

# 4 Geschichte der Lernmaschinen

4.1 Vorgeschichte

4.2 Behaviorismus: Programmierte Unterweisung



4.3 Kognitivismus: Instruktionsdesign,  
Intelligente Tutorielle Systeme

4.4 Konstruktivismus: Mikrowelten, situiertes Lernen

4.5 Hypermediales Lernen und Web-Based Training

## Literatur:

A. Holzinger: Basiswissen Multimedia Band 2, p. 176-182

J. Hasebrook: Multimedia-Psychologie, Kapitel 7 und 8

H. Niegemann et al.: Kompendium E-Learning, Kapitel 1

# Burrhus Skinner: Programmierte Unterweisung

- Rezession lähmt auch Anwendung von Lernmaschinen
- Nach dem 2. Weltkrieg: „Babyboom“, „Sputnik-Schock“, ...
- Programmiertes Lernen nach Skinner (ca. 1958, angeblich aufgrund von Beobachtungen in Grundschule):
  - Jede Antwort bekommt eine sofortige Rückmeldung.
  - Jeder Schüler arbeitet in seinem individuellen Tempo.
  - Lernziele sind klar und objektiv formuliert.
  - Aufgaben sind so gestellt, dass sie mit hoher Wahrscheinlichkeit richtig gelöst werden.
  - Unterrichtsstoff zerlegt in „Frames“ (Frage- und Antwortkombinationen) mit langsam ansteigender Schwierigkeit und der Präsentation des Stoffs aus verschiedenen Perspektiven
  - Lernende werden zur Aktivität angeleitet.
  - Ausdauerndes und gutes Arbeiten führt zu Zusatzbelohnungen.
- Basis vieler (der meisten?) Lernprogramme bis heute!

# Example of Original Skinner Frames

- From Skinner, B.F. (1958). Teaching machines. *Science*, 128 (3330), 969-977.

Frame 1

MANUFACTURE means to make or build.  
Chair factories manufacture chairs.

Copy the word here:

\_\_\_\_\_

Frame 2

Part of the word is like part of the word FACTORY.  
Both parts come from an old word meaning make or build.

M A N U \_\_\_\_\_ U R E

Frame 3

Part of the word is like part of the word MANUAL.  
Both parts come from an old word for hand.  
Many things are made by hand.

\_\_\_\_\_ F A C T U R E

# Ein aktuelles Lernprogramm (incops)

## Lernziele zu "Sensorisches Gedächtnis"

In dem Kapitel "Sensorisches Gedächtnis" sollten sie folgendes lernen:

- die **Funktion** des Sensorischen Gedächtnisses innerhalb des Wahrnehmungsprozesses
- die **Eigenschaften** des ikonischen und auditiv
- die **Methoden** und **Experimente** zur Untersuchung des Sensorischen Gedächtnisses
- die Existenz **präkategorialer** und **kategorialer** Gedächtnis
- die **neurophysiologische Ursprünge** des ikonischen Gedächtnisses

Weiter mit der nächsten von  
[Ikonisches Gedächtnis](#)



Alle Aufgaben der letzten Übung waren **richtig** gelöst!

[Weitere Übungen](#)

Die Fragen waren:

Unter ikonischem Gedächtnis versteht man das Gedächtnis für

Die Antwort war richtig:

- auditive Reize
- gustatorische Reize
- olfaktorische Reize
- visuelle Reize
- haptische Reize

Grund:

Das ikonische Gedächtnis oder auch visuelles sensorisches Gedächtnis genannt ist das sensorische Gedächtnis für visuelle (Sehen) Reize. Es wird durch das Auge aufgenommen.



Sie haben in 2 Aufgaben **1 Fehler** gemacht und sollten daher noch weitere Aufgaben bearbeiten!

[Weitere Aufgaben](#)

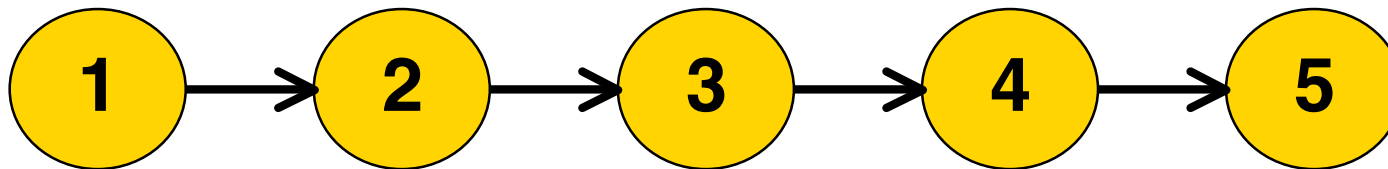
Die Fragen waren:

Wieviele Buchstaben konnten die Versuchspersonen bei der Methode der Ganzwiedergabe richtig wiedergeben, wenn 12 präsentiert wurden?

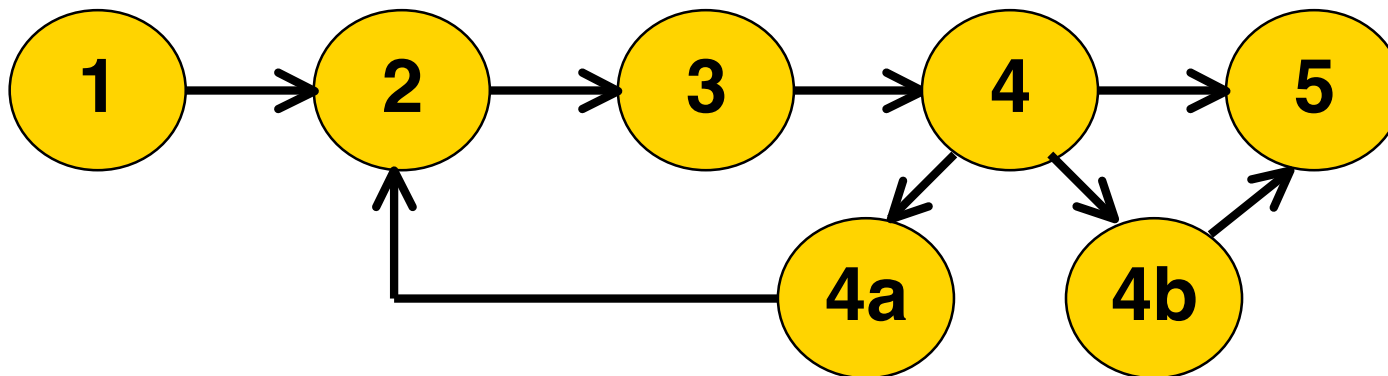
<http://art2.ph-freiburg.de/incops/>

# Lineare und verzweigte Programme

- Reaktionszentrierter Ansatz von Skinner/Holland:
  - Lineare Abfolge des Lehrmaterials durch Lehrenden festgelegt
  - Feedback nur bei korrekten Antworten



- Reizzentrierter Ansatz von Norman Crowder (1959):
  - Rückkopplung, um festzustellen, ob Kommunikationsprozess erfolgreich war
  - Feedback bei negativen Antworten (abweichend von operanter Konditionierung)



# Zwei Großprojekte

- Ziel: Klärung der Effektivität computergestützter Instruktion durch Feldversuche
- National Science Foundation (NSF), USA, 1971
  - Zwei Großprojekte über jeweils 5 Jahre
  - Insgesamt 60 Mio \$
- TICCIT
  - Mitre Corp. und Brigham Young University
  - Minicomputer für je 128 Terminals
- PLATO
  - Control Data Corporation und University of Illinois, Urbana-Champaign
  - Ein Großrechner für 950 Terminals

# Project TICCIT

- TICCIT (1971 – 1977)
  - (Time-Shared Interactive Computer Controlled Information Television)
  - Developed at the University of Texas and Brigham Young University
  - Together with PLATO 60 mio \$ funding
  - Audience: adult learners, but later version for elementary schools
- Goal: Compare class-room and computer-based instruction
- Hardware:
  - Color monitor with loudspeaker (TV)
  - Special keyboard
  - Lightpen (Lichtgriffel)
  - Video tape player

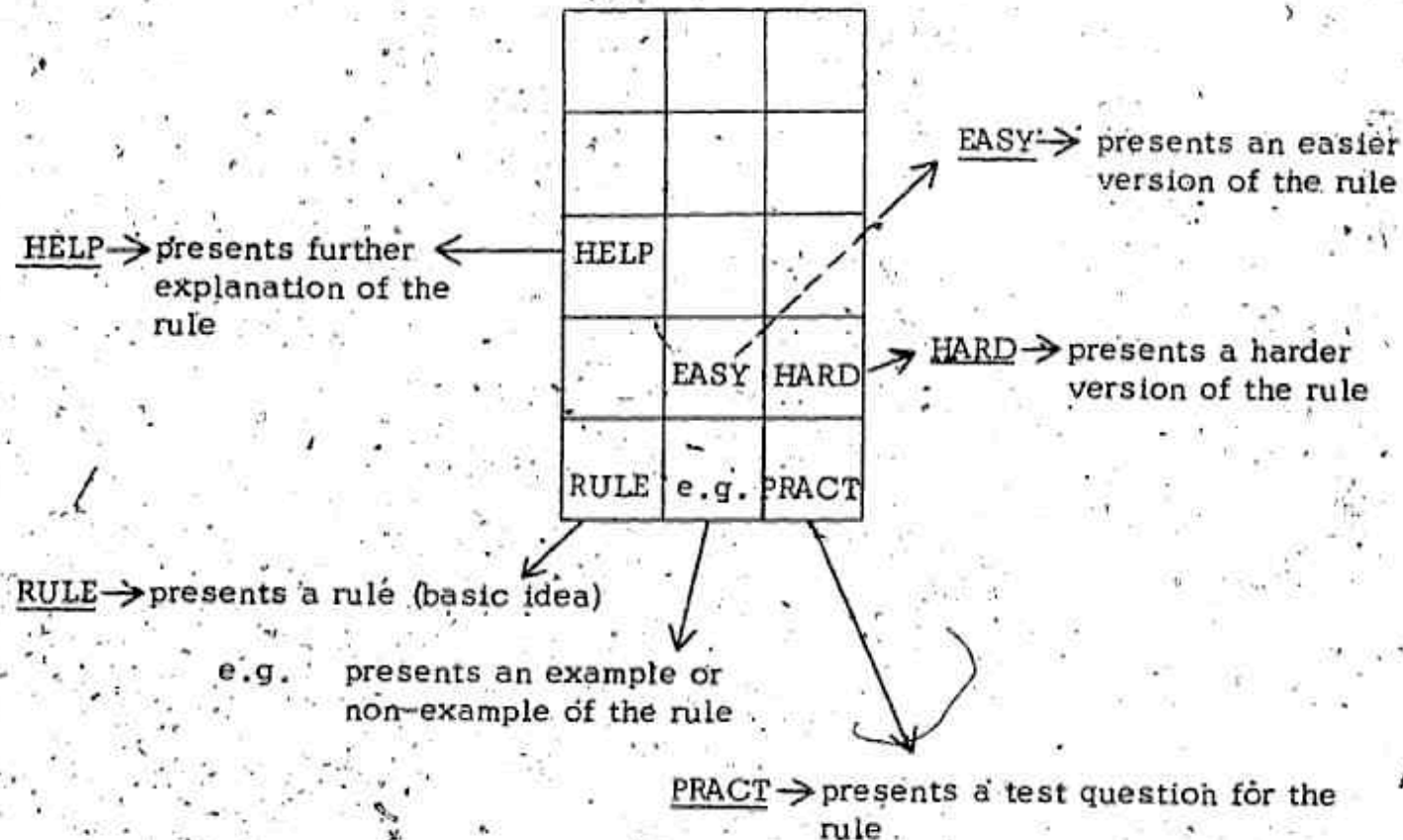


Interactive Television system : TICCIT

# TICCIT Keyboard

## Summary of Keyboard Controls

### 1. Control buttons



More:

- Attention
- Exit
- Repeat
- Go
- Skip
- Back
- Objective
- Map
- Advice

<http://eric.ed.gov>, document ED16006



# TICCIT Evaluation

- Evaluation by ETS (Educational Testing Service) was mixed:
  - TICCIT mathematics and English course students reported "significant achievement" over the traditional classroom formats
    - » For those students who completed the TICCIT courses!
  - Drop-out rate around 50%, 84% for math courses!
  - More students favored lecture classes over TICCIT math courses
  - Acceptance by teachers quite low

# Project PLATO

- PLATO (from 1960)
  - (Programmed Logic for Automated Teaching Operation)
  - University of Illinois, Donald Bitzer
  - PLATO I – III (until 1966)
- PLATO IV (1972), Computer-based Education Laboratory (CERL)
  - Plasma display (partially with back-projected slides)
  - Touch screen
  - TUTOR language for session design
  - Graphics, animations
  - Message exchange among users, message boards (notes), chat rooms
  - Flight simulator, multiplayer games
- Commercial product until 1986
- See [www.cyber1.org](http://www.cyber1.org)



# Example for TUTOR Script

```
unit    math
at      205
write   Answer these problems
```

$$3 + 3 =$$

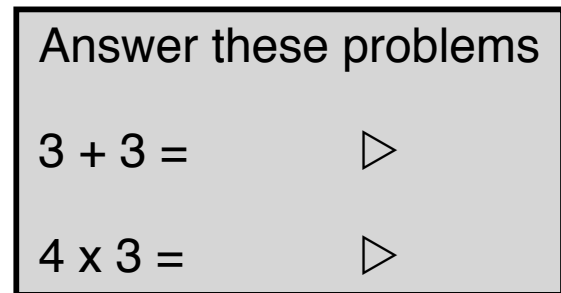
$$4 \times 3 =$$

```
arrow   413
```

```
answer  6
```

```
arrow   613
```

```
answer  12
```




[http://en.wikipedia.org/wiki/TUTOR\\_\(programming\\_language\)](http://en.wikipedia.org/wiki/TUTOR_(programming_language))

# PLATO Evaluation

- No significant difference between learning with the system and traditional learning
- Drop-out quote not higher than in traditional learning
- Reasonable acceptance
- 70% of students used the system outside course times
- 88% of teachers planned to work with the system again
- However:  
83% of students stated that a full course taught only by PLATO is unsatisfactory.

O'Shea and Self 1986

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A. Holzinger: Basiswissen Multimedia Band 2, S. 193 – 198

R. Schulmeister: Grundlagen hypermedialer Lernsysteme, Kap. 5 + 6

D.H. Jonassen (ed): Handbook of Research on Educational Communications and Technology, 2nd ed. 2004.

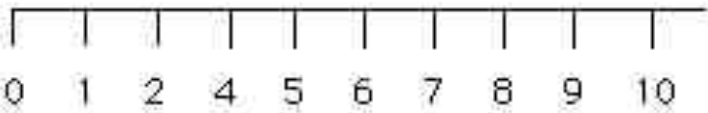
# CAI, CBT, CUU, ...


- Akronyme:
  - CAI = Computer-Aided Instruction
  - CBT = Computer-Based Training
  - CUU = Computer-unterstützter Unterricht
- Unterscheidung CAI/CBT:
  - In Teilen der Literatur:
    - » CAI = Behavioristische "Drill"-Programme
    - » CBT = Programme mit kognitivistischen Elementen
  - Häufig keine wirkliche Unterscheidung im Gebrauch der Begriffe!

# Grundidee kognitivistisch orientierter Systeme

- Feedback:
  - Lerner erhält individuell abgestimmte Rückmeldung
  - "Assistenz"-Funktionen zum Erkennen von Fehlern
- Adaptivität:
  - System versucht Informationsangebot an aktuelle Situation (Wissensstand, Abarbeitungsstand) anzupassen
- Die Grenze zu rein behavioristischen Systemen ist fließend.
  - Grundlegendes Interaktionsprinzip ("Frames", Frage-Antwort-Dialoge) gleich

# Examples from TICCIT (1)

CI PD MO	NUMBER LINE OPERATIONS THE NUMBER LINE
If we think of a straight line as a collection or set of points, we can associate all the numbers of arithmetic with points on the line. Such a line is called a <span style="border: 1px solid black; padding: 2px;">number line</span> .	
	
PRESS --> KEY TO VIEW THE NEXT PAGE PRESS --> KEY TO VIEW THE NEXT PAGE	

POETIC METER		
What makes a poem a poem?		
Why is a poem different from prose?		
Name one characteristic of a poem?		
RHYME is one characteristic. Can you name another? 		
---LAST	[PET]REPEATS	NEXT ---



# Examples from TICCIT (2)

Here is the general rule for grammar-referent agreement.

A pronoun agrees in number with its REFERENT. Singular referents take singular pronouns. Plural referents take plural pronouns. Singular referents which have no sex indicated take the generic pronouns him/he/his.

RULE page 1/1

- TICCIT lessons were designed according to Merrill's CDT

In the passage below, the pronoun in green agrees with its referent in light blue.

Neither John nor Henry brought his coat to the ball game.

This can be reviewed in lesson 4.2.

EXAMP 1 easy page 1/1

Edit any pronoun in the passage below that doesn't agree in number with its referent. If all pronouns are correct, press ENTER.

Several of the mechanics brought his tools.

PRACT 3 easy page 1/1

# Component Display Theory

- M. David Merrill (1983):  
CDT (Component Display Theory)
  - Basic ideas already used in the TICCIT-System!
- Performance/content matrix:
  - Level of learner performance
  - Types of content
- Presentation forms:
  - Rules
  - Examples
  - Repetition
  - Practice
  - ...
- Revised and extended theory by M.D. Merrill:
  - Instructional Transaction Theory (ITT)

LEVEL OF PERFORMANCE	FIND				
	USE				
	REMEMBER				
		FACT	CONCEPT	PROCEDURE	PRINCIPLE
		TYPES OF CONTENT			

# Non-Computerized CDT Example

There are several important events in the invention of the microscope. You will be required to remember each of these events.  
Learning Tip: Use the following cards for drill. Look at the front and say the information on the back. Shuffle the cards and try again. Repeat until you make no mistakes and your answers are immediate.

Front	Back
First magnifying glass What?	Glass globe filled with water
First magnifying glass Who?	Used by engravers
First solid glass lens When?	Late 1200's A.D.
First compound microscope Who?	Zacharias Janssen
First compound microscope When?	About 1590 A.D.

# Adaptive Instruction

- Macrolevel adaptation:
  - Selecting a few main components such as instructional goals, depth of curriculum, delivery system
- Aptitude Treatment Interaction (ATI) approach:
  - Adapt learning methods and procedures according to learner characteristics (aptitudes)
  - Cronbach & Snow (1977): Aptitude = individual characteristic of the learner that increases or impairs probability of success
  - How to measure aptitude variables?  
(intelligence, prior knowledge, cognitive styles, motivation)
- Microlevel adaptation:
  - Adapt to learner's needs during instruction session
  - Feedback not only based on answer but on derivation path to answer
  - Example: "Minnesota Adaptive Instructional System" (MAIS)
    - » Stochastic model to compute level of competence after each learner interaction

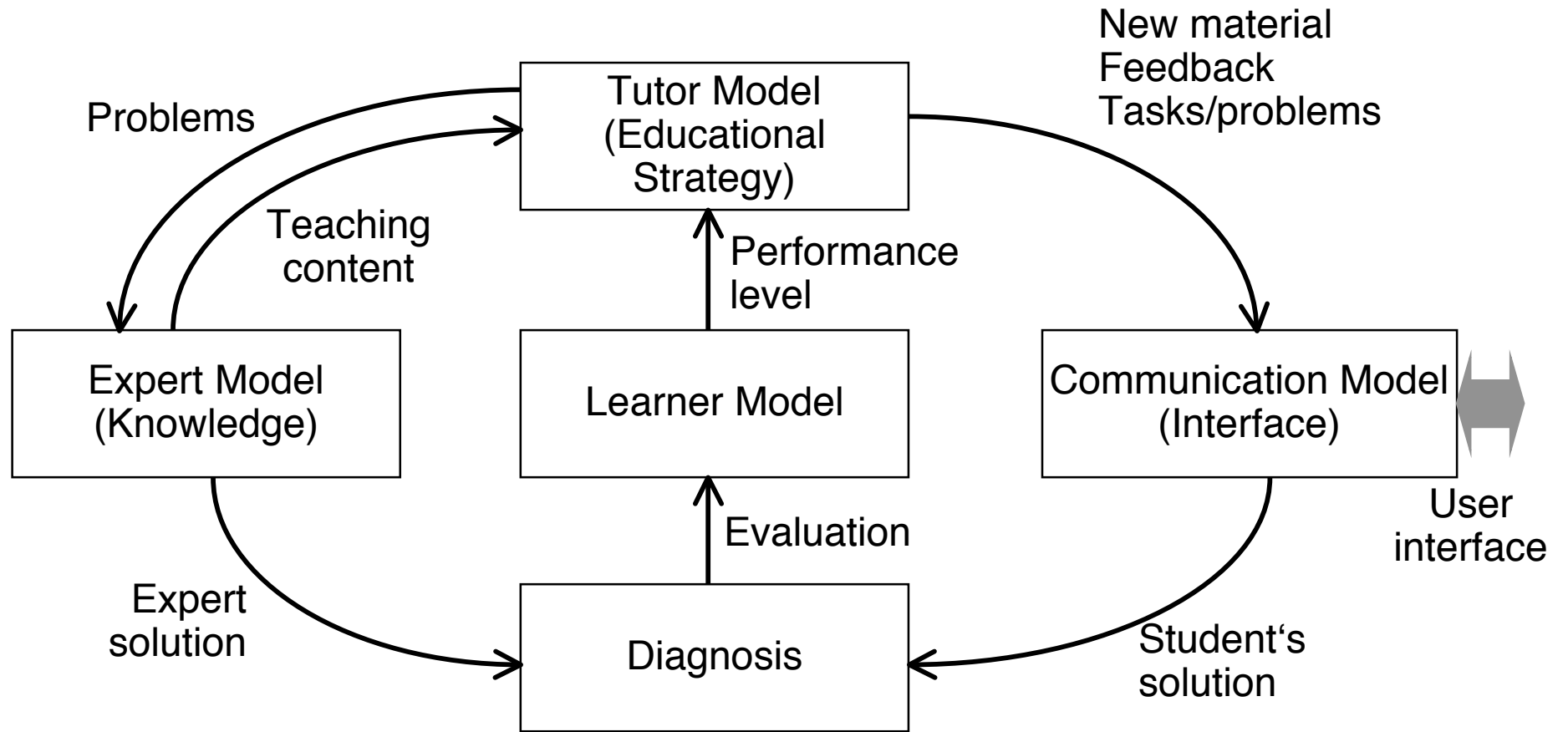
# Intelligent Tutoring Systems (ITS)

- Combining Artificial Intelligence (AI) and education methods
  - Ideas from the 1960s, implementation in the 1980s
- Key characteristics:
  - Representation of domain knowledge, modeling of student + adaptation
  - Mixed initiative: Student can ask questions
- Typical interaction techniques:
  - Socratic dialogue: System guides learner by (adaptive) questions
  - Coaching: Assistance function in background until requested
  - Learning by doing: System closely guides learner through activities
  - Learning while doing: System passively observes learner and gives occasional hints
- Knowledge representation:
  - E.g. Semantic network (see SCHOLAR)
  - E.g. Expert system (see GUIDON)

# History of Intelligent Tutoring Systems

- SCHOLAR (Carbonell, Collins et al. 1979): Geography
  - Socratic dialogue (asking the learner)
  - Mixed initiative
- SOPHIE (Burton, Brown et al. 1982): Electronic Circuits
  - Computer simulation of faulty hardware, strategies to find errors
- BUGGIE (Suppes 1981): Mathematics
  - Identification of misconceptions using wrong (buggy) problems
- GUIDON (Clancey 1983): Medicine
  - Based on expert system MYCIN
  - Diagnose of diseases by natural language dialog
- MAIS (Tennison, Park 1987)
- Geometry Tutor (Koedinger, Anderson 1993)
- ISIS (Meyer, Miller et al 1999)
  - Ecology, simulation-based

# Architecture of an ITS



# Learner Models

- Main approaches:
  - Subset model (or overlay model): Which subset of the expert knowledge has been mastered?
  - Difference model: Which are the differences between expert solution and learner solution?
- Functions of learner models
  - Corrective function
  - Elaborative function
  - Strategic function
  - Diagnostic function
  - Predictive function
  - Evaluative function



# Example: GeoTutor, 1992

## Sample Dialogue:

\*\* Let's talk about Western Canada

Fine. What is the capital of British-Columbia?

\*\* Vancouver.

No, the capital of British-Columbia is Victoria. Where is Victoria situated?

\*\* Let's discuss Banff.

I do not know Banff. Is Banff the name of a place?

\*\* Yes. It is a town.

Where is Banff located?

\*\* In the Rocky Mountains.

Is Banff in British-Columbia or in Alberta?

\*\* In B.C.

What is the population of Banff?

\*\* 5000.

What other towns are near Banff?

\*\* Tell me about Victoria.

Victoria is situated on Vancouver Island. It is the second largest city in British-Columbia.

What else would you like to know?

# Example: ANDES Physics Workbench, 2001

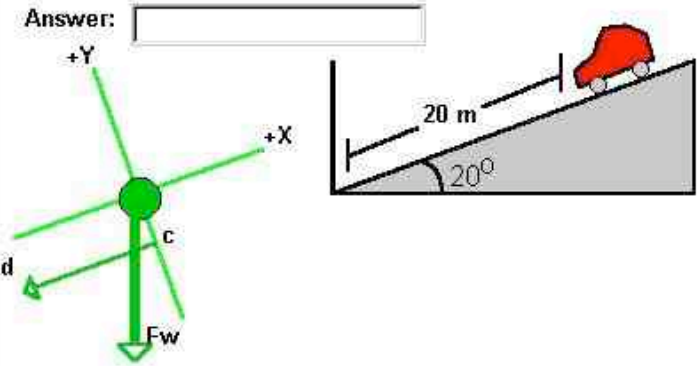
ANDES Physics Workbench - [dt5a-Solution.fbd]

File Edit Diagram Variable View Help

A 2000-kg car in neutral at the top of a 20.0 deg inclined driveway 20.0 m long slips its parking brake and rolls down. Assume that the driveway is frictionless.

What is the magnitude of the velocity of the car when it hits the garage door?

Answer:



T: Now that you have stated all of the given information, you should start on the major principles. What quantity is the problem seeking?

S: The magnitude of the instantaneous Velocity of car at time T1

T: That's right. What is the first principle application that you would like to work on? Hint: this principle application will usually be one that mentions the sought quantity explicitly. Therefore it's equation may contain the sought quantity that the problem seeks.

For Help, press F1

Name	Definition	Dir	X...	Y-Comp
T0	car starts rolling			
T1	car hits garage door			
mc	mass of car			
x	axis	$\theta_x=20^\circ$		
d	magnitude of the Displacement of car at time T0 to T1	$\theta_d=200^\circ$	d_x	d_y
Fw	magnitude of the Weight Force on car at time T0 to T1 due to Earth	$\theta_{Fw}=270^\circ$	Fw_x	Fw_y

- mc = 2000 kg
- d = 20.0 m
- Fw\_y = mc\*g
- 
- 
- 
- 
- 
- 
- 
- 

NUM | 00:49:09 | SCORE: 39

<http://www.andes.pitt.edu/>

# Example: EarthTutor, 2005 (1)

Earth science (remote sensing), in particular usage of image processing software from NASA and NIH


EarthTutor - Oceanography

Go to Card Tools

Lab 1: Intro to Image Processing using Sea Surface Temperature

## Why Study Sea Surface Temperature

Earth's [climate](#) has remained essentially unchanged for centuries. This is because the sources of heat and water that enter the atmosphere have been approximately equal to the amounts of heat and water that are removed from the atmosphere. Today, anthropogenic, or human-caused, emissions of [greenhouse gases](#) into the atmosphere may be changing atmospheric temperature conditions such that the balance between heat gained and heat lost is shifting. This trend, referred to as climate change, has many scientists worried.



You might be thinking, what do the oceans have to do with climate? The oceans and the atmosphere are closely linked and form a "dynamic duo" in global climate. Oceans, which cover over 70% of the Earth's surface, absorb and release massive amounts of heat. Scientists believe that climate is related to the way the oceans store and transport heat. One way scientists study oceanic heat transport is by looking at temperature measurements of the ocean surface, also known as Sea Surface Temperatures (SST).

In this lab you will learn the basics of image processing and interpretation of satellite images using SST data. Specifically, you will:

- Use ImageJ to open and view an SST image.
- Understand the parts of an SST image.
- Become familiar with ImageJ tools to explore SST data.

< Previous      Next >

EarthTutor - Oceanography

Go to Card Tools

Lab 1: Intro to Image Processing using Sea Surface Temperature

## Daily vs Monthly Images

The *temporal resolution* of a remote sensing system refers to how often it records imagery of a particular area. You began the lab by observing a monthly-averaged image of SST for February 2003, in which the SSTs of the single month were averaged into one composite image. One of these images exists for each month in the [Reynold's Optimally Interpolated SST dataset](#). In the last card, you examined the SST reading for a single day (missing data and all.)

Question 17.1

Think about temporal resolution for a minute. What kinds of oceanographic phenomena would you not be able to observe using monthly-averaged images?

Please select an answer below.

- Geographic differences in SST
- Seasonal changes in SST
- Yearly changes in SST
- Hurricane-induced SST changes
- None of the above

Answer      Skip

Question 17.2

Please discuss the benefits and drawbacks of monitoring the ocean temperature using daily images versus using monthly images.

[Give me a hint.](#)

Activity 17.3

< Previous      Report Card >

Report Card for Lab

## Report Card

**Student:** Jane Doe  
**Lab:** [The Biological Response to Upwelling](#)  
Time started (last session only): 1:29 PM  
Time finished (last session only): 2:15 PM

**Overall:**

- 88% cards complete
- 100% questions correct

*This report only includes questions that the student has attempted.*

**Student's Essays:**

- Card 3. Summer California Seasonal Chlorophyll Patterns
  - Question 4.3 How does the do the June chlorophyll concentrations along the shore and offshore compare to the concentrations in January?  
much higher concentrations in june
- Card 5. Chlorophyll Plumes
  - Question 6.5 In the last lab you measured a SST plume in the same region to extend roughly 500 km

# Example: EarthTutor, 2005 (2)

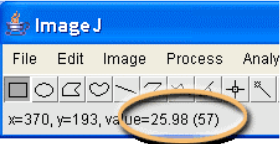
EarthTutor - Oceanography

Go to Card Tools

Lab 1: Intro to Image Processing using Sea Surface Temperature

## Calibrated Values


Now when you move your mouse around in the image, the value is now the calibrated SST with the pixel value in parentheses.



The number to the left is the temperature in degrees Celcius (e.g. 25.98), while the number to the right is the original pixel value (57).

Activity 12.1

[Click here to skip this activity \(Teacher's Edition only\).](#)

- 1 Select the Crosshair Tool  on the toolbar. Look at the color legend. Which colors are the warmest?
- 2 Click on an area of the image with the warmest pixel values.


Sorry, you did not click a correct point. [Give me a hint.](#)

Question 12.2

In February 2003, approximately what temperature is the warmest SST?

degrees C

Activity 12.3

- 1 Select the Crosshair Tool  on the toolbar.
- 2 Click on an area of the image with the coolest pixel values.

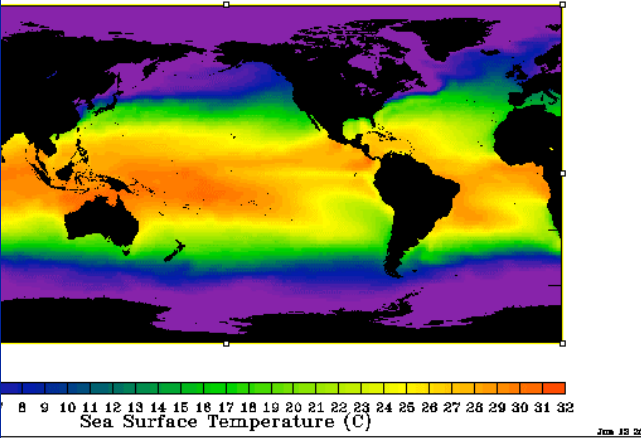
Question 12.4

< Previous Next >

ImageJ

File Edit Image Process Analyze Plugins Window Help

Month: 02 Year: 2003



Sea Surface Temperature (C)

8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Jan 23 2004

<http://www.stottlerhenke.com/earthtutor/>

EarthTutor - Oceanography


Go to Card Tools

Lab 1: Intro to Image Processing using Sea Surface Temperature

## Making a Measurement

You can use ImageJ's tools to perform quantitative measurements on the image data. Here you will calculate the max SST for the entire image.

Activity 13.1

- 1 Select the Rectangle tool from the toolbar. 
- 2 Draw a selection rectangle around the main world image.

Activity 13.2

[Click here to skip this activity \(Teacher's Edition only\).](#)

- 1 From the **Analyze** menu, select **Set Measurements...**
- 2 Make sure the following measurement(s) are checked:
  - ◆ Min & Max Gray Value
- 3 From the **Analyze** menu, select **Measure..**

Question 13.3

Look at the results table that just opened. What is the Max temperature for the image?

degrees C

Activity 13.4

- 1 Please close Results window. You don't need to save the measurements.

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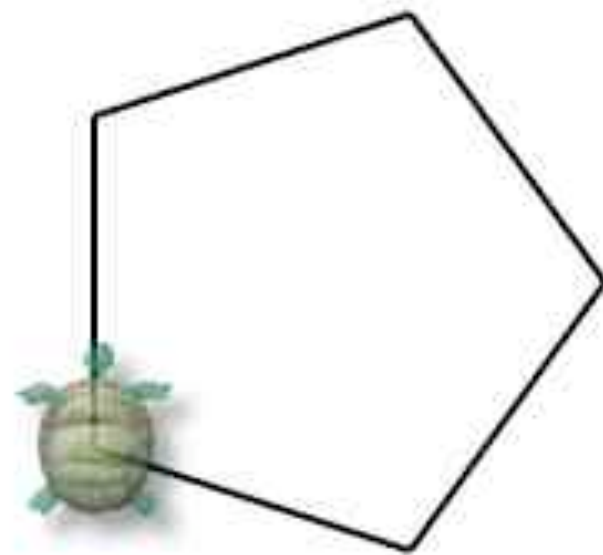
## Literatur:

A. Holzinger: Basiswissen Multimedia Band 2, S. 199 – 203

Handbook of Research on Educational Communications and  
Technology (D.H. Jonassen (ed), 2nd ed. 2004), Chapter 22

([http://aect-members.org/m/research\\_handbook](http://aect-members.org/m/research_handbook))

# Logo (S. Papert): Physical and Virtual Turtles



```
to polygon
repeat :sides
  [ forward :size
    right 360/:sides ]
polygon 5 100
```



# Microworlds

- “Learning by exploration”
- Microworld consists of:
  - Set of computational objects that model the mathematical or physical properties of the microworld’s domain
  - Links to multiple representations of the underlying properties of the model
  - Ability to combine objects or operations in complex ways
  - Set of activities or challenges
- History:
  - Key idea introduced with “LOGO” (Seymour Papert)
  - ThinkerTools (White 1990): Physics activities realized in Logo
  - Boxer (diSessa 1991): Logo-style programming with direct graphic manipulation (objects as boxes)
  - GenScope (1993), SimCalc (2000): Evaluations



# Example: “RollDice”

The screenshot displays the 'RollDice' software interface. On the left, a control panel titled 'Experiment 3 dice' includes three dice icons, a 'Times' counter set to 200, and a 'Reset' button. To the right is a data table with 18 columns labeled 'Got1' through 'Got18' and 4 rows of numerical data. Below the table are navigation buttons: 'Introduction', 'Instruction Page', 'Go to Graphing page', 'Convert to Percentage', and 'Go to Dice page'. On the far right, a partial view of a bar graph is visible, showing a distribution of colored bars.

0	0	2	2	6	8												
Got1	Got2	Got3	Got4	Got5	Got6												
12	26	22	22	26	28												
Got7	Got8	Got9	Got10	Got11	Got12												
19	11	5	5	5	1												
Got13	Got14	Got15	Got16	Got17	Got18												

Created with “Microworlds EX”

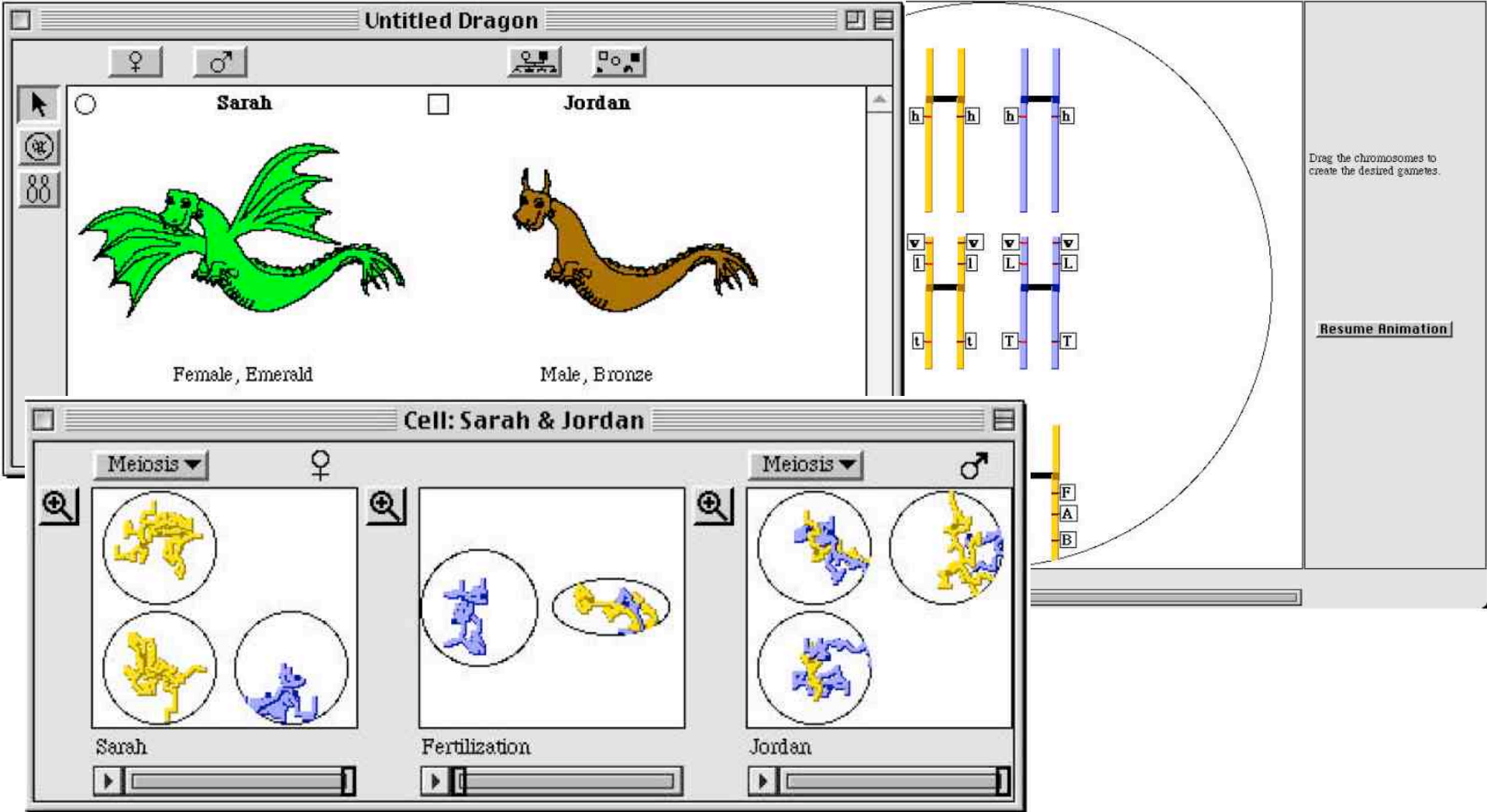


# Example: “Squish”



Created with “Microworlds EX”

# Example: GenScope, 1993



<http://genscope.concord.org/>

# Games and Simulations

- Very popular in the military during Cold War...
- Types of simulations:
  - Experiential simulations (e.g. flight simulator)
  - Symbolic simulations (learner is observer only)
  - Problem solving with simulated materials
  - Virtual environments
- Educational games
  - Challenge the student
  - High motivation
- Little empiric evidence on learning effects

# Example: Sniffy the Virtual Rat

The image shows a screenshot of the 'Sniffy the Virtual Rat' software. On the left, a window titled 'Untitled #1' displays a virtual rat in a metal chamber. On the right, a dialog box titled 'Classical Conditioning Experiment Design' is open. The dialog box is divided into several sections:

- Stage:** View/Edit Experiment Stage 1. Buttons: Next Stage, Previous Stage, New Stage, Delete Stage.
- Interval Between Trials:** 5 Minutes.
- Present Each Trial Type:** 1 Times.
- Trial Types:** View/Edit Trial Type A. Buttons: Next Type, Previous Type, New Type, Delete Type.
- First Stimulus:** Intensity Low High. Options: Light (unchecked), Tone (checked), Bell (unchecked).
- Second Stimulus:** Intensity Low High. Options: Shock US (checked), CS used as US (unchecked), Light (unchecked), Tone (unchecked), Bell (unchecked), None (unchecked).

Buttons for 'Cancel' and 'Save' are located at the bottom of the dialog box.

# Situated Learning

- Embedding learning into real-life problems
  - see e.g. Anchored Instruction
  - Social interaction is important
- Computer-based support for situated learning?
  - James Greeno (1996)
  - Using computer simulations as tools
    - » e.g. constructing a house
  - Actual learning process takes place in the group
    - » Problems are solved jointly
- Literatur:  
Heinz Mandl, Hans Gruber, Alexander Renkl: Situiertes Lernen in multimedialen Lernumgebungen, in: Klimsa 2002, S. 139 – 148

# 4 Geschichte der Lernmaschinen

4.1 Vorgeschichte

4.2 Behaviorismus: Programmierte Unterweisung

4.3 Kognitivismus: Instruktionsdesign,  
Intelligente Tutorielle Systeme

4.4 Konstruktivismus: Mikrowelten, situiertes Lernen

4.5 Hypermediales Lernen und Web-Based Training



## Literatur:

A. Holzinger: Basiswissen Multimedia Band 2, S. 203 – 206

Handbook ... (D.H. Jonassen (ed), 2nd ed. 2004), Chapter 23

R. Schulmeister: Grundlagen hypermedialer Lernsysteme, Kap. 7

# Hypermedia Learning, WBT

- Web-based Training
  - Realizing Computer-Based Training with Web technologies
- History:
  - NoteCards 1985, HyperCard 1987
  - Tim Berners-Lee 1989
- Specifically (Hypermedia learning):
  - Learning environments based on hypertext
- Often associated with “Self-regulated learning”
- Well-known examples:
  - Large hypertext knowledge collections (e.g. Wikipedia)

# Problems in Hypermedia Learning

- Reading on screen is unnatural for many readers
- Additional cognitive load on the reader:
  - Making choices about how to proceed
  - Hypertext may *interfere* with text understanding (e.g. Shapiro 1999)
  - Tutoring or “metacognitive training” helpful
    - » Increases transfer abilities
- Well-structured and unstructured hypermedia
  - Good structure essential for beginners
  - Less structure provokes a more explorative approach (Mannes & Kintsch 1987)
- “Lost in hyperspace” (Dede 1988)
- “Keyhole phenomenon” (Woods 1984)