a planning method as ECT; it is more like a 'restoration' method of existing planning material. The recommended way is to 'plan from scratch', using the ECT.

3 Text Mark-Up (TMU)

TMU is a customised auxiliary technique to transform information from text to diagrams — for instance, to produce CPDs (§4), RBPs (§7) or DCDs (§8).

SEMANTIC CATEGORY	TEXT	EXAMPLE	MARK-UP
Element	quantifiable noun	population, satisfaction	CAPS
Action	verb & specifier	install, create policy	**boldface**
Causality	verb	causes, provokes	`teletype`
Effect	quantifiable noun	increase, decrease	*italics*

TABLE 1 Options for manual text mark-up

OBSERVATION The elements of the 'mark-up' column can now easily take a graphic representation.

SUGGESTION Text mark-up can be done by software — with options indicated in the 'Systems Thinking' book (Perdicoúlis, 2010) —, but the four semantic categories should be preserved.

4 Concise Process Diagrams (CPD)

CPDs are special diagrams representing the organisation and communication of processes — for instance, as a series of actions (tasks or operations) and stages (or outcomes, whether partial or final).

Semantic Category	Text	Example	Graphic
Stage	noun; identifiable state	decision, data	stage
Operation	verb or noun	produce (v.); production (n.)	*action* →
To next stage (certain)			——→
To next stage (uncertain)			- - - →
Information flow			······→

Table 2 Conventions for the representation of concise process diagrams (CPD)

Observation CPDs are streamlined so they feature only the basics: action and outcomes, or tasks and stages. More complete 'extended' process diagrams are being prepared, to include more information such as actors, methods, etc.

Observation Task–stage sequences can be represented in two alternative ways, depending on the choice of which element should be designated as a node, and which one as an edge. The standard way of CPD is the former, with the action (tasks) labelled on the arrows, but the reverse model is also possible — Figure 3.

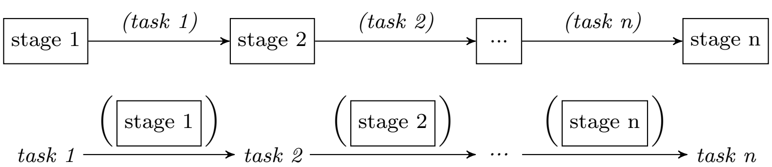


Figure 3 Two alternative ways to represent task–stage sequences

Observation In most 'exploratory' cases of process modelling — including descriptive, predictive, or normative modes — we know (or define) one of the two elements of the process (that is, tasks or stages) and look for the other one — Figure 4.

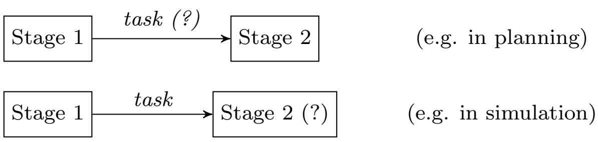


Figure 4 Exploratory cases of process modelling

SUGGESTION At times it may appear desirable to add more resolution to the action, such as (a) the actor and (b) the actor's method. So, instead of plain text, the arrows can carry a compound box such as the one in Figure 5.

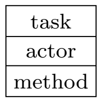


FIGURE 5 Giving more resolution to the 'action'

OBSERVATION The actors are best located near the action, as text or graphic (see above). Representing actors as boxes is not part of CPDs, but is contemplated in EPDs ('extended' PDs). In such cases, multiple inputs and outputs must be identified (e.g. with global or local numbering) to allow tracking of the flow of information.

SUGGESTION When CPDs accommodate various inputs and outputs to nodes, we may need to know whether these are taken as sets — for instance, one *and* the other — or alternatives — for instance, one *or* the other. If this is necessary to know, then it is possible to add appropriate conjunctions near the inputs and outputs, as in in Figure 6.

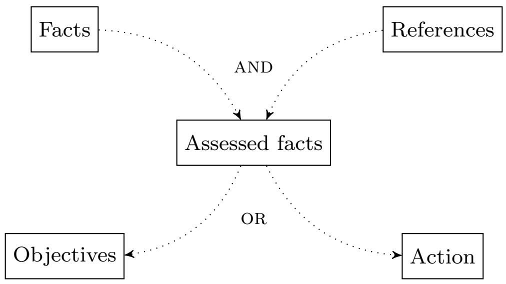


FIGURE 6 Appropriate conjunctions (AND and OR) by the inputs and outputs

OBSERVATION Unmarked concurrent inputs (i.e. confluences) and outputs (e.g. bifurcations) in CPDs are interpreted as AND.

SUGGESTION In addition, we may need to indicate the order of inputs or outputs marked by numbers, as in Figure 7.

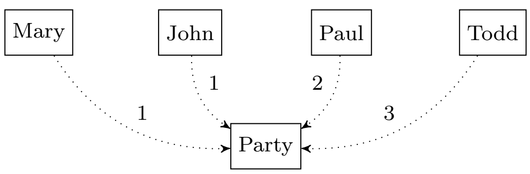


FIGURE 7 Appropriate numbering may be required to mark the order of inputs or outputs

OBSERVATION In any of the above additions, we are advancing the 'concise' process diagrams (CPD) towards 'extended' process diagrams (EPD), which are currently in elaboration.

SUGGESTION *OmniGraffle* users can find a stencil for CPDs at the author's website.

5 Decision Model Analysis (DMA)

DMA is a method (or a normative process protocol) to help explore and define the type of decision-making, through the mapping of mental models. The ECT planning method, for instance, is formed on a special systems-learning decision-making model as illustrated in Figure 8.

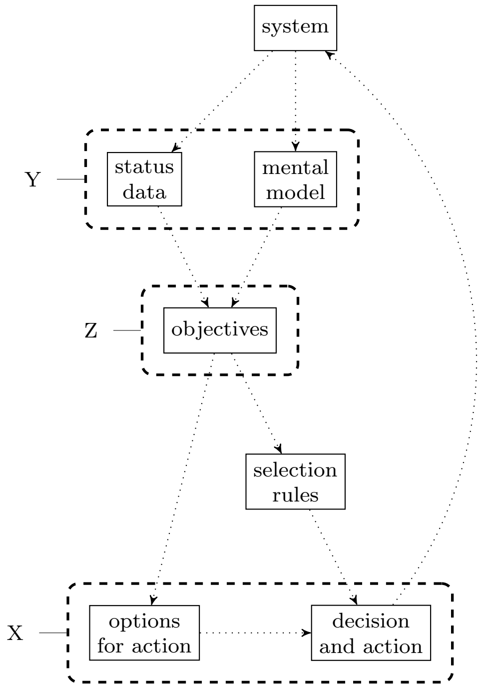


FIGURE 8 Information flow in the ECT systems-learning decision-making method

OBSERVATION Figure 8 represents a 'plan to plan' protocol, which sets up the planning process as a 'meta-planning' problem.

OBSERVATION Besides the one presented in Figure 8, there are many other — and much more popular — decision-making models, as described in the 'Systems Thinking' book (Perdicoúlis, 2010).

SUGGESTION The planner may function as a mediator and use DMA to explore and discover the model which stakeholders find more 'natural' in a particular planning operation.

6 ‘XYZ’ Problem Definition (XPD)

XPD is a method (or normative process protocol) to help define a problem in three essential parts: X, Y, and Z — Figure 9. This corresponds the ECT systems-learning decision-making model (§5).

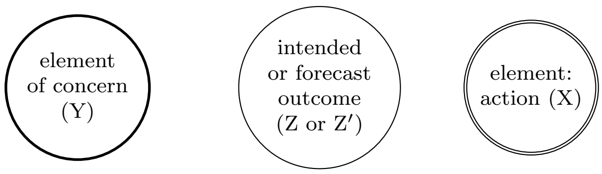


FIGURE 9 The ‘XYZ’ element set in DCDs. The ‘Y’ is marked here with a bold outline.

SUGGESTION Figure 10 illustrates a succinct way (template) to define the problem. To complete the blanks, consult Tables 4 and 5.

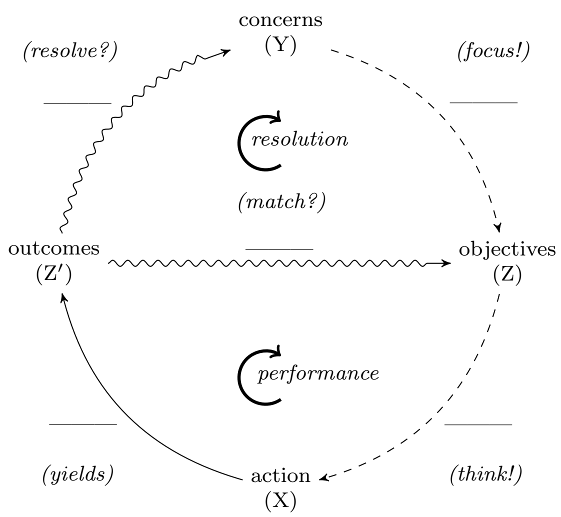


FIGURE 10 ‘XYZ’ problem template with guidance (in parentheses) for the completion of the blanks

7 Reverse Blueprints (RBP)

RBPs are special causal diagrams, used to represent system structure. Although they represent causal relationships, RBPs do not include action — they are mere 'wiring' diagrams.

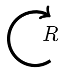
Semantic category	Text	Example	Graphic
System element	quantifiable noun (text)	population, satisfaction	element
Causal relationship	sign of relative change	+/−	
Feedback loop	loop type (R/B); name (optional)	symbol or text	

Table 3 A compilation of RBP conventions

Observation RBPs look similar to causal loop diagrams (CLDs). Contrary to CLDs, though, RBPs merely represent the system structure and function — that is, they do not intend to represent the planning problem, which is properly done by DCDs (§8).

Suggestion System elements as quantifiable nouns are best expressed in their 'positive' form — e.g., 'satisfaction' instead of 'dissatisfaction'.

Suggestion *OmniGraffle* users can find a stencil for RBPs at the author's website.

8 Descriptive Causal Diagrams (DCD)

DCDs are special diagrams for the representation and communication of causal mental models and reasoning. Their main feature is that they can accommodate the definition of the planning problem explicitly, in an 'XYZ' format (§6).

Semantic category	Text	Example	Graphic
System element	quantifiable noun	population, satisfaction	generic element
Action	verb and specifier	install, create	element: action
Causality (physical)	verb	causes, provokes	
Causality (logical)	verb; logical term	means, requires; therefore	
Effect	quantifiable noun	increase (n.), enhancement*	effect

Table 4 Summary of the DCD conventions (Mk.I)

Suggestion System elements as quantifiable nouns are best expressed in their 'positive' form — e.g., 'satisfaction' instead of 'dissatisfaction'.

Suggestion At times it may appear desirable to add (a) the actor and (b) the actor's method in the action element — for instance, as 'element:action (actor:method)'. This is likely to add complexity to the DCDs, but increases the resolution of the information about action — Figure 11.

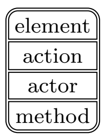


Figure 11 Giving more resolution to the 'action'

Suggestion Without a pressing need for modifications, DCDs are still subject to fine-tuning as they are still at the beginning of their existence. Three innovations for DCDs are summarised in Table 5.

Suggestion *OmniGraffle* users can find a stencil for DCDs at the author's website.

Semantic category	Text	Example	Graphic
System element	quantifiable noun (text)	population, satisfaction	new style for long text strings
Effect (feedback path only)	verification (e.g. Z′ to Y)	facilitates*	effect
Loop (optional)	labelled loop	text or symbol	loop

Table 5 Amendments to the Mk.I DCD conventions

9 Qualitative Simulation (QSM)

QSM is a method (or normative process protocol) that helps organise and communicate the likely outcomes of action proposals — for instance, to assist their assessment and refinement.

Qualitative simulation starts from the action points, and terminates at the natural end points: either the final outcomes — for instance, Z″ — or when reaching the origin of the planning operation — that is, the concerns (Y).

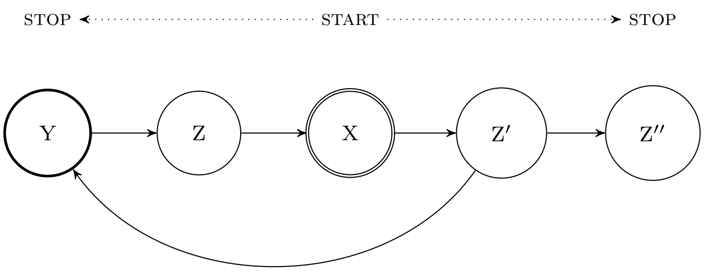


Figure 12 Qualitative simulation — generic representation

Observation The pathways covered by the simulation in Figure 12 are: (a) the 'solution' path X → Z′ → Y, and (b) the 'side effects' path X → Z′ → Z″.

Observation A simulation printout — more detailed than Figure 12 — is likely to be adjusted several times during a public discussion. This is desirable, indeed, and many printouts may be spent before consensus has been reached.

Suggestion If consensus is difficult to reach, then register all (or the most prominent) scenarios as alternative simulations.

10 Questions and Answers

WHAT KIND OF DIAGRAM DO I NEED? It depends on what you want to describe. (a) If you need to describe a process, then use CPDs (concise process diagrams). (b) If you need to describe how a system is built (for instance its 'wiring' or 'blueprint'), without considering any particular action, then use RBPs (reverse blueprints). (c) If you need to describe the reasoning of the problem, from concerns to objectives, to action, to outcomes, then use DCDs (descriptive causal diagrams).

WHAT IS THE DIFFERENCE BETWEEN DCDS AND CPDS? DCDs are effect-centered, whereas CPDs are state-centered. In CPDs, effects are incorporated into the next (or 'downstream') state from the originating action. By contrast, effects in DCDs are expressed individually, so that they can be visible and identifiable (whether in a objective or subjective form); however, the next (or 'downstream') change in DCDs must be composed (see 'manual simulation' below) every time we need to know about it.

WHAT IS THE DIFFERENCE BETWEEN DCDS AND RBPS? DCDs express change in absolute terms, whereas RBPs in relative terms. For instance, let us assume that the value of an upstream element increases; *ceteris paribus*, in a positive link polarity, the value of the downstream element would also increase. The standard RBP arrow conveys the symbol of the link polarity (+), while the DCD arrow conveys the change to the downstream element ('increase'). Thus, DCDs make an 'information commitment' that deprives them of the general validity or flexibility of RBPs' 'relative change' — for instance, the same positive link polarity could also accommodate a 'decrease–decrease' pair of changes.

WHICH SOFTWARE DO I NEED? The CPD, DCD, and RBP types of diagrams can be produced with any flowcharting software, such as *LibreOffice Draw*. *GraphViz* is a visualisation software with built-in optimisation of layout, which helps a great deal in the arrangement of the diagram elements — and even in the discovery of patterns. There is also hybrid software, having both functions, such as *OmniGraffle*.

WHAT IS 'MANUAL SIMULATION'? DCDs are prepared for use with qualitative information, which makes simulation suitable for a 'manual' mode — literally, done by hand. This limits the number of iterations to a small number (typically one or two), but permits a closer interaction and involvement of the user with the system model when processing the qualitative information — for instance, as opposed to trusting a computer for 'crunching' the numbers and 'spewing out' the answer, as it may happen in the case of numerical simulation. Attention and verification are crucial for manual simulation.

References

Perdicoúlis A. (2010) *Systems Thinking and Decision Making in Urban and Environmental Planning*. Cheltenham: Edward Elgar.

Perdicoúlis A. (2011) *Building Competences for Spatial Planners: Methods and Techniques for Performing Tasks with Efficiency*. London: Routledge.

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