Behavioural Dynamics – Exam

Wednesday December 20, 2006, 12:00 – 14.45.

This exam consists of three assignments. The amount of points that can be obtained for each assignment is denoted after each assignment. 10 points are given for free, so an additional 90 points can be earned. Hand in your answers to each exercise on a separate sheet. Always motivate your answers.

Good luck!

Assignment 1 (40)

In this assignment you are going to analyse the behaviour of a typical student:

> Every Saturday student A would like to go out dancing. However, A only desires to do so if (s)he doesn't have to be somewhere on Sunday morning. Given this desire, (s)he checks the local clubs to see if there is an interesting dance event planned. If this is the case (s)he intends to go there. However, before actually going A first checks whether there are friends available to join and also want to join. Then, if (s)he believes friends are coming with him/her, A will go dancing.

Assume the following relevant state properties for the example:

External state properties

saturday	It is a Saturday
appointment_sunday_morning	A has an appointment Sunday morning
interesting_dance_event	There is an interesting dance event this evening
friends_available	A's friends are available this evening
friends_want_to_go_dancing	A's friends would like to go dancing
group_is_dancing	A and his/her friends are dancing

Input state properties

obs(saturday)	A observes that it is a Saturday
obs(appointment_sunday_morning)	A observes that he/she has an appointment Sunday morning
obs(interesting_dance_event)	A observes that there is an interesting dance event
obs(friends_available)	A observes that his/her friends are available this evening
obs(friends_want_to_go_dancing)	A observes that his/her friends want to go dancing

<u>Output state properties</u>

> go_dancing   A goes dancing

<u>Internal state properties</u>

> b   A believes that his/her friends are available and want to go dancing
>
> d   A desires to go dancing
>
> i   A intends to go dancing

a) What kind of behaviour is described in this exercise? **(2)**

b) Give two example traces (showing external, input, output and internal state properties), one leading to dancing and one not leading to dancing. **(4)**

c) Show the dynamics of the example in graphical form. Do not forget to indicate which state properties are persistent. **(4)**

d) Write down the executable dynamic properties that characterise these dynamics. Which ones are step properties and which ones are persistence properties? **(6)**

e) For each of the internal state properties, indicate by which of the dynamic properties in d) its functional role is defined. **(3)**

f) Give a set of dynamic properties that specifies the input-output correlation from an **external** perspective. **(4)**

g) Is it possible to attribute representational content to the desire to go dancing, according to the *causal/correlational approach* (address both forward and backward)? If so, show how. If not, explain why not. **(6)**

h) Give the representational content to the desire to go dancing, according to the *relational specification approach* (both forward and backward). **(6)**

i) Suppose A indeed goes dancing. Give an (iterated) explanation from a functionalist perspective of the following form. **(5)**

> Why does A goes dancing?
> > A goes dancing, because ....
>
> Why .....?
> > ...., because ...
>
> et cetera.

Assignment 2 (20)

Consider a partial execution scenario within some transport company that performs deliveries for customers by trucks:

> Driver D is assigned to deliver order A20. D starts this delivery, but after some time a severe incident I occurs with his/her truck T. D informs his/her fleet manager F about I. Then, F informs customer C, whose order is being fulfilled, about a possible delay with the delivery of order A20.

The following properties describe the dynamics of the agents of the transport company and the events in the environment:

(2.5 for each property; 1 for horizontal axes, 1 for vertical axes, 0.5 for motivation)

P1: In the environment the severe incident I with truck T occurs.

P2: If any type of incident happens with a truck, then the driver responsible for this truck will observe this incident.

P3: If a severe incident occurs with a truck and its driver, who was fulfilling the order of some customer, then this customer will be notified about possible delay with his/her delivery.

P4: If a driver observes any type of incident with his/her truck, then the driver will believe that this incident has happened.

P5: If a driver believes that an incident has happened with his/her truck, then this belief will persist.

P6: If a driver believes that a severe incident has happened with his/her truck, then s/he will react by informing his/her fleet manager about this incident.

P7: If a driver sends any information to his/her fleet manager, the fleet manager will receive this information.

P8: If a fleet manager receives information from a driver about a severe incident, then the fleet manager will inform a customer, whose order is being fulfilled, about the possible delay with his/her delivery.

Consider the two-dimensional classification scheme given in Table 1. Fill each of the properties specified above in the correct cell of Table 1; briefly motivate your choices under the table:

	internal	interaction	external
global			
intermediate			
milestone			
local			

Table 1 Two-dimensional classification scheme

Assignment 3 (30)

Answer the following questions:

a) Explain the difference between *instrumentalism* and *realism*, and give pros and cons of both approaches. **(6)**

b) Explain what *requirements refinement* is, and how this can be used in the analysis of a given multi-agent system. **(4)**

c) Give an example of *reasoning by assumption*. Explicitly indicate different steps in the reasoning process. **(6)**

d) What is an *extended mind*? Give an example, and explain why this extended mind is beneficial for the agent that uses it. **(4)**

e) In Damasio's theory of consciousness, the notion of *emotion* plays an important role. Explain what he means by this concept, and why this definition is a bit unorthodox. **(4)**

f) According to some philosophers, there is a category of mental states for which it is difficult (or even impossible) to define the representational content. Which types of mental states are these? **(2)**

g) For *reductionism* the following attitudes are possible:

- the higher level properties are not needed in scientific practice; by the reduction relations they can (and have to) be eliminated

- by the reduction relations the higher level properties have been shown to have a solid foundation and hence can be used in scientific practice with much confidence

Discuss these two attitudes (pros and cons). **(4)**