

# Design Studies

## Lecture 3 CPSC 533C, Spring 2004

19 Jan 2003

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## Design Study

- describe task
- justify solution
- refine until satisfied

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## Design Study Definition

Design study papers explore the choices made when applying infovis techniques in an application area, for example relating the visual encodings and interaction techniques to the requirements of the target task. Although a limited amount of application domain background information can be useful to provide a framing context in which to discuss the specifics of the target task, the primary focus of the case study must be the infovis content. Describing new techniques and algorithms developed to solve the target problem will strengthen a design study paper, but the requirements for novelty are less stringent than in a Technique paper.

InfoVis03 CFP, [infovis.org/infovis2003/CFP]

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## Architectural Lighting, Glaser

### Prototype 1: Space Series

- Focus+Context
- explore massive data set
- but some users rejected!

### Fieldwork

- who, what tasks?
  - architect, lighting designer, electrical engineer
  - facility manager, daylighting consultant
- daylight possibilities usually ignored

### Prototype 2, User Studies

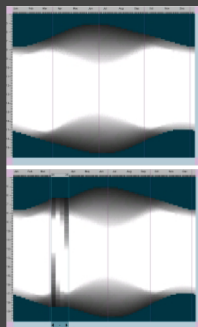
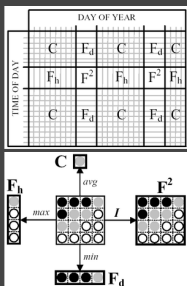
### Prototype 3

- LightSketch
- Scythe and Sew
- LiQuID

iterative design!

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## Space Series



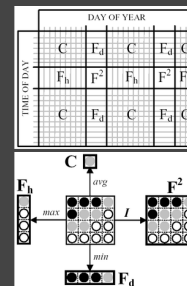
full year  
all day  
unzoomed

spring day  
zoom

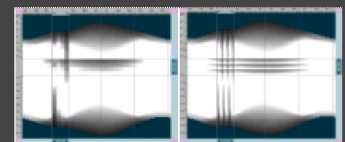
[www.cs.berkeley.edu/~dcg/papers/iv99/iv99.pdf]

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## Space Series



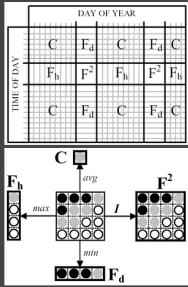
one day  
one hour  
3 contig days  
3 contig hours



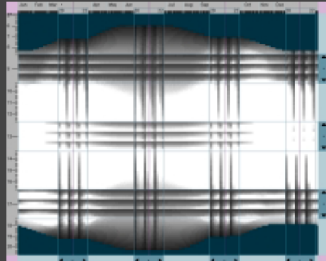
[www.cs.berkeley.edu/~dcg/papers/iv99/iv99.pdf]

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## Space Series



equinox/solstice  
morning, noon, night



[www.cs.berkeley.edu/~dcg/papers/iv99/iv99.pdf]

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## Architectural Lighting

### Space Series

- Focus+Context
- explore massive data set
- but some users rejected!

### Fieldwork

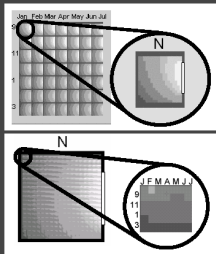
- who, what tasks?
- architect
- lighting designer
- electrical engineer
- facility manager
- daylighting consultant
- daylight possibilities usually ignored

### Final Prototypes

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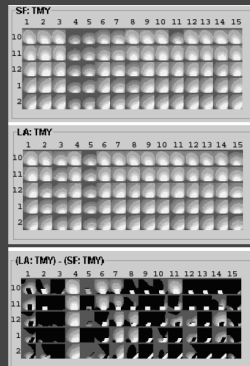
## Scythe and Sew

lighting over surface at  
single time



calendar of values over  
time at single point

user-definable patterns  
diff, other operators

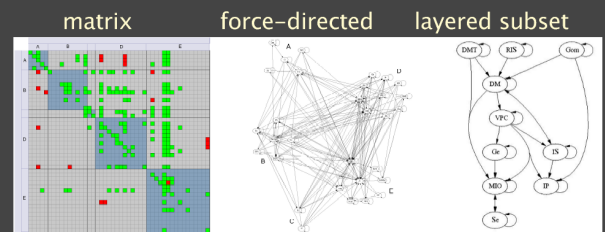


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## Multilevel Call Matrices, van Ham

large software project, implementation vs. spec

link matrix vs. node network



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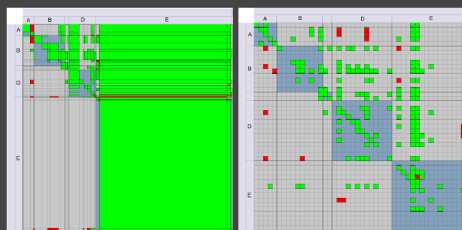
## Matrices

uniform, recursive, stable

subdivide by

total component count

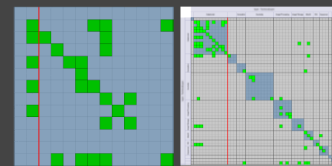
visible subcomponent count



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## Zooming

abstraction levels

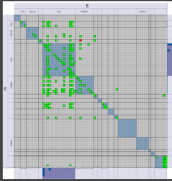


linear interpolation plus crossfade  
trajectories: will read van Wijk 03 in week 6

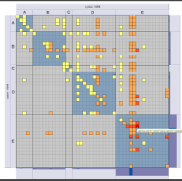


## Additional Encoding

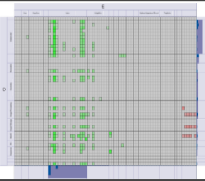
color:  
call allowed  
by spec



color:  
local region  
closest red



transparency:  
call density



histograms: size distribution

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## Tasks Successfully Supported

visual categorization

- i.e. libraries with mostly incoming calls

previous summary shown to be incomplete

spotting unwanted calls

determining component dependencies

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task: plausibility checking for linguists

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## Linguistic Networks, Munzner

data: MindNet query results

definition graph

- dictionary entry sentence
- nodes: word senses
- links: relation types

```
kangaroo100 (000000099.7)
  <Hyp> --- macsuplai100 1.1668e-007
    \Mod--- herbivorous102 2.1727e-010
  <Locn> --- island107 1.1668e-007
    \Mod--- adjacent103 9.5719e-010
  <Part> --- forelimb100 1.1695e-007
    \Mod--- short104 1.4191e-009
  <Part> --- hind_limb100 1.1695e-007
    \Mod--- large110 6.5013e-010
  <Part> --- Macropodidae_of_Australia
  <Prop> --- leap111 1.1722e-007
  <Part> --- tail101 1.1668e-007
  <Obj> --- adept104 1.1668e-007
```

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## Semantic Network

definition graphs used as building blocks

unify shared words

large network

- millions of nodes
- grammar checking now, translation future
- global structure known: dense

probes return local info

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## Path Query

best N paths between two words

words on path itself

```
kangaroo100 --- Part ---> forelimb100 --- Mod ---> short104 --- Join ---> short --- Mod ---> tail100
```

definition graphs used in computation

```
kangaroo100 (vole101 tapir100 #
sharp-tailed_grouse100 scut100 r
pitta100 partridge104 lynx100 lo
kingfisher100 horned_toad100 haw
bobtail101 bobtail100 bobcat100
Scottish_terrier100)
```

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## Task: Plausibility Checking

paths ordered by computed plausibility

researcher hand-checks results

- high-ranking paths believable?
- believable paths high-ranked?
- are stop words all filtered out?

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## Top 10 Paths Kangaroo->Tail

```

Microsoft Windows [Version 6.0.6002.18005] (c) 2006 Microsoft Corporation
C:\> cd /d "C:\Program Files\Microsoft Research\WordNet\bin"
C:\Program Files\Microsoft Research\WordNet\bin> java -jar WordNet.jar kangaroo tail

Number of paths: 10

Similarity score: 0.0068368 ( < 0.0015 - the words are not similar)
1 1.1668e-007 kangaroo100->Hyp->Tail101 kangaroo100
2 0.4417e-014 kangaroo100->Hyp->Macropod100->Hyp->Tasmanian Devil100->Part->Tail101 kangaroo100
3 0.39535e-014 kangaroo100->Hyp->Macropod100->Part->Tail101 kangaroo100
4 0.2954e-014 kangaroo100->Hyp->Macropod100->Hyp->Cuscus100->Part->Tail101 kangaroo100
5 1.2972e-014 kangaroo100->Part->Forelimb100->Mod->Short104->Vln->Shorte-Mod->Tail101 kangaroo100
6 9.623e-013 kangaroo100 (800000099,7) phalanger100
7 2.477e-013 kangaroo100 (800000099,7) wombat100
8 1.5540e-015 kangaroo100 (800000099,7) macropod100
9 1.5488e-015 kangaroo100 (800000099,7) macropod100
10 1.1220e-015 kangaroo100 (800000099,7) macropod100

kangaroo100 (800000099,7)
  <Hyp>-----marsupial100 1.1668e-007
  <Mod>-----herbivorous102 2.1727e-010
  <Locn>-----island107 1.1668e-007
  <Part>-----forelimb100 1.1695e-007
  <Mod>-----adjacent103 9.5719e-010
  <Part>-----hind_limb100 1.1695e-007
  <Mod>-----short104 1.4191e-009
  <Part>-----Macropodidae_of_Australia
  <Mod>-----large110 6.5013e-010
  <Part>-----leap111 1.1752e-007
  <Part>-----tail101 1.1668e-007
  <Mod>-----adapt104 1.1668e-007
  
```

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## Goal

create a unified view of relationships between paths and definition graphs

- shared words are key
- thousands of words (not millions)

special purpose algorithm debugging tools

- not understand structure of English

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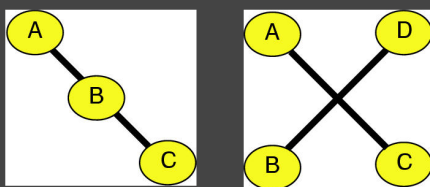
## Constellation Video

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## Traditional Layout

avoid crossings

reason: avoid false attachments



ambiguity

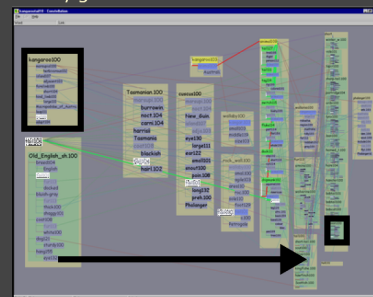
artifact salience

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## Information Visualization Approach

spatial position is strongest perceptual cue

- encode domain specific attribute
- plausibility gradient



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## Constellation Semantic Layout

novel layout algorithm

- paths as backbone, definition graphs attached
- curvilinear grid
- iterative design for maximum semantics with reasonable information density

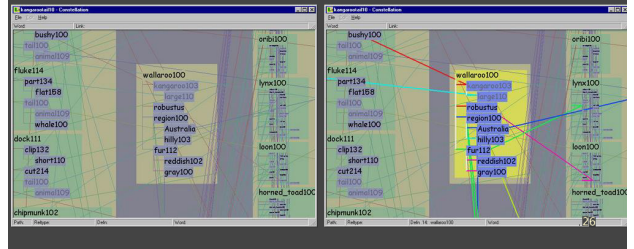
allow crossings for long-distance proxy links

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## Selective Emphasis

highlight sets of boxes and edges

- interaction
  - additional perceptual channels
- avoid **perception** of false attachments



## Hidden State

avoid hidden state

- change salience instead of toggle drawing

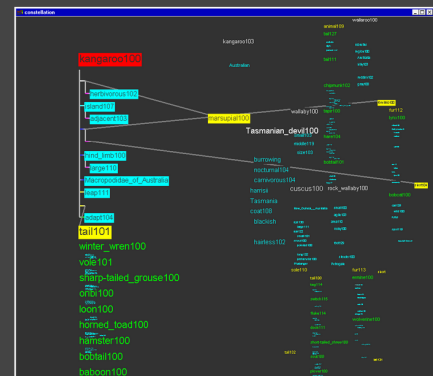
why? closed world assumption

- implicit assumption: if not visible, doesn't exist
- easy to forget previous actions

draw false negative conclusions

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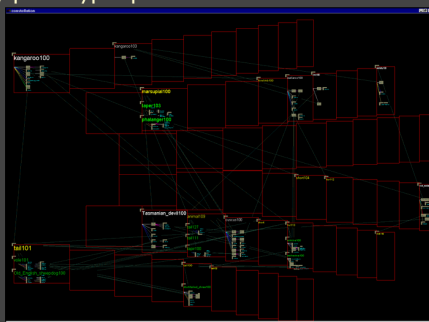
## Single vs. Multiple Word Instances



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## Information Density

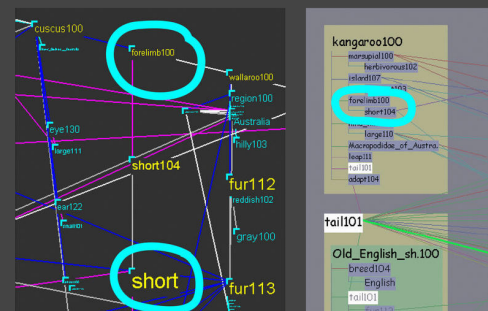
early prototype: poor



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## Information Density

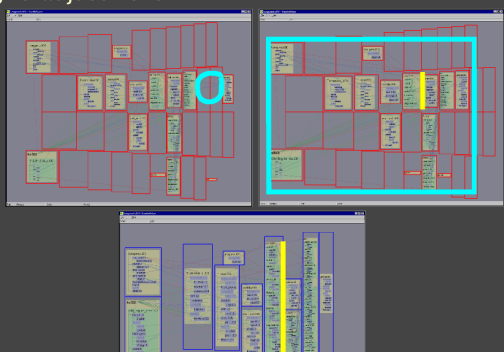
design tradeoff with visual salience



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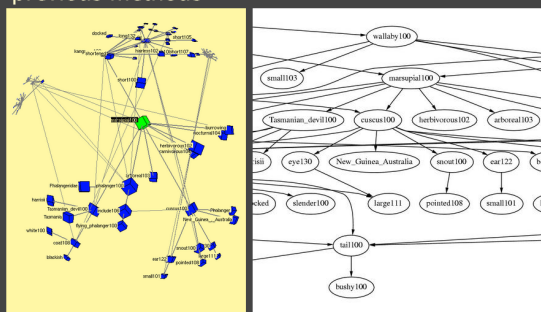
# Information Density

grid adjustment

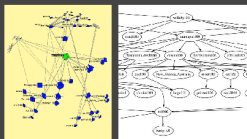


# Task-oriented design

previous methods



# Task-oriented design



task-specific methods

