Behavioural Dynamics - Exam

Wednesday December 17, 2003, 13:30-16:30.

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 the case of *motivation-based behaviour* is analysed:

> Person A has the following typical pattern of mental activity and behaviour. Every week he receives the weekend weather forecast on Wednesday. If this predicts nice weekend weather, then he desires to do a sailing trip on Saturday. Moreover, given the desire to sail, he calls his friends to invite them for a sailing trip for Saturday. Then, if he also believes his friends are available (because they told him), he intends to do the sailing trip with them. If he intends to sail, and on Saturday morning he observes that the weather turns out to be OK, A will actually do the sailing trip.

Assume the following relevant state properties for the example:

External state properties

weather_forecast_OK	the weather forecast (on Wednesday) predicts nice weekend weather
weather_OK	the weather (on Saturday morning) is nice
friends_available	A's friends are available for the trip on Saturday
sailing_trip	the sailing trip is going on

Input state properties

obs(weather_forecast_OK)	A observes that the forecast predicts nice weekend weather
obs(weather_OK)	A observes that the weather on Saturday morning is nice
obs(friends_available)	A observes that his friends are available for the trip on Saturday

Output state properties

call_friends	A calls his friends to invite them for a sailing trip
go_sailing	A does the sailing trip

Internal state properties

b	A believes that his friends are available
d	A desires to go for the sailing trip
i	A intends to go for the sailing trip

a) Give three example traces (showing external, input, output and internal state properties), one leading to the sailing trip and two not leading to the sailing trip.

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

c) Write down a list of executable dynamic properties that characterise these dynamics. Which ones are step properties and which ones are persistence properties?

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

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

f) Is it possible to attribute representational content to the desire to do a sailing trip, according to the *causal/correlational approach* (address both forward and backward)? If so, show how. If not, explain why not.

g) Give the representational content to the desire to do a sailing trip, according to the *relational specification approach* (both forward and backward)?

h) Suppose A indeed does a sailing trip on Saturday. Give an (iterated) explanation from a functionalist perspective of the following form.

Why does A sail on Saturday?

A sails on Saturday, because ....

Why .....?

...., because ...

et cetera.

Assignment 2

In this exercise we analyse a microscopic small animal that lives in water. For this small animal, that feeds itself with certain substances in its environment, a biologist has identified the following (externally observable) behaviours (here it is assumed that all places are either food-poor or food-rich):

- If it is in a food-poor environment, and no food-rich places are near, then it starts to move in any direction
- If it is in food-poor environment, and there are food-rich places near, then it starts to move in the direction of a food-rich place
- If it is in food-rich environment, it does not move

The biologist has formulated the following psychological theory T_2 to explain these behaviours. In this theory the following five internal mental state properties are used: sr(fp), sr(fr), p(mr), p(ma), p(mn). These state properties are related by the following dynamic properties:

- being in a food-poor environment leads to sr(fp)
- the presence of food-rich places near leads to sr(fr)
- sr(fp) and sr(fr) together lead to p(mr)
- sr(fp) without sr(fr) leads to p(ma)
- absence of sr(fp) leads to p(mn)
- p(mr) leads to moving to food-rich place
- p(ma) leads to moving in any direction
- p(mn) leads to not moving

a) Make a graphical representation of the internal dynamics based on the above theory T_2.

b) Suppose the animal is in food-poor water and moves to food-rich water nearby. Give an explanation of why it performs this behaviour based on the psychological theory T_2. Explain why this can be considered an *instrumentalist explanation*.

After further research, the biologist has found a number of internal chemical state properties (denoted by A, B, C, D, E), with the following dynamic properties connecting them:

- being in a food-poor environment leads to A
- the presence of food-rich places near leads to B
- A and B together lead to C
- A without B leads to D
- absence of A leads to E
- C leads to moving to food-rich place
- D leads to moving in any direction
- E leads to not moving

This chemical theory is called T_1. The question to be addressed next is whether the psychological theory T_2 can be reduced to the chemical theory T_1.

c) Make a graphical representation of the internal dynamics based on the above chemical theory T_1.

d) Formulate *bridge principles* for reduction of theory T_2 to theory T_1.
Are these bridge principles *biconditional*?

e) Explain why indeed these bridge principles are a basis for reduction of T_2 to T_1 (i.e., why the criteria of the Nagel-model for reduction are fulfilled).

f) Explain why the explanation at b) now can be considered a *realist explanation.*

g) Suppose a state property s2 from T_2 is connected via a biconditional bridge principle to state property s1 from T_1. Explain, illustrated by an example from d), why the representational content of s2 corresponds to the representational content of s1. Do this both for the *causal/correlational approach* and the *interactivist approach* to representational content.

Assignment 3

Answer the following questions:

a) In design of Agent Systems, two cases can be distinguished: *agent behaviour design* and *interaction protocol design*. Explain the difference between both cases.

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

c) What is an *extended mind*? Give an example.

d) What does Damasio mean by *emotion*, *feeling*, and *feeling feeling*?

e) Consider the two-dimensional classification scheme given in Table 1. Give an example of a dynamic property that can be classified as *local internal property*. Also give an example of a dynamic property that can be classified as a *global interaction property*. If you like, you can make use of the domains of Assignment 1 and 2.

	internal	interaction	external
global			
intermediate			
milestone			
local			

Table 1 Two-dimensional classification scheme