

Outline of AdvGeo Tutor

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1. Spontaneous Scaffolding

AdvGeo tutor provides scaffolding for every single cognitive step involved in theorem proving. Each step has several different scaffolding strategies including *direct exposure of the target step*, *multiple choice questions for the target step*, and *prompting*. At the beginning, all steps are supposed to provide *strongest* scaffolding, namely, the direct exposure of the target step. The tutor traverses the hierarchically defined cognitive model in the depth-first fashion and provides scaffolding bottom-up.

To provide scaffolding for subgoaling, the tutor reifies a *goal stack* as a goal tree representing backward chaining.

To provide scaffolding for operator application, the tutor reifies an *operator instantiation* by highlighting the problem configuration. The tutor also provides iconic representation for postulates. The *proof tree* is used for scaffolding for forward and backward chaining (the goal stack can be implemented upon the proof tree).

2. Fading

The scaffolding should fade away when the student show consistent correct performance on the target step. The fadeout is done by chaining the amount of information provided as a hint or simply turning off scaffolding.

Since cognitive steps are hierarchically defined, once scaffolding on a step is turned off then scaffolding on the steps at the same hierarchical level must be shut off as well. At this point, the student must follow scaffolding provided for the step one level above, but has a freedom to carryout substeps (which are the steps that scaffolding is just shut off).

3. Monitoring

Once scaffolding is turned off, the tutor must be patient with the student's redundant (but "legal") input unless it is wrong. If the student makes a wrong assertion, however, the tutor must provide a negative

acknowledgement. The tutor also allow student not to follow the order of the steps with scaffolding turned off.

4. On-demand Hinting

When the student reaches impasse, he/she can ask a what's-next hint. The tutor picks up a backward step at the fringe and provides top-down scaffolding. Note that this time, the tutor's help starts with the *weakest* scaffolding on the top most cognitive step on the target step.