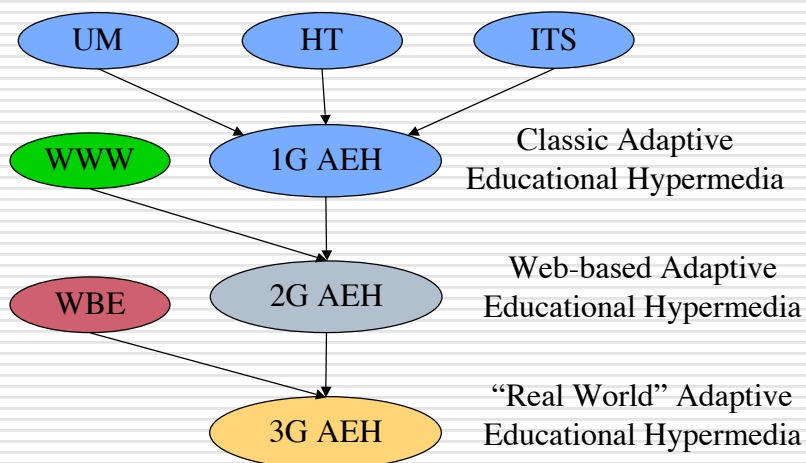


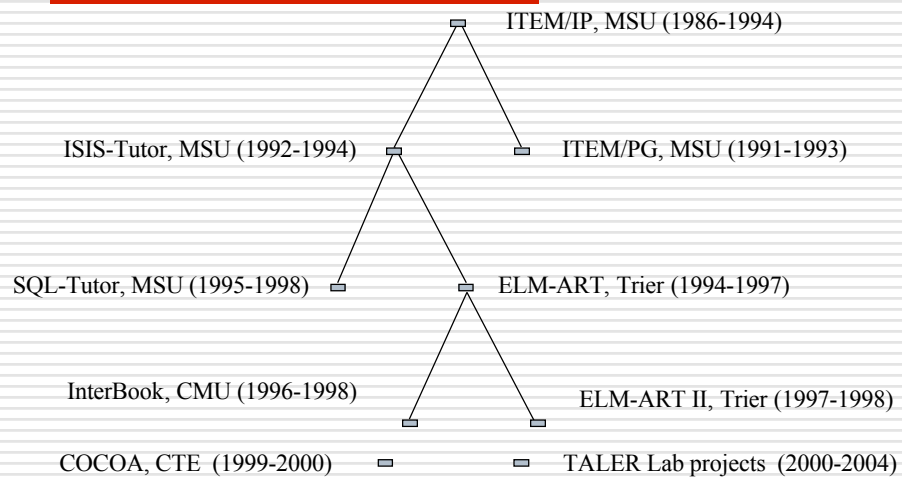
Adaptive Educational Hypermedia: From Generation to Generation

Peter Brusilovsky
School of Information Sciences
University of Pittsburgh, USA

From Generation to Generation



Personal View



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Why Adaptive Hypermedia?

Hypermedia systems are flexible but ...

- ☑ Different people are different
- ☑ Individuals are different at different times
- ☑ "Lost in hyperspace"

We may need to make hypermedia adaptive where ..

- ⇒ There us a large variety of users
- ⇒ Same user may need a different treatment
- ⇒ The hyperspace is relatively large

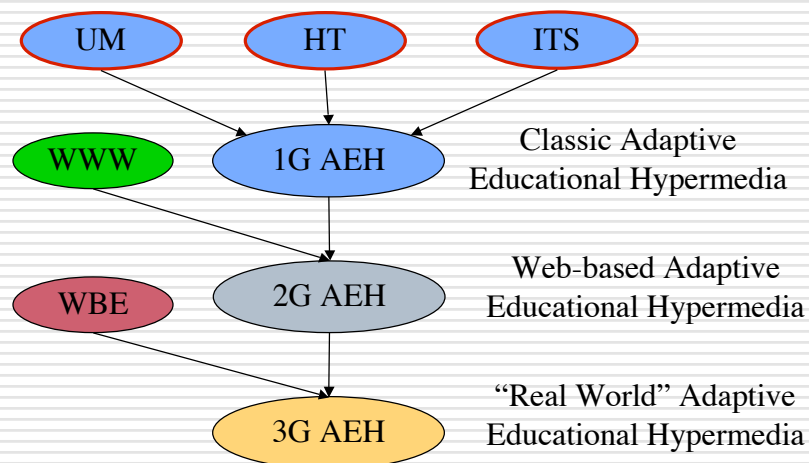
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So, where we may need AH?

- Educational Hypermedia
 - Hypadapter, Anatom-Tutor, ISIS-Tutor, Manuel Excell, ELM-ART, InterBook, AHA
- On-line Information systems
 - MetaDoc, KN-AHS, PUSH, HYPERFLEX
- On-line Help Systems
 - EPIAIM, HyPLAN, LISP-Critic, ORIMUHS

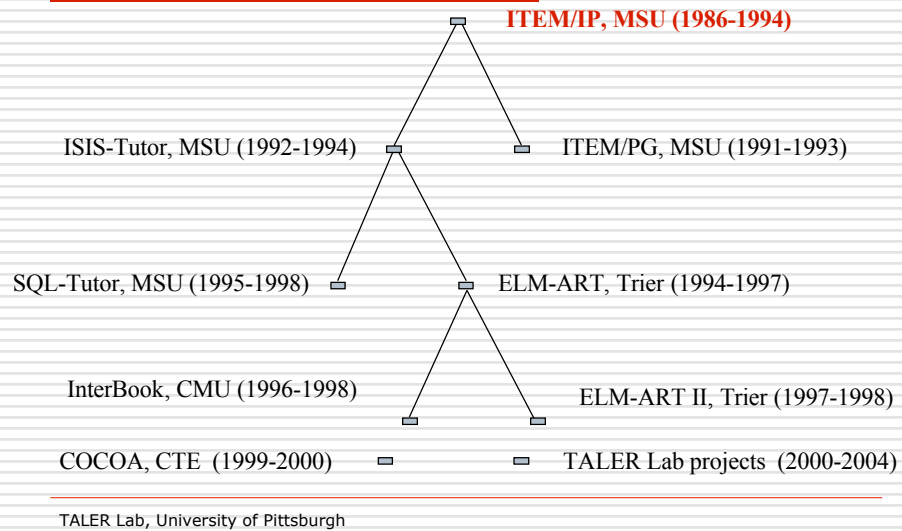
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Generation 0



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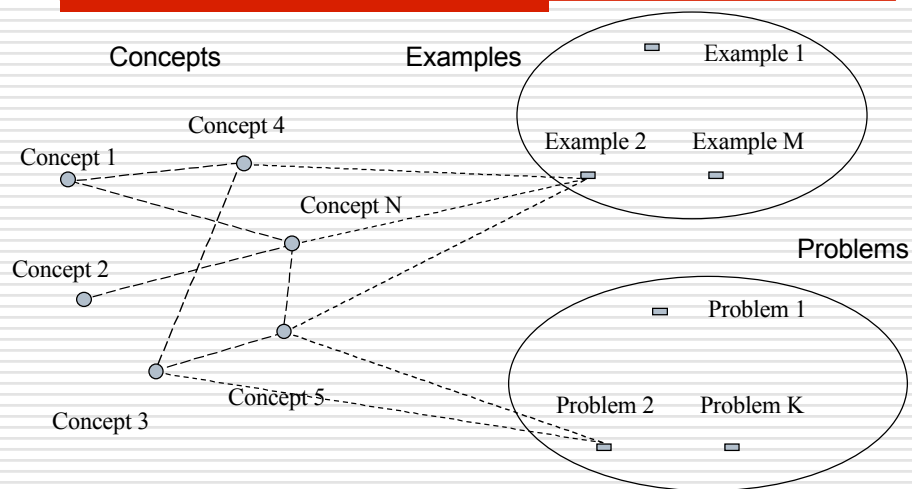
Personal View: Generation 0



ITEM/IP

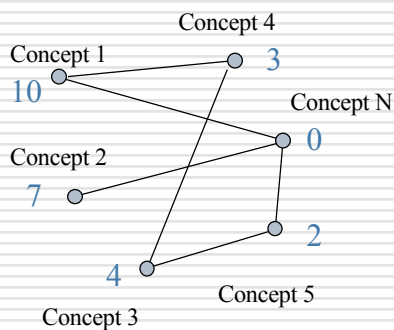
- ILE for Introductory Programming
- Integrated system
 - Tutorial (presentation of optimal sequence of explanations, examples and problems)
 - Environment (playing with examples, design and debug problem solutions)
 - Manual (a manual for reference-style access to studied information, examples, solved problems)

Knowledge and learning material



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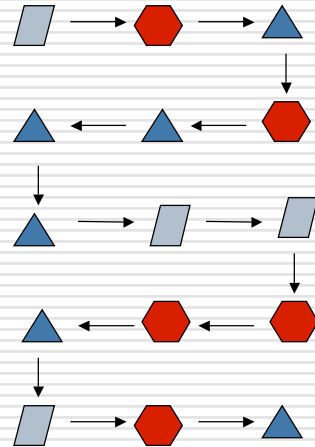
Weighted overlay model



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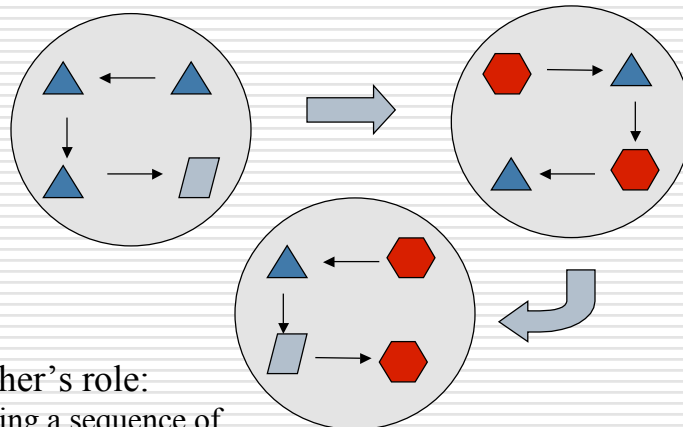
Course Sequencing

- Oldest ITS technology
 - SCHOLAR, BIP, GCAI...
- Goal: individualized "best" sequence of educational activities
- ITEM/IP: multi-type
 - information to read
 - examples to explore
 - problems to solve ...



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Sequencing in ITEM/IP



- Teacher's role:
Defining a sequence of learning goals

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Adaptive presentation

- Goal: make the same “page” suitable for students with different knowledge
 - beginners (in tutorial mode)
 - advanced (in manual mode)
 - smooth transition
- Methods to achieve the goals
 - comparisons of several concepts
 - extra explanations for beginners
 - more complete information for advanced

Conditional text filtering

- Similar to UNIX cpp
- Universal technology
 - Altering fragments
 - Extra explanation
 - Extra details
 - Comparisons
- Low level technology
 - Text programming

If switch is known and
user_motivation is high

Fragment 1

Fragment 2

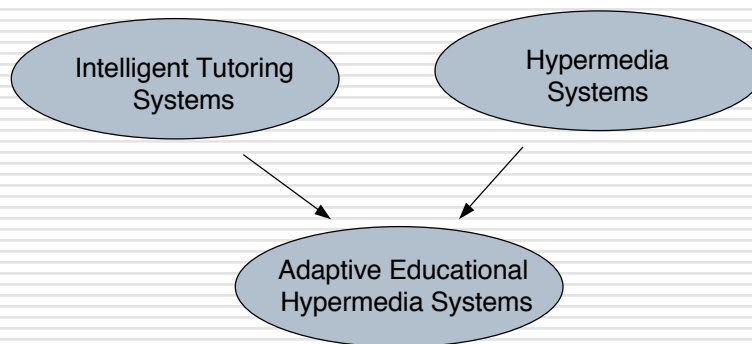
Fragment K

Problems

- ❑ A category of students wanted to make the choice of next thing to do themselves
- ❑ Combining guidance and freedom?
- ❑ Added menu-based access to new material
- ❑ Two information spaces with separate access...
 - Explored material (past)
 - New material (future)
- ❑ And in 1991 we have found hypertext...

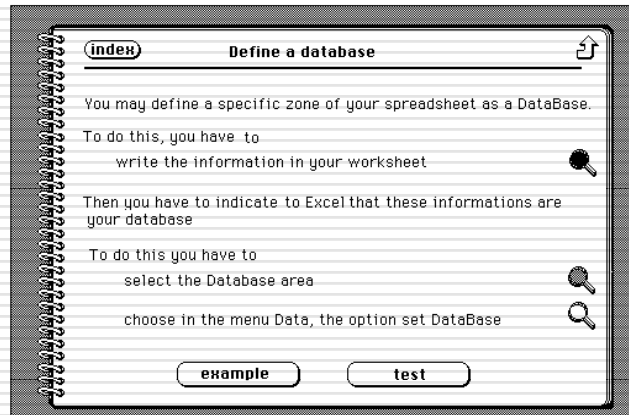
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Origins of Adaptive Educational Hypermedia



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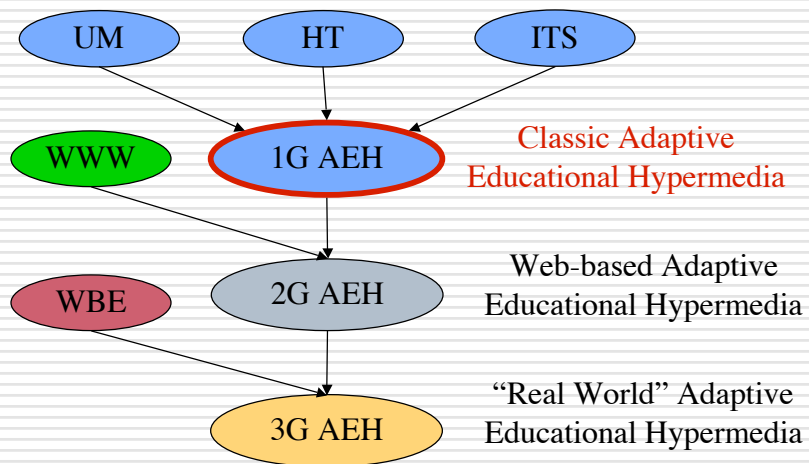
Early Adaptive Hypermedia



Annotations for topic states in *Manuel Excell*: not seen (white lens) ; partially seen (grey lens) ; and completed (black lens)

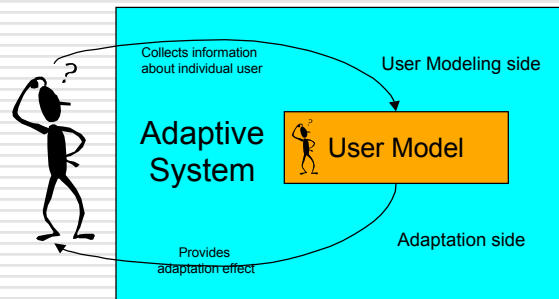
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Generation 1



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Adaptive systems



Classic loop "user modeling - adaptation" in adaptive systems

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What can be taken into account?

- Knowledge about the content and the system
- Short-term and long-term goals
- Interests
- Navigation / action history
- User category, background, profession, language, capabilities
- Platform, bandwidth, context...

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What Can Be Adapted?

- Hypermedia = Pages + Links
- Adaptive presentation
 - content adaptation
- Adaptive navigation support
 - link adaptation

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Adaptive Presentation: Goals

- Provide the different content for users with different knowledge, goals, background
- Provide additional material for some categories of users
 - comparisons
 - extra explanations
 - details
- Remove irrelevant piece of content
- Sort fragments - most relevant first

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Adaptive Presentation Techniques

- Conditional text filtering
 - ITEM/IP
- Adaptive *stretchtext*
 - MetaDoc, KN-AHS
- Frame-based adaptation
 - Hypadapter, EPIAIM
- Natural language generation
 - PEBA-II, ILEX

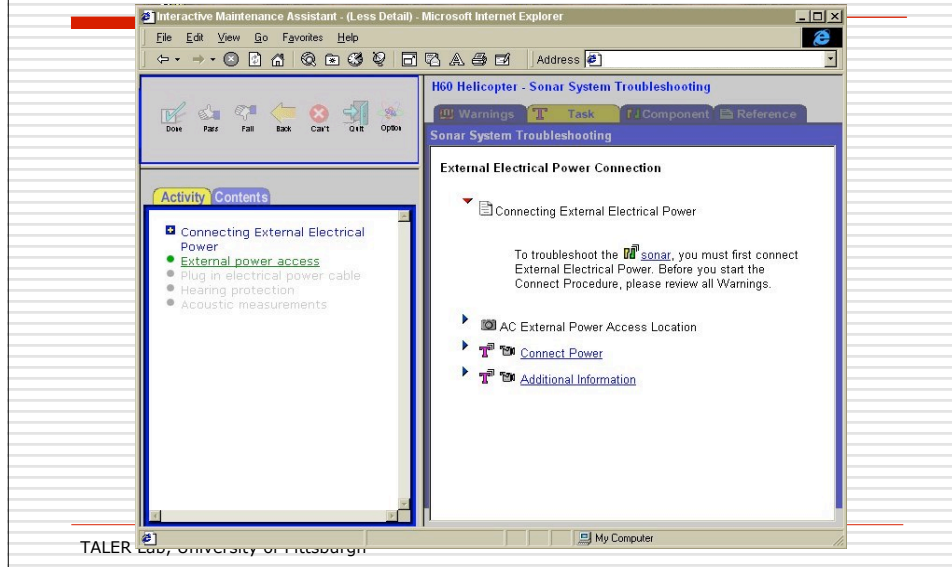
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Adaptive Stretchtext (PUSH)

The screenshot displays a user interface for Adaptive Stretchtext (PUSH). On the left is a vertical navigation menu with the following items: **task**, **summary**, [basic introduction](#), **purpose**, [what is done in this process](#), [how to work in this process](#), [list of activities](#), [release information](#), [input objects](#), [output objects](#), [entry criteria](#), [exit criteria](#), [roles](#), [simple example](#), and [advanced example](#). The main content area on the right is titled 'task' and contains a 'summary' section. The summary text reads: 'In iom we perform and document an **object-oriented analysis** [L1] [Describe object-oriented analysis | Compare object-oriented analysis and object-oriented design] of a subsystem. The model should include the abstractions (represented as **object types** [L1]) necessary to understand how the subsystem described by the functional requirements is expressed in an object-oriented world. This analysis will render us a high-level view of the subsystem without any consideration (or at least as little consideration as possible) taken to distribution, persistence aspects or other design and implementation considerations. The goal is a model that clearly describes and gives an understanding of a subsystem without the gory details of design and implementation.' Below the summary is a 'basic introduction' section with the text: 'The ideal object model resulting from the ideal object modelling process, is functionally complete in the sense that it covers all areas of the functional specification of a subsystem.' A 'purpose' section follows with the text: 'The ideal object model resulting from the ideal object modelling process, is functionally complete in the sense that it covers all areas. The intention behind the ideal object modelling process is to focus on'. The interface includes standard window controls like scroll bars and a mouse cursor.

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Example: Stretchtext (ADAPTS)



Adaptive Presentation: Evaluation

- MetaDoc: On-line documentation system, adapting to user knowledge on the subject
- Reading comprehension time decreased
- Understanding increased for novices
- No effect for navigation time, number of nodes visited, number of operations

Adaptive Navigation Support: Goals

- Guidance: Where I can go?
 - Local guidance (“next best”)
 - Global guidance (“ultimate goal”)
- Orientation: Where am I?
 - Local orientation support (local area)
 - Global orientation support (whole hyperspace)

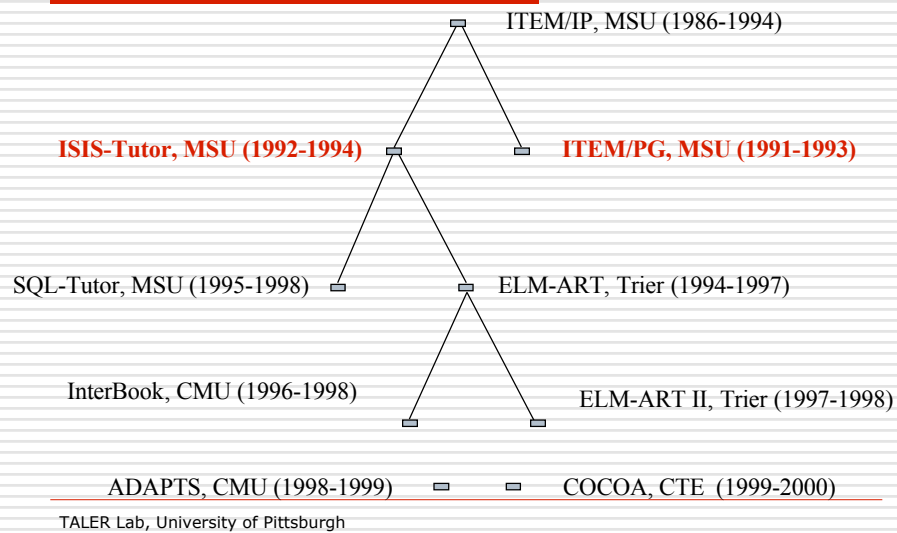
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Adaptive Navigation Support: Techniques

- Direct guidance
- Restricting access
 - Removing, disabling, hiding
- Sorting
- Annotation
- Generation
 - Similarity-based, interest-based
- Map adaptation techniques

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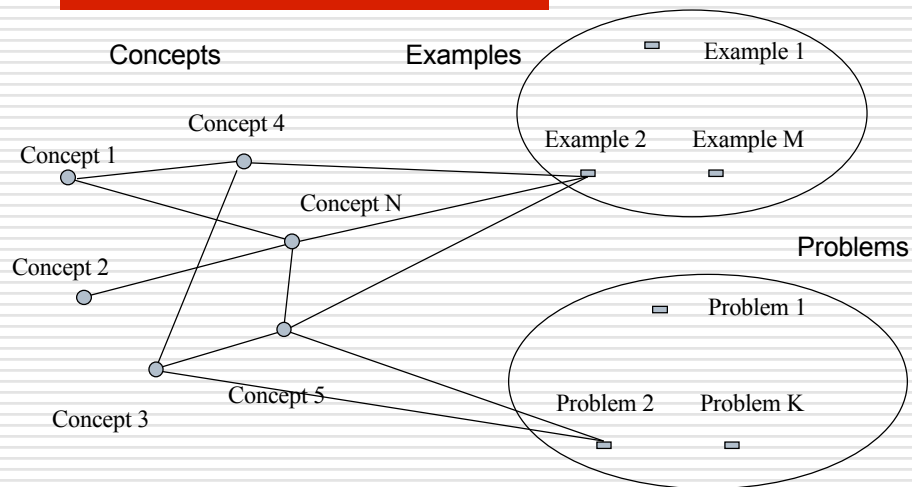
Personal View: Generation 1



ISIS-Tutor: ILE + hypertext

- ❑ An adaptive tutorial for CDS/ISIS/M users
- ❑ Domain knowledge: concepts and constructs
- ❑ Hypertext - a way to access learning material:
 - Description of concepts and constructs
 - Examples and problems indexed with concepts (could be used in an *exploratory environment*)
- ❑ Educational status of explanations, examples and problems is shown with link annotation

Knowledge and learning material



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Student modeling and adaptation

- States for concepts:
 - not ready (may be hidden)
 - ready (red)
 - known (green)
 - learned (green and '+')
- State for problems/examples:
 - not ready (may be hidden)
 - ready (red)
 - solved (green and '+')

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Sample index page (annotation)

Доступные темы	
+ 1 Общий вид формата	2 Арифметические выражения
3 Удаление пустых строк	4 Безусловный переход на новую строку
+ 5 Переход на новую строку	6 Выбор позиции в строке
7 Печать пробелов	+ 8 Вывод поля
9 Понятие MFN	10 Безусловный литерал
11 Арифметическая функция L	12 Арифметическая функция Mfn
13 Арифметическая функция Val	14 Арифметическая функция Rsum
15 Арифметическая функция Rmin	16 Арифметическая функция Rmax
17 Арифметическая функция Ravr	18 Совмещение % и #
19 Совмещение / и #	20 Условный литерал
21 Повторяющийся литерал	22 Вывод MFN
23 Строковые выражения	24 Префиксный условный литерал
25 Суффиксные литералы	26 Нуль-литералы
27 Повторяющийся литерал с +	28 Префиксный повторяющийся литерал
29 Установка режима вывода	30 Совмещение условных литералов и %
31 Совмещение условных литералов с #	32 Совмещение условных литералов с /
33 Совмещение условных литералов с C	34 Совмещение условных литералов с X
35 Совмещение условных литералов с M	36 Режимы L,U в команде M.
37 Режим H в команде M	38 Режим D в команде M
39 Режим P в команде M	40 Строковая функция F
41 Строковая функция Ref	42 Строковая функция S
43 Программы пользователя format	44 Выражения отношения
Enter - изучить F4-практ F6-учи F8-инд.задач F9-назад PgDn-след.стр.	
+ Хорошо изучен	Изучен
Можно изучать	Не готов

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Sample index page (annotation and hiding)

Доступные темы	
+ 1 Общий вид формата	2 Арифметические выражения
3 Удаление пустых строк	4 Безусловный переход на новую строку
+ 5 Переход на новую строку	6 Выбор позиции в строке
7 Печать пробелов	+ 8 Вывод поля
9 Понятие MFN	10 Безусловный литерал
13 Арифметическая функция Val	20 Условный литерал
21 Повторяющийся литерал	22 Вывод MFN
27 Повторяющийся литерал с +	28 Префиксный повторяющийся литерал
29 Установка режима вывода	52 Размещение первой строки поля
53 Выбор длины фрагмента поля	54 Выбор смещения фрагмента поля
55 Вывод подполя	56 Повторяющиеся группы
Enter - изучить F4-практ F6-учи F8-инд.задач F9-назад	
+ Хорошо изучен	Изучен
Можно изучать	

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ISIS-Tutor: Evaluation

- 26 first year CS students of MSU
- 3 groups:
 - control (no adaptation)
 - adaptive annotation
 - adaptive annotation + hiding
- Goal: 10 concepts (of 64), 10 problems, all examples

ISIS-Tutor: Evaluation Results

- The students are able to achieve the same educational goal almost twice as fast
- The number of node visits (navigation overhead) decreased twice
- The number of attempts per problem to be solved decreased almost 4 times (from 7.7 to 1.4-1.8)

THM1: It works!

- Adaptive presentation makes user to understand the content faster and better
- Adaptive navigation support reduces navigation efforts and allows the users to get to the right place at the right time
- Altogether AH techniques can significantly improve the effectiveness of hypertext and hypermedia systems

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THM2: AH as “best of both worlds”

- The Artificial Intelligent approach: machine intelligence makes a decision for a human
 - Adaptive NL generation, sequencing
- The HCI approach: human intelligence is empowered to make a decision
 - Classic stretchtext and hypertext
- Adaptive hypermedia: human intelligence and AI collaborate in making a decision

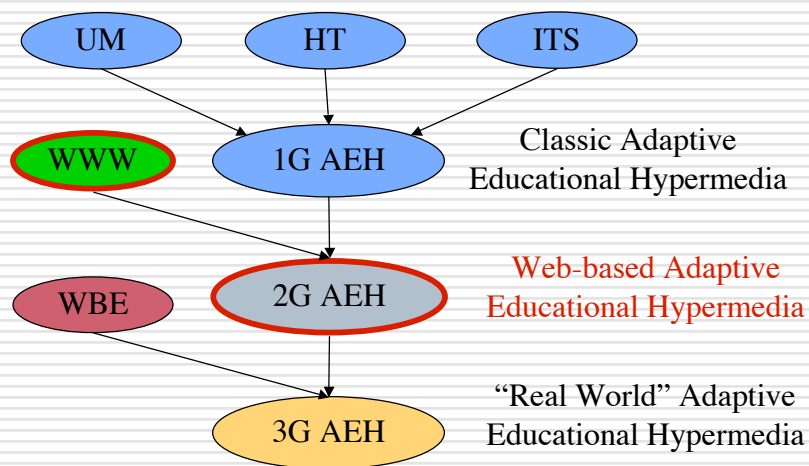
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Similar works 1991-1994

- $\gamma\pi$ Adapτερ (Hohl, Böker, Gunzenhauser, 1991)
 - Sorting page fragments and links by relevance
- Manuel Excel (de La Passardiere, Dufresne, 1992)
 - Adaptive link annotation with icons
- ANATOM-Tutor (Beaumont, 1994)
 - Adaptive presentation, hypertext + ITS
- MetaDoc (Boyle, Encarnacion, 1994)
 - Adaptive stretchtext

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Generation 2



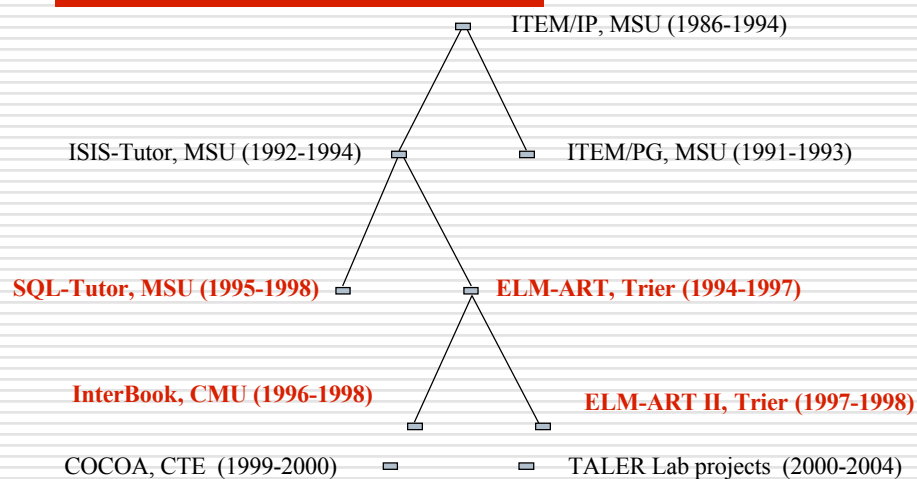
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Generation 2 vs Generation 1

- Generation 1 systems:
 - Research oriented
 - Traditional hypertext/hypermedia
 - Developed independently
- Generation 2 systems
 - Practically oriented
 - Web-based hypermedia
 - Influenced by earlier research
 - Less value on evaluation

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Personal View: Generation 2



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ELM-ART: Lisp ITS on WWW

- ELM-ART:
 - ELM-PE (ILE with problem solving support)
 - Adaptive Hypermedia (all educational material)
- Model: adaptive electronic textbook
 - tests
 - examples
 - problems

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Knowledge representation

- Domain knowledge
 - conceptual network for Lisp
 - problem solving plans
 - debugging knowledge
- Student model
 - Overlay model for Lisp concepts
 - Episodic model for problem-solving knowledge

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ELM-ART: Adaptive Textbook

- ❑ Electronic Textbook
 - Intelligent, adaptive, interactive
- ❑ Adaptive navigation support
- ❑ Adaptive sequencing (pages and questions)
- ❑ Adaptive similarity-based navigation
- ❑ Adaptive selection of relevant examples
- ❑ Intelligent program diagnosis
- ❑ Open student modeling

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Adaptive navigation support

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Adaptive Diagnostics

The screenshot shows a Netscape browser window titled "Netscape: ELM-ART: Lisp-Course". The main content area displays the "RECTANGLE-AREA" task. It includes a description: "Define a function RECTANGLE-AREA, that takes as input the side lengths of a rectangle and calculates its area." Below this, there are examples: `(RECTANGLE-AREA 3 5)` returns 15, `(RECTANGLE-AREA 4 2)` returns 8, and `(RECTANGLE-AREA 0 10)` returns 0. A text input field labeled "Type in your solution here:" contains the code `(defun r-a (num1 num2) (* num1 num2))`. Below the input field are buttons for "define" and "diagnosis", and a checkbox for "Return formatted code". A "show example" link is also present. The right sidebar contains a "Chat Room" link, "LISP Constructs" (with links for AREA, RECTANGLE-PURCHASE, and CUBOID), "New Functions" (with links for CUBOID, RECTANGLE-PURCHASE, and AREA), and "Private Notes on this Page" with a "store" button. The bottom status bar shows a tooltip: "Shows an example that may help to solve the problem." The footer of the slide reads "TALER Lab, University of Pennsylvania".

Similarity-Based Navigation

The screenshot shows a Netscape browser window titled "Netscape: Example". The main content area is titled "Examples for Task RECTANGLE-AREA". It features an "Example: AREA-OF-SQUARE" section with the instruction: "Write a function that computes the area of a square with given length of side as its argument." Below this is a table of examples:

Input	Output
(area-of-square 3)	9
(area-of-square 4)	16

Below the table is the "Example Function Definition:" `(DEFUN SQUARE (NUMBER) (* NUMBER NUMBER))`. There are links for "Example Function Calls" and "Involved Lisp Functions:" which includes a link for "DEFUN *". A "Similar examples:" section contains a link for "1.0 VOLUME-OF-CUBOID". At the bottom, there is a tooltip that says "This window may cover other windows you worked with." The footer of the slide reads "TALER Lab, University of Pennsylvania".

The screenshot shows a Netscape browser window titled "Netscape: User Model". The main content is a "Learner Model" table. The table has four columns: "Page", "Link-Status", "% learned", and "User Modification". The "Page" column lists various topics like "Datatypes", "Atoms", "S-Atom", "Numbers", "Lists", "Nested Lists", "Empty List, NIL, and T", and "Tests on Data Types". The "Link-Status" column provides feedback on the user's progress. The "% learned" column shows progress bars and percentages. The "User Modification" column has checkboxes for "already known".

Page	Link-Status	% learned	User Modification
Datatypes	The system suggests to work at this section.		<input type="checkbox"/> already known (Modification will be inherited to all subordinated pages)
Atoms (exercises solved)	You successfully worked at this page.	100 %	<input type="checkbox"/> already known
S-Atom (with exercises)	The system assumes the content of this page is known to you already.	10 %	<input type="checkbox"/> already known
Numbers (with exercises)	The system suggests to work at this page.	17 %	<input type="checkbox"/> already known
Lists (exercises solved)	You successfully worked at this page.	100 %	<input type="checkbox"/> already known
Nested Lists (exercises solved)	You successfully worked at this page.	100 %	<input type="checkbox"/> already known
Empty List, NIL, and T (with exercises)	The system suggests to work at this page.	0 %	<input type="checkbox"/> already known
Tests on Data Types	Working at this page is not yet recommended.	0 %	<input type="checkbox"/> already known

Below the table is a "Change Model" button and a link "Back to current page (Datatypes)". At the bottom, there is a footer: "ELM-ART-3.4.3 is a project of the ELM Research Group using [CL-HTTP](#). In case of problems send Email to [elm-admin](#) --- October 13, 1997 (11:02:59)".

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ELM-ART: Evaluation

- No formal classroom study
- Users provided their experience
- Drop-out evaluation technology
- 33 subjects
 - visited more than 5 pages
 - have no experience with Lisp
 - did not finish lesson 3
 - 14/19 with/without programming experience

ELM-ART: Evaluation Results

- Users with no previous programming and Web experience worked twice as longer if adaptive guidance was provided. No effect of adaptive annotation
- Users with starting programming and Web experience worked twice as longer if adaptive annotation was provided. No effect of adaptive guidance.

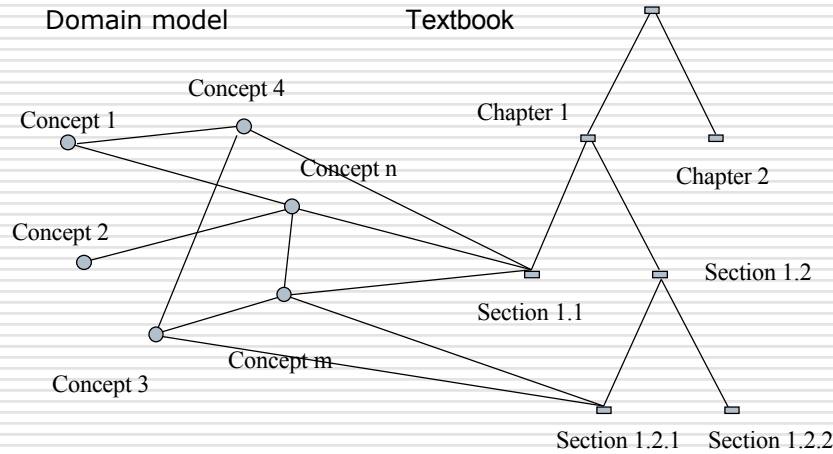
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InterBook: a Shell for AET

- "Knowledge behind pages"
- Structured electronic textbook (a tree of "sections")
- Sections indexed by domain concepts
 - Outcome concepts
 - Background concepts
- Concepts are externalized as glossary entries
- Shows educational status of concepts and pages

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Knowledge and hyperspace



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The screenshot shows a Netscape browser window titled "Netscape: InterBook User and Author Manual". The address bar shows the URL "http://www.taler.org/interbook/". The browser interface includes standard navigation buttons (Back, Forward, Home, Reload, Images, Open, Print, Find, Stop) and a status bar at the bottom.

The main content area displays the following text:

[InterBook User and Author Manual](#)
• [3. Interbooks, InterBook-served electronic textbooks](#)
• [3.1 Content structuring](#)
• [3.1.3 The annotated textbook](#)

3.1.3 The annotated textbook

To make the [textbook](#) "more intelligent" and to connect it to the [glossary](#), we have to let the system know what about each [section](#) of the textbook is. It is done by indexing the textbook sections by [domain model](#) [concepts](#). For each unit, a list of concepts related with this unit is provided (we call this list [spectrum](#) of the unit). For each involved concept, the spectrum of the unit can represent also the role of the concept in the unit. Currently we support two roles: each concept can be either an [outcome concept](#) or a [background concept](#). A concept is included in the spectrum as an [outcome concept](#) if some part of this page presents the piece of knowledge designated by the concept. A concept is included into the spectrum as a prerequisite concept if a student has to know this concept to understand the content of the page. Indexing is a relatively simple but powerful mechanism, because it provides the system with knowledge about the content of its pages: the system knows which concepts are presented on each page and which concepts have to be learned before starting to learn each page. It opens a way for several adaptation techniques.

Buttons: [Continue](#) [Teach me](#)

Navigation menu (right side):

- Content
- Glossary
- Help
- Search
- Hint

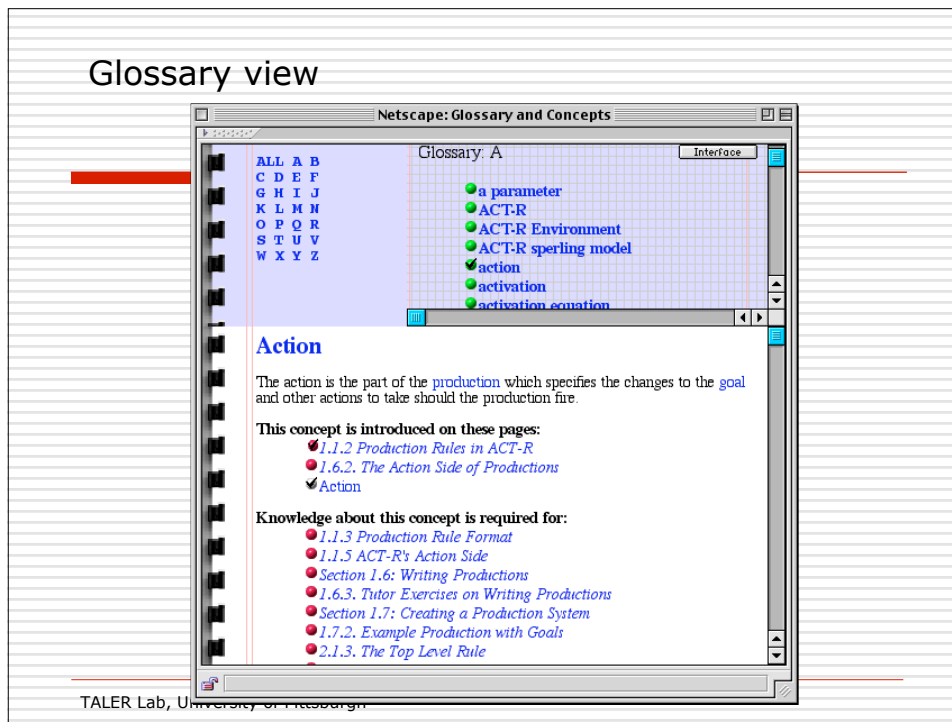
Background list (right side):

- [concept](#) ✓
- [domain model](#) ✓
- [glossary](#)
- [section](#)

Outcome list (right side):

- [background concept](#)
- [outcome concept](#)
- [spectrum](#)

Glossary view



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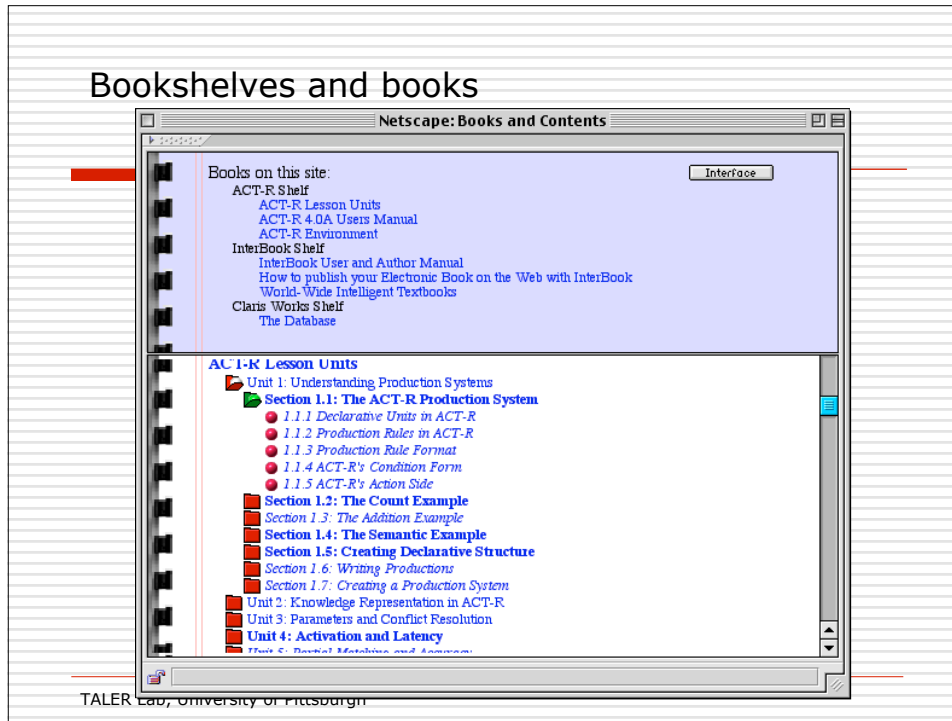
Adaptive annotation in InterBook

The screenshot shows a Netscape browser window titled "ACT-R Lesson Units". The main content area displays a hierarchical list of lesson units. The current section is "0.1.1 Declarative Units in ACT-R". Below the section title, the text reads: "In ACT-R, elements of declarative knowledge are called chunks or WMEs (for working memory elements)". The text is annotated with blue arrows and circles. Three numbered circles (1, 2, 3) point to different parts of the text and the browser interface. A table on the right side of the window lists navigation options: Content, Glossary, Help, Search, and Hint, each with a question mark icon. Below the table, there is a "Background:" section with a dropdown menu set to "ACT-R" and the text "declarative knowledge".

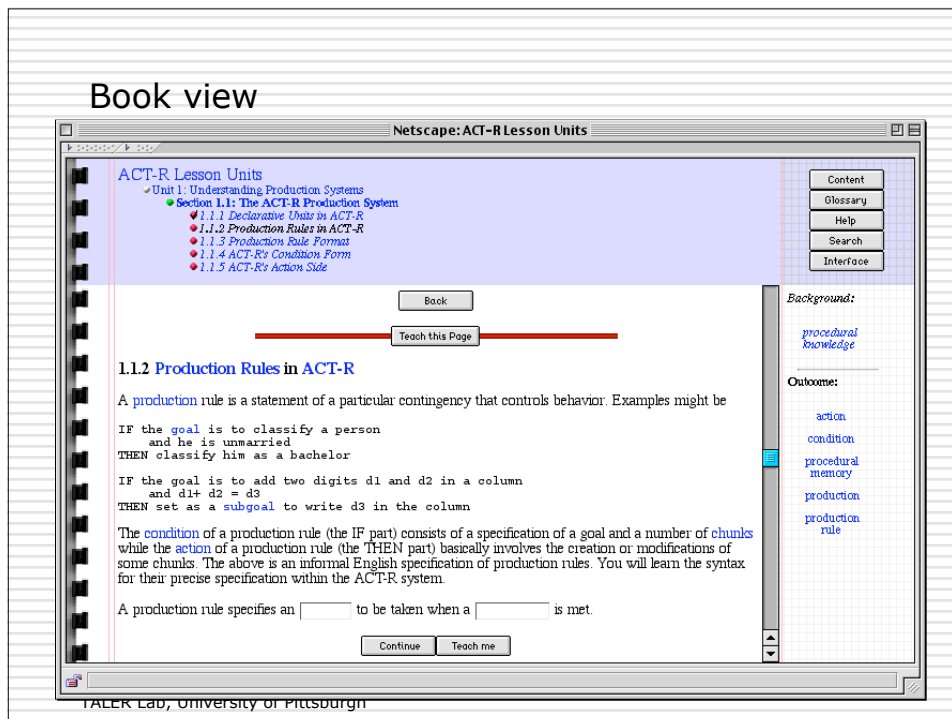
1. State of concepts (unknown, known, ..., learned)
2. State of current section (ready, not ready, nothing new)
3. States of sections behind the links (as above + visited)

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Bookshelves and books



Book view



Goal-directed learning: "help" and "teach this"

The screenshot shows a Netscape browser window titled "ACT-R Lesson Units". The main content area displays a hierarchical menu of lesson units, including "Unit 2: Knowledge Representation in ACT-R" and "Section 2.2: Designing Chunk Types". A "Back" button and a "Teach this Page" button are visible. A "Help" popup window is open, titled "Netscape: Help on '2.2.1 Goals as Sources of Chunk Types'", listing related pages such as "1.1.4 ACT-R's Condition Form" and "1.5.2. Creating Declarative Chunks". The main page also features a "Background:" section with terms like "chunk type", "goal", and "initial goal", and an "Outcome:" section with terms like "chunk creation" and "Designing Chunk Types".

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InterBook: Evaluation

- ❑ Goal: to find a value of adaptive annotation
- ❑ Electronic textbook about ClarisWorks
- ❑ 25 undergraduate teacher education students
- ❑ 2 groups: with/without adaptive annotation
- ❑ Format: exploring + testing knowledge
- ❑ Full action protocol

InterBook Evaluation Results

- No performance difference between groups
- About 90% of clicks were made with sequential navigation buttons
- Adaptive annotation encourages non-sequential navigation
- Adaptive annotation benefits those who use it as expected

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Adaptive annotation can:

- Reduce navigation efforts
- Reduce repetitive visits to learning items
- Encourage non-sequential navigation
- Make system more attractive for students
- But we still need to understand better
 - When it is helpful
 - How to match functionality to students

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THM3: AH is not a Silver Bullet

- ❑ Myth: AH is an alternative to user-centered design. No need to study the user - we will adapt to everyone
- ❑ The truth:
 - AH is a powerful HCI tool - as mouse, visualization, VR
 - We need to study our users and apply all usual range of usability techniques - we just have one more tool to use in our repository

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THM3: AH is not a Silver Bullet

- ❑ Myth: Just plug AH in and it will work
- ❑ The truth:
 - Most AH techniques are “non-prescriptive” - the user retains freedom
 - To benefit from AH the users should understand how AH works and collaborate with the system towards achieving her goal

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Other Generation 2 AEHS

- ELM-ART stream: Exploring new approaches and techniques
 - AHA!, INSPIRE, MetaLinks, MANIC
- InterBook stream: Creating authoring frameworks and tools
 - Frameworks:
 - KBS-HyperBook, Multibook
 - Authoring Tools:
 - AHA!, NetCoach, MetaLinks

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MetaLinks (Murray)

0
nab> You're OFF agenda.
Clear Agenda

NAV [T.2.4] Author | TOP | History | Glossary | TOC | Search | UP | PREV - NEXT (book)

◆ Topic T.2.4 : Plutons and Volcanoes

Introtext [none]

You learned that magma forms deep within the Earth. In some instances, it solidifies within the crust to form plutonic rocks. In others, it erupts onto the Earth's surface to form volcanic rocks.

Because plutonic rocks crystallize within the crust, we cannot see them form. However, tectonic forces commonly raise them, and erosion exposes these intrusive rocks in many of the world's greatest mountain ranges. California's Sierra Nevada, portions of the European Alps, and parts of the Himalayas are made up of plutonic rocks.

In contrast, a volcanic eruption can be one of the most conspicuous and violent of all geologic events. During the past 100 years, eruptions have killed approximately 100,000 people and caused about \$10 billion in damage. Some eruptions have buried towns and cities in hot lava or volcanic ash. For example, the 1802 eruption of Mount Pelee on the Caribbean island of Martinique buried the city of Saint Pierre in glowing volcanic ash that killed 29,000 people. Other volcanoes erupt gently. Tourists flock to Hawaii to photograph flowing lava and fire fountains erupting into the sky (Fig. A).

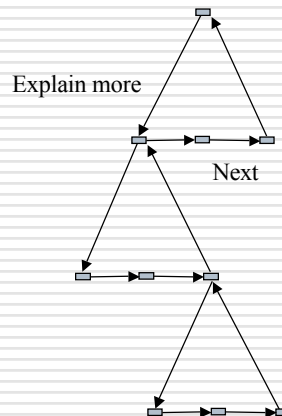
Volcanic eruptions can trigger other deadly events. (The 1883 eruption of Krakatoa...)

FIGURE A Two geologists retreat from a slowly advancing lava flow on the island of Hawaii. (F. S. Geological Survey)

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Metalinks

- ❑ Related links
- ❑ Custom depth control
- ❑ Narrative smoothing
- ❑ No effect of smoothing!
- ❑ Good narration...



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AHA! (De Bra)

Netscape: Hypermedia Structures and Systems

tu Eindhoven University of Technology **change configuration** **message board**

Peter Brusilovsky has read 1/188 pages. ([these read](#), [these still to do](#))

Hypermedia structures and systems

author: **Prof. dr. P.M.E. De Bra**

Welcome to the hypermedia course at the Eindhoven University of Technology.

Since you are just beginning to browse through this course, you should first read [the instructions](#). These will explain how to use this course text together with a graphical World Wide Web browser such as the Netscape Navigator or Microsoft Internet Explorer. They also explain how you can study this course off-line. In order to get to the instructions you must click (the left or only mouse button) on the phrase "[the instructions](#)".

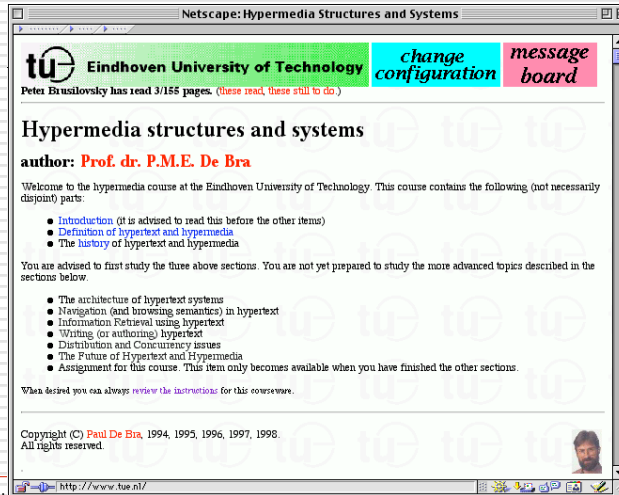
The items below indicate (not necessarily disjoint) parts of the course text, which you may study after reading [the instructions](#).

- Introduction (it is advised to read this before the other items)
- Definition of hypertext and hypermedia
- The history of hypertext and hypermedia
- The architecture of hypertext systems
- Navigation (and browsing semantics) in hypertext
- Information Retrieval using hypertext
- Writing (or authoring) hypertext
- Distribution and Concurrency issues
- The Future of Hypertext and Hypermedia
- Assignment for this course. This item only becomes available when you have finished the other sections.

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All rights reserved.

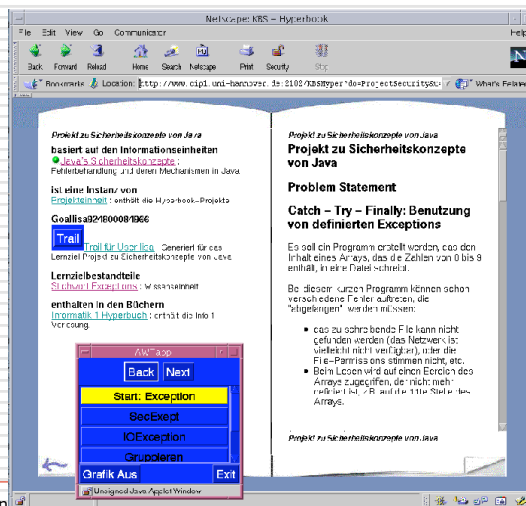
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AHA!



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KBS-HyperBook (Nejdl, Henze)



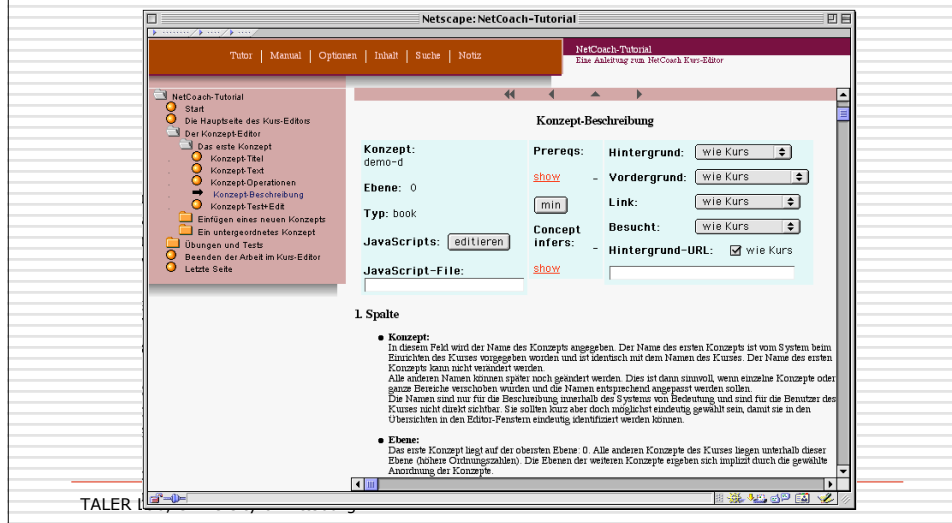
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INSPIRE (Grigoriadou, Papanikolaou, Kornilakis, Magoulas)



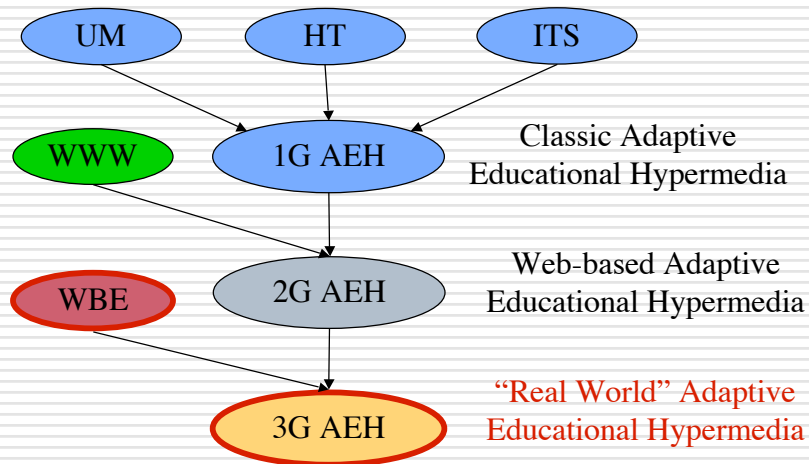
TAL

NetCoach (Weber)



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Generation 3



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Practical E-Learning

- Integrated Course Management Systems
 - Blackboard, WebCT, ...
- Support almost all aspects of E-Learning
 - Course material presentation
 - Assessment with quizzes
 - Threaded discussions
 - Student management and grading
- "MS Word"-style all-in-one tool for WBE

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Adaptive E-Learning?

- Adaptive E-Learning systems can provide a more advanced support for most functions
 - Course material presentation - InterBook, AHA
 - Assessment with quizzes - SIETTE
 - Threaded discussions - help agents
 - Student management - intelligent monitoring
- Why they are rarely used in practical E-Learning?

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Practical Adaptive E-Learning

- Model 1: Adapting to current E-Learning Paradigm - CMS
- More versatile adaptive systems
- An ability to integrate open corpus content
- Improving CMS content
- Giving more power to the teacher
 - Customize the system to specific course and material

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Emerging E-Learning

- Interoperability and standards
 - IEEE CMI, SCORM
- Semantics and metadata
 - LOM
- Component-based architectures
 - OKI, uPortal
- Resource reusability
- Distributed learning content
- Semantic Web

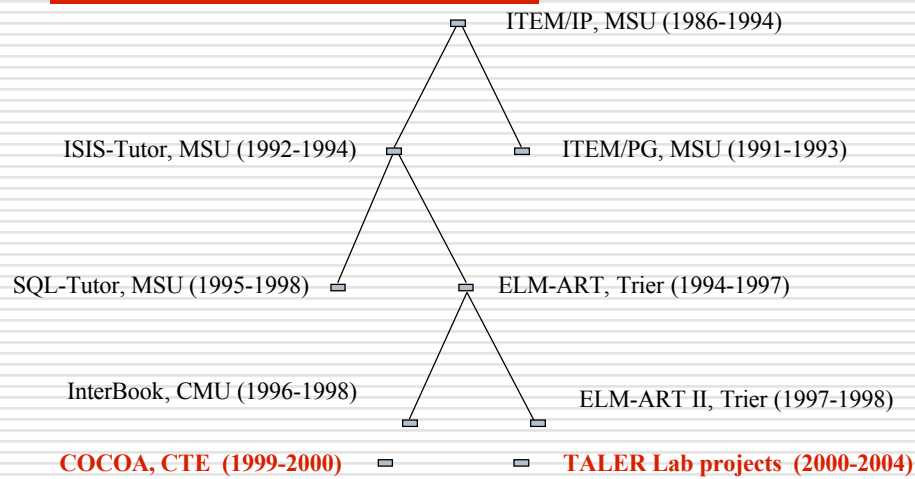
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Practical Adaptive E-Learning

- Model 2: Embedding adaptivity into emerging E-Learning
- Use of current interoperability standards (SCORM, LOM)
- Developing new interoperability architectures
- Resource discovery
- The use of Semantic Web

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Personal View: Generation 3

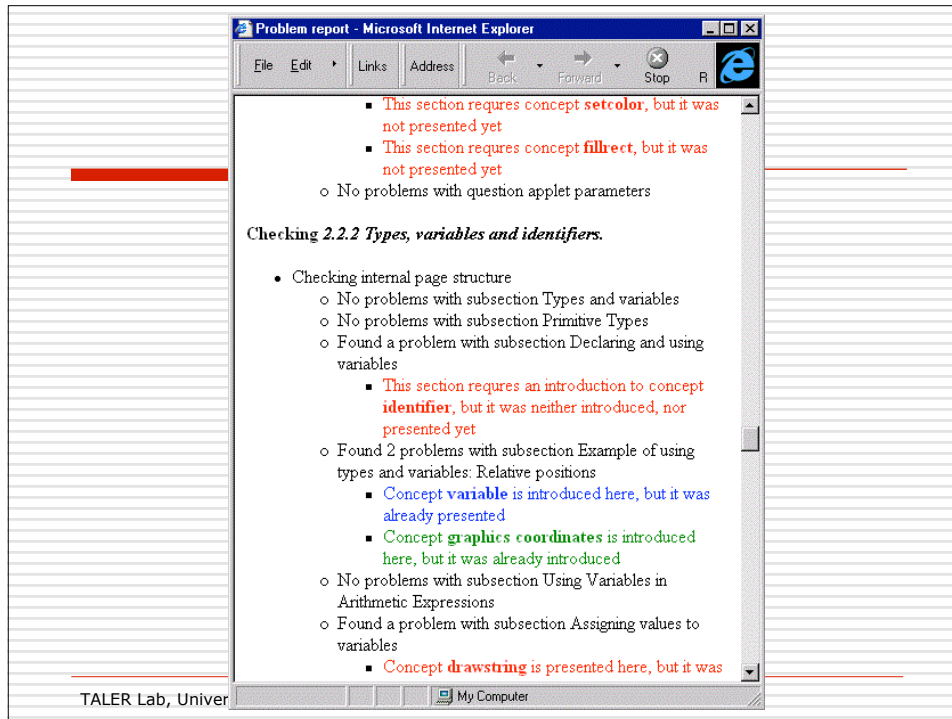


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CoCoA - Static Sequencing

- ❑ Many contributors for a single course
- ❑ Almost impossible to keep the course consistent without special tool
- ❑ Courseware engineering: From course authoring in small to course authoring in large
- ❑ CoCoA - Static sequencing
 - Prerequisite checking
 - Goal focusing
 - Learning activity balance

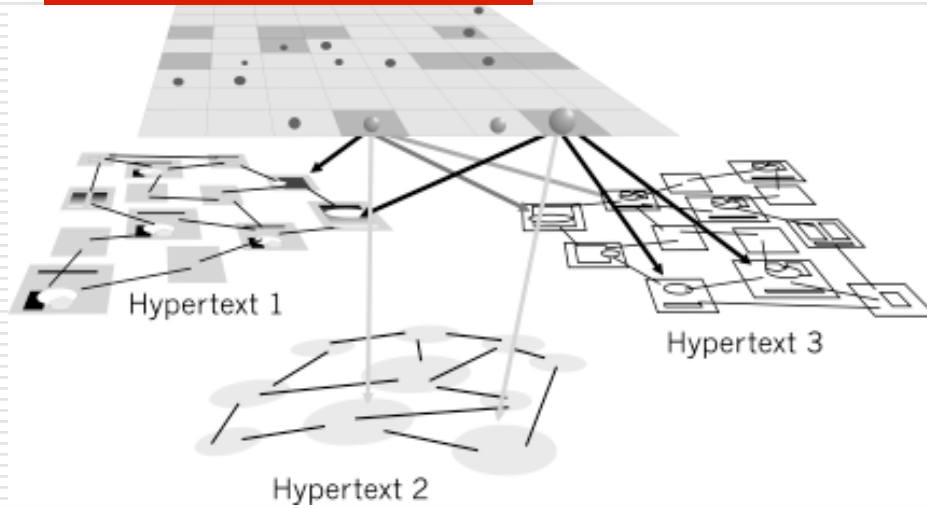
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Open Corpus Adaptive Hypermedia

- Classic AH - Closed Corpus of pre-processed content
- Integrate Open Corpus content
- Bringing open corpus content in by indexing
 - KBS-HyperBook, SIGUE
- Processing open corpus content without manual indexing
 - Knowledge Sea

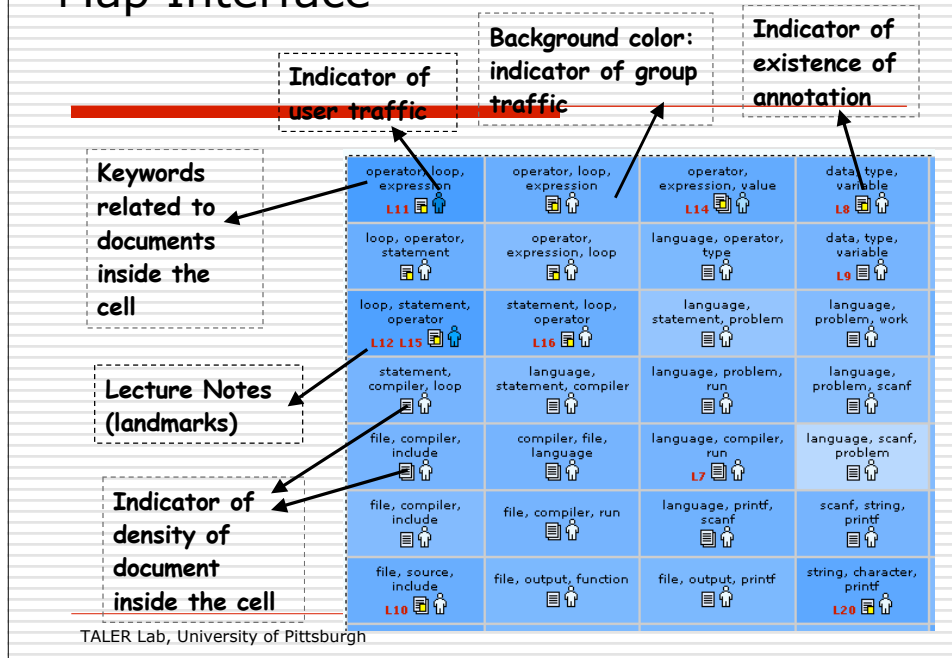
Knowledge Sea Map



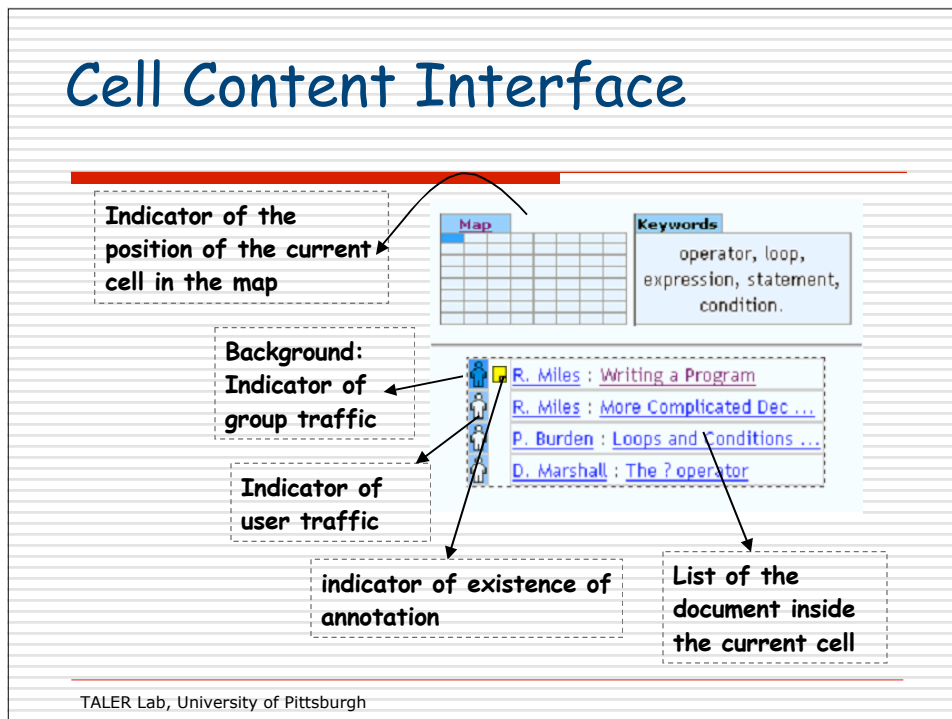
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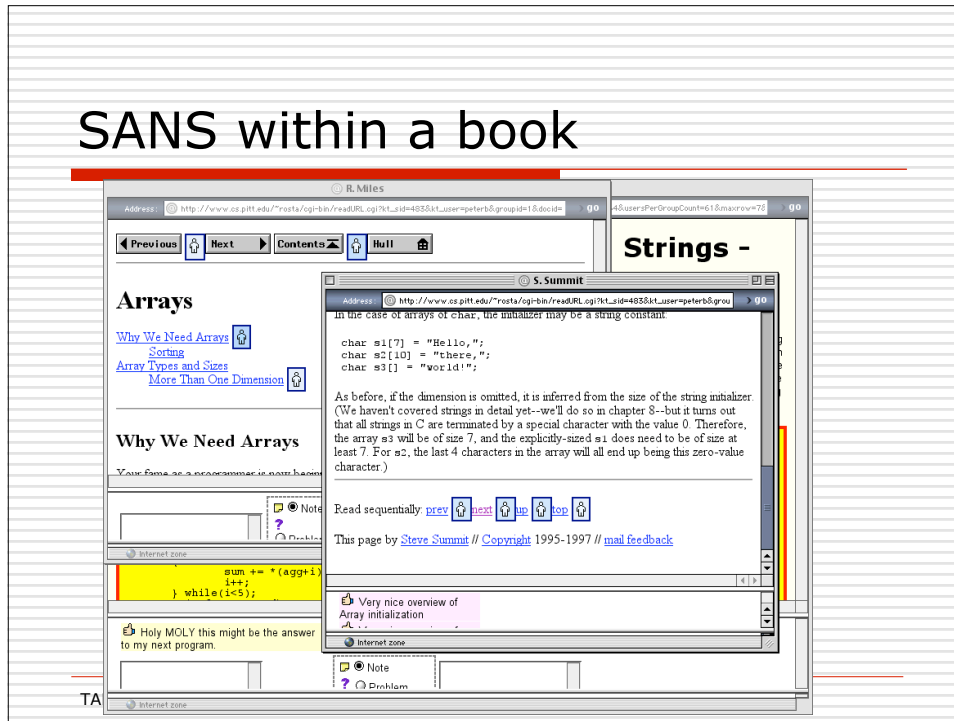
Map Interface



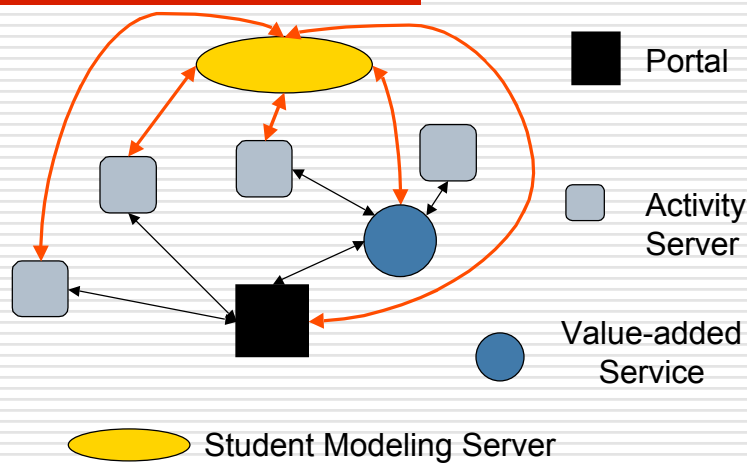
Cell Content Interface



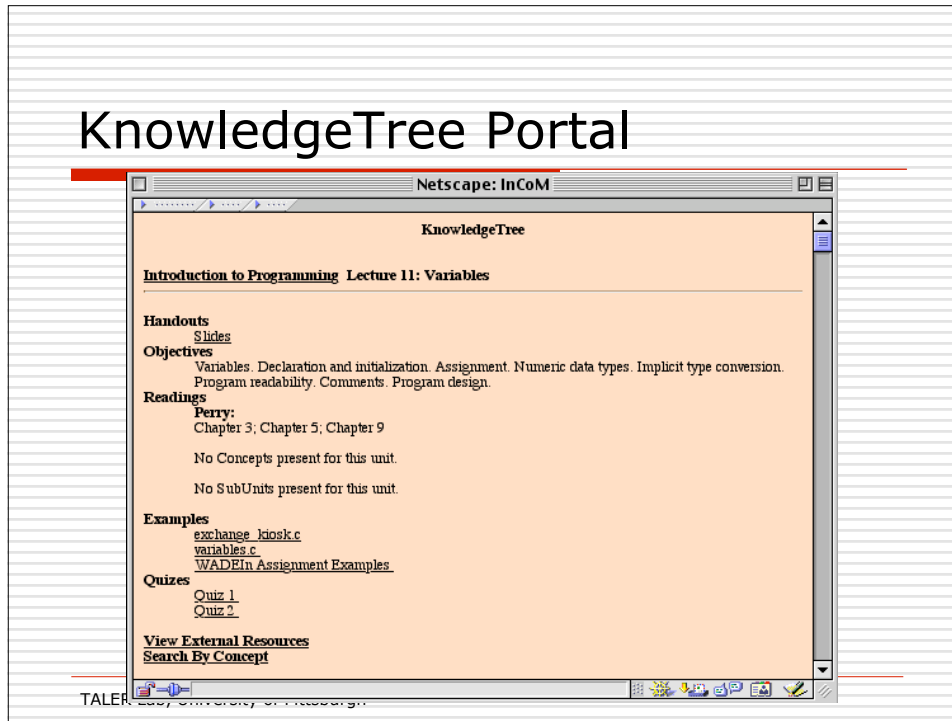
SANS within a book



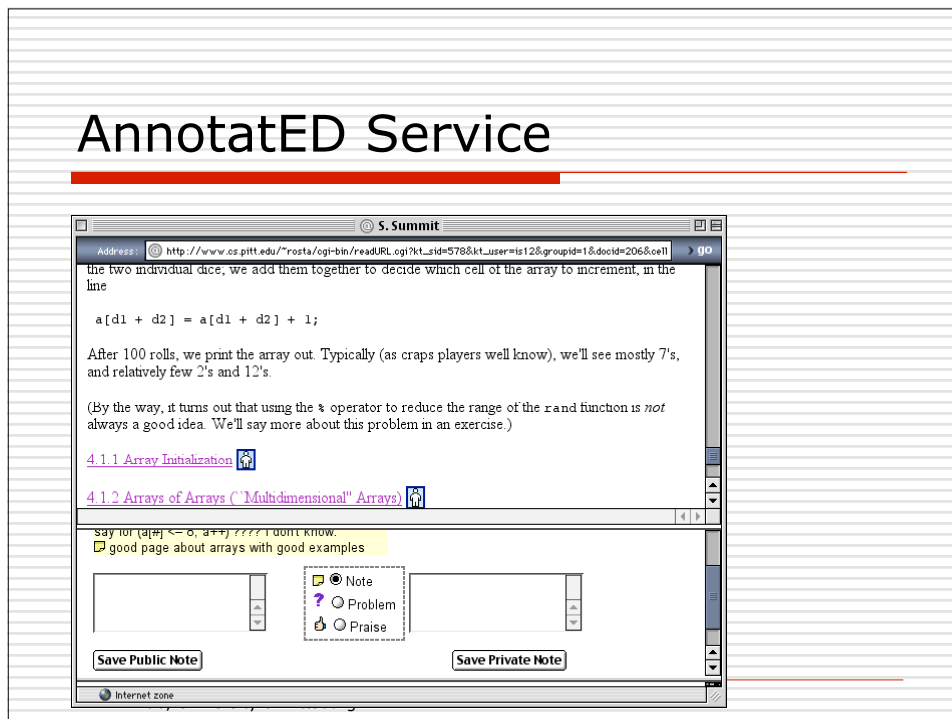
Knowledge Tee Architecture



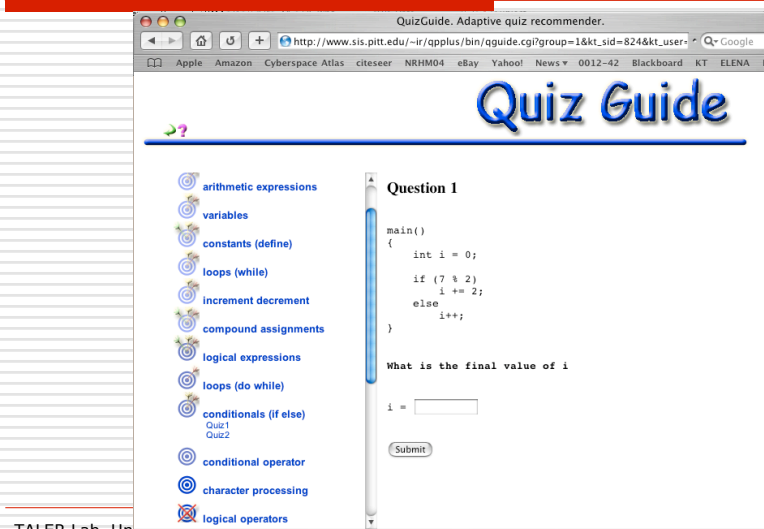
KnowledgeTree Portal



AnnotatED Service



QuizGuide value-added service



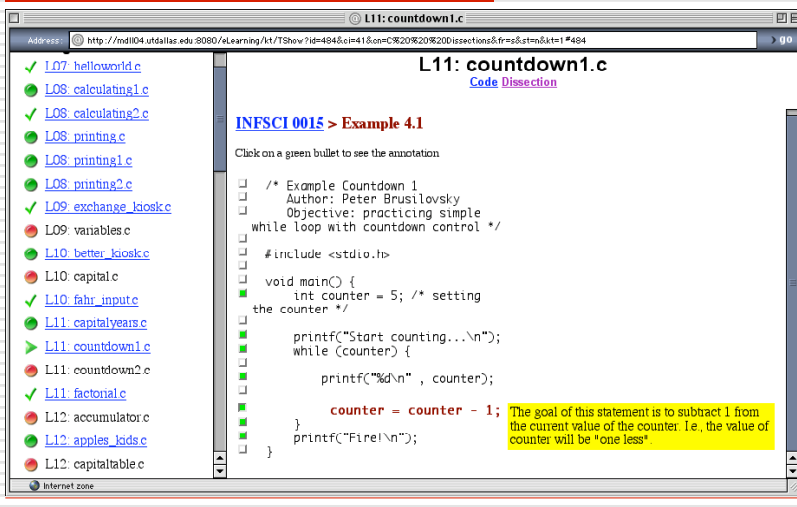
The screenshot displays the QuizGuide website interface. On the left, a navigation menu lists various programming topics: arithmetic expressions, variables, constants (define), loops (while), increment decrement, compound assignments, logical expressions, loops (do while), conditionals (if else), conditional operator, character processing, and logical operators. The main content area is titled 'Question 1' and shows a C code snippet:

```
main()
{
    int i = 0;
    if (7 % 2)
        i += 2;
    else
        i++;
}
```

The question asks: 'What is the final value of i'. Below the code is an input field with 'i = ' and a 'Submit' button.

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NavEx Value-added Service



The screenshot shows the NavEx web application. The browser title is 'L11: countdown1.c'. The page content includes:

- Navigation menu on the left with items like 'L07: helloworld.c', 'L08: calculating1.c', 'L10: fahr_input.c', and 'L11: countdown1.c' (highlighted).
- Section title: 'L11: countdown1.c' with a 'Code Dissection' link.
- Section header: 'INFSCI 0015 > Example 4.1'.
- Text: 'Click on a green bullet to see the annotation'.
- C code snippet:

```
/* Example Countdown 1
Author: Peter Brusilovsky
Objective: practicing simple
while loop with countdown control */

#include <stdio.h>

void main() {
    int counter = 5; /* setting
the counter */

    printf("Start counting...\n");
    while (counter) {
        printf("%d\n", counter);

        counter = counter - 1;
    }
    printf("Fire!\n");
}
```
- Annotation for 'counter = counter - 1;': 'The goal of this statement is to subtract 1 from the current value of the counter. I.e., the value of counter will be 'one less'.'

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More information...

- *Adaptive Hypertext and Hypermedia Home Page:*
<http://wwwis.win.tue.nl/ah/>
- Brusilovsky, P. (1996) Methods and techniques of adaptive hypermedia. *User Modeling and User-Adapted Interaction* 6 (2-3), 87-129.
- Brusilovsky, P., Kobsa, A., and Vassileva, J. (eds.) (1998), *Adaptive Hypertext and Hypermedia*. Dordrecht: Kluwer Academic Publishers.