**RESEARCH METHODS FOR THE LEARNING SCIENCES, 2010 TERM C**

**INSTRUCTOR: RYAN S.J.d. BAKER**

**ASSIGNMENT FOUR**

**COGNITIVE MODELING**

**HANDED OUT:** Tuesday, February 16

**DUE:** Wednesday, February 24, 11:59am by email to instructor  
(if your submission is over 10.0MB, please email me a web link)

In this assignment, you will develop a cognitive model. You can carry out this assignment either in pairs, or individually. If you carry out the assignment in a pair, you should hand in this assignment together.

**STEP ONE:** Choose your process or task

You should choose a process or task that is of educational importance. It does not necessarily need to be a task you are researching, although you are welcome to use such a task. A task almost certainly has educational importance if it is taught in a significant number of schools or universities (or in trade schools, professional training, etc.). It is OK for this task to be one that you studied in assignment 2 or assignment 3, but this is not required. You should choose a task that can be in expressed in between 8 and 20 correct English-language production rules. If your preferred task needs more than 20 production rules, you should reduce the scope of your chosen task. Do not choose scatterplot generation, algebra, or picture algebra, as we have discussed models of these domains in class. Other mathematical domains are OK. Other domains are OK, including meta-cognitive domains.

**STEP TWO:** Develop if-then production rules expressing correct performance of the task

Write out 8 to 20 English-language production rules expressing correct performance of the task. It should be possible for me to actually execute the task based on your production rules (so do not forget to include sub-goals, necessary “if” conditions, and break the process down into executable cognitive rules rather than having the model “eyeball” something; non-deterministic behavior, however, is OK -- for instance, your model could choose a random number between 1 and 100). Your correct performance rules can express expert performance, or a recent learner. Your rules should also represent a process that is realistic and plausible (as an example of an implausible process, people drawing graphs do not test every scale between 1 and 200 while choosing a scale for a scatterplot). Your rules can be based on think-aloud data or rational modeling, as discussed in Lovett et al. Be sure to show the initial state of the model.

Here are example rules:

INITIAL STATE: I am George-of-the-Jungle, I am swinging tree to tree,

I do not hear “look out for that tree!”, there are no trees in front of me

PRODUCTION LOOK-OUT-FOR-THAT-TREE

If I am George-of-the-Jungle

AND

I am swinging tree to tree

AND

I hear “look out for that tree!”

THEN

Dodge to the right

**STEP THREE:** Develop 3 “bug” rules expressing semantically meaningful incorrect performance

Write out 3 English-language production rules expressing semantically meaningful incorrect performance (e.g. multiplying 3 and 3 and getting 16,384 is not semantically meaningful, but   
 3 x 3 = 6 probably is plausible, as it reflects a confusion between multiplication and addition).

Here is an example bug rule:

PRODUCTION DO-NOT-LOOK-OUT-FOR-THAT-TREE

If I am George-of-the-Jungle

AND

I am swinging tree to tree

THEN

Go straight forward at high-speed

**STEP FOUR:** Offer a hypothesized process for how each bug rule was produced in a hypothesized subject’s mind.

**STEP FIVE:** Write 1-2 paragraphs on alternate ways that this problem could be successfully solved, that your model does not capture. If there are no alternate problem-solving strategies, please justify this claim.

**STEP SIX:** Reflect on whether this method elucidated understanding of the domain that you did not have before creating this model. If you learned nothing from the modeling process (which \*is\* possible), explain why you already had a full understanding of the task.

**Writeup:** Your writeup should describe your task, discussing why this task was amenable to production-rule cognitive modeling. Be sure to detail whether you are modeling expert performance, a recent learner, or some other type of performance. Present your full model, including representing the original state of the model. Present your bug rules, and your explanation for how each bug rule could have been produced in a hypothesized subject’s mind. Then present your 1-2 paragraphs on alternate ways that this problem could be successfully solved, that your model does not capture. Finally, please reflect on whether this method elucidated understanding of the domain that you did not have before creating this model.

**Grading Rubric:** Hand-ins will be graded on the basis of:

1. Choice of educational task amenable to production-rule cognitive modeling
2. The model is executable by hand (by me) and can be used to complete the intended task
3. The model is cognitively plausible
4. The bug rules are plausible and semantically meaningful
5. Quality of discussion of alternate problem-solving strategies (or justification that there is only one possible strategy).
6. Thoughtful reflection on what you learned from creating the model.