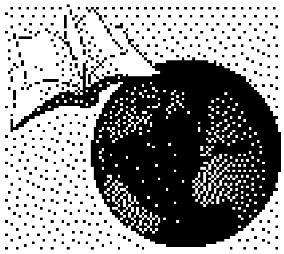
The "World-Wide Web" in Education



Slides for FLISH 95

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Outline

☞ **“Dense” overview talk (few examples)**

☞ **Some “Flash” slides**
(other speakers will address the topic)

Those slides (and more) are available on the Net!

1. Introduction: The WWW in Education

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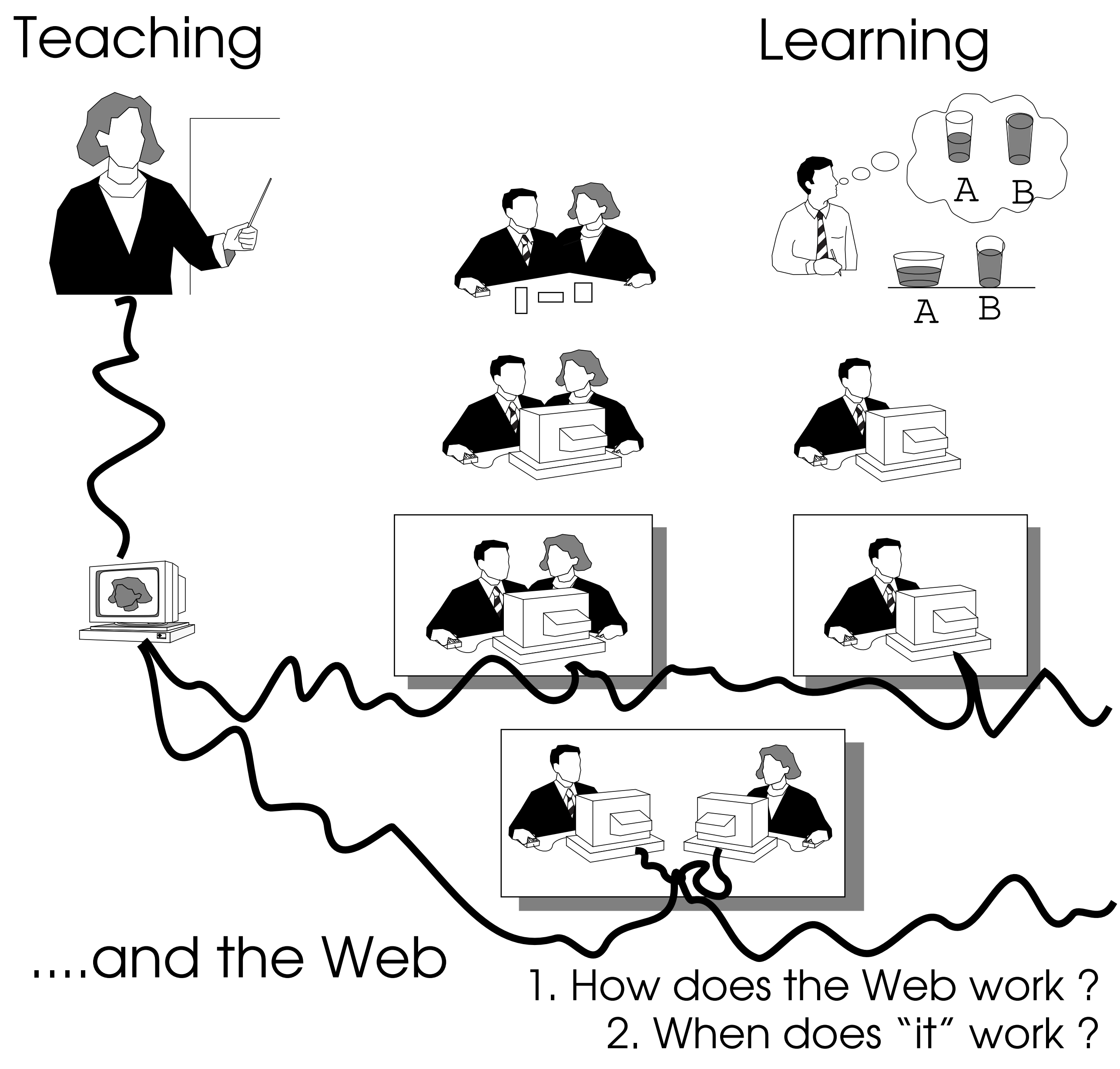

1. Introduction: The WWW in Education

1.1. The WWW is 3 (related) things:

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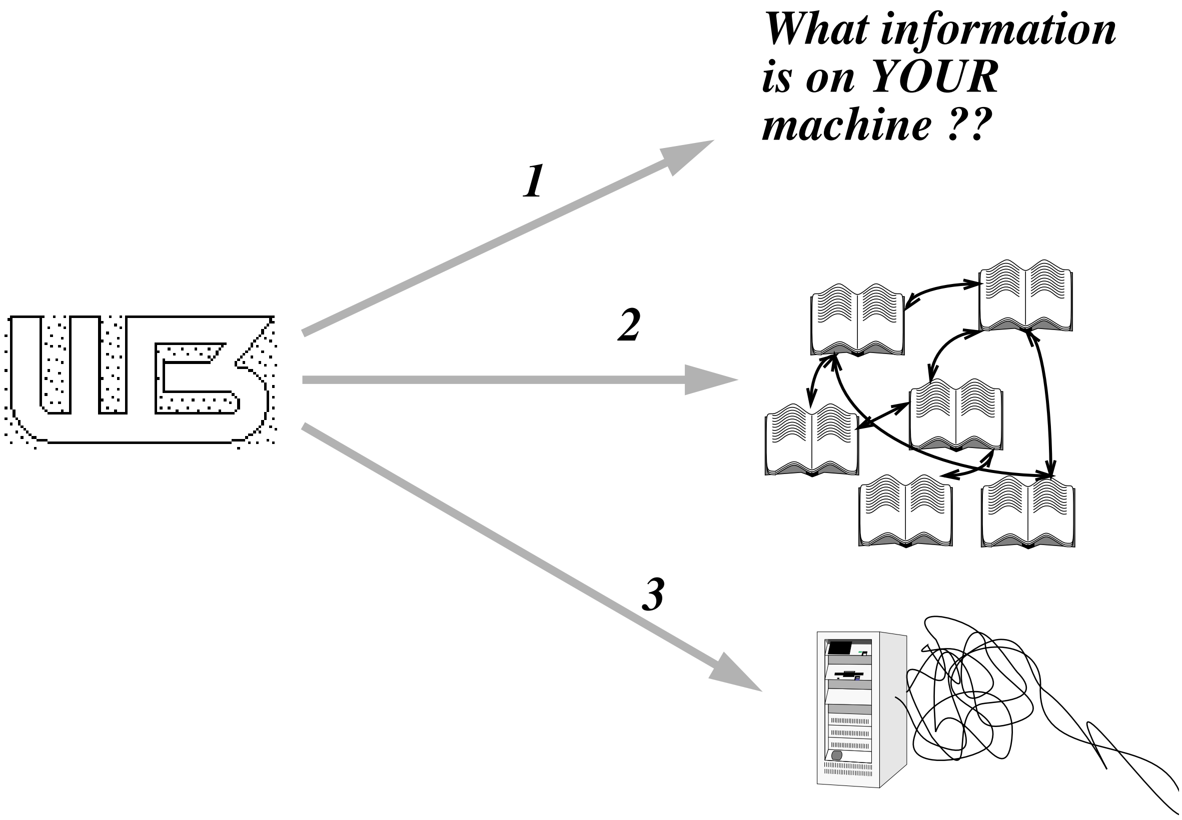
(1) A *Knowledge Integrator* ➲(2.1)

(2) A *distributed Hypertext* ➲(2.2)

(3) An *Interface to any kind* of remote program ➲ (7.4)



1. Introduction: The WWW in Education

1.2. “Education” = Teaching + Learning

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(1) *Teaching* “setups” ➲ (4.1)
e.g. Distance Teaching, Open Learning, Semi-Distance Teaching, Traditional Class room teaching, ...

(2) *Learning* ➲ (3.1) - shortly

☞ **Teaching & Learning “meet” in**
the *teaching & learning environment* ➲ (3.2)
e.g. Curriculum, Teaching, Tutoring,
Learning Materials ➲ (5.1), Co-Learners ➲ (5.2), ..

So:

what *teaching & learning functions*
can the *WWW* provide
for what *educational setups* ?

2. The WWW - Purpose, basic mechanism

2.1. Knowledge Integrator

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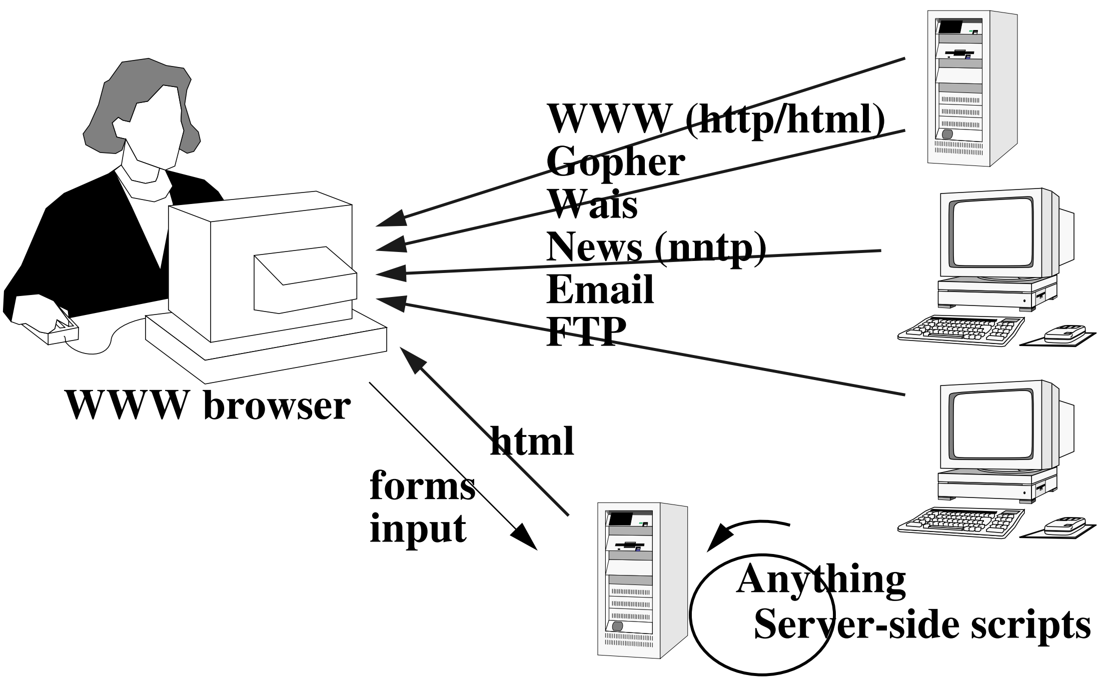
2.1 Knowledge Integrator

- all available information on the Internet could be accessed in a simple and consistent way on every kind of machine architecture. (TBL at CERN in 1989)
- Goal: Exchange of information between researchers.



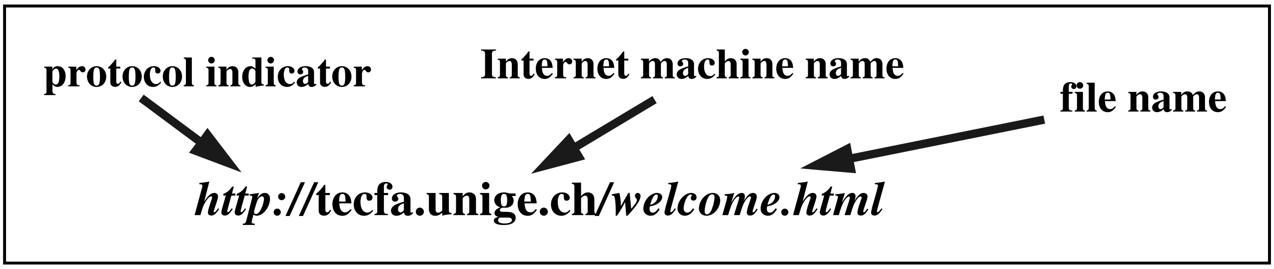
- The WWW has exponential growth rates (1%/day).

2. The WWW - Purpose, basic mechanism

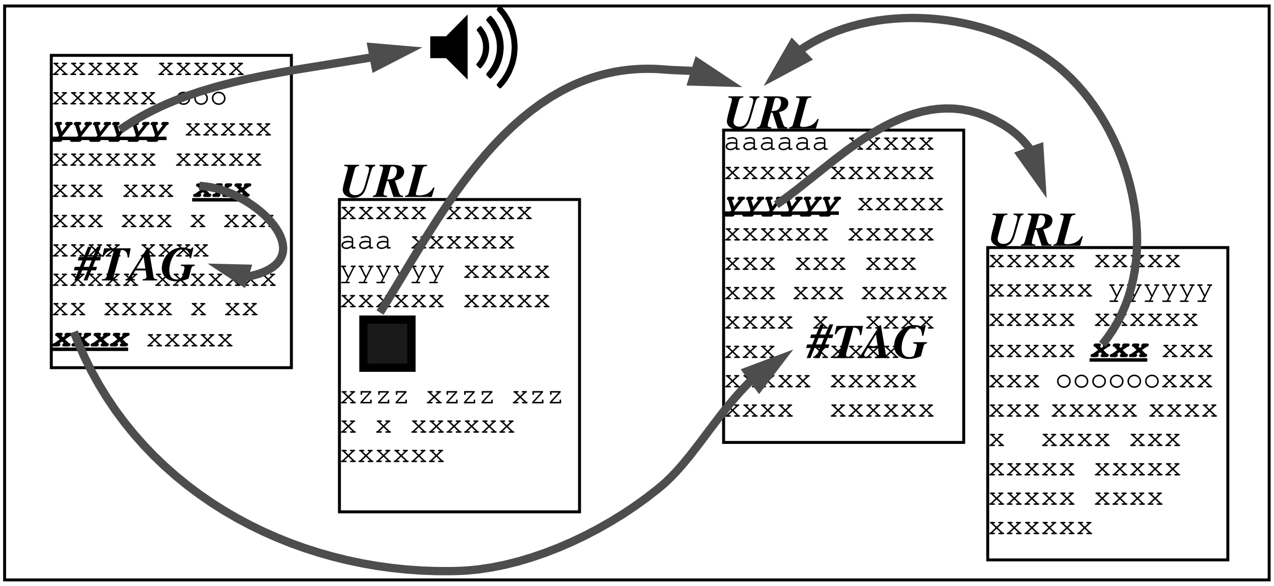
2.2. Universal Resource Locators (URL) &

2.2 Universal Resource Locators (URL) & Hypertext

URL = <protocol>://<address>/<directory/file-name>



Building Hypertext = connecting URLs (files & programs)



Hypertext = writing *Hypertext Markup Language* (html)
or creating *"html on the fly"* (server-side)

3. Learning, Education & Technology

3.1. What is learning?

3. Learning, Education & Technology

3.1 What is learning?

- **One learns by *doing* something (psychology)**
- **One learns by pursuing an *instructional goal* (education)**

Learning as the Psychologists see it:

- **needs *external "conditioning"* (behaviorism);**
- **Is related to active *problem solving*;**
  - involves integration, construction and compilation of new content (cognitivism)
- **is constrained by *human cognitive capacities***
  - (e.g. how much hypertext can we handle?)$

Several kinds of learning:

e.g. Factual information, Concepts, Reasoning, Procedures, Problem Solving,...)

☞ **One does not learn by browsing, we need a variety of learning tasks (not just exploration)**

3. Learning, Education & Technology

3.2. The teaching and learning environment

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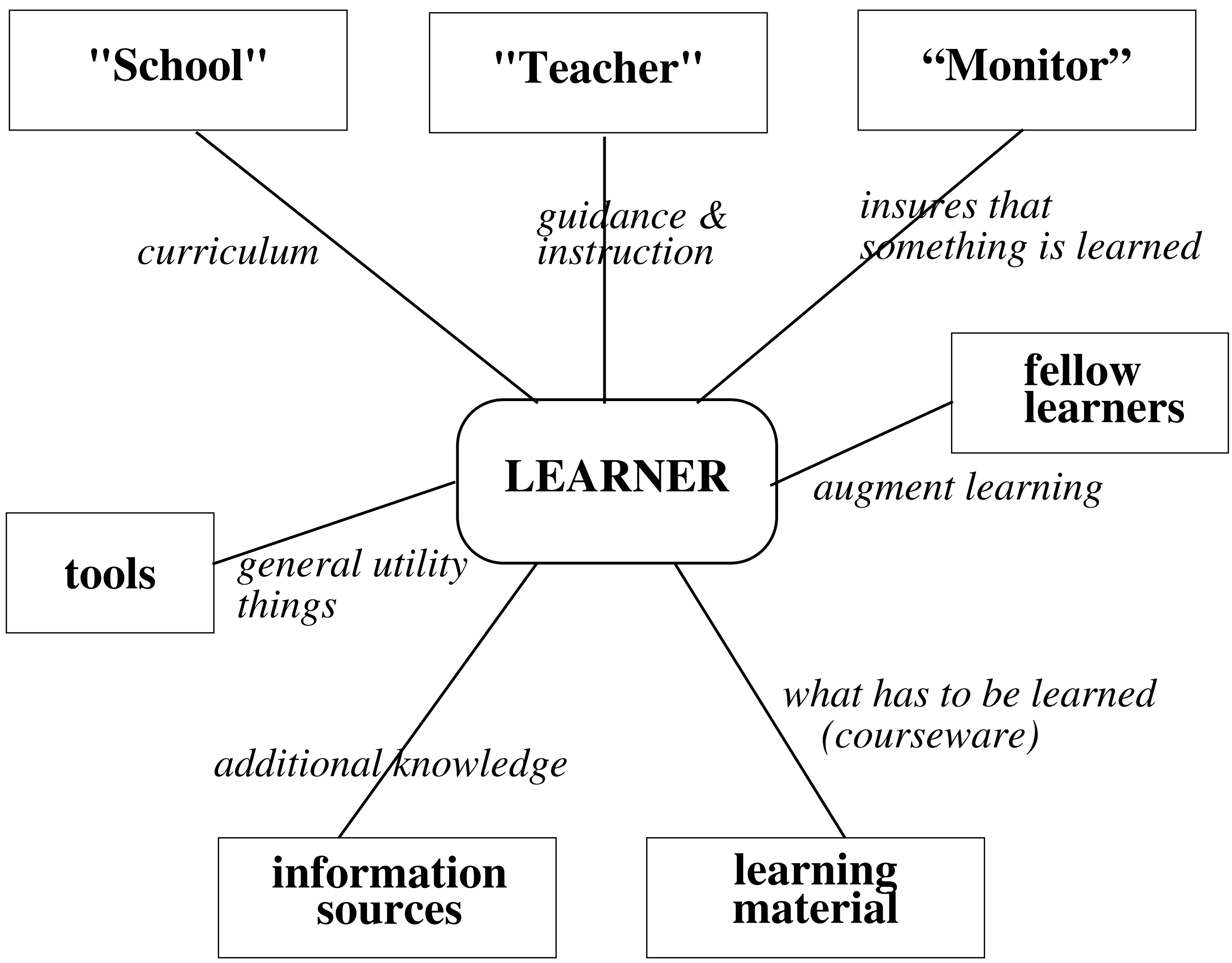

Figure 1: Overview of the Learning Environment (inspired by Sandberg 94:225)

4. Who needs the Web (and the Net in general) ?

4.1 Distance Teaching, Open Learning

Distance Teaching Institutions

- **Requirement: Students need *access to the Web***
- **Pro: *Standardization***
- **Con: *Cost*, technical *gaps* of the WWW**

"Just in Time Open Learning" Providers (same issues)

Semi-Distance curricula (e.g. TECFA's postgraduate diploma)

- **Pro: *Up-to-date* learning materials**
- **Cons: Additional *Work* for the Instructors, lack of experience with *DT.***

DT Courses offered by regular institutions

- **Pro: *Pooling of Resources* across institutions**
- **Cons: *Additional Work* for the Instructors, lack of experience with *DT***

4. Who needs the Web (and the Net in gen-

4.2. "Classical" Institutions

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Class Room teaching

- **Pro: *Flexibility* - *new ways of teaching* - *shared material***
- **Problem: Often done on an "ad hoc basis", needs involvement and "follow up".**

Departmental Research and Training Information

- **Pro: Quite *easy* to implement**
- **Cons: *Training* of Department members, *updating*, etc. can be REAL problems**

4.3 All Institutions

Campus-Wide Information Systems (Virtual, DT, or classic)

- **Requirement: Needs "*organizational* planning"**
- **Cons: none!**

☞ General Problem: students need Net training, Internet access is expensive (rural areas!)

5. Education on the WEB

5.1. The "Learning Material"

5. Education on the WEB

5.1 The "Learning Material"

The CBT view:

- **Programmed Instruction**
  (little step by step transfer of content)
- **Computer Assisted Instruction**
  (Drills & Tutorials)
- **Intelligent Computer Assisted Instruction**
  (ITS Tutorials)
- **Computer Based Learning**
  (Simulations, Hypertext & Microworlds)
- **Intelligent Learning Environments**
  (Microworlds + tutors, helpers, experts)
- **Cognitive Learning Support Environments**
  (some hypertexts)
- **Knowledge Construction Environments**

☞ **The Web fits in rather poorly**

5. Education on the WEB

5.1. The "Learning Material"

A general "Courseware" view, topics are:

- **Courseware = *optimize access* to edu "information"**
  - via an appropriate interface and structuring of the material
- **implementation of *instructional strategies,***
  - i.e. sequencing of teaching materials
- **implementation of *instructional tactics*, e.g.:**
  - giving examples
  - multiple choice questions
  - asking the student to perform a task, etc.
  - telling what learning strategy to adopt with some material
- **Learning material contains *what has to be learned* in a very broad sense (e.g. knowing what, knowing how).**
  - It can be computational in various ways (exploratory hypertext, lesson & task oriented hypertext, simulation software, task solving environments, etc.)

☞ **Web potential: For teachers, the focus shifts from *"information transfer"* to *"organization of information access"* + *"organization of collaboration"*.**

5. Education on the WEB

5.1. The "Learning Material"

WWW Courseware:

(1) Educational Hypermedia (NOT easy!)

- Hypertext
- on-line text-books
- "museums"
- multi-media data
- manuals
- ....

☞ **Often textbooks are better that HT books!**

- hint: Use the same source for both!

(2) Test and Quiz (self-assessment, assessment)

(3) Pedagogical access to scientific Data

(4) Interactive software

- "Interfaces" to server-side programs:
  E.g. simulations, saves the WWW from being too limited for producing REALLY interactive software
- Interfaces to client programs (easier solution)
  All kinds of interactive courseware (that you can put on a diskette) (e.g. programs written with Toolbook).

☞ **The Web is best for exploratory learning**

5. Education on the WEB

5.2. The WWW as collaboration tool

5.2 The WWW as collaboration tool

Focus on:

- **person-to-person interactions (e.g. individual tutoring and monitoring as well as collaboration between students)**
  - Not: “person-to-many-persons” delivery of learning material and learning instructions (e.g. exercises, educational text, educational software, instructional information)

Uses of asynchronous communication on the Web:

- **Organizing better information exchange among students**
  - (who does what, students have to turn in html pages)
- **Distribution of work to be shared**
  - Students have to coordinate over the network
- **Co-writing of text**
  - Students have to co-produce over the network
- **Discussion & Conferencing**
  - Students have to comment text and argument about ideas

☞ High need for synchronous CSCW extensions

- **Prototypes: Web-Chat, WWW<->MOO, ... exist**

5. Education on the WEB

5.2. The WWW as collaboration tool

New roles for “Teachers” and “fellow learners”

Teachers

☞ **With networked computers, teachers become rather: “information organizers”, “tutors”, “facilitators” .... instead of “information transmitters”.**

Fellow learners

☞ **The Network favors collaborative work, which in turn favors learning (see: Dillenbourg & Schneider 95)**

PS: Cooperative learning works well under certain conditions and there exist several mechanisms (10.3)

5.3 An unordered list of things seen on the Web

- Information servers to look up information (manuals, books, expositions, bibliographies, programs, etc.)
- Distribution of educational material
- Curricula information & guidance to lessons
- Educational textbooks & exercises in hypertext format
- Tools for collaborative work (dynamic hypertext, “News” like conferencing systems, co-writing hypertexts)
- Implementations of “Jigsaw puzzles”
- Question & Answering pages
- Interfaces to local clients (e.g. simulations, programming environments, tutors, etc.).
- Interfaces to learning environments running on a server machine

The Web is already quite popular in education (Examples can be found in many places)

☞ **See e.g. : http://tecfa.unige.ch/info-edu-comp.html**

5.4 Levels of WWW Use (in order of difficulty)

(1) The Web as information tool

- Courses syllabus (program, grading info, exercises, etc.)

=> ***Needs simple WWW training of instructors***

(2) Distribution of learning material ➔ (5.1)

- books (in various formats like postscript, word-processor, etc.)
- programs
- applications needing a specific interpreter/language for the client

(3) Collaboration tools ➔(5.2)

- Simple prototypes are available

(4) Interactive applications ➔(5.1)

- Problematic: fall-back into the early ages of programming

6. Conclusion

6.1. Educational research is needed, e.g.

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- **When do we need hypertext ?**
- **How can we make sure that people learn ?**
- **What tools for what kind of learning (old pb)**
- **Can we make education better with the Web ?**

6.2 Presently the Web needs complementary software

- **CSCW (groupware) tools**
- **Multi-user low-bandwidth synchronous software (see Marcus Speh's talk)**
  - Multi-user text-based "Dimension", Spacial orientation, Various communication "verbs" & tools, Artifacts, ...

☞ **AND: better integration of WWW with this software e.g. one should be able to "show" and co-edit web-pages**

6. Conclusion

6.3. So what can we do with the Web ?

6.3 So what can we do with the Web ?

Table 1: The WWW in a Global Learning Environment

Which technology ?	"school"	teacher	monitor	fellow learners	learning material	Ext. info sources	tools
Simple WWW	***	*	-	*	**	***	*
WWW with server-side scripts	**	**	*	**	**	***	**
WWW & local clients	*	*		-	***		***
WWW with "CBT server-side computing					** ??	***	**
WWW interfaces to Internet tools		**	**	**		**	
WWW multi-user VR interfaces	**	***	***	***	**		

☞ **Each column is covered ! - We "can do it"**
But a LOT of development work is still needed

6. Conclusion

6.4. 4 aspects need to be considered:

6.4 4 aspects need to be considered:

☞ **Technological aspects,.e.g**

- Filters for generating HTML
- Server-side programs
- Data-Bases

☞ **Organizational aspects**

- Who is going to do the extra-work?
- How can we train all involved persons

☞ **Pedagogical/psychological aspects**

- How can we be produce good courseware on the Net ?
- How can we build full teaching & learning environments ?

☞ **Media aspects**

- How to "mediatize" educational content?
  (Important issue for DT institutions)

6. Conclusion

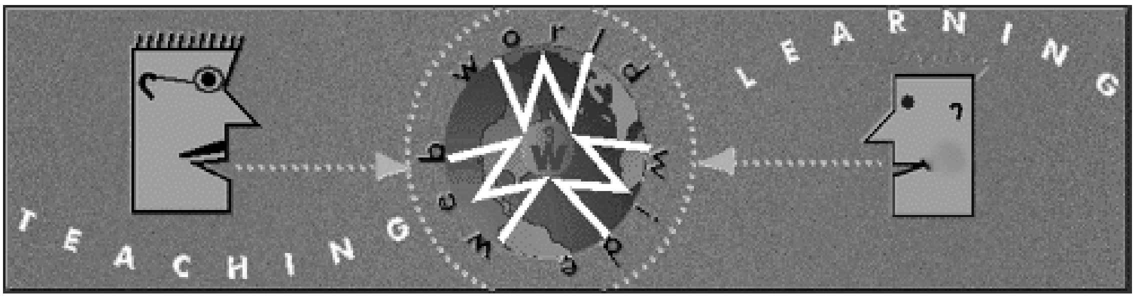
6.5. The Web is best used as:

6.5 The Web is best used as:

Communication & Collaboration Tool

for Information & Courseware Dissemination

To share educational material over the world



☞ **Starting point: http://tecfa.unige.ch/info-edu-comp.html**

7. Appendix - Technical aspects of the WWW

7.1. HTTP & HTML - Simple Protocols

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7.1 HTTP & HTML - Simple Protocols

"Hypertext Mark-Up Language" (HTML)

- **document structuring (description of logical contents with influence on formatting)**
- **Hypertext buttons (internal & external)**
- **Subset of SGML**

Server-Client negotiation (flexibility)

- **Multi-media browsers**
- **Text browsers**
- **Helper programs**

Stateless Connections

- **"Following an URL" implies:**
  - **(1) open a connection,**
  - **(2) get a file {or execute a file and return the result},**
  - **(3) close the connection.**

7.2 The HTML language: An example

```
<HTML>
<HEAD>
<TITLE>Title (Name) of html page</TITLE>
</HEAD>

<BODY>

<H1>Big Title</H1>

<H2>Title 2</H2>

Here is a list:
<UL>  <LI> element 1
      <LI> element 2
</UL>

This is an enumerated list:
<OL><LI> element 1 <LI> element 2</OL>

This is a simple paragraph. Text will be formatted.<A
HREF=”http://tecfa.unige.ch/info-www.html”>Click HERE </a> to
learn more about the World-Wide Web.
<p> Here is a preformatted paragraph:
<pre>
Text will not be formatted.
Text will not be formatted.</pre>
<A HREF=”http://tecfa.unige.ch/tecfa/general/tecfa-people/
schneider.html>D.S.</A>
</BODY>
</HTML>
```

7. Appendix - Technical aspects of the WWW

7.2. The HTML language: An example

```
               Title (Name) of html page

                   BIG TITLE
Title 2

Here is a list:
   * element 1
   * element 2

This is an enumerated list:
   1. element 1
   2. element 2

This is a simple paragraph. Text will be formatted. Click HERE
to learn more about the World-Wide Web.

Here is a preformatted paragraph:
Text will not be formatted.
Text will not be formatted.
D.S.
```

7.3 Producing HTML: 4 strategies

(1) Using a simple text editor

- = inserting html tags manually

(2)Using a "smart" text editor or an HTML tool

- editor extensions (like Emacs), has menus and hotkeys for insertion of HTML tags
- specialized HTML editors (like HTML assistant for Windows)
- "HTML tool" (like HotMetal);

(3)Using "filters"

- = translation programs that translate from text processing or other formats into HTML;

(4)Using programs that create HTML "on the fly"

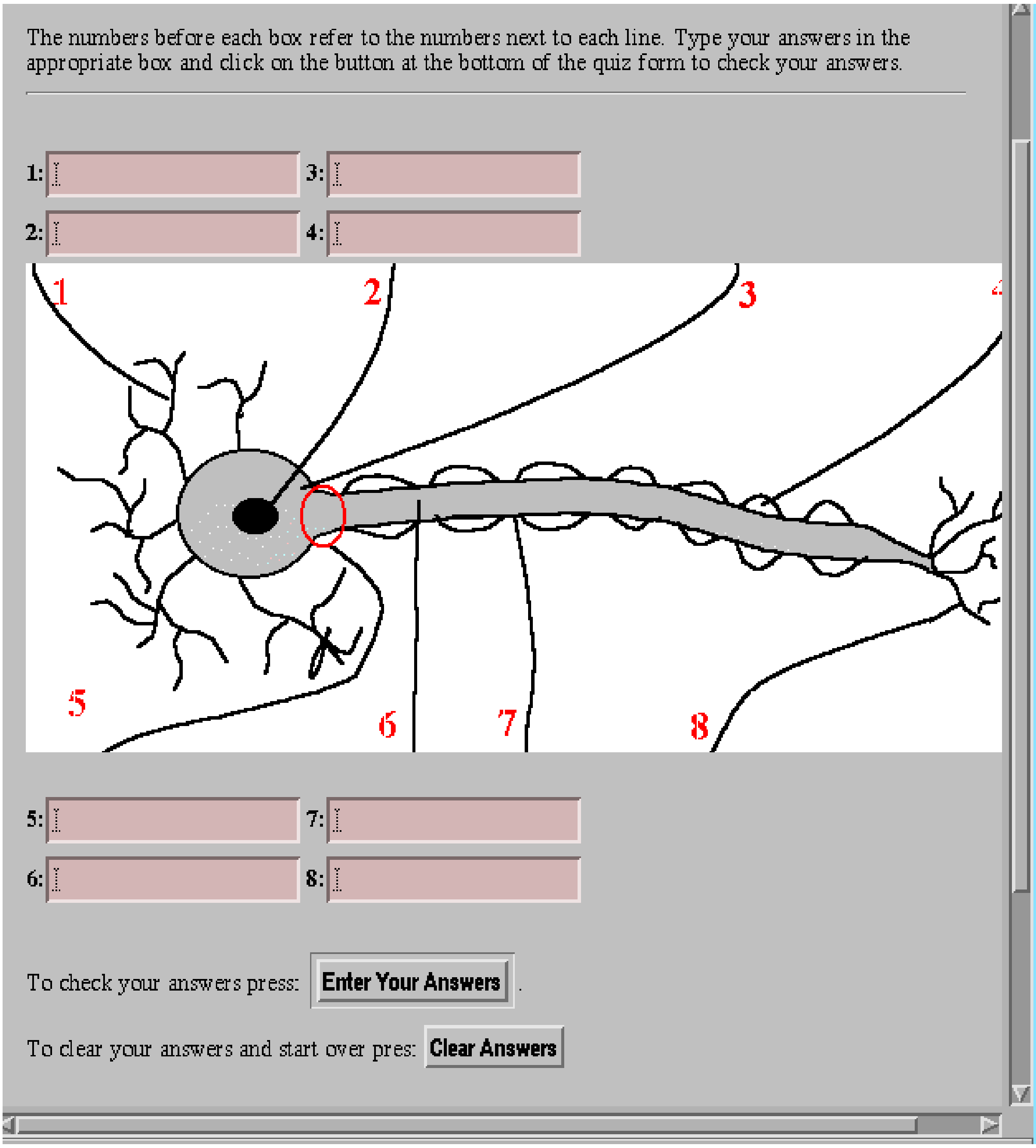
- = a feature frequently used to display output resulting from a data base request, on-line questionnaires and assessment programs.

7.4 Interactive "Forms" pages - An example

```
<HTML><HEAD><TITLE>Neuron Structure Quiz</TITLE></HEAD>
<BODY><H1>Neuron Structure Quiz</H1>
<H3>Part I:  The Neuron</H3>
The numbers before each box refer to the numbers next to each line.
Type your answers in the appropriate box and click on the button at
the bottom of the quiz form to check your answers.<HR>

<FORM METHOD="POST" ACTION="http://psych.hanover.edu/cgi-win/
polyform.exe/structansers2">

<B>1:</B><INPUT NAME="Dendrite">
<B> 3:</B><INPUT NAME="Soma"><BR>
<B>2:</B><INPUT NAME="Nucleus">
<B> 4:</B><INPUT NAME="Myelin"><BR>
<IMG SRC  = "neuron.gif"></IMG><BR>
<B>5:</B><INPUT NAME="Axon_Hillock">
<B> 7:</B><INPUT NAME="Node_of_Ranvier"><BR>
<B>6:</B><INPUT NAME="Axon">
<B> 8:</B><INPUT NAME="Axon_Terminal"><P>

To check your answers press: <INPUT TYPE="submit" VALUE="Enter Your
Answers">. <BR>
To clear your answers and start over pres: <INPUT Type="reset"
Value="Clear Answers"><P>
</FORM><HR>
<A HREF = "http://psych.hanover.edu/#contents"><IMG SRC ="/
psy_smal.gif">Return to Psychology contents.</A><P>
<A HREF = "http://psych.hanover.edu/Krantz/neurotut.html"><IMG SRC
= "neuricn2.gif"></IMG>Return to the beginning of the Neural
Tutorials.</A>
</BODY></HTML>
```

7. Appendix - Technical aspects of the WWW

7.4. Interactive "Forms" pages - An example



7.5 Technical Summary Remarks

"Social" Difficulties:

- **Training**
- **Updating**

Technical Difficulties (summary):

- **Installation of a server (easy)**
- **Filters for transforming documents (quite easy)**
- **Search Engines and Data-Bases (hard)**
- **Educational Server-Side scripts (quite hard)**

General Limits of the Web

- **"Statelessness"**
- **Speed**
- **Security**
- **lack of easily installable & understandable server-side scripts (educators are not PERL hackers!)**

7. Appendix - Technical aspects of the WWW

7.5. Technical Summary Remarks

Interfacing the Web with other programs

On the Client Side

- **Use Mime types in order to launch an application on the client-side.**
  - An elegant solution, risky, since such an application could damage your system.
  - Needs some modifications of Clients (sometimes)
- **+/-Standard Interfaces to programs like mail & news**
  - (Job of Client providers)

On the Server Side

- **Use forms to run programs on the server side. Secure, but slow, sometimes tricky and not always appropriate.**
  - Ex: dynamic hypertext
  - Ex: Interfaces to any kind of program: e.g. simulations

WWW standards

- **HTML 1 (basic)**
- **HTML 2 (HTML+) (forms & inlined images)**
  - Today's de facto "standard"
- **HTML 3 (tables, ???)**

7. Appendix - Technical aspects of the WWW

7.5. Technical Summary Remarks

WWW-based CMC

- **synchronous (difficult today)**
  - WWW<->MOO Interfaces
  - Web-Talk

  => ***Still experimental, the future is probably integrated www-communication clients.***
- **asynchronous (by using server-side programs, i.e.**
  - Mail/News gateways (integration of other standard Internet tools for ease of use)
  - Collaborative Annotation
  - Conferencing Systems
    e.g. WebForum, WIT, Hypernews

8. Appendix - MUDs - Towards large multi-user educational VR

- **Multi-user text-based "Dimension"**
- **Spacial orientation**
- **Various communication "verbs" & tools**
- **Artifacts**

The TecfaMOO

```
TecfaMOO Arrival Station
  _________
 /___  ___/                                Official Opening: around easter
    / /                                   Builders and Programmers Permits
   / /                                   will be issued
  /_/ ECFA MOO   Arrival Area

  A Virtual Space for Educational Technology, Education, Resarch & Life
  at TECFA, School of Psychology & Education, University of Geneva

  'go w' (for Visitor Information) 'go s' (Builder's Information)

  More information: http://tecfa.unige.ch/tecfamoo.html

You see Strange black dog here.
Guest is here.
Obvious Exits: Up (to Les Puces de Plainpalais), UC (to Underground
Corridor), W (to Visitor Information), Up2 (to Transportation Center of
Rond Point de Plainpalais), and S (to Underground Construction Office).
```

8. Appendix - MUDs - Towards large multi-

7.5. Technical Summary Remarks

```
>@go atrium
The Tecfa Atrium
The Atrium of TECFA with its spring fountain is the place where TECFA
people can relax and talk about the latest advances in Educational
Technologies. Type a ROOM NUMBER to enter an room.
  +---------------------------o   o-----------------------------------+
  |11=Patrick     10=Francoise|   | UP<     26=Daniel   25=Pierre     |
  |   Mendelsohn     Schmitt  | N | DOWN>       Peraya     Dillenbourg|
  |                 o---------o   o---------------------------o       |
  |12=Meeting       |                           o-----------o |23=Fr. |
  |   Room          |                           |           | |Giezen |
  |                 |             (*)           |24 Seminar | |       |
  |                 |                           |   Room    | |       |
  |         o-------o                           |           | |       |
  |         |         The Atrium                o-----------o |       |
  |         o-------------------------o   o-------------------o       |
  |17=Daniel   18=Patrick  19=Sylvere |   |20=Boris                   |
  |   Schneider   Jermann     Martin-M| S |Borcic                     |
  +-----------------------------------o   o---------------------------+
You see Machine a Cafe and WWW-box here.

>look www
WWW-box
A laptop sized WWW display. Type help 'www-box' or 'help www' !
 'reset www' will reset - 'pick <n> on www' will display an item.
Remembered documents:

  [1] TECFA WWW home page
  [2] TECFA's WWW Home Page for Internal Use
  [3] Tecfa's page on educational MUDs
  [4] The TecfaMOO page
  [5] The TecfaMOO Manuel
```

9. Appendix D - Get started!

9.1. Basics

9. Appendix D - Get started!

9.1 Basics

Get connected first!

- **You need either a TCP/IP connection or a PPP/Slip Modem connection**
- **Private providers do exist (cheap rates for students)**

WWW Clients

- **Mosaic Netscape: *“ftp.mcom.com”***
- **Mosaic NCSA: *“ftp.ncsa.uiuc.edu”*.**
- **Lynx: *“ftp2.cc.ukans.edu”*.**
  (DOS and VMS/Unix terminals)

WWW Servers

- **Run on several types of machines, relatively easy to install**

9. Appendix D - Get started!

9.2. Introductory Bibliography

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(Technical)

DECEMBER, John and RANDALL, Neil (1995) The World Wide Web Unleashed, Macmillan, 1,058 pages; ISBN 0-672-30617-4; Price: $35.00. An overview and guide to the World Wide Web for a general audience; including how to get started with Web browsers, Web navigation techniques, how to develop webs, a tour of Web applications, and an exploration of future issues. Highly recommended.

GAFFIN, A. and HEITKOETTER, Jörg (1994) *Big Dummy's Guide to the Internet.* Electronically available via WWW from *"http://www.germany.eu.net/books/bgtti/bgtti.html"* or via FTP from *"ftp://ftp.germany.eu.net/pub/books/big-dummys-guide/"*. Huge, up-to-date and recommended.

GILSTER, P. (1993) *The Internet Navigator: The Essential Guide to Network exploration for the Individual Dial-Up User,* Wiley, New York, 470 pages, 1993. Recommended.

HAHN,H. (1993) *The Internet Complete Reference*, McGraw-Hill, New York, 800 pages, 1993.

KEHOE,B.P. (1992) *Zen and the Art of the Internet: A Beginner's Guide to the Internet*. Prentice Hall, Englewood Cliffs, 112 pages, 1992. The big classic, but outdated.

KROL,E. (1992) *The Whole Internet: Catalog & User's Guide*. Sebastopol, O'Reilly, 376 pages, 1992. Recommended, but outdated.

LAQUEY, T. and RYER,J.C. (1993), *The Internet companion: a beginner's guide to global networking*. Addison-Wesley, New York, 208 pages, 1993. Recommended. An on-line version is available at *"ftp://ftp.germany.eu.net/books/laquey/"*.

RANDALL, Neil (1994) *Teach yourself the Internet around the world in 21 days*, SAMS Publishing, 1994. Not too authorative, but has many pictures from many WWW sites.

WIGGINS, Richard W. (1994) *The Internet for Everyone: A Guide for Users and Providers*: McGraw-Hill, New York, 1994. Most recommended, has a good section on the WWW.

(there are more)

9. Appendix D - Get started!

9.2. Introductory Bibliography

(Theory - only cited authors)

Aronson, Dennis T., & Leslie J.Briggs, (1983). “Contributions of Gagné and Briggs to a Prescriptive Model of Instruction”, in Reigeluth, C.M. (1983) (e.d). Instructional Design Theories and Models: An Overview of their Current Status. Hillsdale, NJ: Prentice-Hall.

Dillenburg, Pierre and Schneider, Daniel, (1995), “Collaborative learning and the Internet”, paper presented to ICCAI 95.

Gagné, R.M. (1985). The Conditions of Learning (4th Ed). New York: Holt Rinehart, and Winston.

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10.1. Learning types

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10.1 Learning types

Types of Learning

(according to Kearsley 1993):

- Attitudes: "....Disposition or tendency to respond positively or negatively towards a certain thing (idea, object, person, situation)." Also: Choose to behave this or that way according to opinions and beliefs.
- Factual Information (Memorization): Processing of factual information and remembering is tied to previous knowledge. Memory research has also a lot to say about processing constraints.
- Concepts (Discrimination): Concept learning encompasses learning how to discriminate and categorize things (with critical attributes). It also involves recall of instances, integration of new examples and sub-categorization. Concept formation is not related to simple recall, it must be constructed.
- Reasoning (Inference, Deduction): "Reasoning encompasses all thinking activities that involve making or testing inferences. This includes inductive reasoning (i.e., concept formation) and deductive reasoning (i.e., logical argument). Reasoning is also closely related to problem-solving and creative behaviors".
- Procedure Learning: Procedures refer to being able to solve a certain task by applying a procedure. Once a procedure is mastered its excused usually does not take much effort (e.g. ftp a file). Cognitive theories like Act or Soar are interested in this, because procedures are important in diminishing cognitive load.
- Problem-Solving: A good example is Newell & Simons information processing paradigm for the study of problem-solving and the concepts of "means-ends-analysis" and "problem space". According to their GPS framework, problem-solving involves the identification of subgoals and the use of methods (especially heuristics) to satisfy the

subgoals. And important contribution was also the methodology of protocol analysis (of “thinking aloud methods” which has been extensively used by Anderson (87) to implement intelligent tutoring systems according to his Act* theory (Anderson 83).

- Learning Strategies: can be learned too to some extent. Very much dependant on what you want to learn
- Sensory-Motor:

Note that learning types can be strongly related to different kinds of cognitive task behaviors (that are being used while learning or that are targets for learning). As an example, Kearsley (93) lists the following types of task behaviors:

- Searching for/receiving information (detects, observes, inspects, identifies, reads, surveys)
- Processing information (categorizes, calculates, codes, itemizes, tabulates, translates)
- Problem-solving (analyzes, formulates, estimates, plans)
- Decision-making (examines, chooses, compares, evaluates)
- Communication (advises, answers, directs, informs, instructs, requests, transmits)
- Sensory-motor processes (activates, adjusts, connects, regulates, tracks)

By combining those two kinds of typologies one can imagine the “haystack” Instructional Design theory is faced with when trying to operationlize how to learn what.

10.2 Instructional Design Theory

Gagné’s steps of instruction

What is the optimal sequencing of courseware and how is it related to various types of learning? Gagné suggests nine universal steps of instruction (cf.Gagné 85 or Aronson 1983) which should be found in any instructional context:

(1)**Gain attention** e.g. present a good problem, a new situation, use a multimedia advertizement.

(2)**Describe the goal:** e.g. describe the goal of a lesson (task,...), state what students will be able to accomplish and how they will be able to use the knowledge, give a demon-

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10.2. Instructional Design Theory

stration if appropriate.

(3)**Stimulate recall of prior knowledge** e.g. remind the student of prior knowledge relevant to the current lesson (facts, rules, procedures or skills). Show how knowledge is connected, provide the student with a framework that helps learning and remembering. Tests can be included.

(4)**Present the material to be learned** e.g. text, graphics, simulations, figures, pictures, sound, etc. e.g. follow a consistent presentation style, chunking of information (avoid memory overload, recall information)

(5)**Provide guidance for learning** e.g. presentation of content is different from instructions on how to learn. Should be simpler and easier that content. Use of different channel.

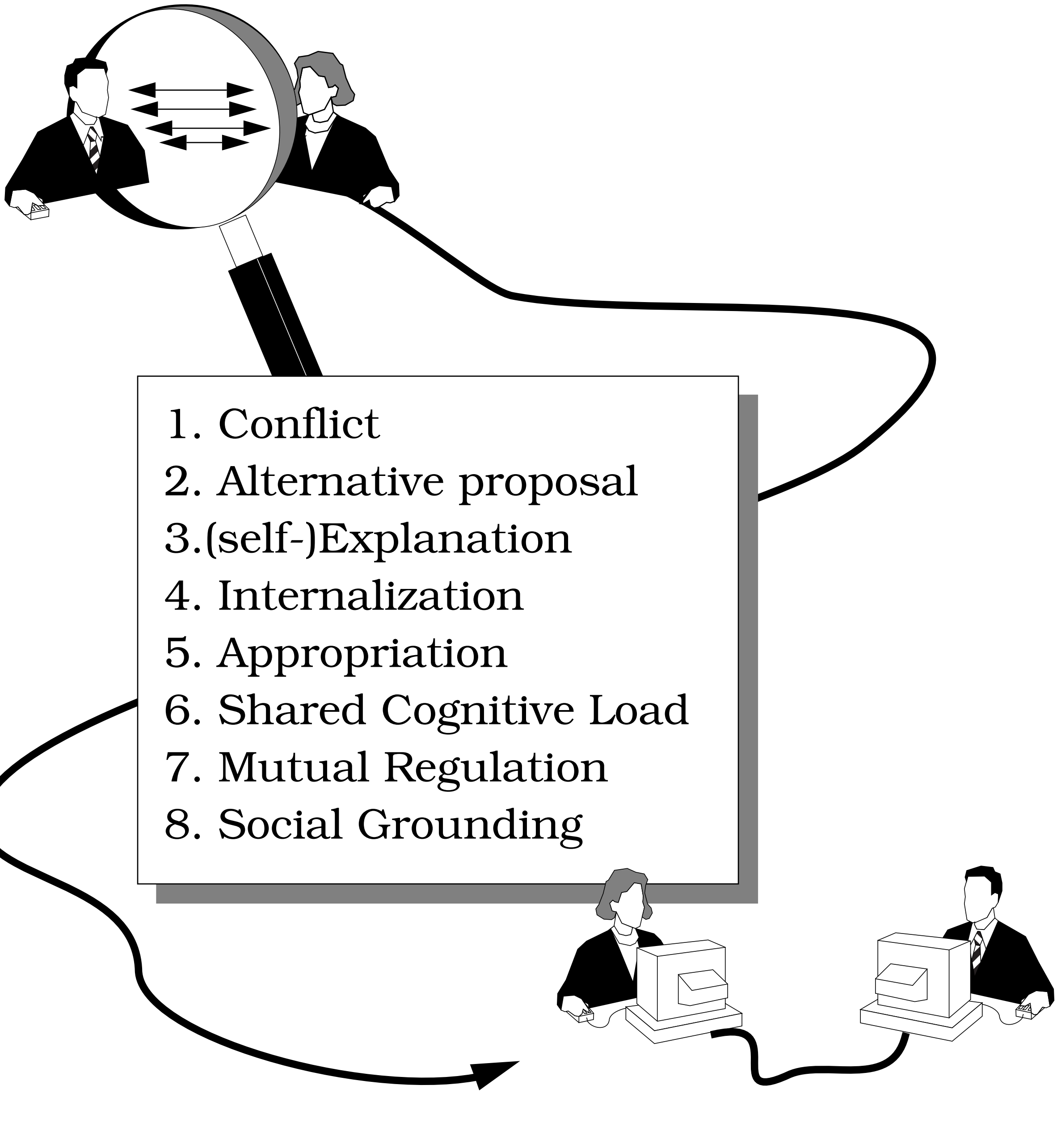
(6)**Elicit performance** "practice", let the learner do something with the newly acquired behavior, practice skills or apply knowledge

(7)**Provide informative feedback** show correctness of the trainee's response, analyze learner's behavior (or let him do it), maybe present a good (step-by-step) solution of the problem

(8)**Assess performance** test, if the lesson has been learned. also give sometimes general progress information

(9)**Enhance retention and transfer** inform the learner about similar problem situations, provide additional practice. Put the learner in a transfer situation. Maybe let the learner review the lesson.

10.3 Mechanisms of Collaborative Learning



1. Conflict
2. Alternative proposal
3. (self-)Explanation
4. Internalization
5. Appropriation
6. Shared Cognitive Load
7. Mutual Regulation
8. Social Grounding