Questions

- How to facilitate learning/teaching through language (knowledge building, feedback, etc.)

- Computer is good at storing-recalling-matching. More difficult to assess higher-lever language uses, understanding

- Which Natural Language Processing techniques to provide just-in-time feedback as freely as possible?
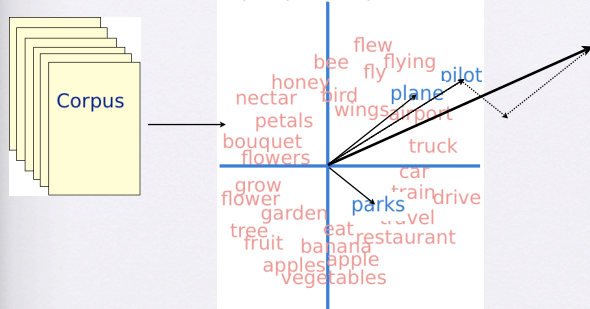
L2 Comm

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How to Get More with ICT?

- Three main levels of analysis [Dessus et al. '00]

  - multiple-choice exams (term by term matching);

  - free-text assessment based on shallow features (e.g., readability, frequency count)

  - free-text assessment based on course content

L2 Comm

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Latent Semantic Analysis: Intuitive Presentation
[Lemaire & Denhière '05]

"The pilot parks the plane"

Corpus

flew
flying
bee
fly
honey
bird
plane
pilot
nectar
wings
airport
petals
bouquet
flowers
truck
car
grow
train
drive
flower
garden
parks
travel
tree
eat
restaurant
fruit
banana
apples
apple
vegetables

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1. MCQs [Dessus '00]

- Les principes de la causalité naturelle sont…
    - A. Des principes causaux qui existent réellement dans la nature. (0,37)
    - B. Des principes que tous les scientifiques utilisent. (0,32)
    - C. Des principes des scientifiques modernes. (0,27)
    - D. Des principes qui ont fait leur preuve mais qu'on n'utilise plus beaucoup. (0,37)
    - E. Des principes inexacts qu'on a naturellement tendance à appliquer. (0,47)

- LSA-based comparisons predict answers. Overal grade: 12/27 (random 5,4/27)

L2 Comm

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2. Note Taking
[Mandin et al. '05]

Page de cours
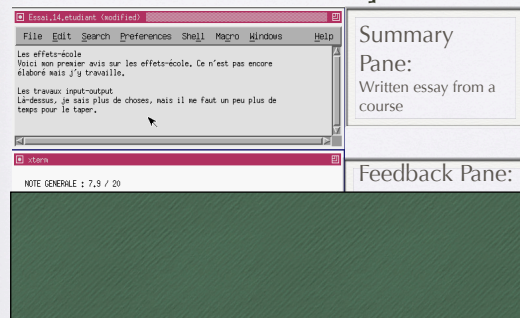
Espace de prise de notes

Note-taking with feedback: Turtle vision
weak cohesion of notes, higher similarity with source text

Note-taking without feedback: Eagle vision
higher cohesion of notes, lower similarity

Bachelor students in educational sciences (*N*=44).
Knowledge Pretest + Course reading + Knowledge Posttest
Factors: Feedback from pretest + Note-taking

L2 Comm

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3. Essay Writing [Lemaire & Dessus '01]

Essai.14.etudiant (modified)

File Edit Search Preferences Shell Macro Windows   Help

Les effets-école
Voici mon premier avis sur les effets-école. Ce n'est pas encore élaboré mais j'y travaille.

Les travaux input-output
Là-dessus, je sais plus de choses, mais il me faut un peu plus de temps pour le taper.

xterm

NOTE GENERALE : 7,9 / 20

Summary Pane:
Written essay from a course

Feedback Pane:

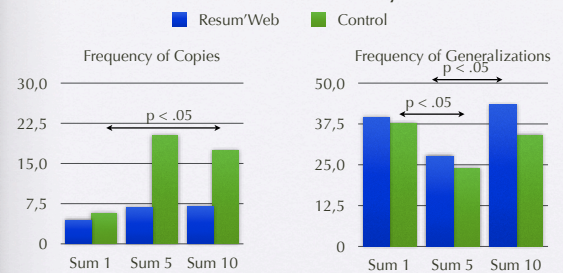- 21 real-settings essays processed:teacher *vs. Apex 1* grades *r* = .59

L2 Comm

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4. Summary Writing

- 2 intertwined cognitive processes in summarizing:
  - selection of the most important ideas of the source text (ST)
  - macrorule application on some sentences of ST to compose the summary (Sum) [Kintsch & van Dijk '78]
- *copy*: a Sum sentence is very close to a ST one
- *deletion*: a ST sentence is very far to all Sum ones
- *generalization*: a Sum sentence is close to several ST sentences
- *construction*: a Sum sentence is not very close to all ST one, but pretty close to some of them
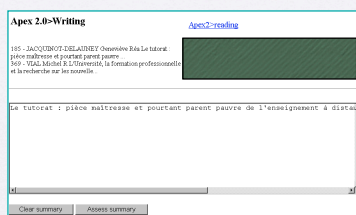- See the Demo @ http://webu2.upmf-grenoble.fr/sciedu/smandin/demos/resumwebdemo.swf

37

---

4. Summary Writing. Effect on student's activity

■ Resum'Web ■ Control

Frequency of Copies

Frequency of Generalizations
$p < .05$

$p < .05$

$p < .05$

Sum 1   Sum 5   Sum 10

Sum 1   Sum 5   Sum 10

Frequency of "off-the-subject" and constructions were equal
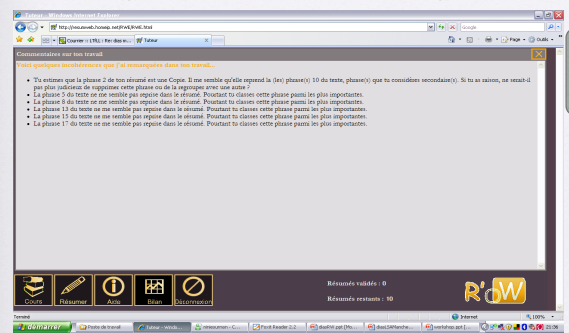Summary grades by teachers were equal

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5. Adding SRL Functionalities 1/2 [Dessus & Lemaire '02]

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5. Adding SRL functionalities 2/2 [Mandin et al. '07]
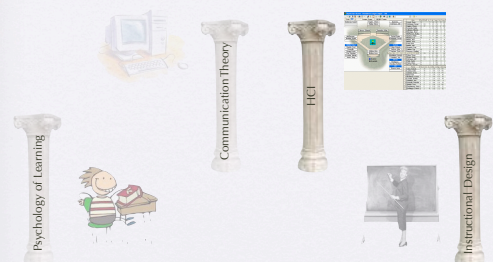
40

I.3 Human-Computer Interaction

Fourth Pillar

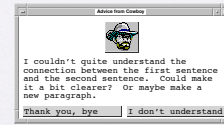---

Human-Computer Interaction [after Spector 08]

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Focus on HCI

- ❑ "Googleization" of interfaces and feedback: "Be brief and they shall learn" [Di Eugenio & Fossati '08]

- ❑ Not only simple interface, but ones that embed psychological/instructional models (see 1st & 2nd pillars)

- ❑ Personalize the interaction (agents, feedback) or the content (graphs, word clouds)

- ❑ Warning: Author of none of the following examples

I.3 HCI

Personalizing Feedback [Wiemer-Hastings & Graesser '00]

- ❑ Cohesion-centered feedback from an agent (Cow-boy)

I.3 HCI

Graphs & Word Clouds

- ❑ Stored content easy to compute and grasp with vector-based representation

- ❑ *Graphs* can represent semantic distances between pieces of content, persons etc.

  - ● betweenness, centrality, cohesion, density [Wild '08]

- ❑ *Word clouds* (e.g., Wordle.net) allow immediate perception of language-based corpora

I.3 HCI

Research Trends in ED-MEDIA Conf. [Wild et al. ip]

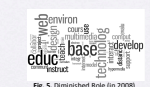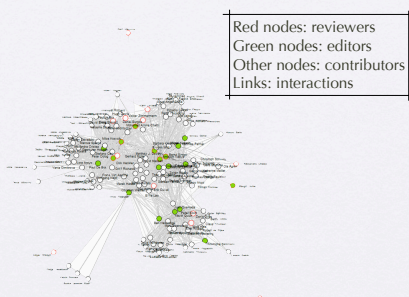Fig. 3. New Terms (2000 to 2008).   Fig. 4. Disappeared Terms (from 2000 to 2008).

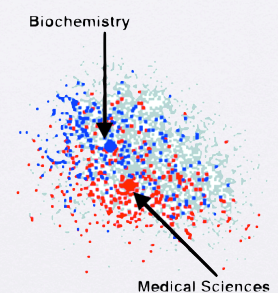Fig. 5. Diminished Role (in 2008).   Fig. 6. Enfored Role (in 2008).

I.3 HCI

Relations between Persons [Wild '08]

Red nodes: reviewers
Green nodes: editors
Other nodes: contributors
Links: interactions

I.3 HCI
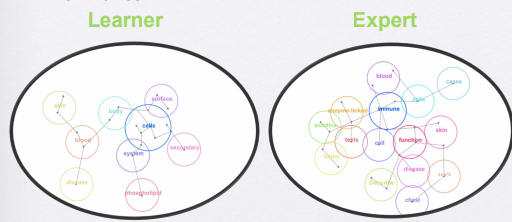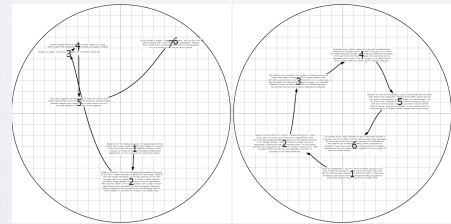

Knowledge from Papers [Landauer et al. '04]

Biochemistry

Medical Sciences

I.3 HCI

Learner Positioning from Interviews
[Berlanga et al. '09]

☐ Generation of expert and student concept maps with *Leximancer*

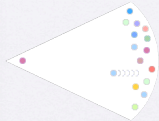**Learner**   **Expert**

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Representing Topic Flow in Essays
[O'Rouke & Calvo '09]

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Social Proxies
[Erickson & Kellogg '04]

On-Line Lecture   Chat Discussion

Color Circles: People
White Circle: Conversation Flow
Black-line Circle: Chat Room

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Research Questions

☐ The design of cognitive tools wrt. HCI:

- Interface not too cognitively demanding

- Underlying metaphor?

- Representing intentions/beliefs/desires, which are crucial in collaborative learning and teaching?
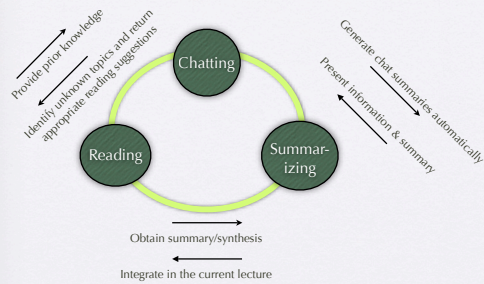
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II. Research Projects

Rationale

1. Embed teaching and learning models into ILEs

2. Integrate them in a communication way or technique, which can help teaching/learning

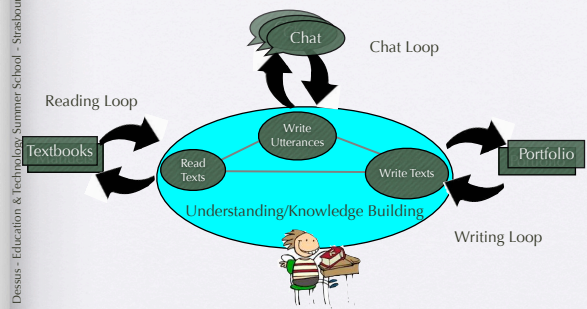3. Design the interface and fix HCI concerns, according to

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Activity Integration [Dascalu '09]

Provide prior knowledge

Identify unknown topics and return appropriate reading suggestions

Generate chat summaries automatically

Present information & summary

Chatting

Reading

Summar-izing

Obtain summary/synthesis

Integrate in the current lecture

II. Projects

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Three mainactivity loops [Dessus et al. 09]

Chat

Chat Loop

Reading Loop

Textbooks

Read Texts

Write Utterances

Write Texts

Portfolio

Understanding/Knowledge Building

Writing Loop

II. Projects

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Future Concerns

☐ Combine cognitive-based and narrative-based points

☐ Multiple-source syntheses

☐ Embed individual comprehension-focused processing to predict student's own understanding of course and utterances

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Questions for Discussion

☐ All these activities are already existing in current classroom settings

☐ Is ICT the good way to assist teacher activity? Why not to use pencil/paper-based ones?

☐ What kind of improvements, experiments or new cognitive tools to devise, accounting for the 4 pillars

- psychology of learning & Instructional Design

- communication theory

- HCI?

II. Projects

Thanks for your attention !

Philippe.Dessus@upmf-grenoble.fr

Get the refs:
http://www.citeulike.org/user/pdessus/tag/ictresearch

Get these Slides:
http://webu2.upmf-grenoble.fr/sciedu/pdessus/

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Additional Material

Analysing Content with LSA [Landauer '02; Lemaire & Denhière '05]

☐ LSA determines the statistical context in which each word occurs; semantically compares words; serves as semantic memory

- ✤ two words are similar if they occur in ~~same~~ paragraphs

- ✤ two paragraphs are similar if they contain ~~common~~ words

- ✤ two words are similar if they occur in **similar** paragraphs

- ✤ two paragraphs are similar if they contain **similar** words

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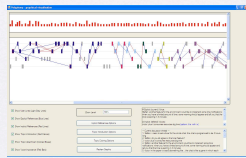# Latent Semantic Analysis 2/2 [Lemaire & Denhière '05]

☐ Given a corpus processed beforehand

- ✤ split in paragraphs

- ✤ words are projected in a n-dimension space so that

  - words can be compared to each other by computing the cosine of their corresponding vectors

  - paragraphs can be compared to each other by computing the cosine of the sum vector of the words they are composed of

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Polyphony : Feedback tool for Chat [Trausan-Matu & Rebedea 09]

Visualization of chat threads and feedback

Chat with explicit links (blue) and implicit (red). Red bars = contribution's importance

Automatic detection of themes and discussion threads (token analysis)