

# Adaptive Coherence Information as an Approach to Facilitate the Comprehension of Online Learning Courses

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# Overview

- Background
  - Aim of the study
  - Knowledge Acquisition & Text Comprehension
- Application
  - Hint Texts in NetCoach
- Empirical Studies
  - Exploration
  - Experimental Phase
  - Future Perspectives

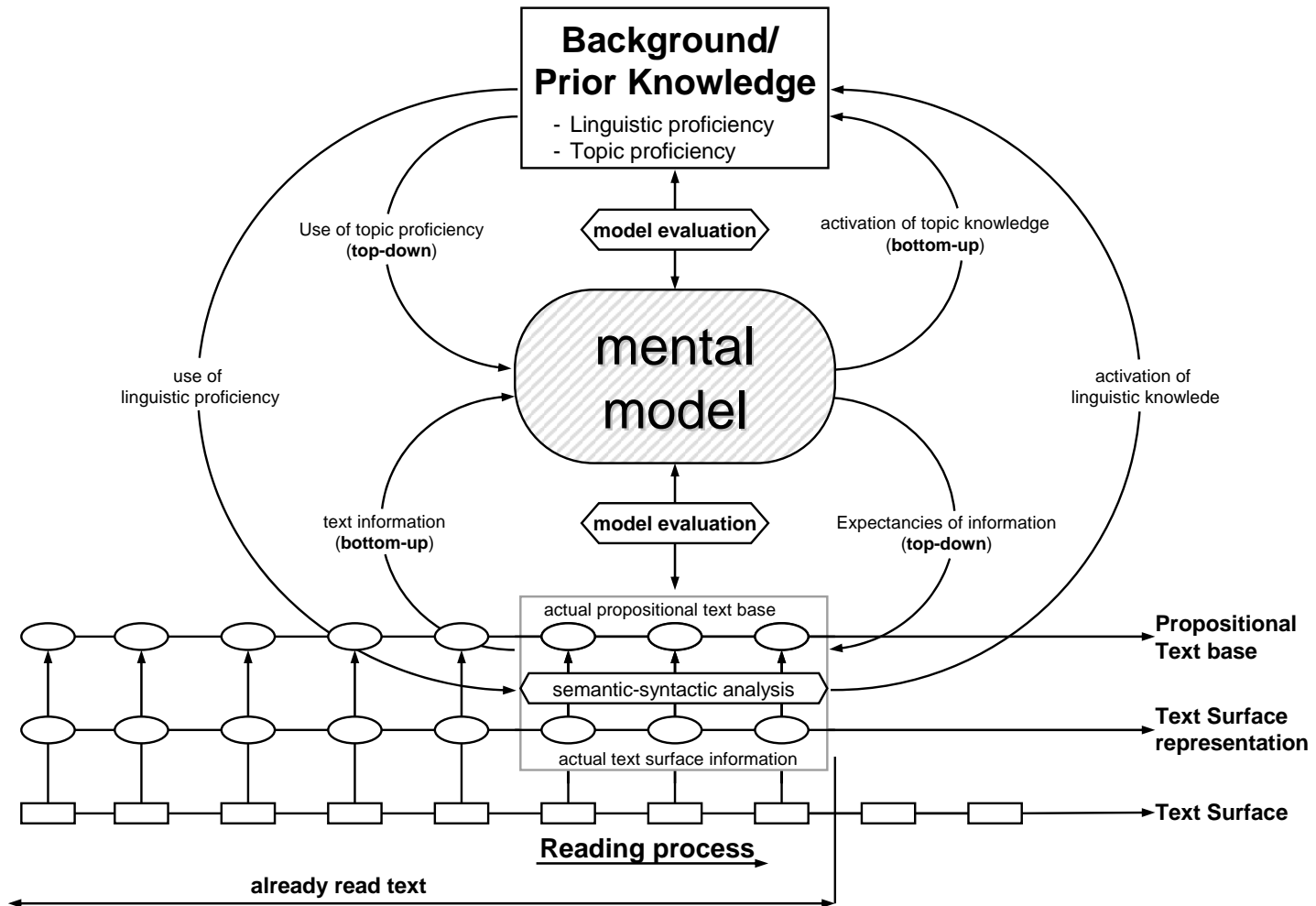
# Approach to Comprehension Facilitation

## Central Goal:

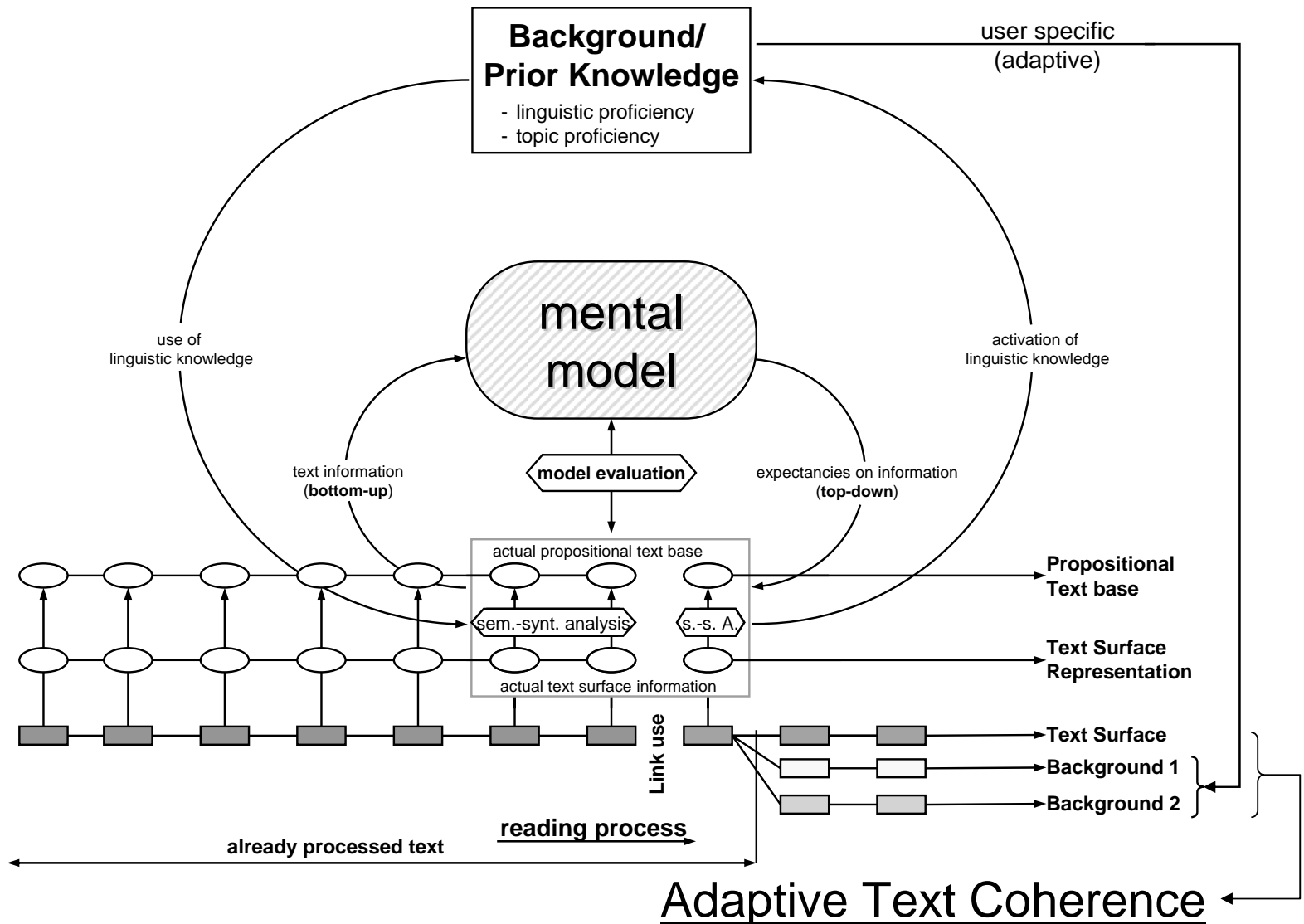
Provision of a **better course comprehension** by adapting the **text presentation** in online learning courses to the user

- Adding hint texts (coherence) when necessary (adaptively)
- Combination of the user's goals and his/her proficiency may be relevant

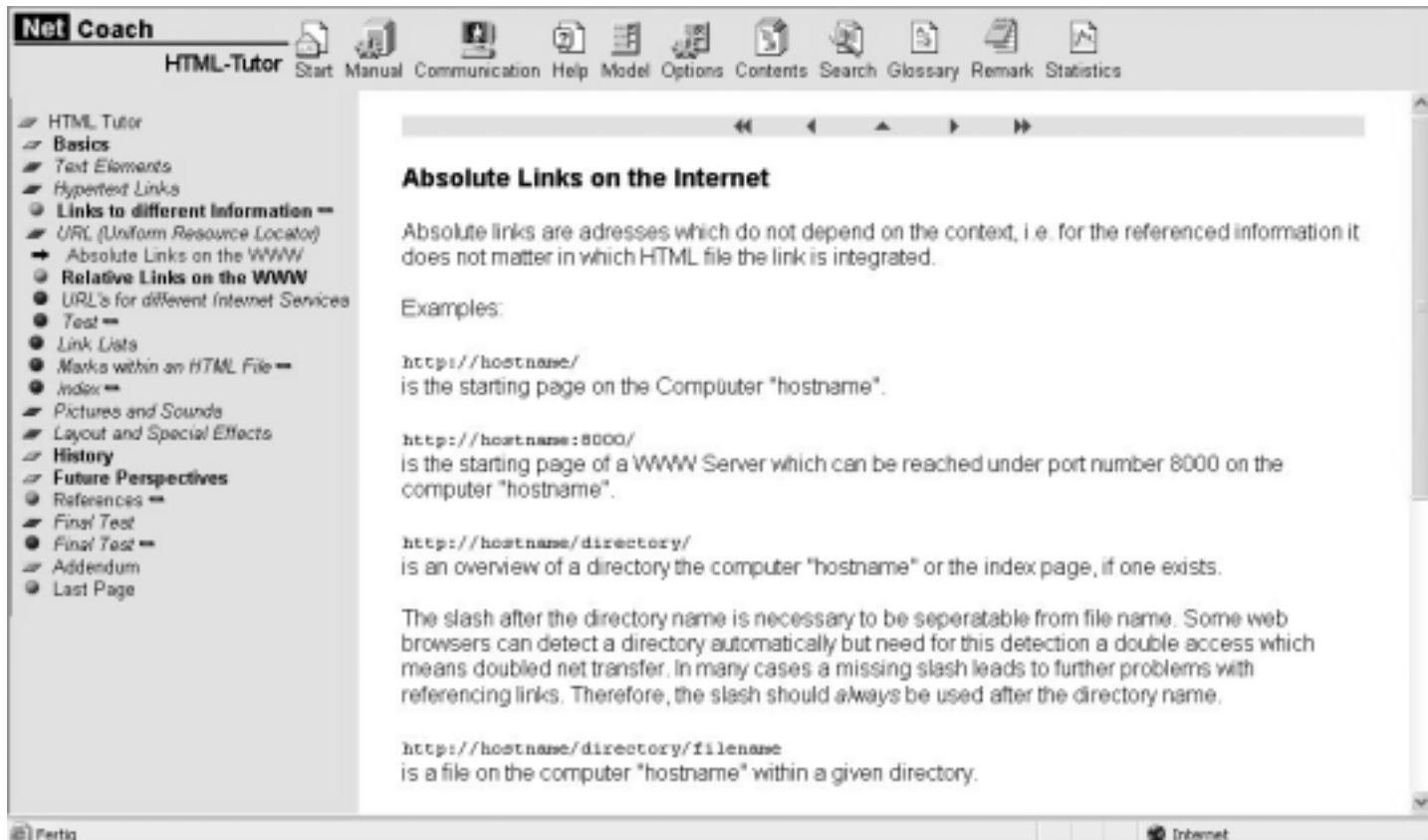
# Text Comprehension Model for Linear Text



# Additional Coherence for Nonlinear Text



# Sample Page without Hint Texts



The screenshot shows a window titled "Net Coach" with a menu bar containing "HTML-Tutor", "Start", "Manual", "Communication", "Help", "Model", "Options", "Contents", "Search", "Glossary", "Remark", and "Statistics". A sidebar on the left lists a table of contents with items like "HTML Tutor", "Basics", "Text Elements", "Hypertext Links", "Links to different information", "URL (Uniform Resource Locator)", "Absolute Links on the WWW", "Relative Links on the WWW", "URL's for different Internet Services", "Test", "Link Lists", "Marks within an HTML File", "Index", "Pictures and Sounds", "Layout and Special Effects", "History", "Future Perspectives", "References", "Final Test", "Final Test", "Addendum", and "Last Page". The main content area displays the following text:

## Absolute Links on the Internet

Absolute links are addresses which do not depend on the context, i.e. for the referenced information it does not matter in which HTML file the link is integrated.

Examples:

`http://hostname/`  
is the starting page on the Computer "hostname".

`http://hostname:8000/`  
is the starting page of a WWW Server which can be reached under port number 8000 on the computer "hostname".

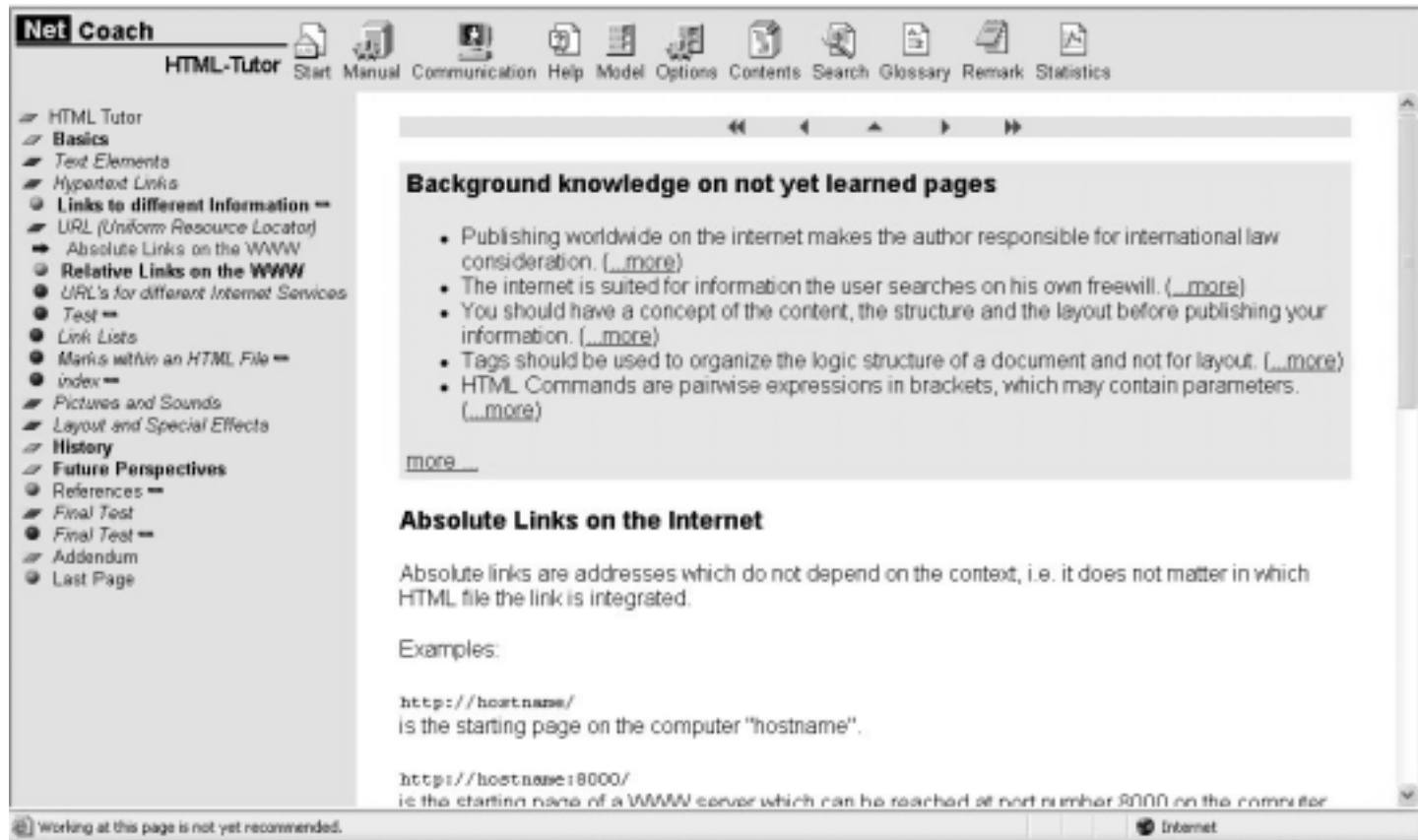
`http://hostname/directory/`  
is an overview of a directory the computer "hostname" or the index page, if one exists.

The slash after the directory name is necessary to be separatable from file name. Some web browsers can detect a directory automatically but need for this detection a double access which means doubled net transfer. In many cases a missing slash leads to further problems with referencing links. Therefore, the slash should *always* be used after the directory name.

`http://hostname/directory/filename`  
is a file on the computer "hostname" within a given directory.

At the bottom left of the window, the text "© Pertig" is visible, and at the bottom right, there is an "Internet" icon.

# Sample Page with Hint Texts



The screenshot shows the Net Coach HTML-Tutor interface. The title bar reads "Net Coach HTML-Tutor". The menu bar includes "Start", "Manual", "Communication", "Help", "Model", "Options", "Contents", "Search", "Glossary", "Remark", and "Statistics". The left sidebar contains a navigation tree with the following items:

- HTML Tutor
- Basics
  - Text Elements
  - Hypertext Links
    - Links to different Information ==
    - URL (Uniform Resource Locator)
      - Absolute Links on the WWW
      - Relative Links on the WWW
      - URL's for different Internet Services
    - Test ==
    - Link Lists
    - Marks within an HTML File ==
    - index ==
  - Pictures and Sounds
  - Layout and Special Effects
- History
- Future Perspectives
  - References ==
  - Final Test
  - Final Test ==
  - Addendum
  - Last Page

The main content area displays a sample page with the following structure:

- A navigation bar with left and right arrows.
- A section titled "Background knowledge on not yet learned pages" containing a bulleted list:
  - Publishing worldwide on the internet makes the author responsible for international law consideration. ([...more](#))
  - The internet is suited for information the user searches on his own freewill. ([...more](#))
  - You should have a concept of the content, the structure and the layout before publishing your information. ([...more](#))
  - Tags should be used to organize the logic structure of a document and not for layout. ([...more](#))
  - HTML Commands are pairwise expressions in brackets, which may contain parameters. ([...more](#))
- A link labeled "more\_..."
- A section titled "Absolute Links on the Internet" containing a paragraph: "Absolute links are addresses which do not depend on the context, i.e. it does not matter in which HTML file the link is integrated."
- A section titled "Examples:" containing two examples:
  - `http://hostname/` is the starting page on the computer "hostname".
  - `http://hostname:8000/` is the starting name of a WWW server which can be reached at port number 8000 on the computer

The status bar at the bottom indicates "Working at this page is not yet recommended." and "Internet".

# Hint Texts as Additional Adaptive Coherence Elements

Additional coherence...

- consists of
  - one short sentence
  - for each prerequisite page the user
  - had not yet learned
- is not meant to substitute the reading of the background page but to facilitate the user's decision to look up that page or not
- has to be generated manually by the course author

# Why not Present Additional Coherence to Everyone?

		Prior Knowledge (Prerequisites)	
		Low	High
Text Coherence	Low	-	Higher text coherence should <u>facilitate</u> <u>compre- hension</u>
	High	+	Higher (additional) coherence could <u>reduce</u> <u>working</u> <u>accuracy</u>

➔ Adaptation of additional coherence presentation to the individual prior knowledge within the course seems more adequate (e.g., empirical evidence was found by Kintsch, 1994)

# Course Subject

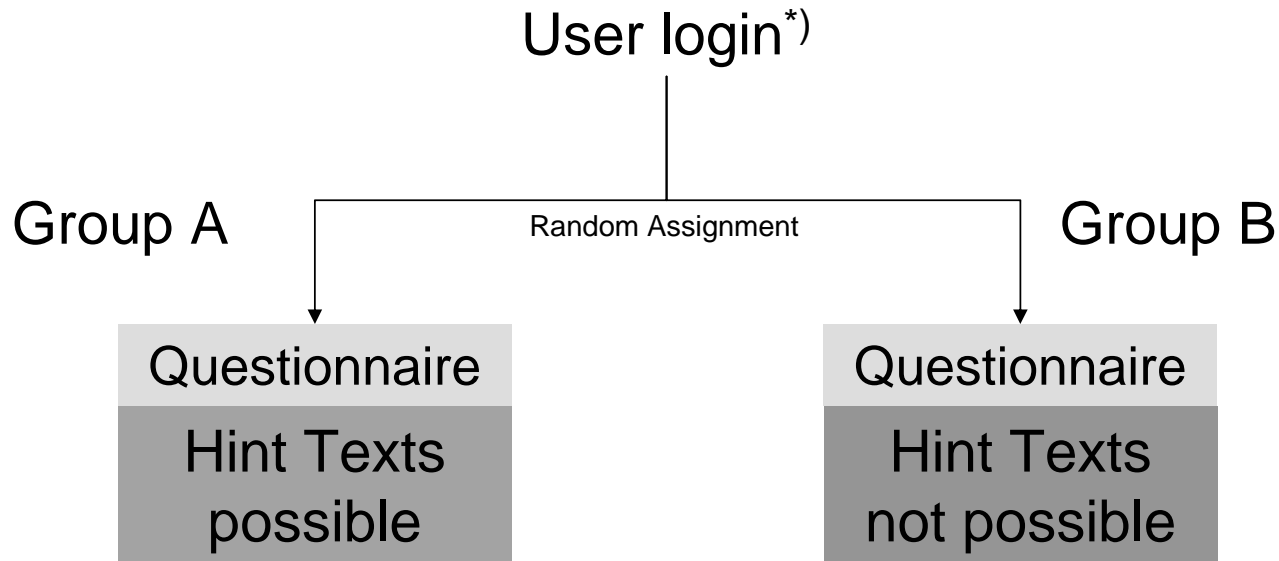
We used an already existing course about **HTML-programming**.

Advantages:

- Many users are working with the course
- HTML provides more modularity than a more sequential course of, e.g. a psychological domain

*Results of a study from Foltz showed that possibly the use of a course on a more social domain (i.e., economic market) would tempt the user to navigate through the text in a more linear way und thus just rarely producing hint texts.*

# Exploration



Goal: Assessment of navigation behavior and use of hint texts

\*) <http://art.ph-freiburg.de/HTML-Tutor>

# Sample Description

- Phase of Assessment: 4 Feb. – 16 May 2003
- 642 total new logins, of which just 603 used their access at all (resulting N=603)
- Age: M=30.3, SD=12.8
- Sex: 75.1% male, 24.9% female
- Working Duration: M=20:33, SD=45:26

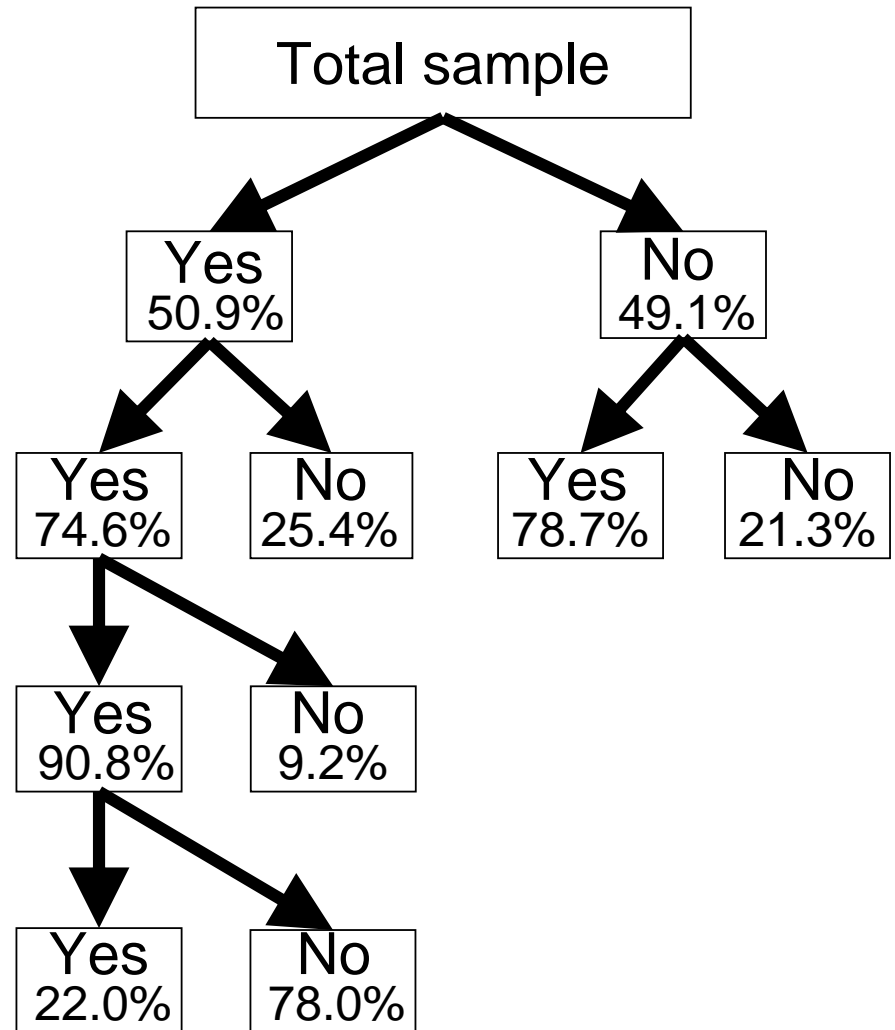
# Navigation Behavior and Use of Hint Texts

Random assignment  
(Hint Texts possible?)

Navigation behavior  
(Nonlinear Navigation?)

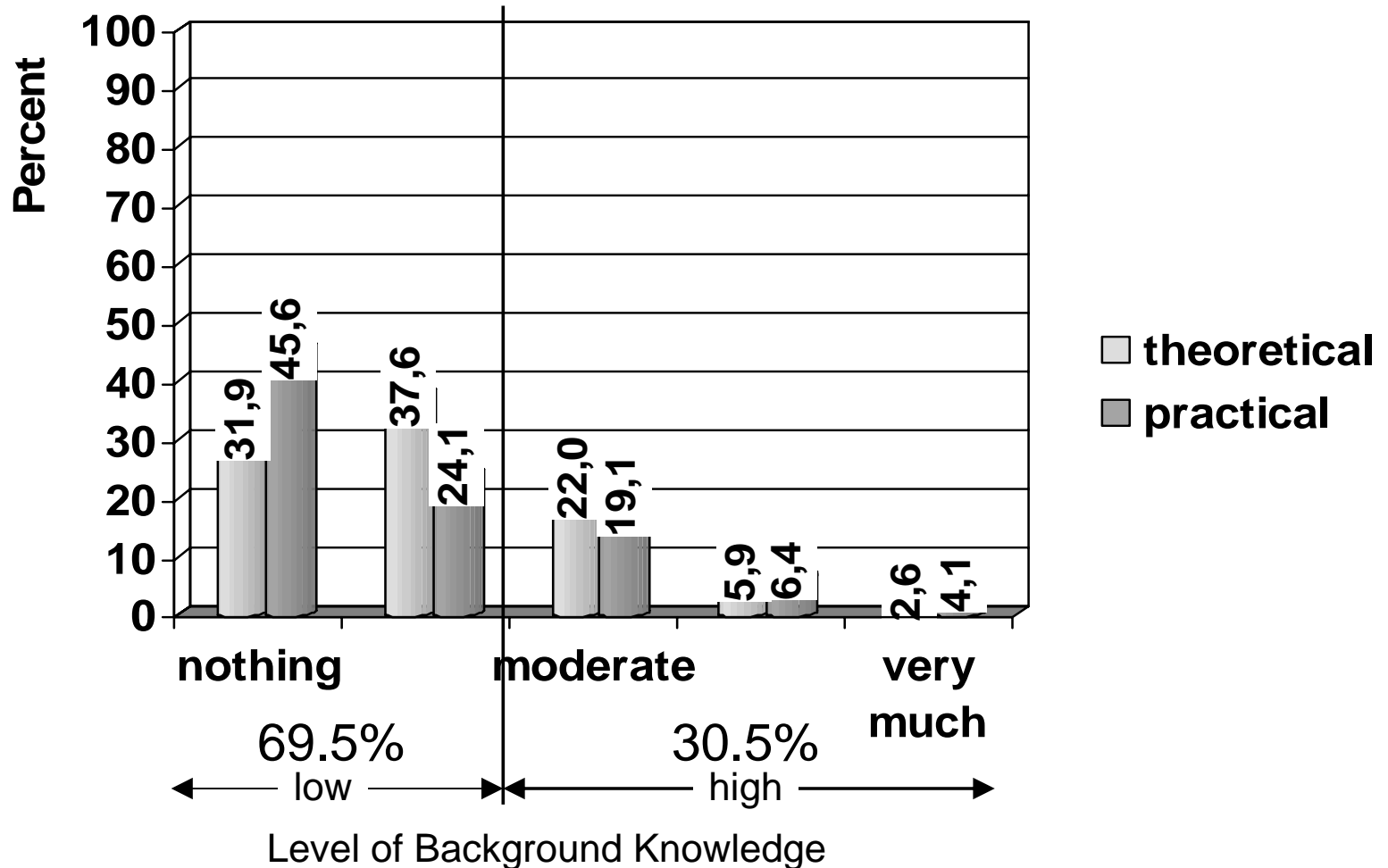
Hint text availability  
(Hint Texts Presented?)

Use of hint texts  
(Are the presented  
Hint Texts used?)



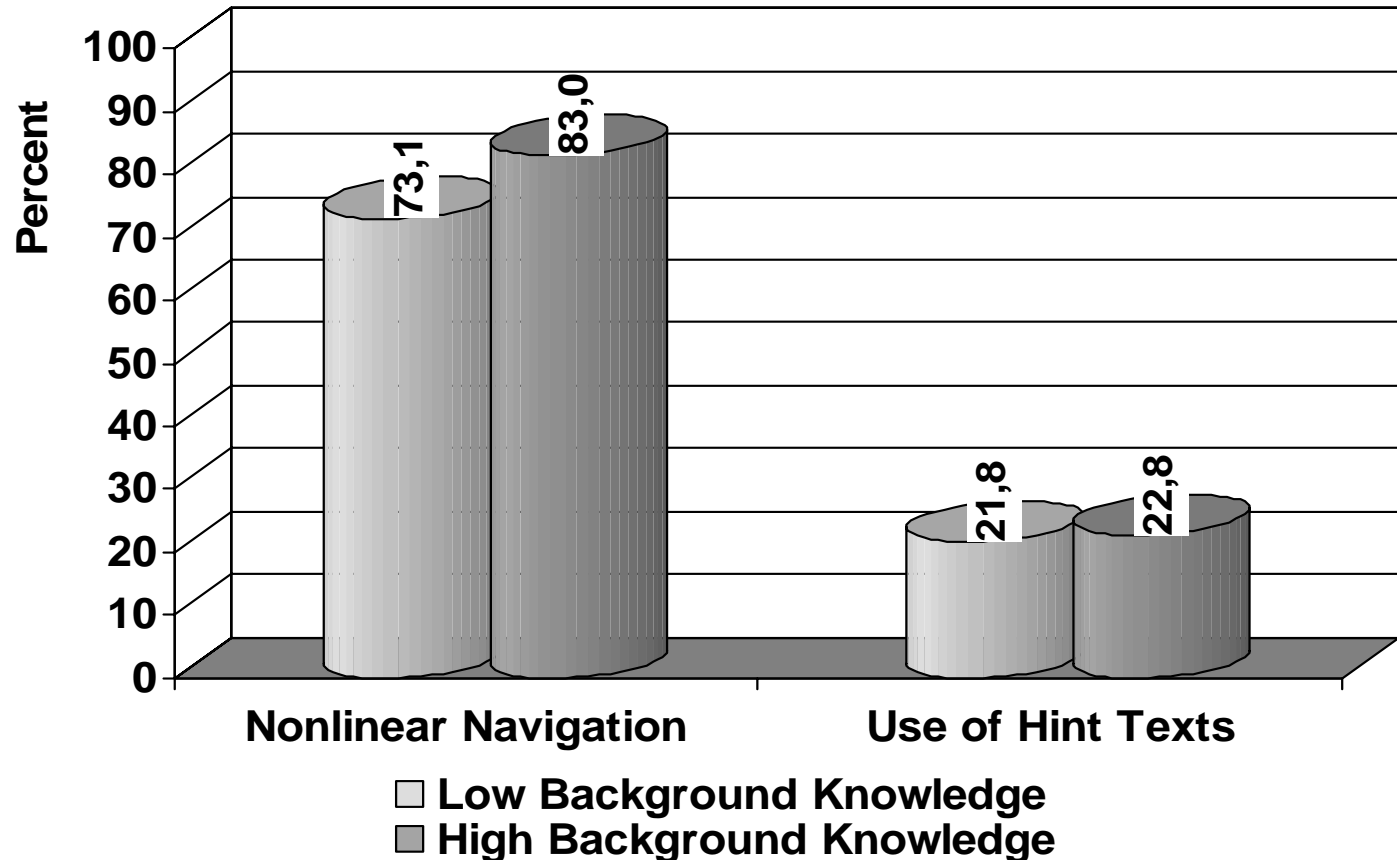
# Distribution of Background Knowledge

Questionnaire Data

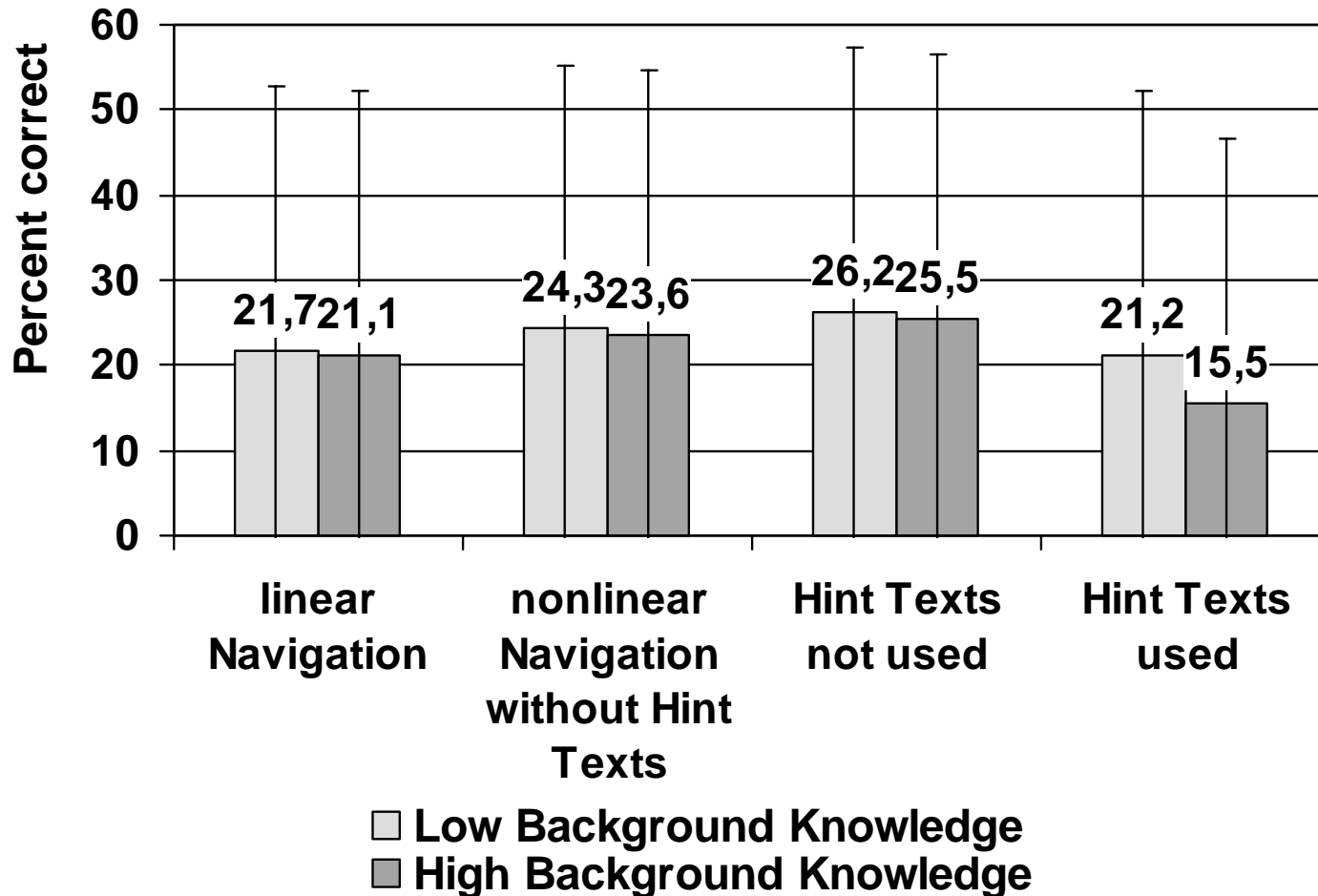


(correlation theoretical/practical  $r=.83$ )

# Navigation Behavior and Use of Hint Texts depending on the Background Knowledge



# Correct Answers depending on the Use of Hint Texts



# Confounding of Background Knowledge

Goal	Background Knowledge		
	Low	High	
Solve a <u>specific</u> HTML Problem (%)	14.1%	21.2%	<.05
Get a <u>general</u> Overview on HTML (%)	57.1%	39.6%	<.001

	Background Knowledge				p
	Low		High		
	M	±SD	M	±SD	
Working Duration (mm:ss)	22:22	±45:16	14:58	± 32:55	<.05

# Effects of Confounding Variables on Exercise Performance

		Percent of correct Answers		p
		M	$\pm$ SD	
A specific HTML Problem	Yes	18.5%	$\pm$ 30.4%	<.05
	No	25.5%	$\pm$ 31.5%	
A general Overview on HTML	Yes	26.8%	$\pm$ 32.6%	<.10
	No	21.9%	$\pm$ 30.7%	

Correlation of Exercise Performance with Working Duration:

$r=.35, p<.001$

# Recent Approach of Outcome Centered Help Links

- Situation: Irrelevancy of the user's actual comprehension  
(i.e., even users with no obvious comprehension problems get additional coherence)
- Approach: Adaptive help links are presented when the user answered an item incorrectly (and thus showed his/her malcomprehension)

# Sample Description of Outcome Centered Help Links

- Data collection from Aug., 22<sup>nd</sup> to Oct., 3<sup>rd</sup>
- Requirements for sample inclusion:
  - First login within data collection phase
  - At least 1 false answer to exercise items
- Resulting Sample:
  - N=220 (just about 40% of the 554 total logins)
  - 67.7% male
  - Mean age = 30.7 years ( $\pm$  14.6)
  - Mean working duration = 37:31 ( $\pm$  61min)
  - 78.4% no or little subjective background knowledge

# Use of Help Links

- Overall 12.7% users used (followed) the presented help links (n=28)
- Differentiating between users' goals:

	yes	no	sig.
Specific HTML problem	26.3%	11.4%	p<.10
General overview	13.2%	12.3%	n.s.
Whole HTML in detail	17.3%	9.0%	p<.10

# Performance Differences due to the Use of Help Links

No significant performance difference:

<u>% correct answers</u>	<u>Mean</u>	<u>SD</u>	} n.s.
No Use of Help Links	40.8%	27.6	
Use of Help Links	44.5%	26.8	

Relevant confounding:

<u>Working duration</u>	<u>Mean</u>	<u>SD</u>	} p<.01
No Use of Help Links	30:12	48:31	
Use of Help Links	87:42	106:13	

# Summary of the First Results on the Use of Help Links

- Quite a few users used the help links at all
- The influence of the background knowledge is not significant (sample size too small?)
- The user's goal seems to influence his/her tendency to use the help links
- There are relevant confounding variables which have to be controlled in an experimental design

# Planned Design for a Laboratory Experiment

Instruction / login

random assignment\*

general (A1)

detail (A2)

general (B1)

detail (B2)

Quest.

Quest.

Quest.

Quest.

Pretest

Pretest

Pretest

Pretest

All Hint Texts

No Hint Texts

All Hint Texts

No Hint Texts

External Post Test,  
Questionnaire

\*random assignment of goal (general vs. detail),  
and hint texts (all = A vs. none = B)

# Future Perspectives

1. Usage of a pretest to determine the user's background knowledge and to trigger the user model
2. The user may get the additional opportunity to mark the summarized concepts as already known

The screenshot shows a web interface with a grey navigation bar at the top containing the text "Navigation Bar". On the left side, there is a vertical grey sidebar with the text "Content overview" written vertically. The main content area has a white background and contains the following text:

The system assumes that you don't have sufficient knowledge of the following background concepts (feel free to consult the pages by following the links):

Each content description in HTML is bracketed by tags <a href="#">.more...</a>	<input type="checkbox"/>	familiar
Absolute references contain the complete URL. <a href="#">more...</a>	<input type="checkbox"/>	familiar

[Register now](#)

**Relative Referencing**

To use relative references in hypertext, the HTML author has to....

} Example for 2.

Thank You