Exam Behavioural Dynamics 2011 (February 7th, 2011, 18:30 – 21:15).

Assignment 1 (40 pts)

In this assignment the case of *motivation-based behaviour* is analysed:

Agent Bas receives every Wednesday the weekend weather forecast. If this predicts nice weekend weather, then Bas desires to go hiking on Saturday. Moreover, given the desire to hike, Bas calls his friends to invite them for a hike for Saturday. Then, if he also believes his friends are available (because they told him), he intends to go hiking with them. If he intends to hike, and on Saturday morning he observes that the weather turns out to be OK, Bas will actually go hiking.

Assume that generation of each cognitive state takes time, which you can choose yourself. Furthermore, assume the following relevant state properties in your model:

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	Bas's friends are available for a hike on Saturday
hiking_trip	the hiking trip is going on

Input state properties

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

Output state properties

call_friends	Bas calls his friends to invite them for a hiking trip
go_hiking	Bas does the hiking trip

Internal state properties

bel(weather_forecast_OK)	Bas observes that the forecast predicts nice weekend weather
bel(weather_OK)	Bas believes that the weather on Saturday morning is nice
bel(friends_available)	Bas believes that his friends are available
d	Bas desires to go for the hiking trip
i	Bas intends to go for the hiking trip

a) Show the dynamics of the example in graphical form. Do not forget to indicate which state properties are persistent. **(8)**

b) Write down at least 3 executable dynamic properties in the semi-formal form that characterise these dynamics. **(7)**

c) For the properties you defined in b), indicate which ones are *step properties* and which ones are *persistence properties*. **(4)**

d) If possible, give the representational content of internal state property d (Bas desires to go for the hiking trip) according to the externalist causal/correlational approach. Look both backward and forward. **(7)**

e) Name the classical problems with the externalist causal/correlational approach. For each problem explain whether it occurs in d). **(6)**

f) If possible, give the representational content of internal state property i (Bas intends to go for the hiking trip) according to the second-order relational specification approach. Do not forget to look backward and forward. **(8)**

Assignment 2 (20 pts)

Consider the Agent System for cooperative information gathering described in the Reader. In particular, consider the following dynamic properties:

P1 Information request pro-activeness
Agent X eventually requests information to (the other) agent Y.

P2 Concluding effectiveness
If at some points in time E generates all the correct relevant information,
then C will receive a correct conclusion.

P3 Information acquisition reactiveness
If agent X receives an information request from agent Y,
then X will start information acquisition from E.

P4 Information provision reactiveness
If X has received information from its source from E,
and it has received an information request from the other agent Y,
then it will generate this information for Y.

a) In your opinion, which from the properties above can be considered as local, intermediate and global dynamic properties? Please, motivate your answer. **(8)**
b) Suppose that **P2** is not satisfied. How would you use the compositional analysis method to identify the cause of failure of this property in the context of this multi-agent system? **(12)**

Assignment 3 (40 pts)

To build a house at a certain location, civilians need to apply for a building permit at the municipality in which the location lies. The organisation of this application process is described below.

The only role that in principle has contact with a Civilian concerning building permits in a municipality is the Desk Clerk (DC). The Civilian interacts with the Desk Clerk in a special group, namely the Civilian Contact Group (CCG). In addition, a group which takes care of Task Distribution (the Task Distribution Group, TDG) is present. Herein two interacting roles are present, namely the Desk Clerk Representative (DCR, played by the same agent as the role Desk Clerk) and the Administrator Representative (AR). Finally, there is a group in which the actual decision is made about whether the permit is granted or not, namely the Permit Department Group (PDG), herein an Administrator is present that coordinates the process (which is fulfilled by the same agent playing the role Administrator Representative), and in addition two roles are present, namely an Expert Environmental Issues (EEI) and an Expert Building Matters (EBM).

Now the process works as follows. When a Civilian outputs a request for a building permit in the Civilian Contact Group, this request is received by the Desk Clerk. As a result, the Desk Clerk Representative assigns the request to an Administrator Representative in the Task Distribution Group. This input causes the Administrator in the Permits Group to output two requests for advice, namely from the Expert Environmental Issues, and the Expert Building Matters. In case both agree with giving the permit (and the Administrator receives this as input), a positive outcome is outputted by the Administrator Representative to the Desk Clerk Representative. Otherwise, a negative outcome is passed on. This finally leads to an output of the Desk Clerk to the Civilian in the Civilian Contact Group of the outcome.

In this exercise you need to model this description using the AGR framework.

a) Express the AGR-specification of this organisation in **graphical** format. **(14)**

b) Express the behaviour of the organisation in terms of semi-formal dynamic properties. Try to limit yourself to the behaviour described in the text above. **(14)**

c) Provide a proof tree for the organisational property *"if Civilian outputs a request for a building permit, then Administrator eventually receives an expert outcome"* **(12)**