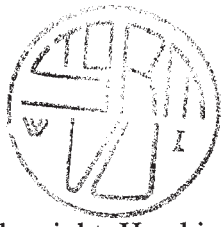
Behavioural Dynamics - Exam



Wednesday December 21, 2005, 9:30-12:30.

This exam consists of three assignments, which count with equal weight. Hand in your answers to each exercise on a separate sheet. Always motivate your answers.

Good luck!

Assignment 1

In this assignment you are going to model the behavior of an agent, who often arranges his vacation journey at the last moment. The agent observes that vacation time is coming soon and based on this observation goes to a travel agency to book a journey. At this time, the travel agency has no options left to suggest to the agent. However, the agent does not give up and tries to search for "last minute" offers on the Internet. The agent succeeds in his search and gets an attractive proposal for a journey. In the next year, the agent is again late with his vacation arrangements; however, having learnt from the last year experience, now he starts immediately searching for "last minute" offers on the Internet, by-passing the travel agency.

Assume the following relevant state properties for the example:

External state properties

vacations_soon	vacations are coming soon
no_options	the travel agency has no options to suggest to the agent
lm_offers_available	"last minute" offers are available

Input state properties

obs(vacations_soon)	the agent observes that vacations are coming soon
obs(no_options)	the agent observes that there are no options available at the travel agency
obs(lm_offers_available)	the agent observes that the "last minute" offers are available

Output state properties

visits_travel_agency	the agent visits the travel agency
searches_lm_offers	the agent searches for "last minute" offers on Internet

Internal state property

s	the agent knows that if he is late with his vacation arrangements, he should search for "last minute" offers on Internet immediately, by-passing the travel agency.

a) What type of behavior is considered in this assignment?

b) Give an example trace (showing external, input, output and internal state properties), characterizing the behavior of the agent for the whole period as described.

c) Show the dynamics of the example in a graphical form. Do not forget to indicate, which state properties are persistent.

d) Write down a list of *executable* dynamic properties, which characterize these dynamics. Denote which ones are step properties and which ones are persistence properties.

e) For the internal state property **s**, indicate by which of the dynamic properties in d) its functional role is defined.

f) Give a set of dynamic properties that specifies the input-output correlation from an **external** perspective.

g) Is it possible to attribute representational content to the internal state **s**, according to the *causal/correlational approach* (address both forward and backward)?
If so, show how. If not, explain why not.

h) What are the {disjunction, conjunction, dynamics} problems? Do they occur in g)?

i) Give the representational content to the state **s**, according to the *relational specification approach* (both forward and backward).

j) Suppose in the second year the agent indeed receives a "last minute" offer for a vacation trip. Give an (iterated) explanation from a functionalist perspective of the following form:

Why does the agent receive a "last minute" offer for a trip?

The agent receives a "last minute" offer for a trip, because ….

Why …..?

…., because …

et cetera.

Assignment 2

Consider the firing behaviour of an agent:

An employee has made a big mistake with a very important task and deliberates whether or not to tell his manager:

'If he believes that I am the cause of the problems, he will try to fire me.'

To describe this, the following *internal mental state properties* of the manager are assumed:

- desire to fire the employee
- intention to fire the employee

The following *inputs* are taken into account

- communication that the employee caused the problem
- observation that law allows to fire the employee (from documentation)
- observation that employee is present

and the following *output*

- firing action

Note that it is assumed that to actually have the opportunity to perform an intended firing action, the employee has to be present.

a) Express the internal dynamics of the above mental properties and their functional roles as a variant of the dynamic properties of beliefs, desires and intentions.

b) Give an account of this dynamics in graphical form.

c) The table below describes some typical externally observable behaviours of the manager in such cases, possibly leading to the firing action. Give (iterated) explanations of these behaviours from an instrumentalist perspective, based on attributed mental properties, for the following traces of externally observable behaviour.

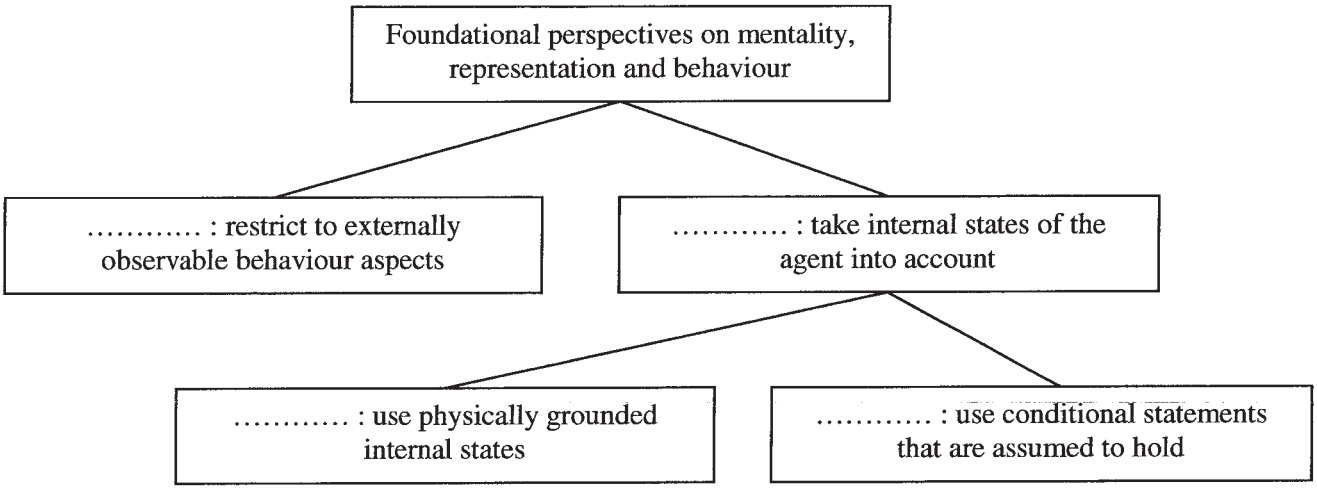
time / *trace*	*time point 0*	*time point 1*	*time point 2*	*time point 3*
trace 1	comm: employee cause of problem	obs: law allows firing	obs: employee present	firing action
trace 2	comm: employee cause of problem	obs: law does not allow firing	obs: employee present	
trace 3	comm: employee cause of problem	obs: law does not allow firing	no obs: employee present	

d) Explain why an instrumentalist explanation as given in c) would be valid.
Which criteria should be satisfied in order to obtain a valid explanation?

e) From a realist perspective, is an explanation from the physical stance possible? Why?

f) What is your opinion about the instrumentalist type of explanation addressed here? Explain.

g) Fill in the following four terms in the hierarchy below: behaviourism, functionalism, instrumentalism, realism.



Assignment 3

Answer the following questions:

a) For a certain domain (e.g., computer science, cognition, biology) choose a system and describe its dynamic properties (in semi-formal or formal form) at three adjacent aggregation levels. Show relations between the dynamic properties of different levels in the form of a property tree. Provide a two-dimensional classification type for every property (first dimension classes: global, intermediate, milestone, local; second dimension classes: internal, interaction, external).

b) Show how the idea of *compositional verification* can be realized in the system built in a)

c) Specify dynamic properties (in semi-formal or formal form) that describe different types of behavior (reactive, delayed-response, adaptive and motivation-based) of a system in the domain chosen in a)