Process and Story Evolution by Genetic Programming, Insight Mechanism and Rudimentary Natural Language Text Understanding

D i e t e r V e t t e r k i n d

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ABSTRACT: In this paper five new process insight mechanisms and a rudimentary natural language text understanding are introduced in order of modelling deep understandimng of technical or man-machine or every-day processes. By use of genetic programming thus process and (technical or belletristic) story evolution is under development.

KEYWORDS: process insight mechanism, story evolution, genetic programming, natural language text understanding, every-day processes, artificial persons, scene automaton, container-element physics

1. PROBLEMS

In order of modelling deep understanding of technical or man-machine or every-day processes there seems to be need for (a) insight mechanisms, (b) some text understanding and (c) evolutionary intelligence. In [1,2] the author uses a new "Container-Element-Physics" and genetic algorithms in diagnosing thermohydraulic processes in order to make diagnostics work without differential equations and with the advance of genetic induction. However, in tackling the so-called every-day processes of life (and numerous man-machine processes) usually one has just to more or less rely on human intuition (and programs often totally written by hand).

The Process and Story Evolution System Project is right now in its start phase. In this paper five new insight mechanisms and a new natural language text understanding are introduced as an approach; both cooperate with a genetic programming method. First results from testing this system are promising in overcoming the lack of deep understanding as well as in text-related process modelling or natural language (man-machine or belletristic) story evaluation.

2. PROCESS AND STORY EVOLUTION SYSTEM

As shown in fig. 1, the system is configurated by the Insight Mechanisms (1), the Rudimentary Natural Language Text Understanding (2), the Genetic Programming (3), and the Data Input (4) / Data Output (5).

2.1 Insight Mechanisms (1)

2.1.1 Cellular Model Automaton (6):

It is an expansion of the "Container-Element-Physics" [1,2,3] insofar that it enables modelling not only of thermohydraulic processes but also of other physical processes and of every-day physical processes. Thus in a cellular micro world there may be simulated (see fig. 2 for water outflow from a vessel or pour-out into another vessel) diverse physical phenomena, i.e. materials which are falling down or which have weight in a gravitational field; temperature; heat transport; behaviour of gases; cinematics and motions of objects or bodies with or without links.

2.1.2 Induced Qualitative Physics (9):

This physical insights are induced from Cellular Model Automaton and are then transformed to the macroscopic level in order to send information to other mechanisms (Scene Automaton, Loop Systems Automaton).

2.1.3 Scene Automaton (8):

This mechanism provides sequential scene processing in space and time using objects, materials, artificial persons and intentional aspects.Thus, fig. 3 shows Man-drinks-coffee scenes, and fig. 5 shows Family-and-Neighbour scenes. With the help of such scenes a good insight of object/body-space-time-physics relations may be extractacted and used in understanding prepositional conceptions (in; out of; above; etc.), grouping conceptions (persons or objects) or distancing by means of an example, or in so many other conceptions which are required for textual utterances of every-day life.

2.1.4 Loop Systems Automaton (7):

It establishes flow diagrams of technical or physical or every-day processes at the macro level. This automaton extracts information or tasks from Scene Automaton and Induced Qualitative Physics and/or from text. Additionally it may process predefined conceptions. So it is capable of also inducing new conceptions or new system interrelations which were not known before. Fig. 4 shows the analysis phases of the Man-drinks-coffee process, and fig. 6 presents some text semantic primitives (conceptions).

2.1.5 Artificial Persons (11):

They are modelled by artificial body features, "emotions" and "cognitive capabilities". These artifacts have chance to prove their worth in the same context as every-day or man-machine processes, and in cooperating with the Conception-Process-Life nets (CPL nets). Here, Artificial Persons are seen to be incorporated in processes depicted in fig. 3 to 7. The psychological model of the Artificial Persons is under development. Thus, particularly emotions and cognition of these artifacts are broken down in accordance to usual conceptions (fancy, love, antipathy, disappointment, fear, rage, comparison, expectation, hypothesis, etc.), and varying psychologically relevant values (numbers or code) are simultaneously processed (e.g. see fig. 7, CPL net of Family-Neighbour-sequences).

2.1.6 Problem Coordinator (10):

It creates the rational "AGACHAA" aspects (Actuals/Goals/Abilities/Constraints/Hypotheses/Actions/Affects). It cooperates with Genetic Programming in extracting the different arguments that are definitely relevant to AGACHAA and the actual process (objects, persons, features, abstractions, etc.) to be computed by Insight Mechanisms, Rudimentary NL Text Understanding and Genetic Programming.

2.2 RUDIMENTARY NATURAL LANGUAGE TEXT UNDERSTANDING (2)

2.2.1 Syntax Operators (12), Text Semantic Primitives (13):

Supported by syntax operators there is programmed construction of simple natural language sentences (or destruction of sentences for corresponding postprocessing by Insight Mechanisms) from given or produced conceptions and from information coming from the Insight Mechanisms. For use of conceptions within the Process and Story Evaluation System, conceptions introduced by systems input or transferred between diverse Insight Mechanisms, are mutually converted to processable language of each called mechanism.

Text Semantic Primitives (conceptions of lower or higher level; combinations of conceptions) primarily are textual coded (text), but they have to be translated into another code (Scene Automaton: pictural and time code; Loop Systems Automaton: code of flow diagrams and text; Cellular Model Automaton: code of physical micro rules and of moving cells or of moving container elements where diverse numbers of formal heat particles or pressure particles or material particles are contained that may diffuse to other containers; CPL nets: process information coded by text, flow formalism, underlying psychological model, value calculating, etc.).

2.2.2 Textual Reasoning (14):

This reasoning mode would be limited to simple cases if there were no cooperation with the Insight Mechanisms. However, Textual Reasoning always will be incorporated to Insight Mechanism runs or will be a process partner of CPL nets.

3. GENETIC PROGRAMMING (3)

In the genetic programming method a library of functions, subprograms, and object-oriented programming are used (C++). Pogrammed macro functions (feature detectors, separators, constructors, aspect generators, interface operators, etc.) are required to underly genetic programming. The Genetic operators used are mutation, crossover, reproduction, insert/cutoff, inversion, ignore/attention, switch, forget/remember, blocks. Here utility/punishing functions must be automated for use in genetic programming. This uneasy task is done by functions or subprograms that have overhead features, but nevertheless are able to identify "physical correctness", "esthetics" of process states, "ethic features" of artificial persons, abstractly generated "zones" (family; partnership; danger; protection; etc.) as well as other values, synergies, interesting new states, and so on. The genetic programming method may be expected to be a powerful and evolutionary intelligence since it provides operation of Insight Mechanism and Rudimentary NL Text Understanding. This work is under development.

4. EXAMPLES

Man-drinks-coffee sequences (fig. 3 a,b,c, and fig. 4 a,b,c), Family-Neighbour sequences (fig. 5 a,b,c, fig. 7 a,b,c), and some text semantic primitives (fig. 6 a to f) are examples in order to explain the methods and mechanisms used. Within the scope of the project extensions for the completion of short story fragments (belletristics) or analysis of instructions-for-use and cases of diagnosis of the man-machine process are now under work.

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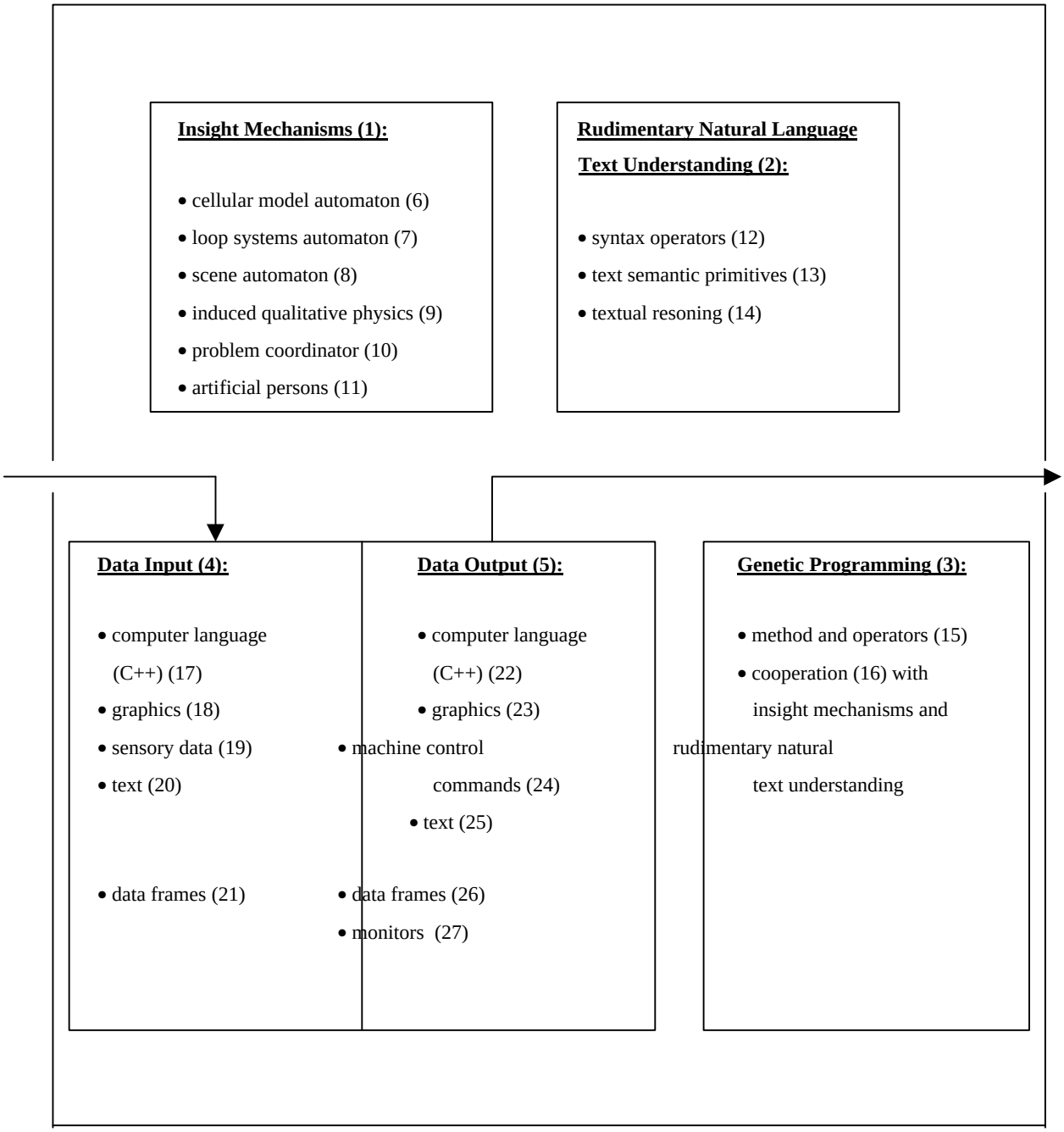
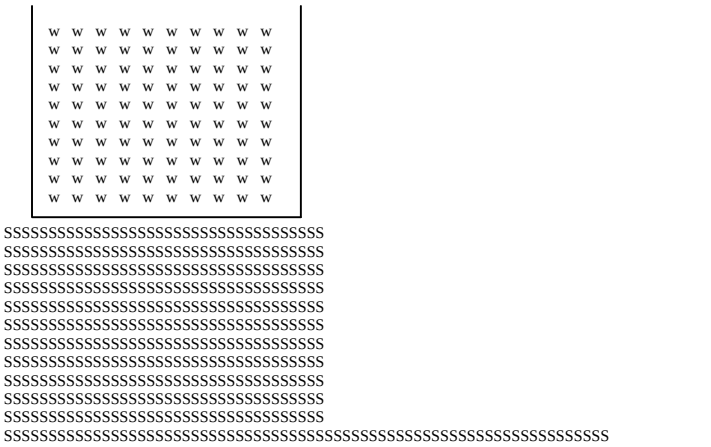
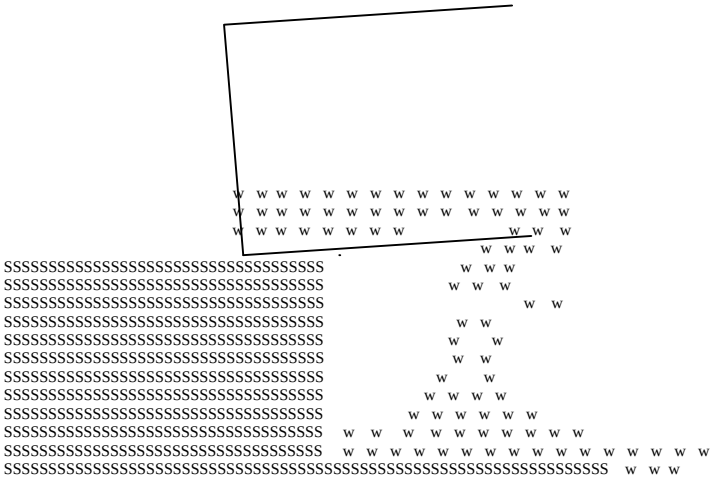


fig. 1: Process and Story Evolution System

[D. Vetterkind, Feb. 1999]



(a)



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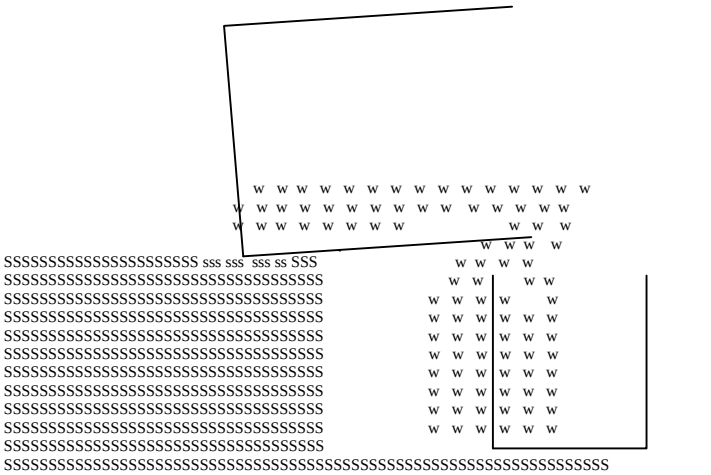
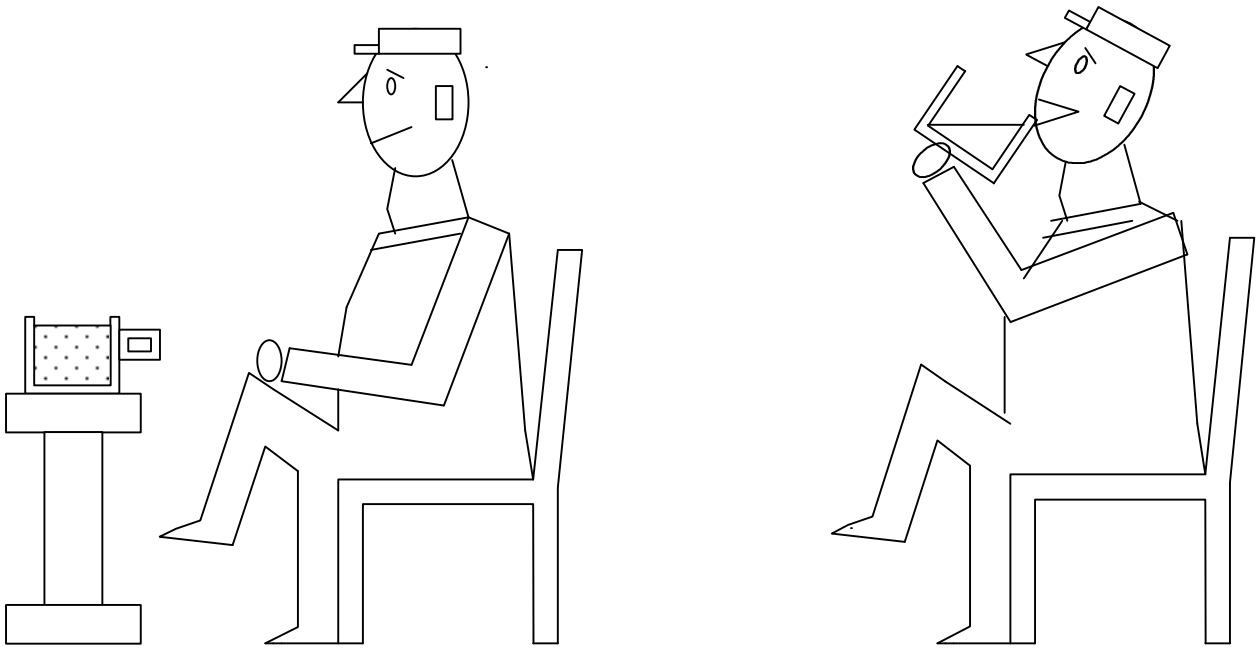


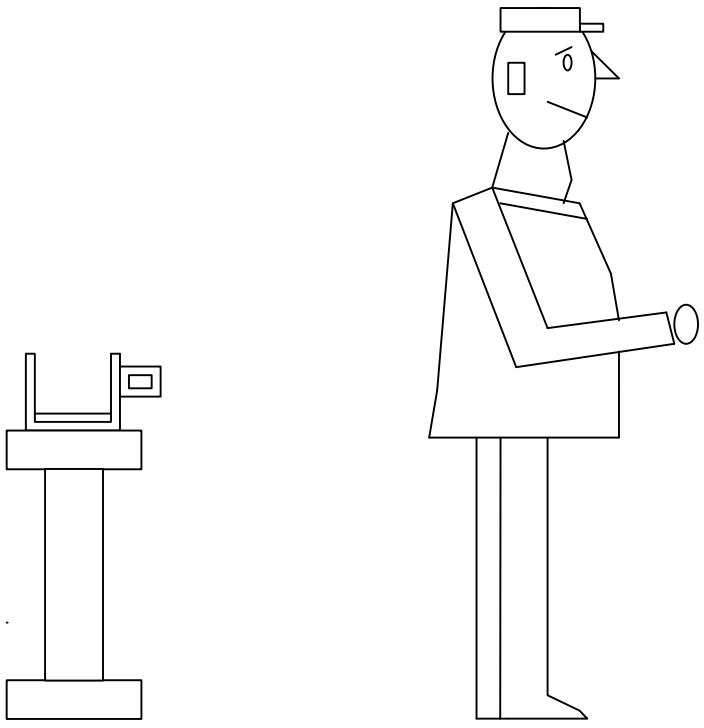
(c)

fig. 2: water flow in cellular model automaton:

cells: w = water, ——= wall and bottom of vessels, S = support or floor
(a) upright vessel full of water
(b) water outflow from tipped vessel onto floor
(c) water pour out into another vessel [D. Vetterkind, Feb. 1999]



(a) (b)

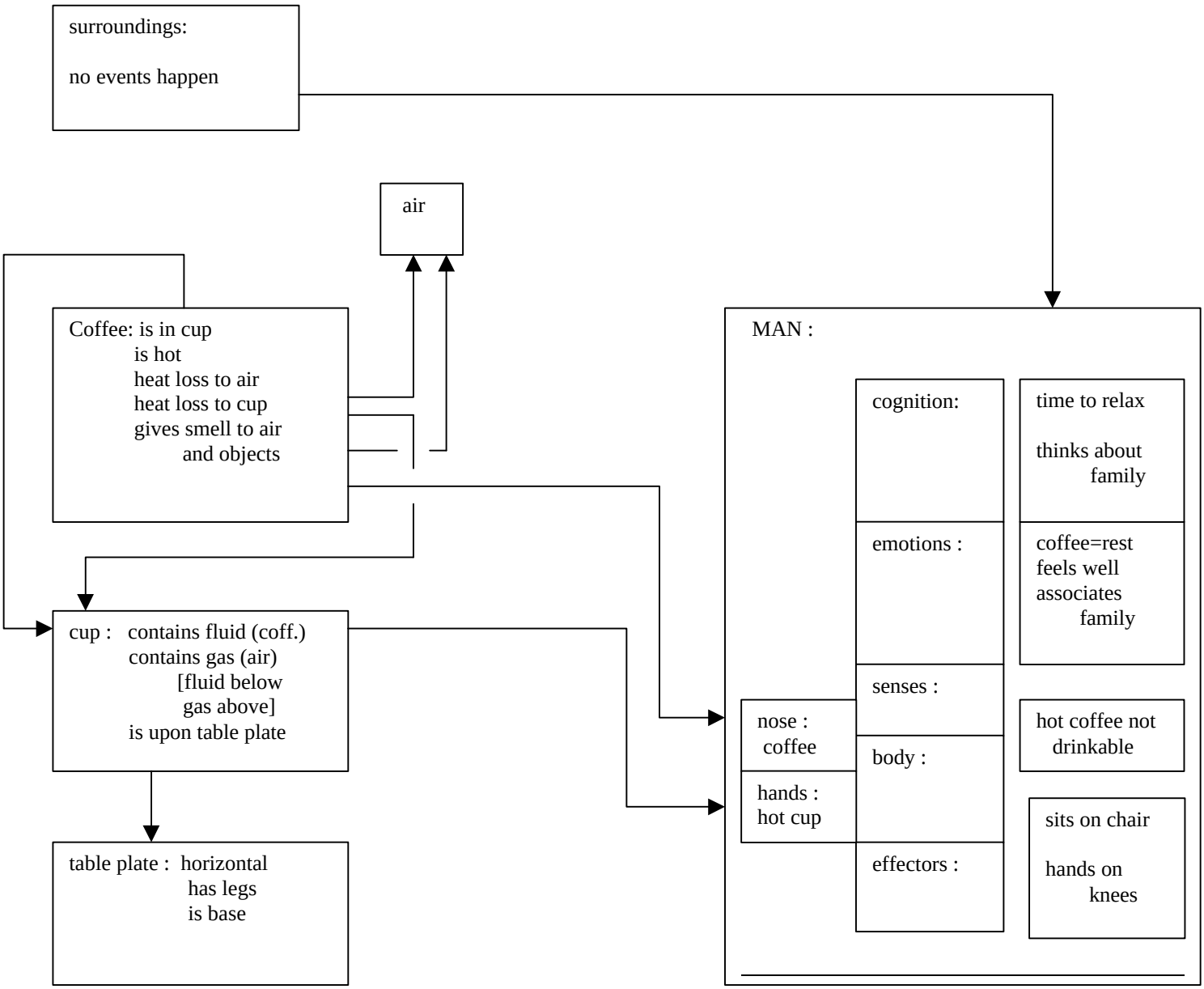


(c)

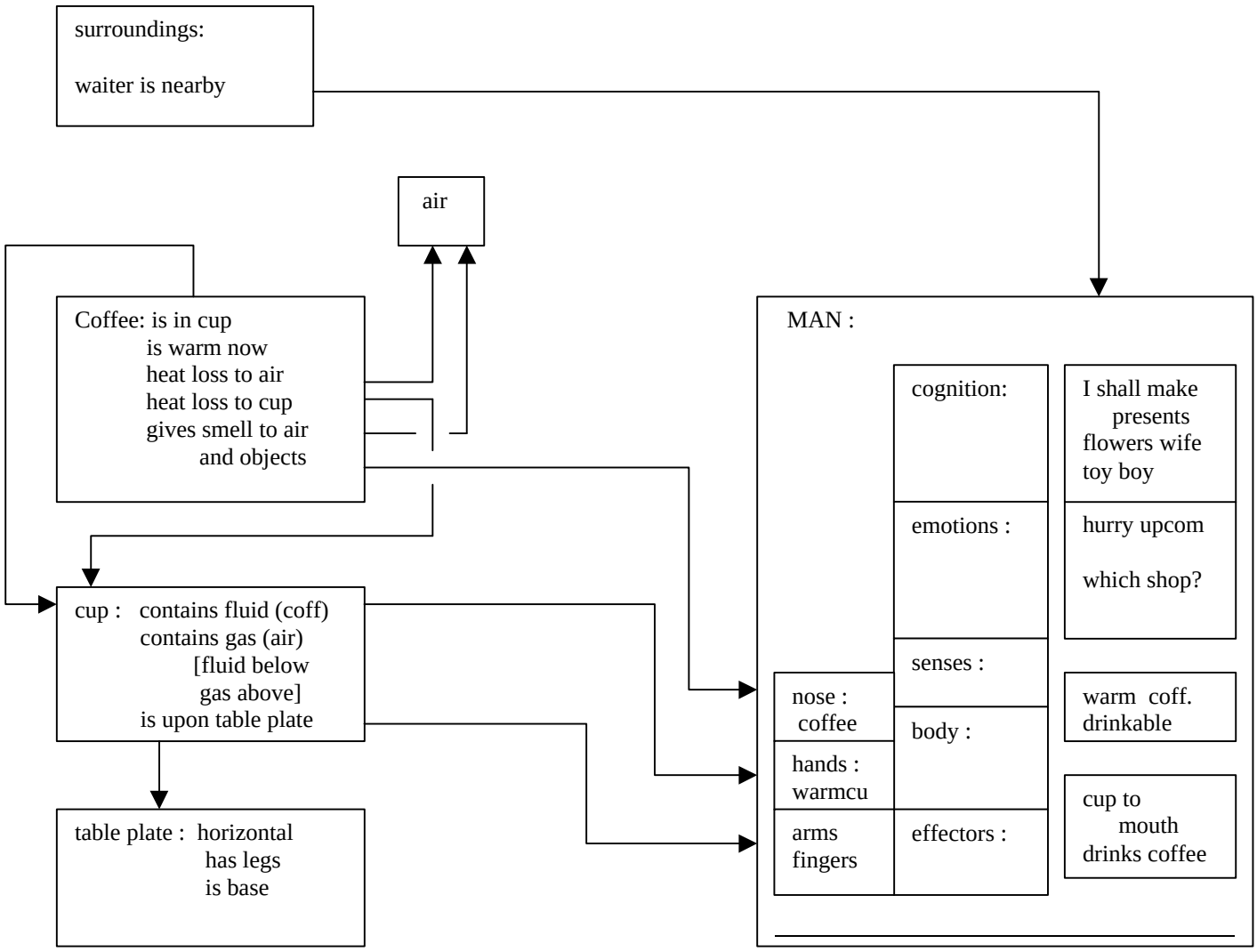
Fig. 3 : Man-drinks-coffee sequences by Scenic Automaton

(a) man sitting at hot cup of coffee, having rest
(b) man drinking warm coffee
(c) man leaving cold coffee remainder, starts off

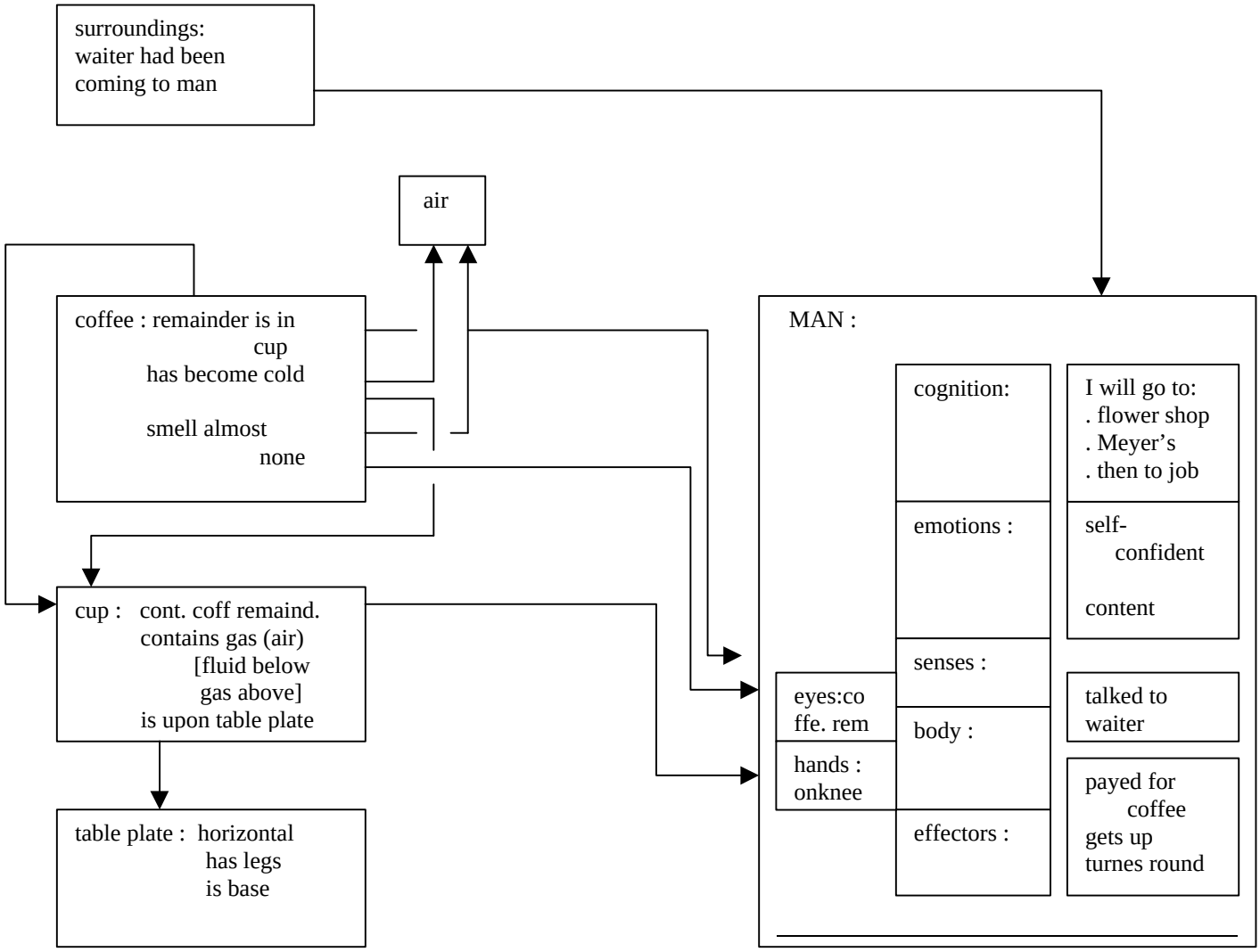
[D. Vetterkind, Jan. 1999]


surroundings:
no events happen
air
Coffee: is in cup
is hot
heat loss to air
heat loss to cup
gives smell to air
and objects
cup : contains fluid (coff.)
contains gas (air)
[fluid below
gas above]
is upon table plate
table plate : horizontal
has legs
is base
MAN :
cognition:
time to relax
thinks about
family
emotions :
coffee=rest
feels well
associates
family
senses :
nose :
coffee
hot coffee not
drinkable
body :
hands :
hot cup
sits on chair
hands on
knees
effectors :

(a)


surroundings:
waiter is nearby
air
Coffee: is in cup
is warm now
heat loss to air
heat loss to cup
gives smell to air
and objects
cup : contains fluid (coff)
contains gas (air)
[fluid below
gas above]
is upon table plate
table plate : horizontal
has legs
is base
MAN :
cognition:
I shall make
presents
flowers wife
toy boy
emotions :
hurry upcom
which shop?
senses :
nose :
coffee
warm coff.
drinkable
body :
hands :
warmcu
cup to
mouth
drinks coffee
arms
fingers
effectors :

(b)



(c)

Fig. 4 : Man-drinks-coffee process analysis by Loop Systems Automaton

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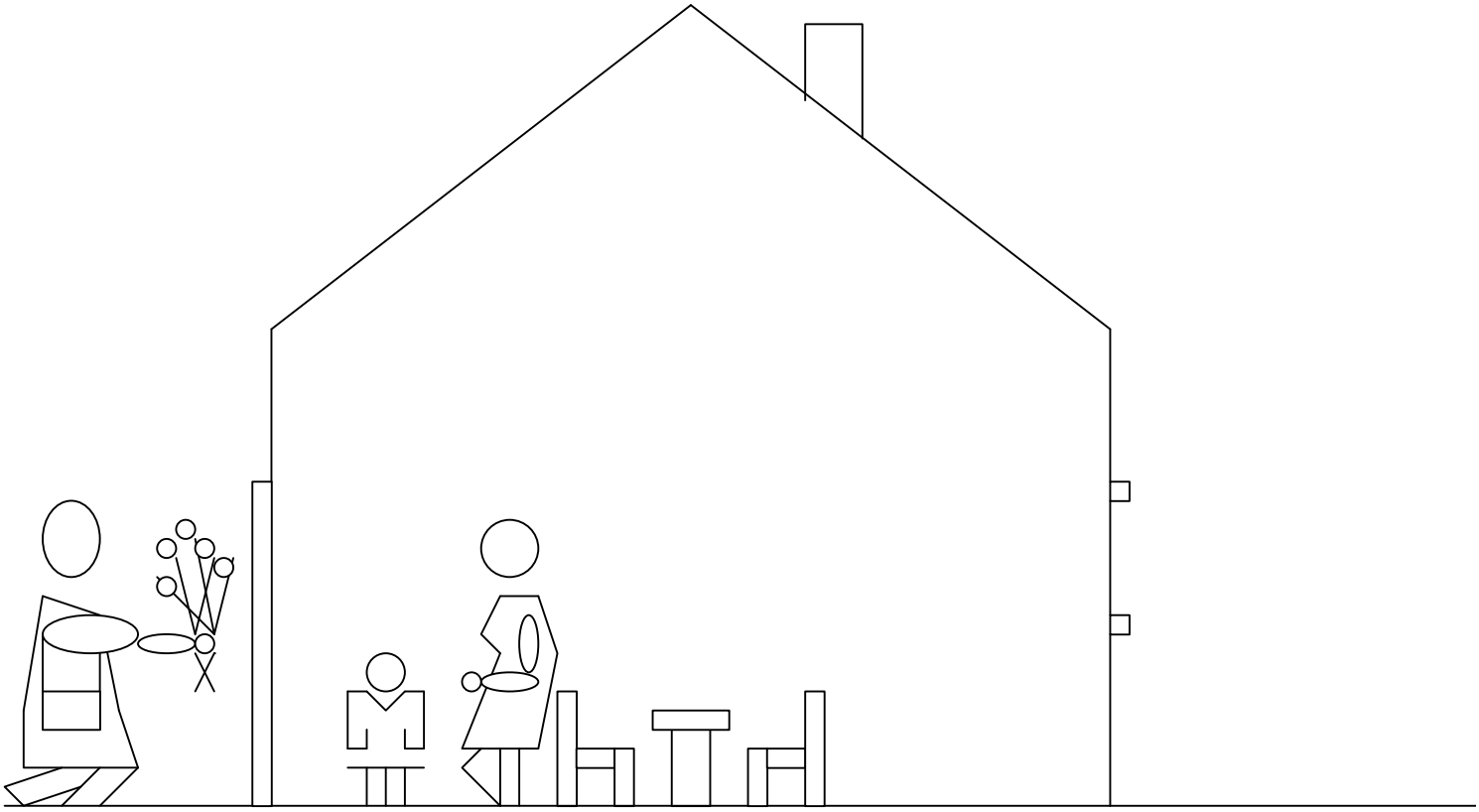
(a) man sitting at hot cup of coffee, having rest (feeling, thinking)
(b) man drinking warm coffee, decides to make presents
(c) man leaving cold coffee remainder, startes for shopping

[D. Vetterkind , Feb. 1999]



(a)

(b)

(c)

Fig. 5 : Family and Neighbour sequences
demonstrated by Scene Automaton

(a) Man arrives house and has been expected by Wife and Boy
(b) Family happiness
(c) Neighbour brings back big hammer

[D. Vetterkind, Jan. 1999]

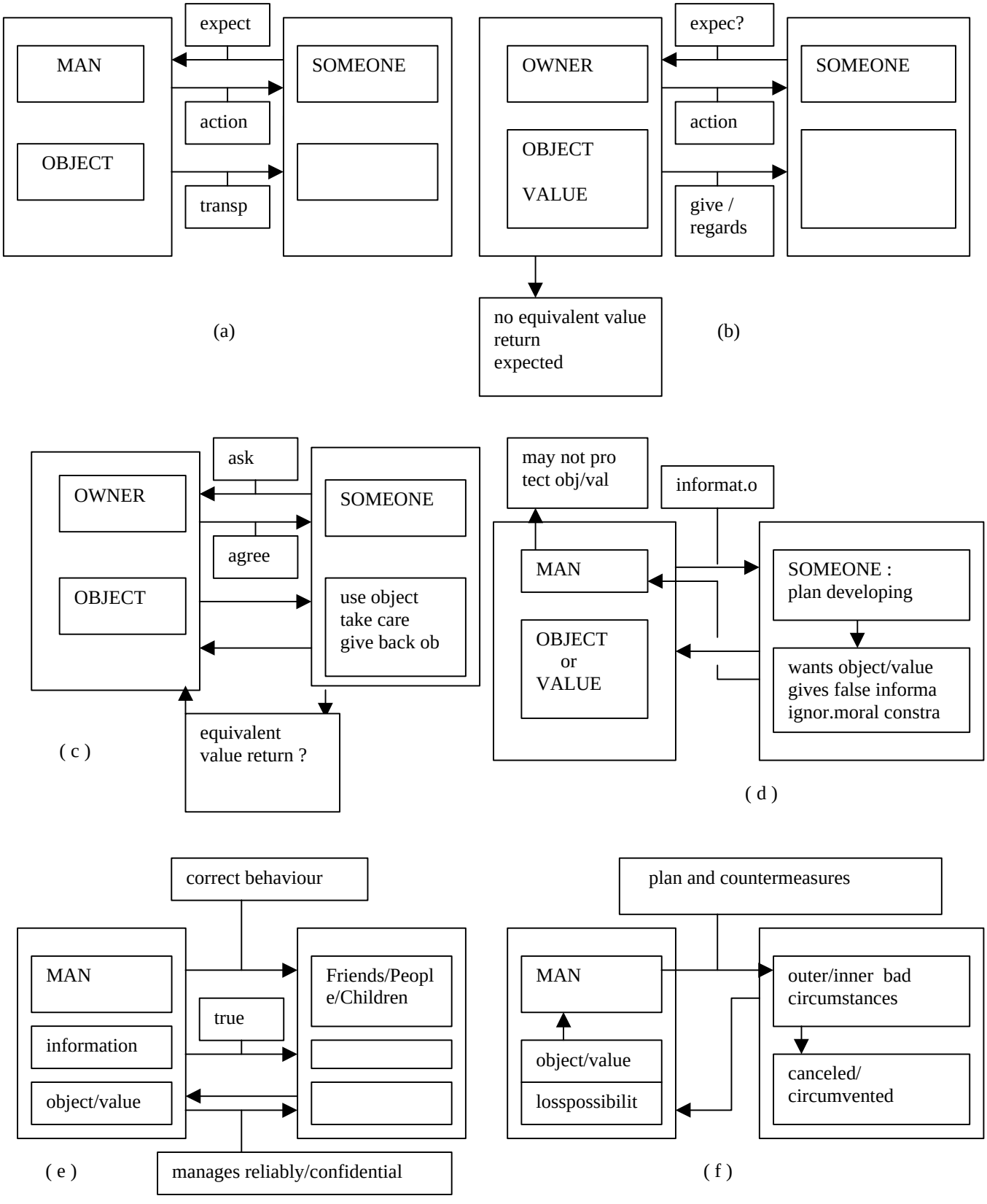
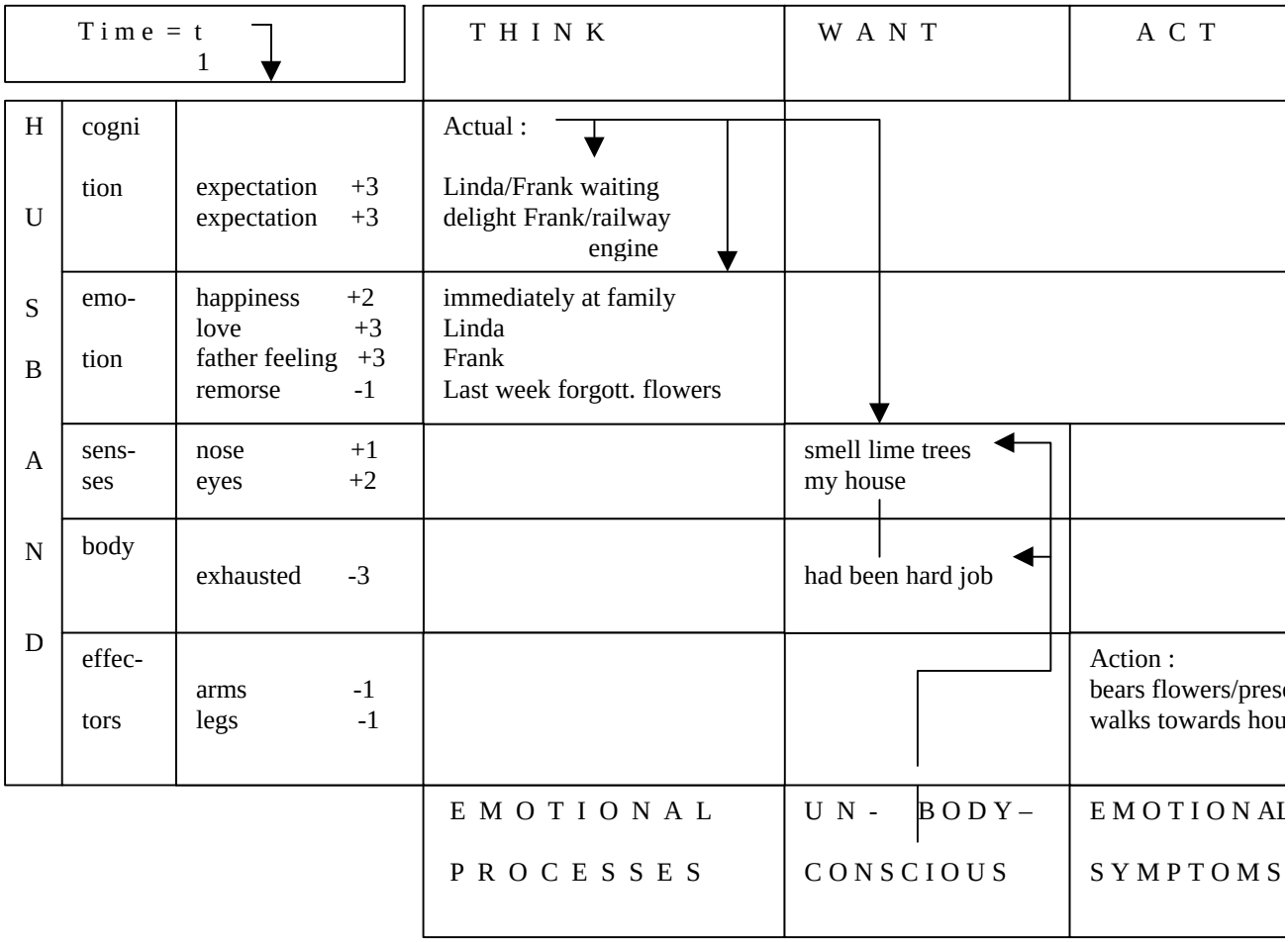


fig. 6 : some text semantic primitives (conceptions)
-------- defined by Loop Systems Automaton

(a) give/take
(b) make a present
(c) lend/give back
(d) pretend
(e) honest man
(f) protect

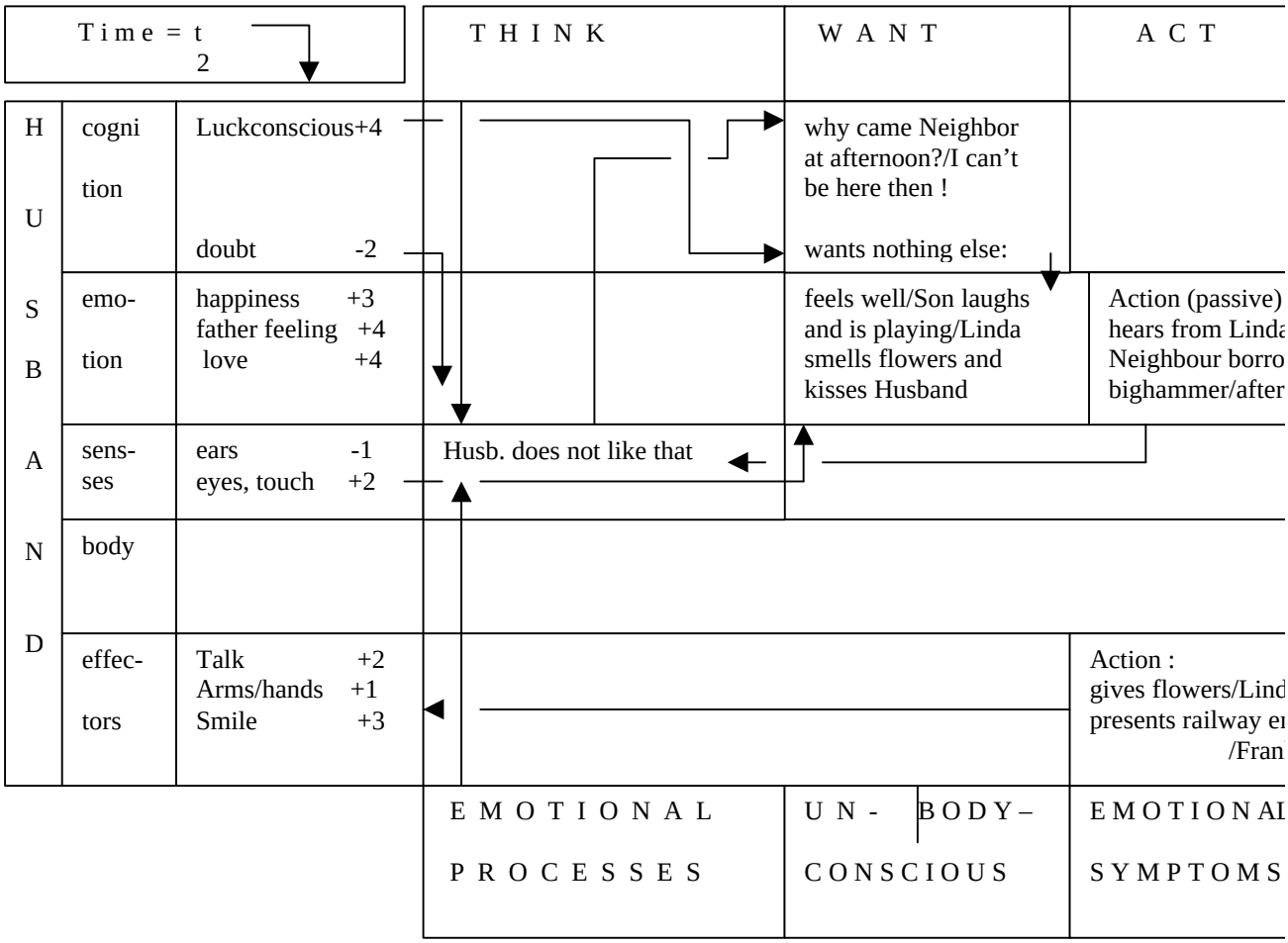
[D. Vetterkind, Jan. 1999]



ZONES		
	Family	
	Partnership	
	Deception/ Danger	
	Protection	

conceptions	give/take (fig. 6a)
introduced from	make a present (fig. 6b)
Loop Systems Automaton	diverse other conceptions (not shown)

(a)



ZONES		
	Family	
	Partnership	
	Deception/ Danger	
	Protection	

Conceptions Introduced from Loop Sys. Autom	lend/give back (fig. 6c) diverse other conceptions (not shown here)

(b)

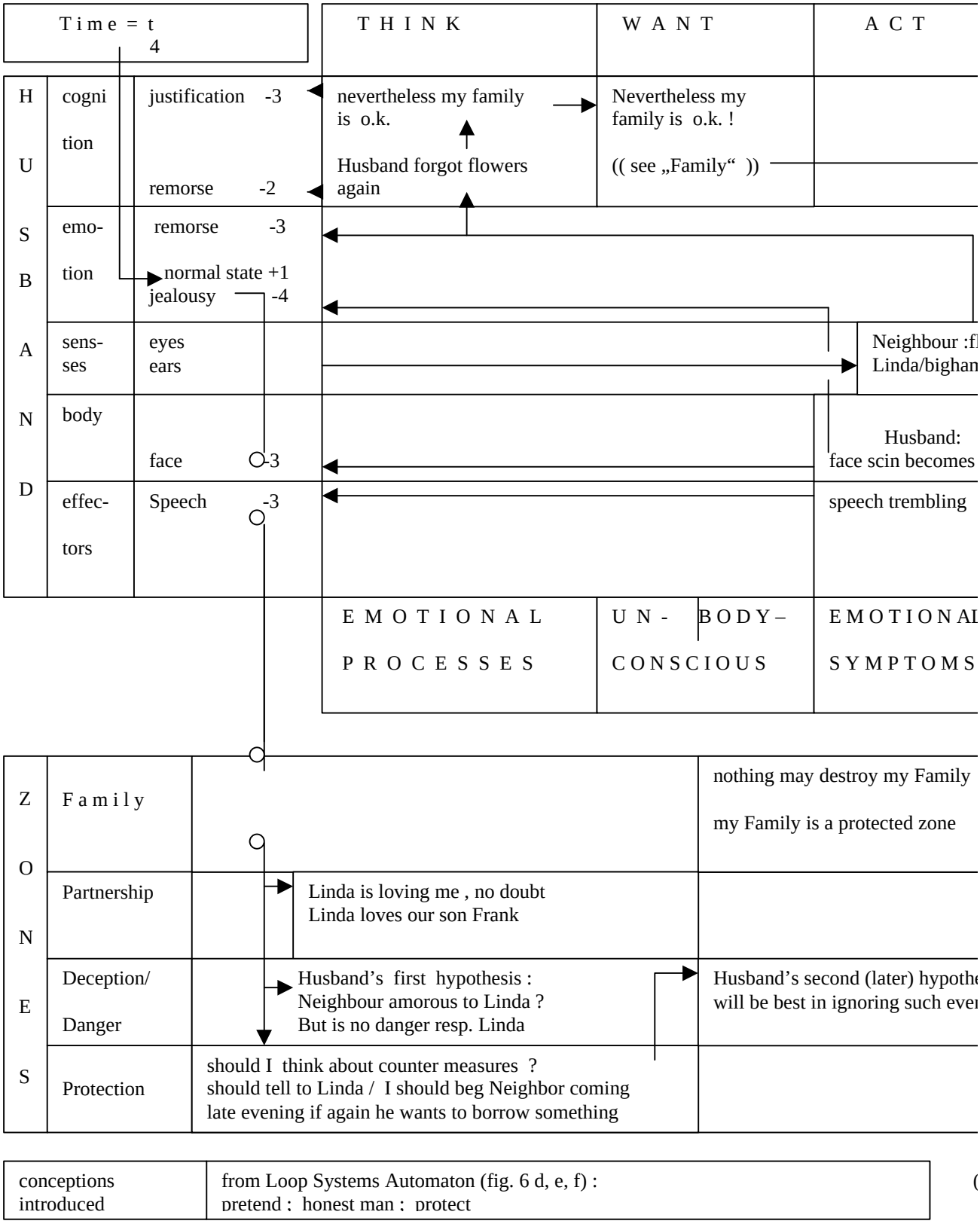


fig. 7 : Conceptions-Process-Life net (CPL net) of Family and Neighbour sequences

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(a) Man arrives house and has been expected by Wife and Boy
(b) Family happiness
(c) Neighbour brings back big hammer

[D. Vetterkind , Feb. 1999