

Investigating Synthetic Web-Based Tutoring: Research on What Works

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2008 AAPT Summer Meeting EG10



**This work is supported in part by U.S. National Science Foundation
under grant numbers REC-0632587 and REC-0632657**

Motivation



Student-tutor interaction

- More effective than typical classrooms and mastery learning¹
- Perceived interaction is known to be important²
- Provides direct access to students' knowledge construction process

Can we simulate this interaction?

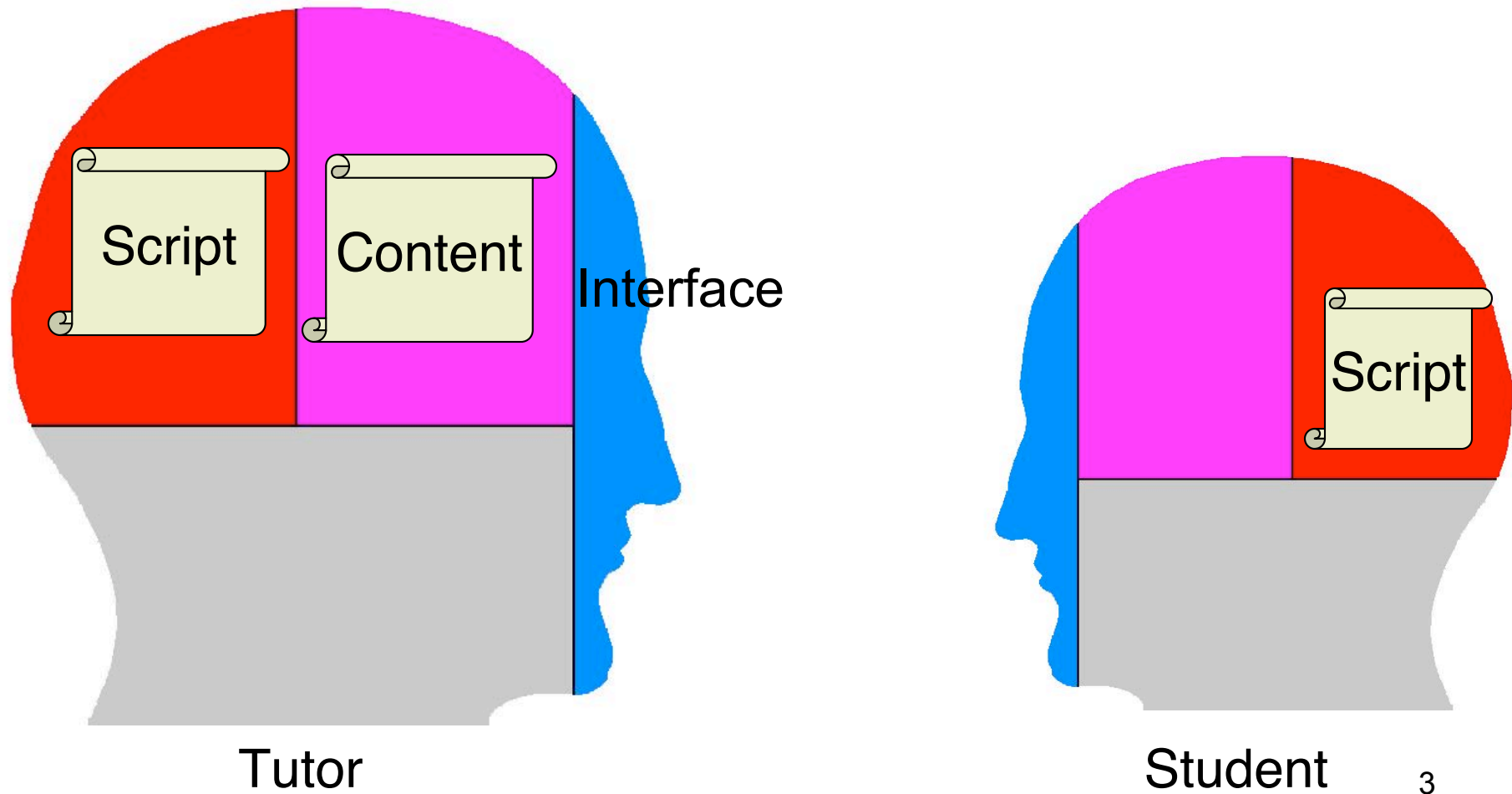
- To provide a supplemental learning aid
- To provide insight into students' learning process

¹ Bloom (1984) ² Okita (2007)

Tutoring Interaction



A view of the tutoring interaction



Synthetic Interaction



The Interface

provided by Synthetic Interview Technology³

A screenshot of the Synthetic Interview Technology interface. At the top, there is a video player showing a woman with dark hair and glasses, wearing a red jacket, identified as Roberta Lang. Below the video player, there is a dropdown menu for the teacher's name, a star rating system, and a "More feedback..." button. The interface displays the question "Answering: How should I relate momentum to reality?" and provides a reference: "References: H. Brody, Am. J. Phys. 47, 482-487 (1979)". At the bottom, there is a text input field containing the question "Are force and momentum related?" and two buttons labeled "Ask" and "Clear".

Natural language questions

Answered by a real person

Responses are pre-recorded, but can simulate a real conversation.

³ Stevens (2007)

Synthetic Interaction



The Content Knowledge

Stored in the Informedia Digital Video Library³

A screenshot of a Windows Internet Explorer browser window. The title bar reads "Air Bag, Impulse, and Passenger Safety - Windows Internet Explorer". The address bar shows the URL "http://www.infsearch.cs.cmu.edu/html/streaming/video.asp?id=878&st=0". The main content area is split into two columns. The left column contains a video player with a "Force And Momentum" navigation bar at the top and a video frame showing a crash test dummy in a car. The right column contains a text transcript with physics-related content. The text includes phrases like "acted upon by an external force", "change in momentum", "force applied", "impulse", and "Newton's second law". The video player has standard controls like play, stop, and volume, and buttons for "ADD A NOTE", "VIEW ALL NOTES", "VIDEO INFO", and "SPEED". The status bar at the bottom shows "Done" and "Internet" with a 100% zoom level.

Multimedia content can be searched by keywords

Complete transcripts are displayed

Can be linked to Synthetic Interview

³ Stevens (2007)

Synthetic Interaction



The Script

What should be taught?

What should a tutor say for effective results?

What do students expect from the interaction?

Synthetic Interaction



The Script

What should be taught? ← Our Choice

– Newton's Laws

Current Research Questions:

What should a tutor say for effective results?^{4,5}

What do students' expect from the interaction?

⁴ Chi (1996)

⁵ Chi (2001)

Creating the Script



- Designed 3 lessons on Newton's Laws
- Lesson scenarios inspired by FCI questions⁶
- Utilize a 3 stage learning cycle for each lesson⁷
- Implementation combines Web materials, traditional written materials and a live human facilitator
- Lessons focus on empirical observation and task as measure of understanding



⁶ Hestenes (1992) ⁷ Karplus (1977)

Creating the Script



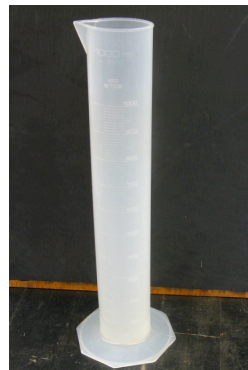
Sample

I. Exploration: Make observations or measurements



II. Formal Introduction/Discussion: Discuss exploration results in context

III. Application: Perform a relevant task and explain solution



Pilot Testing



Summer 2008 Study:

- 7 students in algebra-based and concept-based physics
- 3 female, 4 male
- 2 hour tutoring/interview sessions
- A human tutor facilitated the sessions

Pilot Testing



Preliminary Results:

Confirming the things we (hopefully) already knew

- Questions are the language of tutoring.
- Observed normal student difficulties (Ex: Force moves with objects., Motion implies force. etc...)
- Students believe lessons and tutor are helpful.
- Time per lesson varied 30min to 2hrs.

A detailed analysis is in progress to find what works.

Ongoing Efforts



- Refine scripts based on student & teacher feedback
- Combine scripts with synthetic interview and informedia digital library technologies
- Study relation between available interactions and student learning

References



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Thank You!

More info:

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