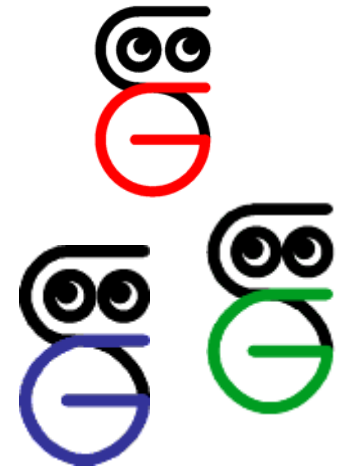


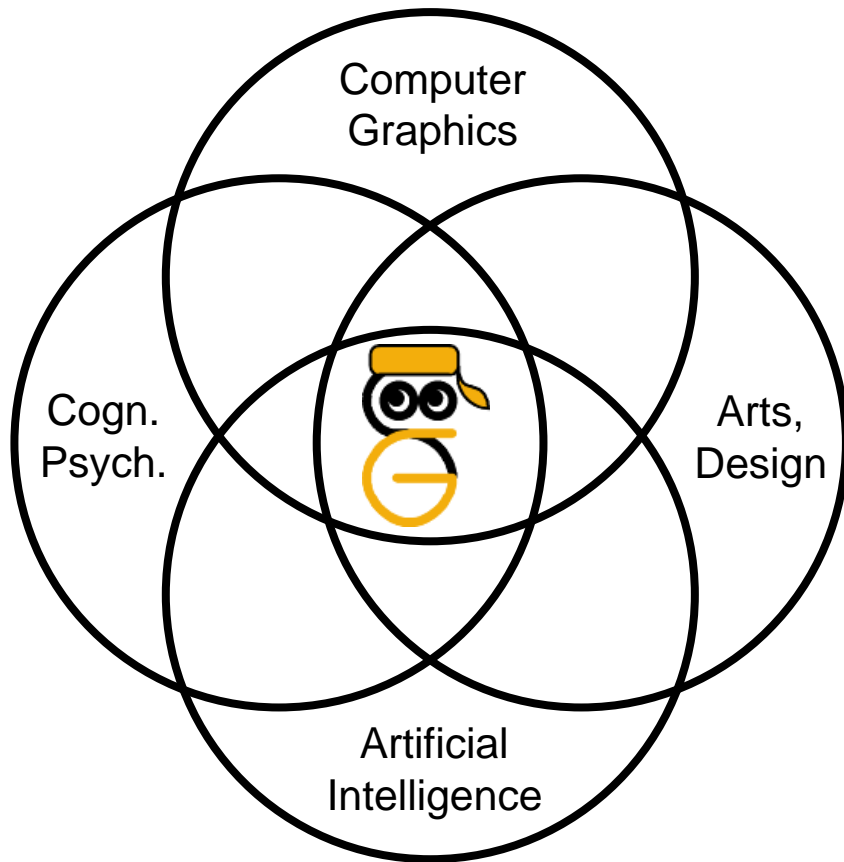
Smart graphics: Overview of lecture content

Lecture „Smart Graphics”
Andreas Butz, Otmar Hilliges

8.2.2006



Goal: 4 disciplines talking to each other



- Designers have produced graphics forever
- Psychologists tell us how humans perceive and process
- AI provides the tools to use this knowledge
- Computer Graphics provides the medium

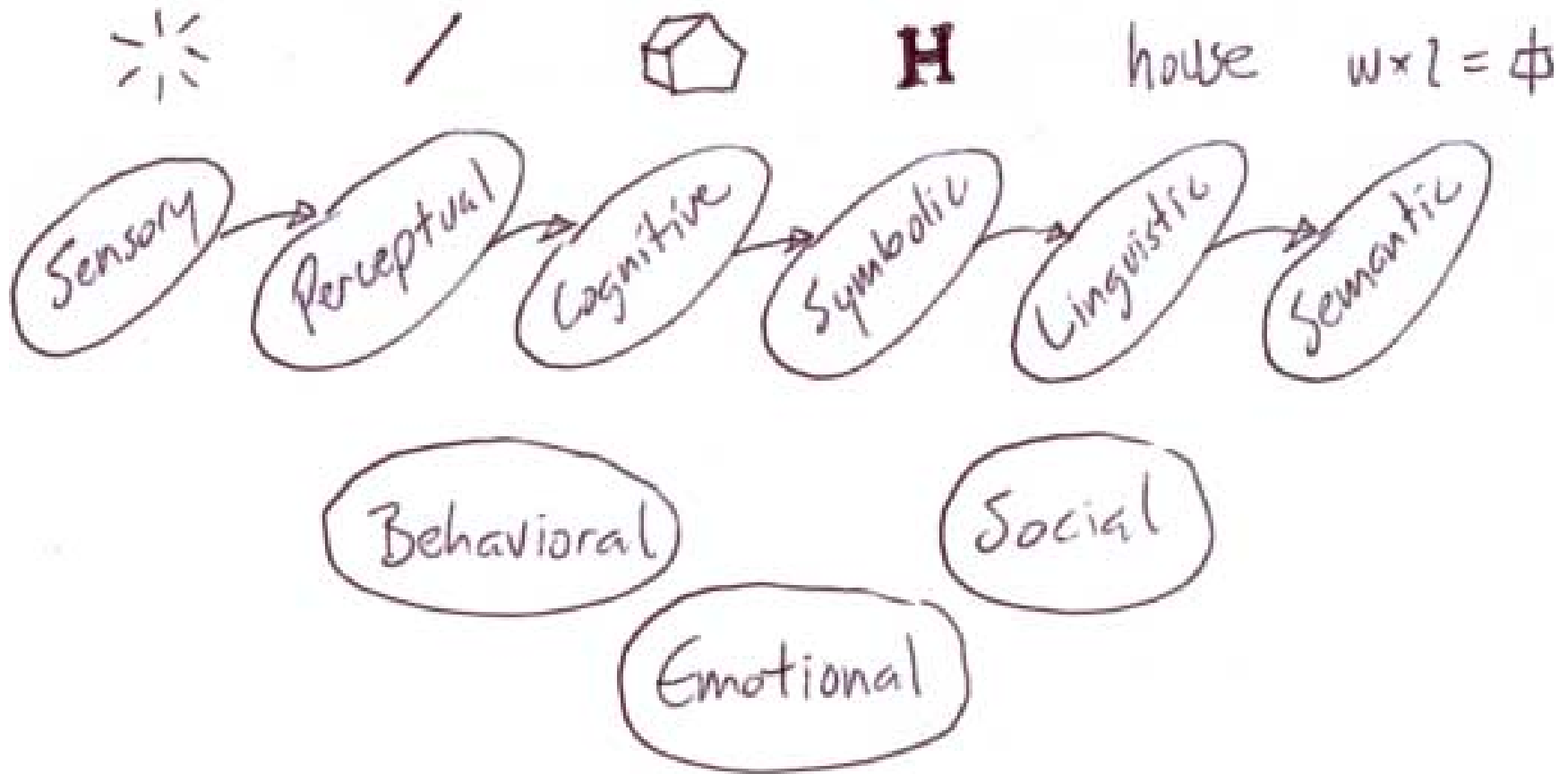
3 main parts of the lecture

- Motivations
 - Graphics & Perception
 - Graphics & Design
 - Graphics & Communication
- Methods
 - Representation & Reasoning: A collection of AI tools and formalisms
 - Rendering: How they can be applied to graphics
- Milestones
 - Examples from various fields

Graphics & Perception

Knowledge acquisition pipeline

[W. Bradford Paley, SG 2003]



Simplified model of human sensemaking processes,
useful for designing visual representations

Graphics & Design

How to use visual design effectively?



Refer to human survival strategies

- Organize



- Economize



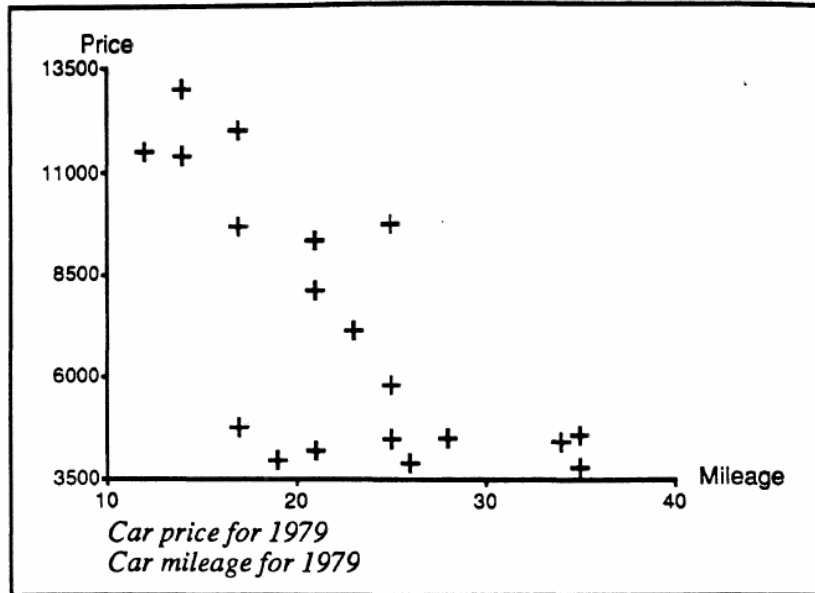
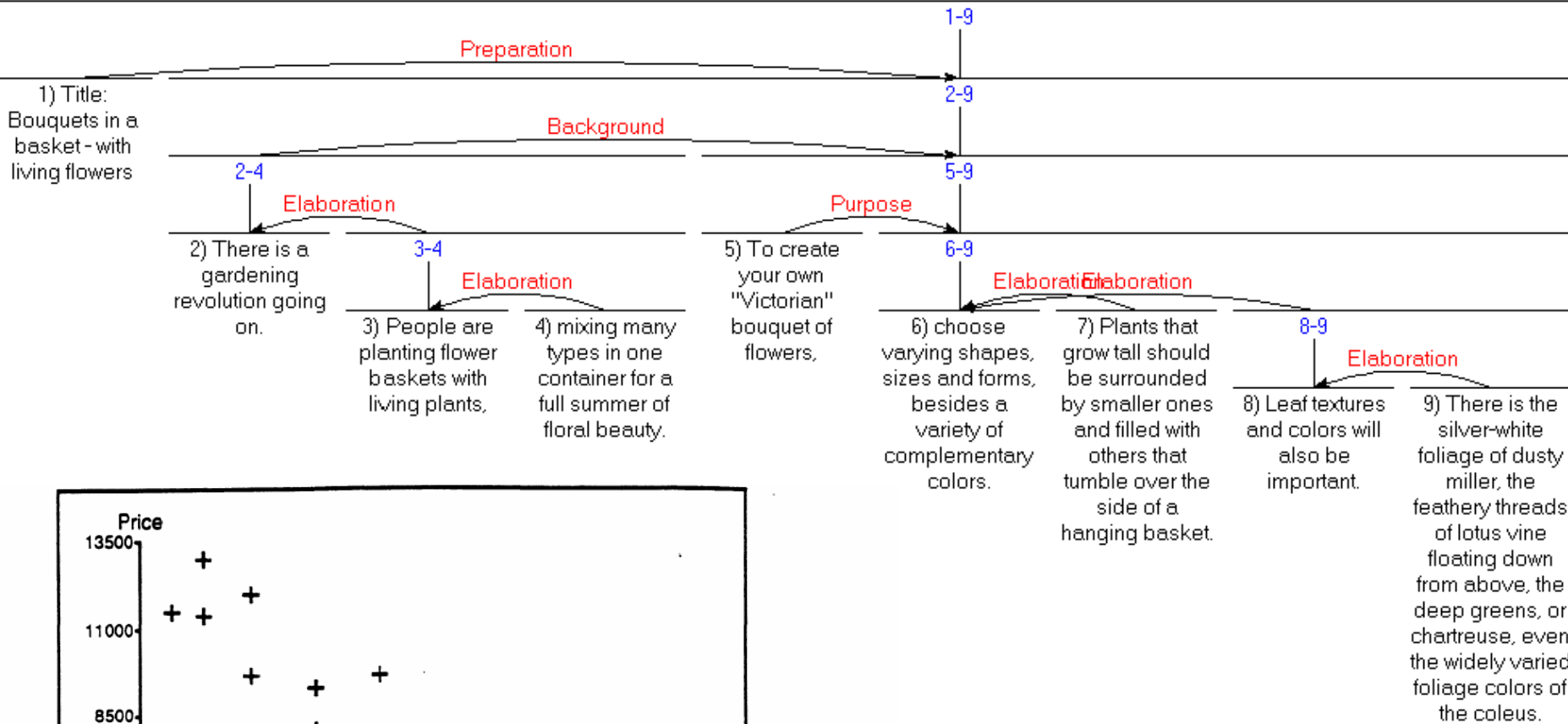
- Communicate

Color theory acc. to Johannes Itten (1961)



Graphics & Communication

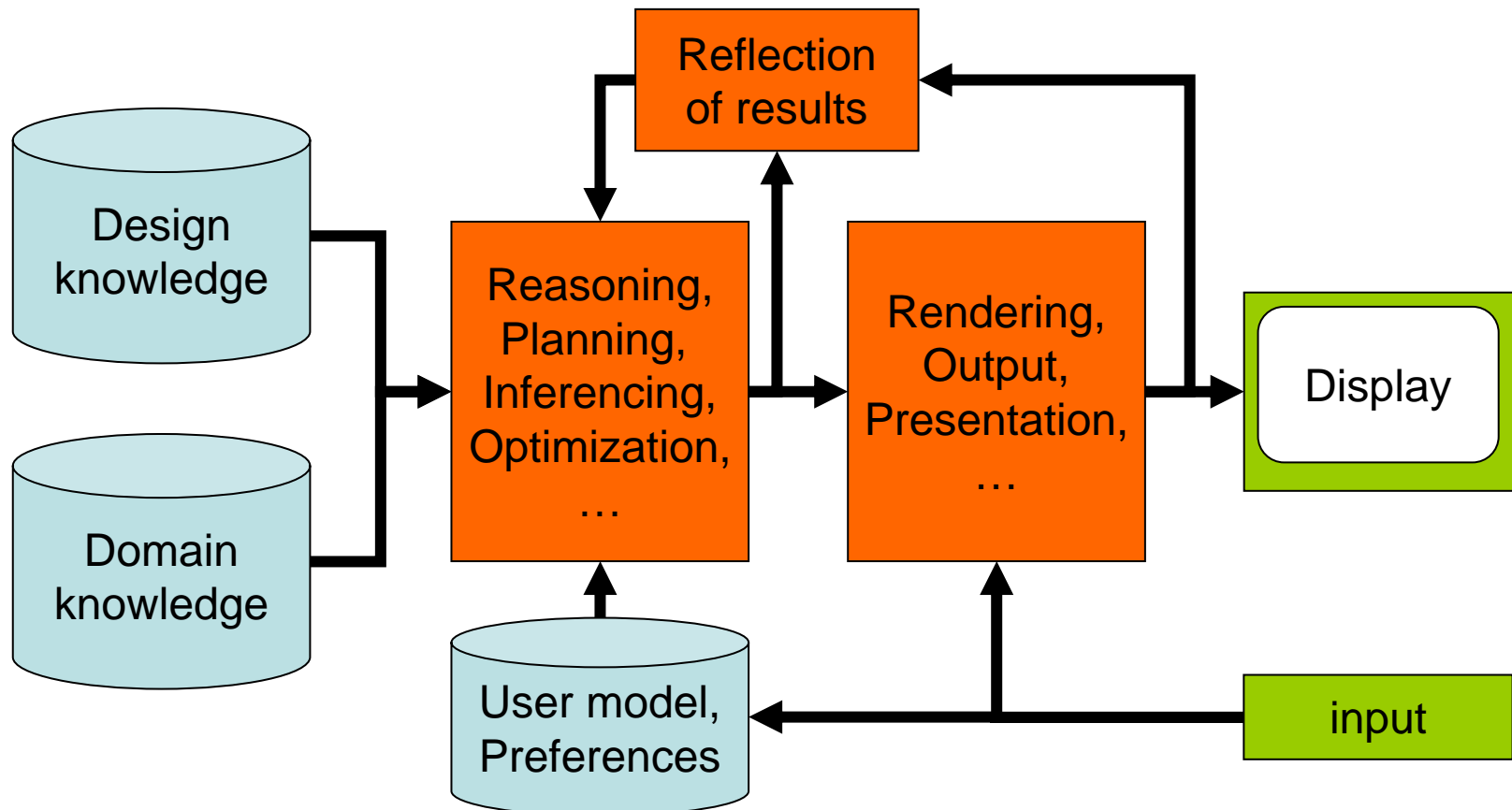
Structure of Graphics



Methods

Some typical elements of SG systems

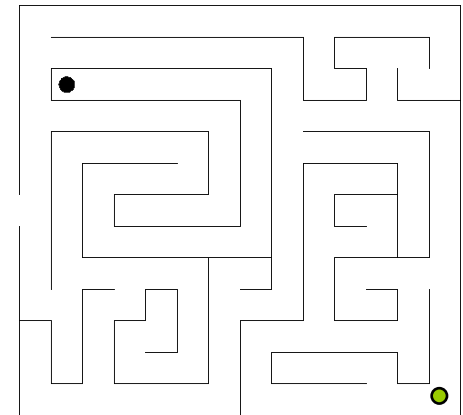
- Strong simplification and generalization
- Often only some elements present



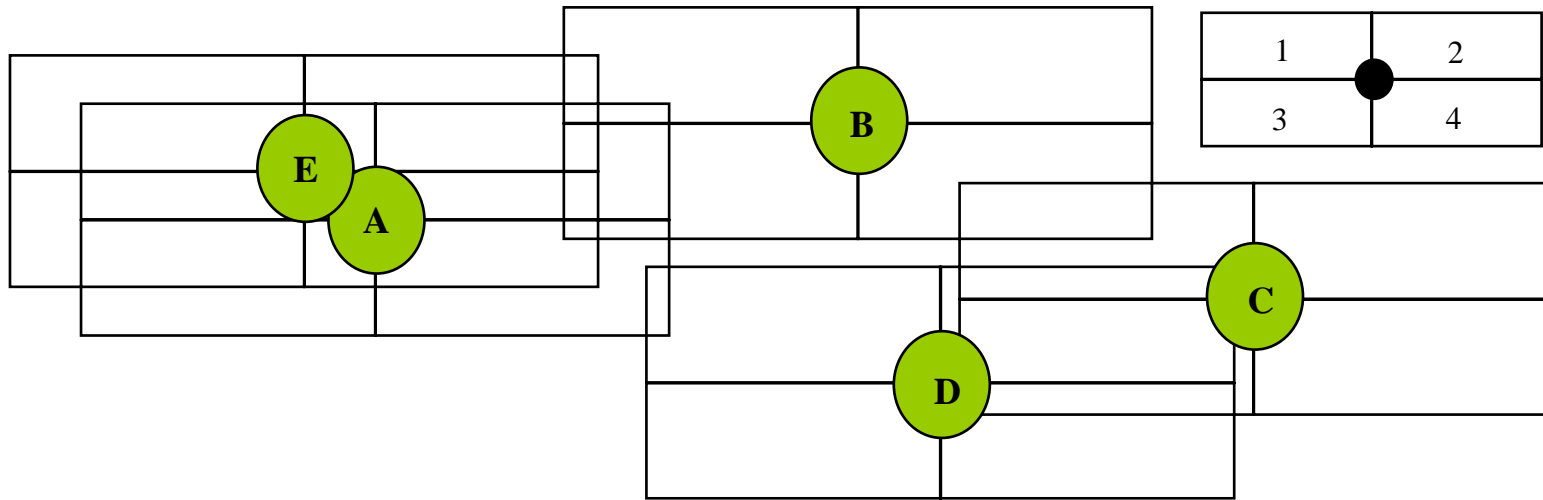
Representation & Reasoning

Suche und Constraintverfahren

- Suche:
 - (blinde) Tiefen- und Breitensuche
 - Algorithmus $A + A^*$
 - Minimax- + Alpha-Beta-Verfahren
 - Hillclimbing
 - Bidirektionale Suche
 - Simulated Annealing
- Constraints
 - Formalisierung
 - Lösungsverfahren



A simple PFLP example



- total size of search space $b^d = 4^5 = 1024$
 - b = number of possible labeling for a point feature
 - d = number of point features to be labeled
- if the search proceeds A, B, C, D, E with preference 1, 2, 3, 4 then since A1 conflicts with all E labelings, we know we'll explore at least 4^4 labelings (256)
- we can examine how the heuristics and pruning techniques might affect this

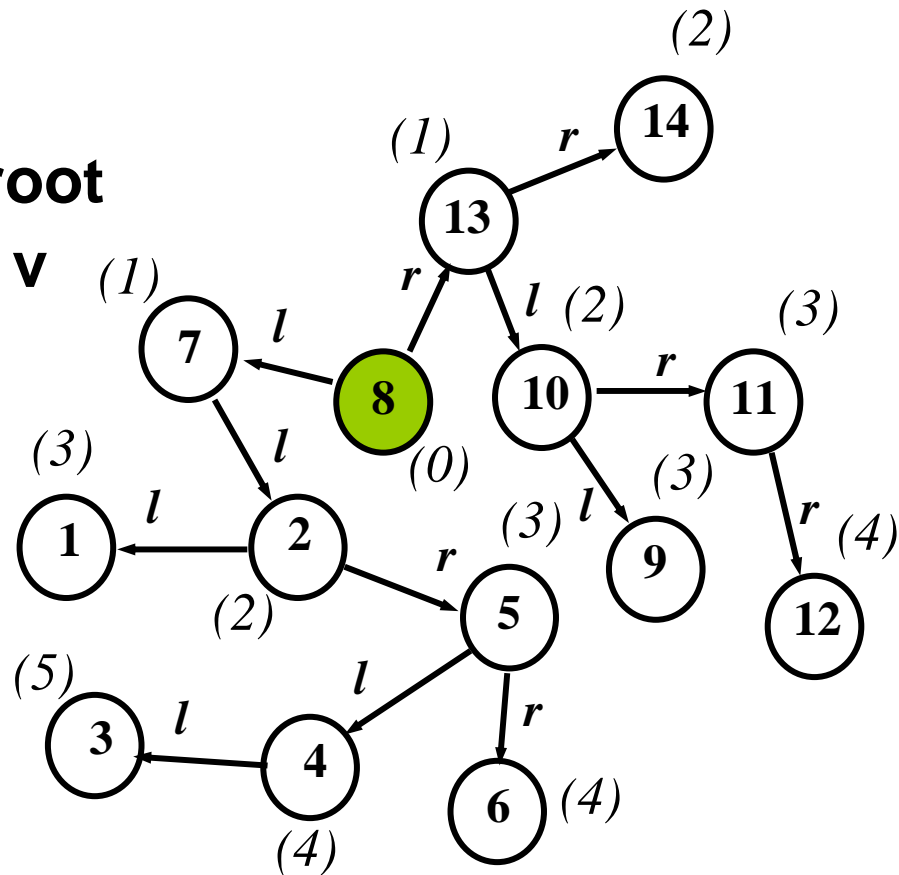
Algorithm 1: layering

“**layered drawings** place vertices according to their *depth* from a reference node, typically this prescribes the y-coordinates of the vertices”

For example:

- set: $y(v) = \text{distance from root}$
- set: $x(v) = \text{inorder rank of } v$

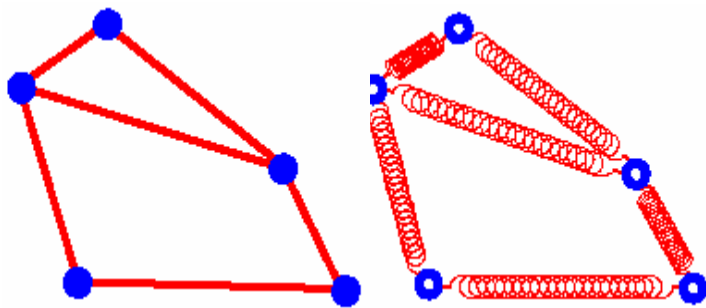
inorder traversal: defined for binary trees as the recursive traversal of the left subtree of the root, followed by the root, and then the right subtree.



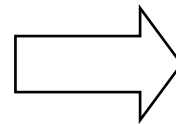
Force-directed methods

- Hirsch formulated a successful solution technique for the PLFP problem using a force analogue, where the repulsion of a label position was estimated from the overlap regions
- graph drawing can also be done by force-directed methods

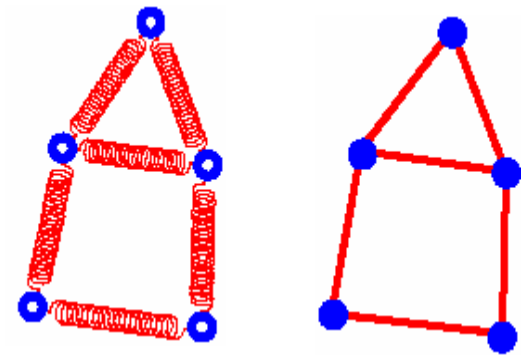
initial configuration



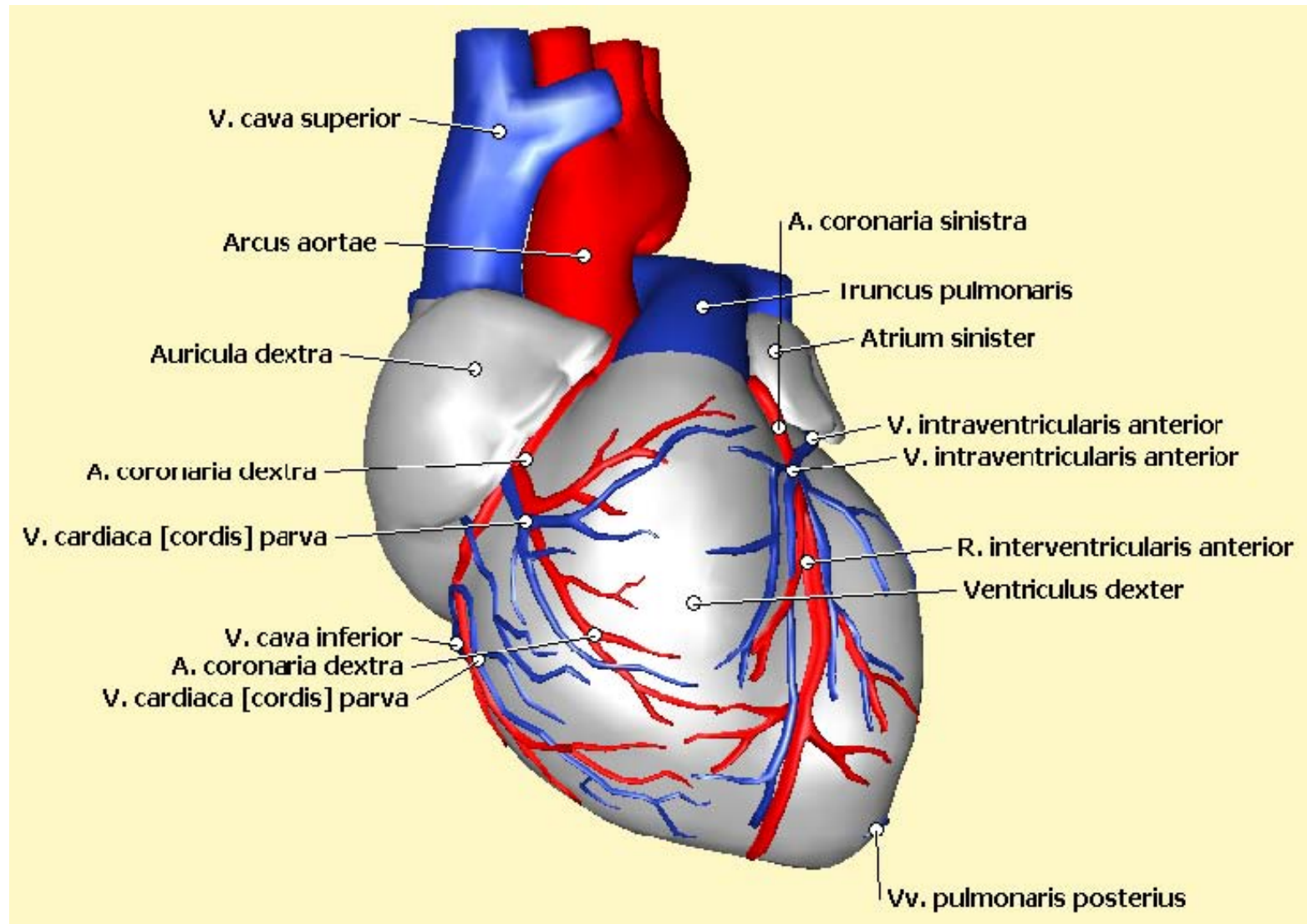
**release
springs**



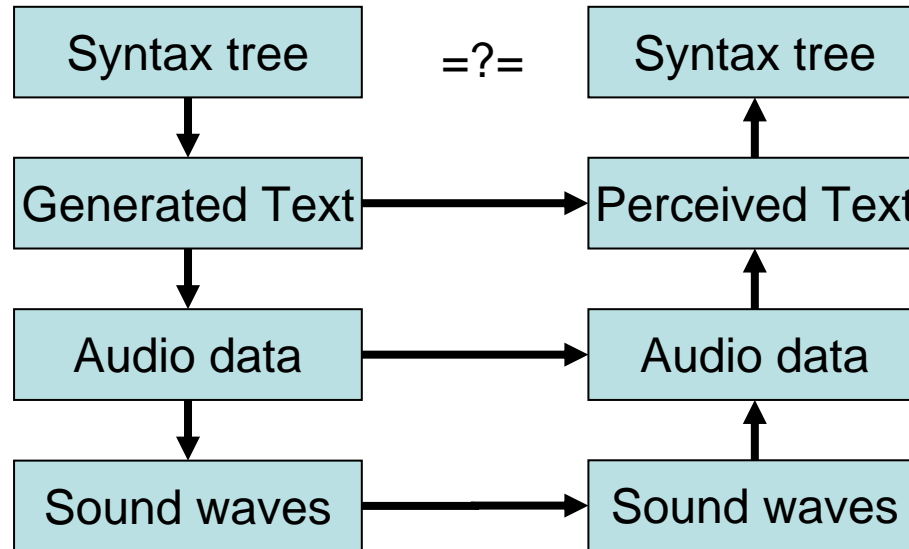
final configuration



Example (15/23 Objects)



AFLs at different levels



Questions answered:

Is the text correct?
No homonyms?

Are the sounds correct?
No homophones?

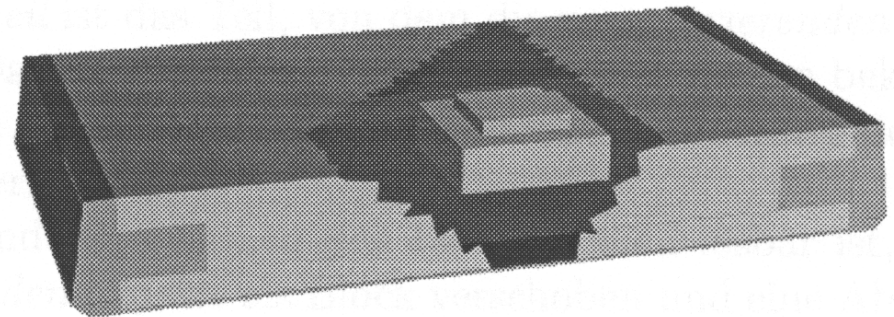
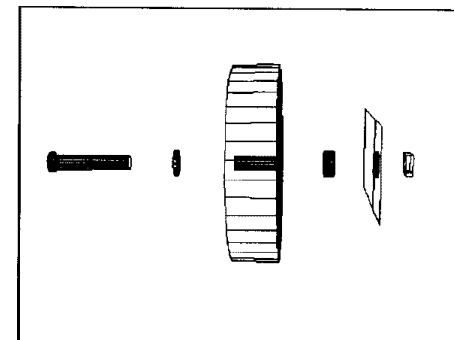
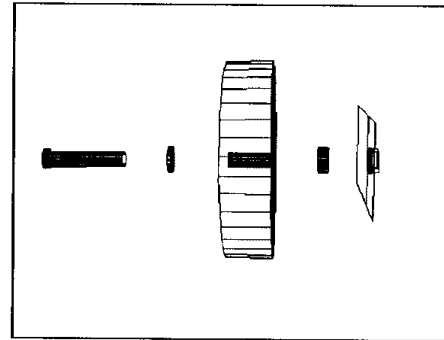
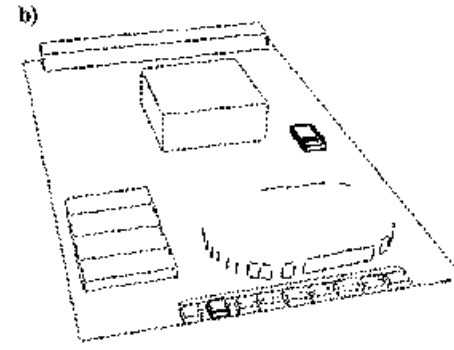
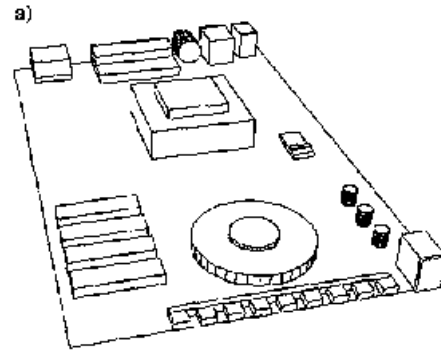
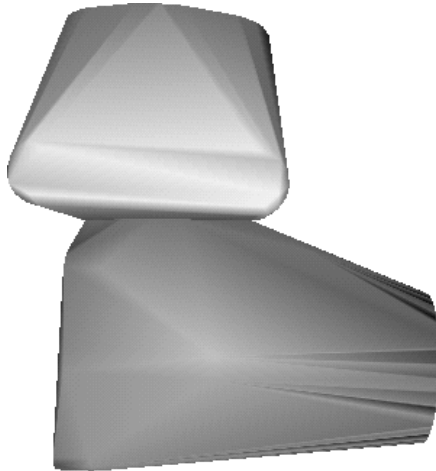
Is the sound played correctly?
Are the speakers OK?

- AFLs can be used at different levels for different purposes
 - Example above is for language generation
- Assumption: the analysis process is perfect
- Problem if generation and analysis have the same bug

Milestones

SG & 3D

- Aufriss
- Explosion
- Metagraphik
- Annotation
- Abstraktion
- Kameraplanung

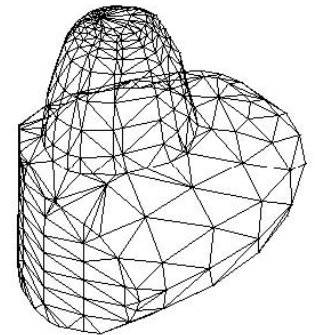
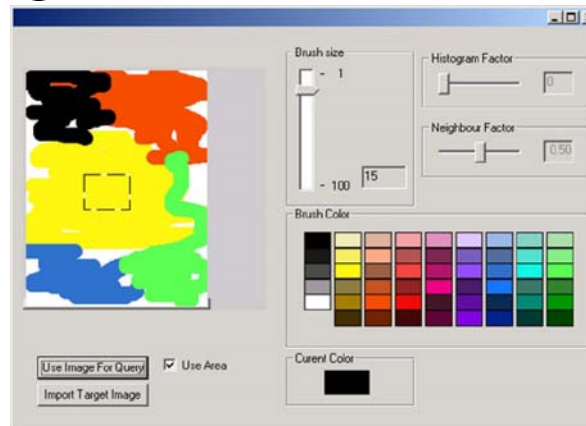


Interactive SG Systems

- So far only: intelligent generation of graphics
- But also: analysis, matching and processing of graphics and input according to cognitive criteria
- → different meaning of „Smart Graphics“

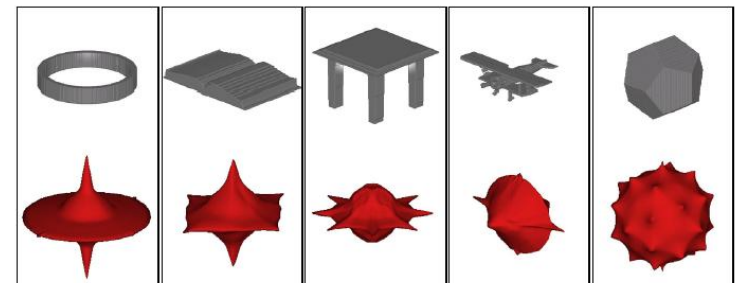
- Querying

- Bitmap images
- Vector drawings
- 3D models




- Sketching

- Polygonal shapes
- Organic 3D models



SG & Text

- Smart Text Arvo 00

Smart Text 

- Fluid Documents, Chang 00

When in the Course of human Events, it becomes necessary for one People to dissolve the Political Bands which have connected them with another, and to assume among the Powers of the Earth, the separate and equal Station to which the Laws of Nature and of Nature's God entitle them, a decent Respect to the Opinions of Mankind requires that they should declare the causes which impel them to the Separation.

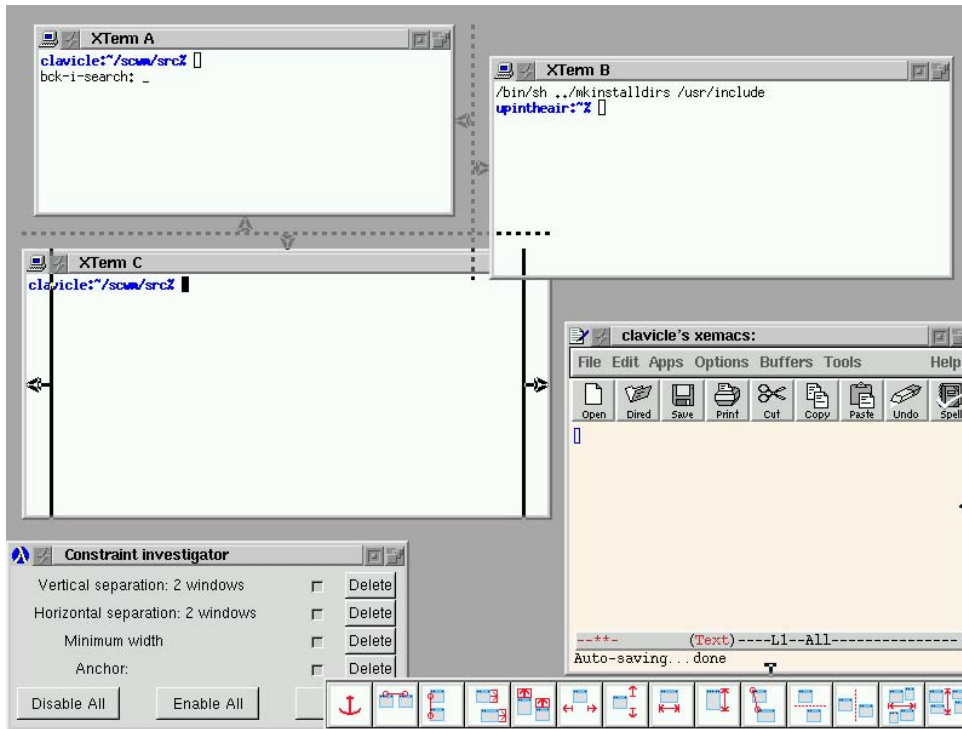
We hold these Truths to be self-evident, that all Men are created

As unequal in many ways as humans may be, no one human or class of humans is superior to another human or class of humans.

equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the Pursuit of Happiness -- That to secure these Rights, Governments are instituted among Men, deriving their just Powers from the Consent of the Governed, that whenever any Form of Government

SG & UI

- Freeform Interfaces (Igarashi)
- SCWM, Badros 00



Exercises

- One major class project (in infoviz)
 - Base concept, criteria
 - Choice of tools
 - Implementation of a working demo
 - Documentation in the form of a research paper
- Groups of 2-4 students
- Final presentation at the end of the semester
 - Short talk explaining what and how
 - Demo of the implementation
 - Will be open to the public

Structure of the research paper

- Introduction
 - What is it about? Which problem are you solving?
- Related work
 - What have others done to solve your problem?
- Approach
 - What is your formalism, math, key concept?
- Implementation
 - How did you implement your approach?
- Result, Example
 - Documented test run of your work, screen shot, execution times..
- Conclusions & future work
 - What did you learn in the process?
 - What problems remain unsolved?

Style of the research paper

- Templates for Springer LNCS
<http://www.springer.de/comp/lncs/authors.html>
- PDF file, Max. 12 pages
- All image captions self-contained
- Full references
- American English (or German)
- Active voice
 - We describe a system which..., we found that...
- As simple and understandable as possible
 - Goal: any computer scientist should be able to understand and reproduce your work