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Thinking *inside* the box.

IMPACT
Intelligent Modeling for Pedagogically-Aware Cultural Training

Office of Secretary of Defense SBIR Contract
Air Force Research Lab, Mesa AZ

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IMPACT team

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- Subcontractors
  - Creative Technologies Research and Applications Center
    - Institute for Creative Technologies, USC
    - Phases I & II
  - Dr. Brian Magerko
    - Phase II

Goal

- Develop a robust approach to student modeling to support performance assessment and feedback in a cultural game environment.

What is a student model?

- It is the component of a training system that contains information about the student's knowledge and skill.
- It can be used to provide summative assessment information.
- It can also be used as the basis for providing individualized instruction.
- The kinds of information in the student model determine the degree of individualization possible.
  - Guidance
  - Feedback on performance (real-time and post-instruction)
  - Variations in instructional content

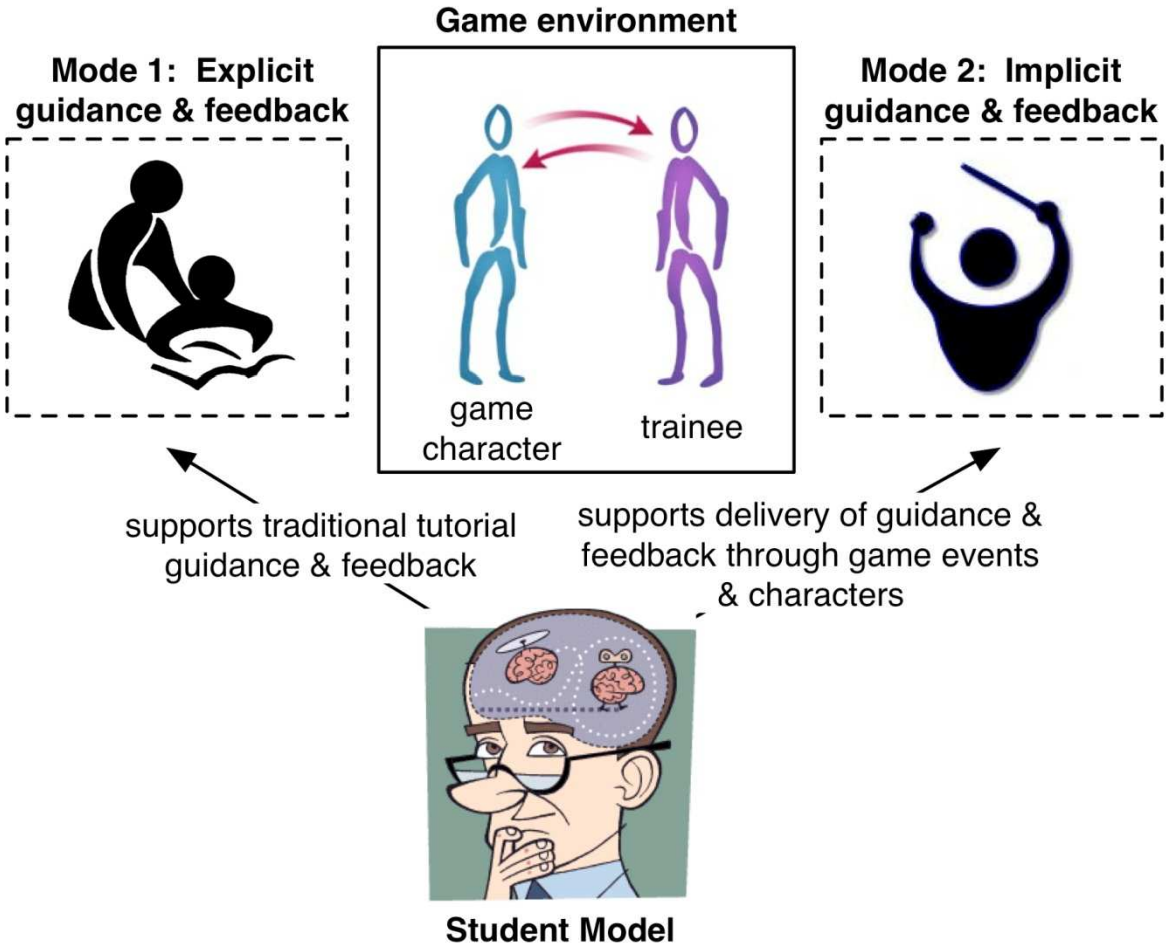
IMPACT Vision

Intelligent Modeling for Pedagogically-Aware Cultural Training

IMPACT aims to:

- Provide a realistic practice for cultural training in a game-based environment
- Support delivery of guidance and feedback during game play
  - Driven by deliberate instructional strategies
  - Tailored to individual student needs
  - Enabled by student model
- Support two modes of guidance and feedback
  - Explicit: through tutorial character
  - Implicit: through game events and characters (a tailored practice environment!)

IMPACT Vision



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Phase I building blocks & challenges

- Cultural skills
  - Challenge: What important skills can we train?
- Game-based training environments and pedagogical agents
  - Challenge: How to provide guidance and feedback?
- Intelligent tutoring systems (ITS)
  - Challenge 1: How to represent domain knowledge?
  - Challenge 2: How to work with an ill-defined domain?

Cultural Skills: ELECT BiLAT

- Cultural training game
- Developed by ICT/CCT at USC
- Focused on bilateral engagement
  - Negotiation activities aimed at bringing about agreement
  - Social and cultural considerations in negotiation
- Primary game phases
  - Meeting preparation
  - Meeting rehearsal
  - ***Meeting conduct***
  - Meeting AAR

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Game-based training & pedagogical agents

Providing training support

ELECT BiLAT

- Intelligent Guided Experiential Learning (IGEL) Coach
- Game actions are mapped +/- to training objectives
  - Show photograph of wife: (-) small talk
  - Greet in Arabic: (+) begin meeting
- IGEL coach delivers positive or negative feedback
- Delivery of feedback determined by coach settings (controlled by instructor)
  - E.g., positive feedback after every third correct action and negative feedback after every error
- **Explicit guidance and feedback delivered through a tutor character**

Game-based training & pedagogical agents

Providing training support

Interactive Story Architecture for Training (ISAT)

- Combines interactive story and intelligent tutoring approaches
- Intelligent director agent orchestrates an appropriate experience for each trainee
  - Alters story
  - Reacts to trainee actions
  - Does not disrupt immersive game experience
- **Implicit guidance and feedback delivered through game events and characters (a tailored practice environment)**

Intelligent Tutoring Systems (ITS)

- Three traditional components
  - **Expert** or domain model
    - Targeted domain knowledge
  - **Student** model
    - Representation of trainee's knowledge (inferred from behaviors)
  - **Instructor** model
    - Responses to trainee actions/pedagogical strategies
- Challenge 1: How to represent domain knowledge and trainee's knowledge to support the use of pedagogical strategies
- Challenge 2: Ill-defined domain makes representation task even more challenging

Ill-defined domains

- Space of possible actions is large
- Not always possible to classify actions as correct or incorrect
  - Dependent on contextual factors that vary from situation to situation
- Rules underlying the domain may not be well-understood or formalized

- CCT addressed some challenges in ELECT BiLAT
  - Finite set of actions (accessible through menus)
  - Some action-training objective mappings are “mixed”

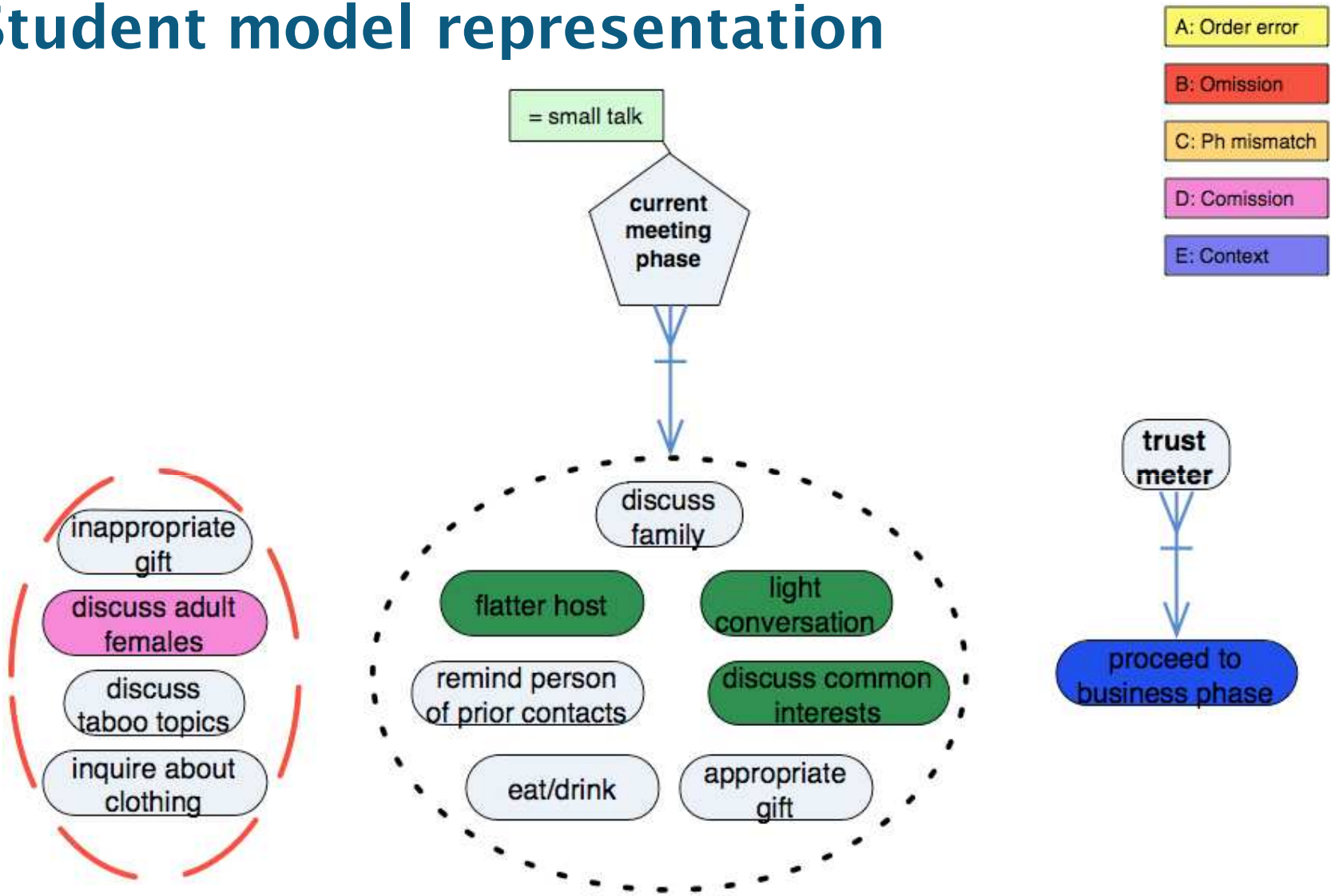
Constraint-based modeling

- Alternative to more common rule-based representations of domain knowledge
- Example
  - Declarative knowledge
    - Not very useful form for training
    - “The speed limit in New Zealand is 50 km/h.”
  - Procedural knowledge
    - Can be used to generate behavior
    - “If driving in New Zealand, drive at a speed of 50 km/h.”
  - Constraint
    - Can be used to assess behavior
    - “If driving in New Zealand, speed ought to be 50 km/h.”

Constraint-based modeling (cont.)

- Constraint is an ordered pair <R, S>
  - R is the relevance condition *(If the situation is…)*
  - S is the satisfaction condition *(… then X should be true.)*
- Used in tutorial systems
  - Does not require delineation of all solution paths
  - Constraints reflect important pedagogical points
  - Violation of constraints triggers need for guidance or feedback
- IMPACT representation
  - Constraint-based
  - Constraints currently represented conceptually, and not yet expressed in <R,S> computational form

Student model representation



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Nuggets & Coal

- Constraint-based representation is useful for
  - Pedagogy
  - Ill-defined domains
- Phase II awarded!
  - Will implement and test effectiveness

- Student model is only a graphical representation
  - No code yet
- Phase II award in January, but still waiting for the $$ to get started

