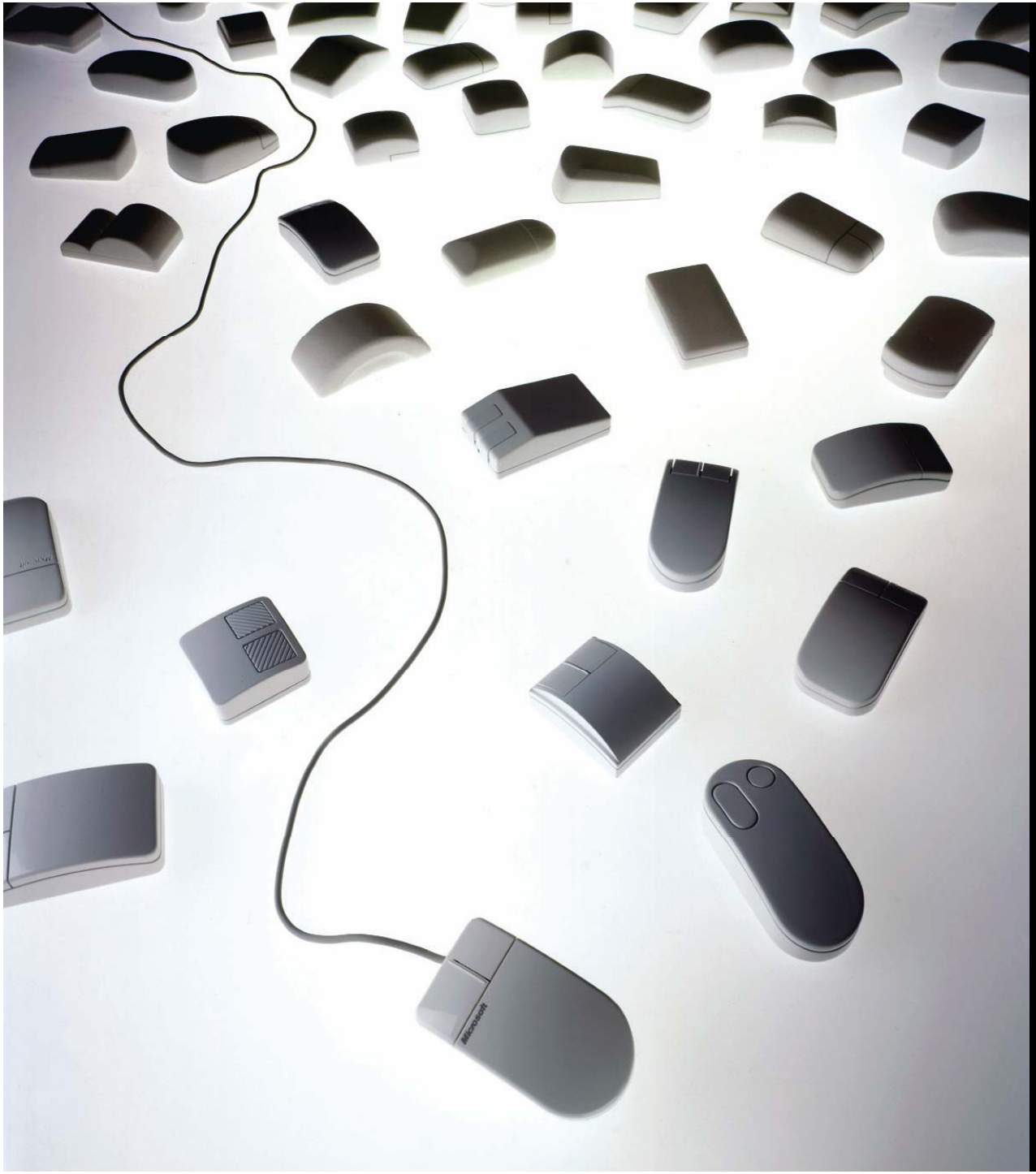
Design Tools for
Variations and Alternatives

Björn Hartmann (bjoern@cs.stanford.edu)

"The best way to have a good idea is to have lots of ideas."

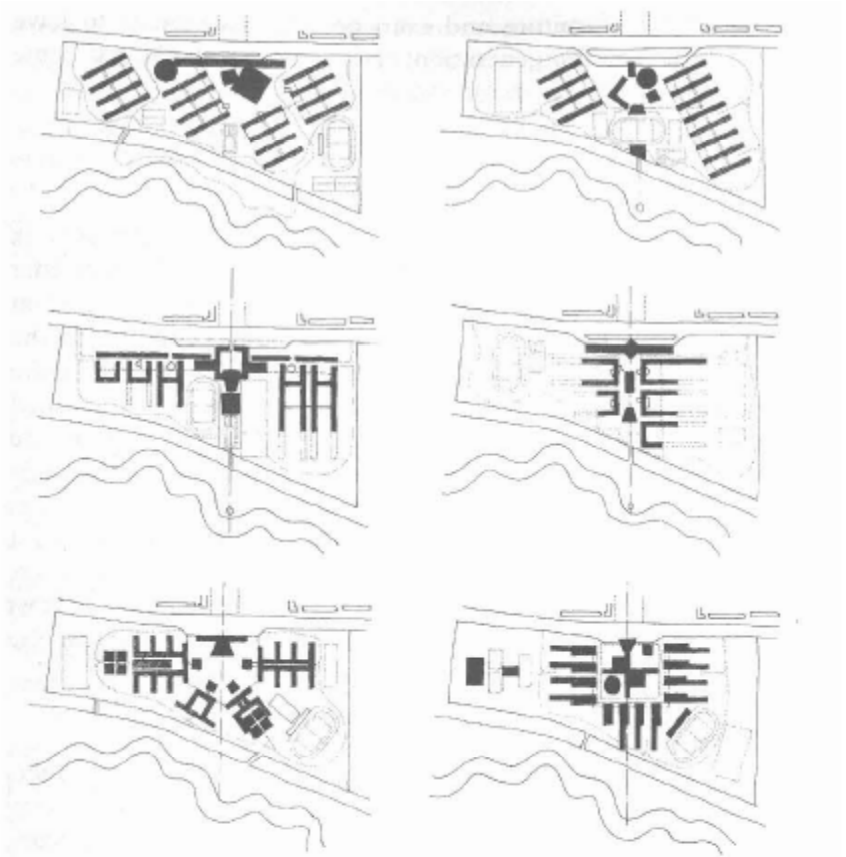
-Linus Pauling



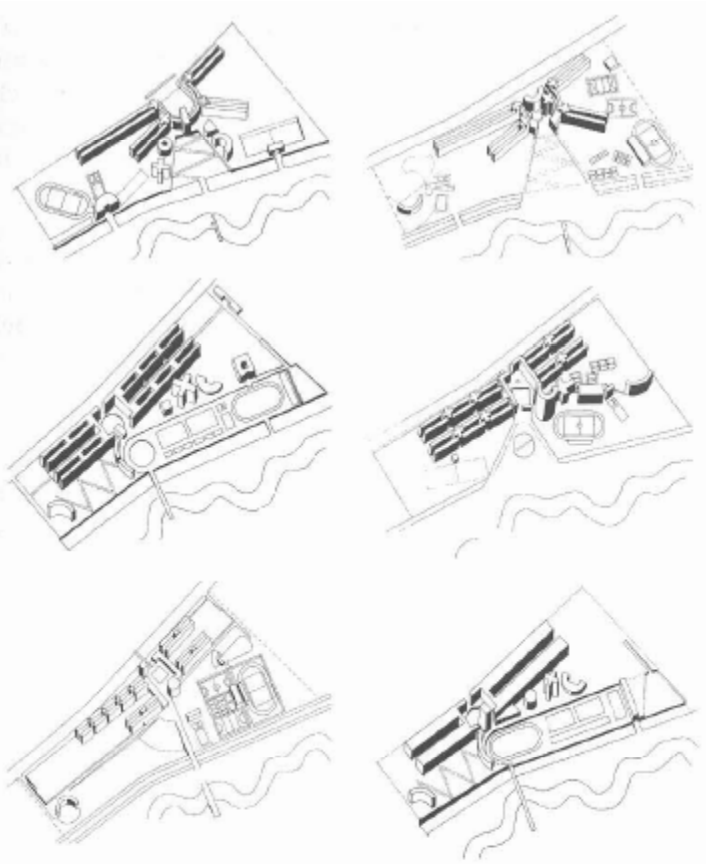
Prototypes for the Microsoft mouse From Moggridge, Designing Interactions, Ch2

"...a designer that pitched only one idea would probably be fired. I'd say 5 is an entry point for an early formal review (distilled from 100's). Oh, and if you are pushing one particular design you will be found out, and also fired."

Alistair Hamilton, quoted in Tohidi et al. , CHI 2006



12.3a Michael Wilford describes a process involving the generation of many alternatives. These are just some of the alternative layouts considered for Temasek Polytechnic in Singapore. See also 12.3b



12.3b

Counterpoint

"You have to let an idea run and proceed with it to be convinced... of course you criticize it and you may leave it and start again with something new, but it is not a question of options, it is always a linear process."

- Santiago Calatrava, quoted in Lawson, 1997

calatrava.com

Multiplicity matters,
but how?

Why and how do alternatives matter?

- To support creative action
  - Creativity is non-sequential, bouncy – tools need to support working with alternatives to get out of the way; "near-term experimentation"(Terry)
- For exploration:
  - "Mapping the territory" (Lawson)
  - "...to understand the range of [products] that might evolve" (Gaver)

Why and how do alternatives matter?

- For justification: design rationale
- To get more information from 3rd parties:
  - During critique
  - During testing (Tohidi, CHI06)
  - During client meetings (Lawson)

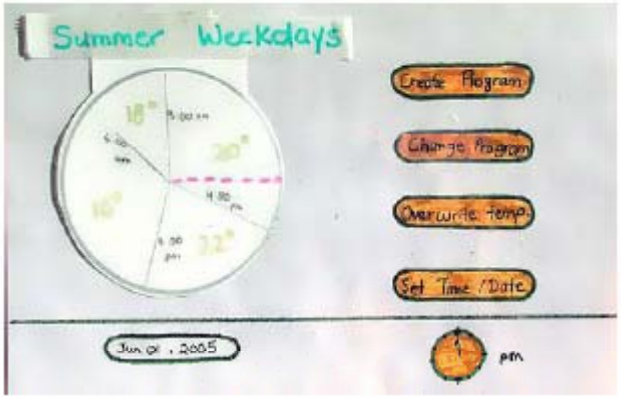


Figure 1. The "Circular" paper prototype

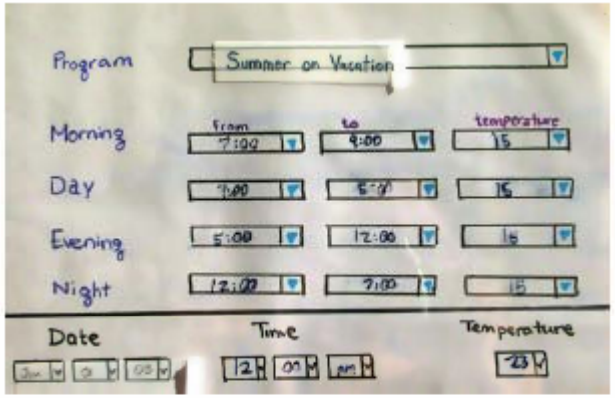


Figure 2. The "Tabular" paper prototype

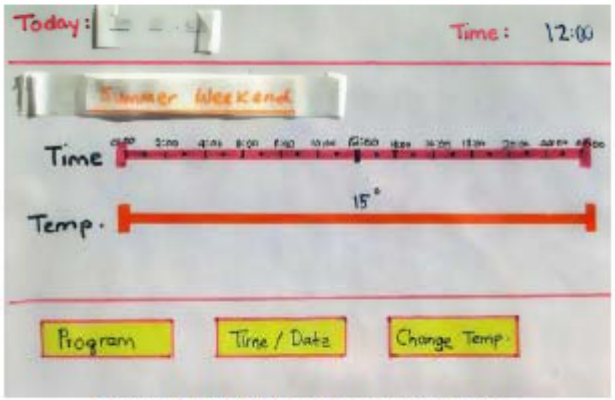


Figure 3. The "Linear" paper prototype

Tohidi et al, CHI 2006

Tohidi et al., Hypotheses

- **H1:** Participants will rate designs lower when all alternatives are seen, compared to when they see only one.
- **H2:** Participants exposed to alternative designs will be less pressured to be positive, expressing fewer positive comments than those who only see one.
- **H3:** Participants who see alternative designs will provide more suggestions for improvement compared to those who only see one.

Disentangling Definitions

- **Alternatives:** offer choice; pertain to the **design problem domain**
- **Variations:** changes to a common base; pertain to the **implementation domain**
- **Iterations:** Instances of the *same solution at different points of* revision (from Terry)

What tools are out there, and what problems do they solve?

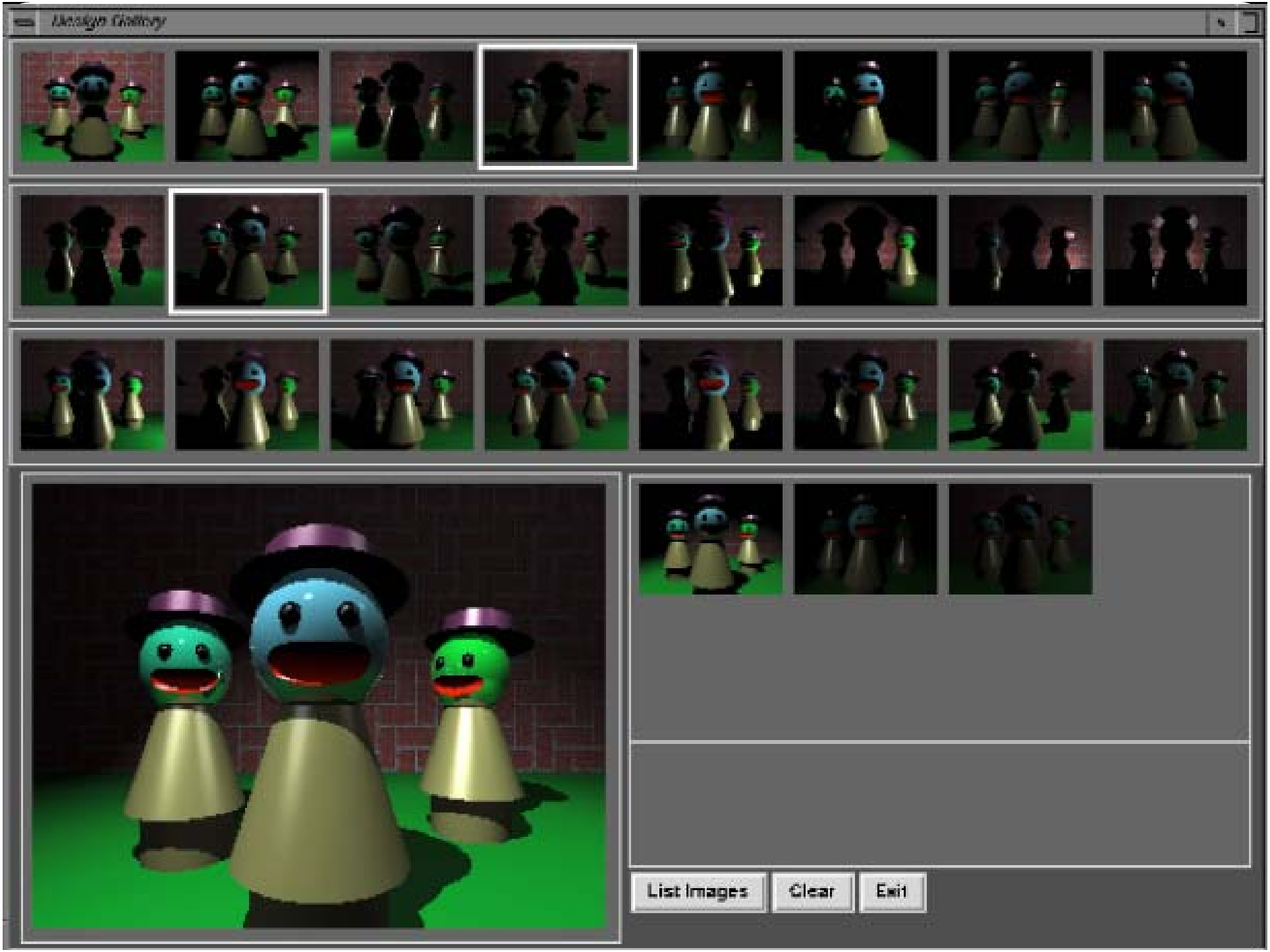
- Design Galleries (Marks, SIGGRAPH 97)
- SideViews & Parallel Pies (Terry, 2002 & 04)
- Subjunctive Interfaces (Lunzer, various)
- Linked Editing (Toomim, VL/HCC 2004)

Design Galleries (DG)

- Domain: graphics rendering; simulation of physical phenomena (light transport, particle systems) with lots of parameters
- Characteristics:
  - High computational cost
    (can't do realtime adjustment)
  - Unquantifiable output qualities
    (need human judge)

Design Galleries (DG)

- Given formal description of
  - input vector (set of parameters to tweak)
  - method to create output (rendering, simulation)
  - output vector (relevant qualities of image)
  - distance metric
- generate space-spanning set of **variations** with maximum dispersion along with a UI for structured browsing of solutions


Design Gallery
List Images
Clear
Exit

Input:
L, a set of lights and corresponding thumbnail images.
$n < |L|$, the size of the selected subset.
c, an average-luminance cutoff factor.

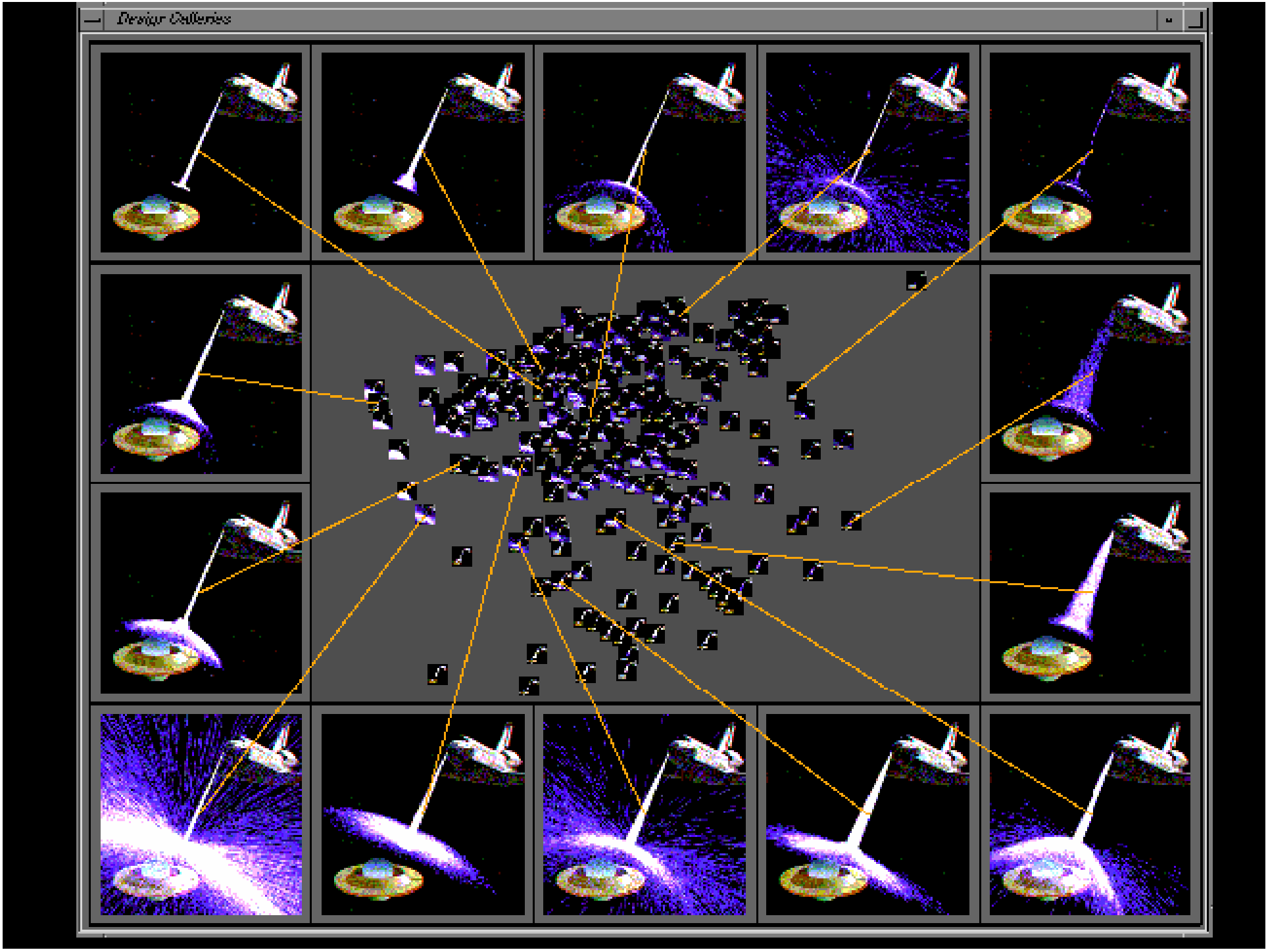
Output:
$I \subset L$, a set of n dispersed lights and their images.

Procedure:

```
SELECTION_DISPERSE(L, n, c) {
    L ← L \ find_dims(c, L);
    I ← ∅;
    for i ← 1 to n do {
        p_score ← −∞;
        foreach q ∈ L do {
            q_score ← ∞;
            foreach r ∈ I do
                if image_diff(q, r) < q_score then
                    q_score ← image_diff(q, r);
            if q_score > p_score then {
                p_score ← q_score;
                p ← q;
            }
        }
        I ← I ∪ {p};
        L ← L \ {p};
    }
}
```

Notes:
\ denotes set difference.
find_dims(c, L) returns those lights in L with average luminance less than c.
image_diff(q, r) returns the value computed by Equation 1.

Figure 1: A selection-based dispersion heuristic.


Design Galleries

Side Views & Parallel Pies

- Domain: 2D graphic design (still images)
- “What If Tools” for ill-defined problems
- Get beyond Single State Document Model
- A bag of tricks to support trying out multiple alternatives in parallel:
  - Fast previews
  - Multiple previews
  - Make previews stick persistent & composable

Side View

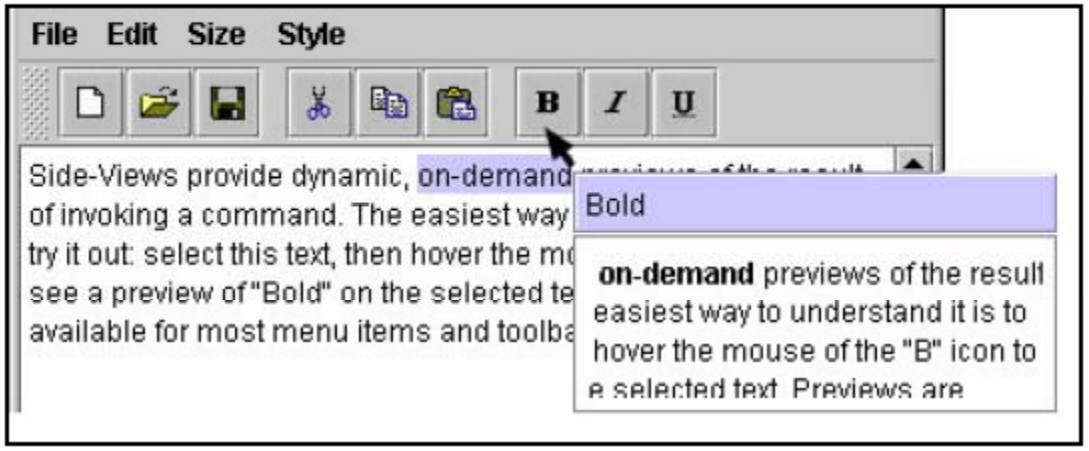
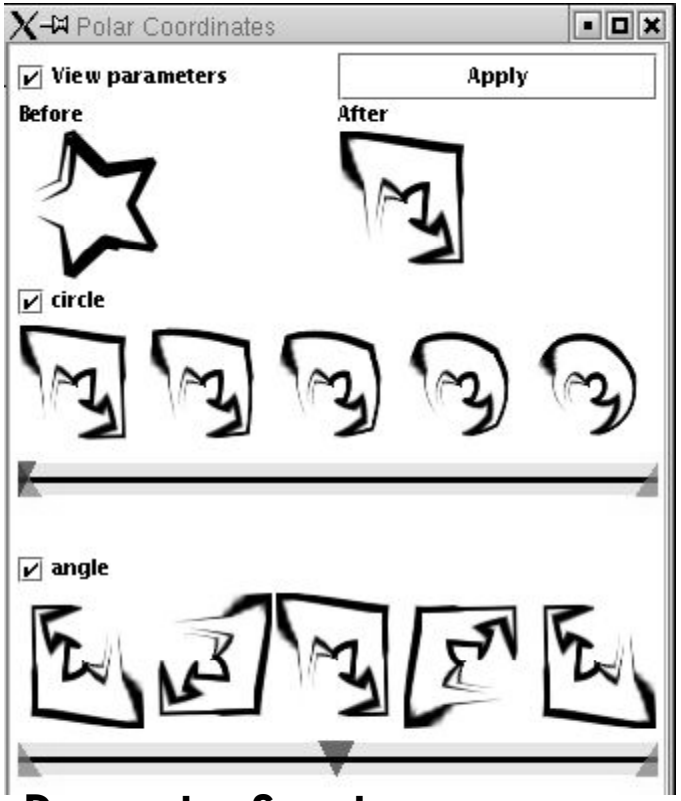
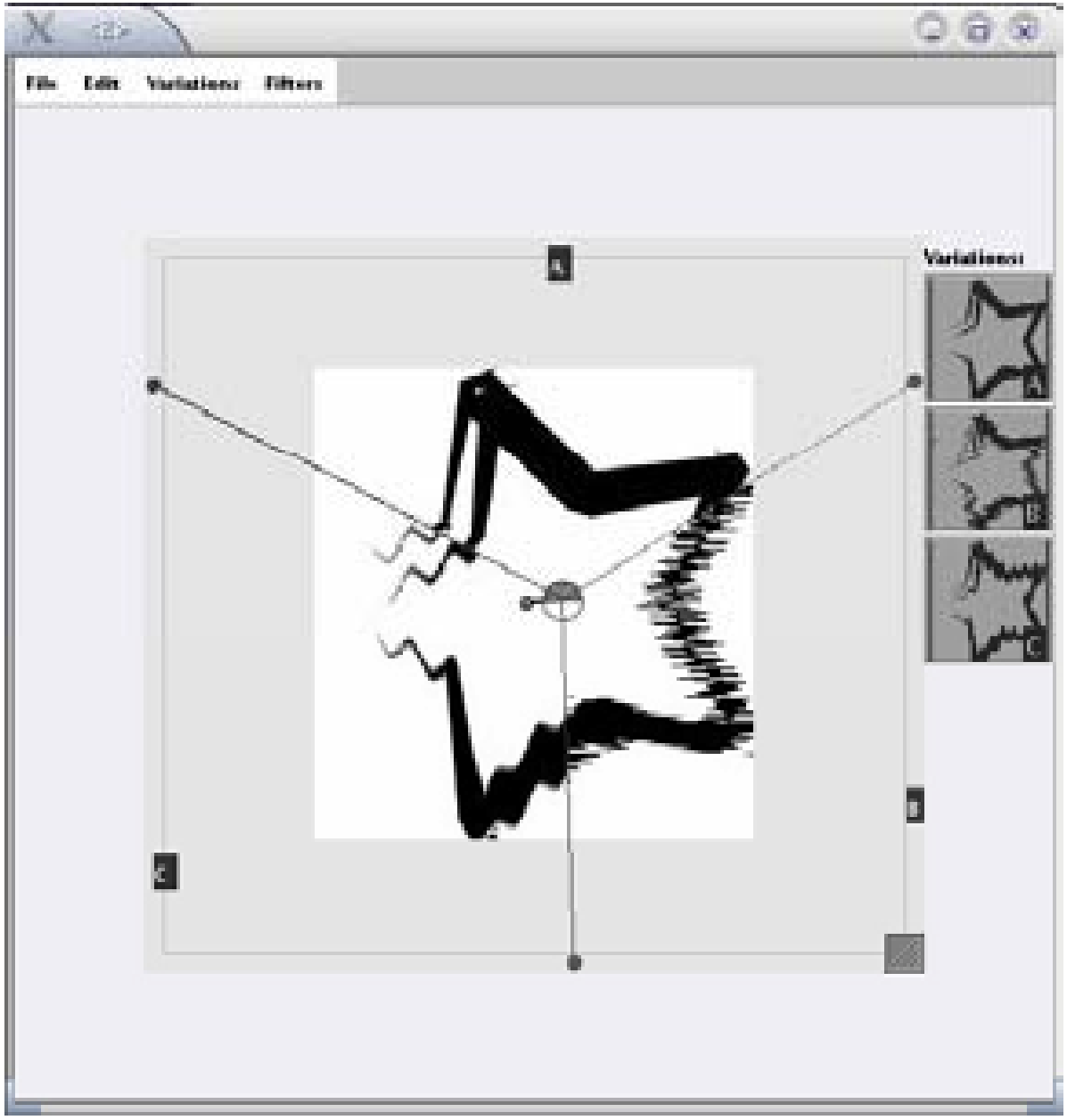


Figure 1. Side Views provide a preview of a command using a copy of the data to be affected. In this figure, a preview of "bold" is shown in a word processor



Parameter Spectrum

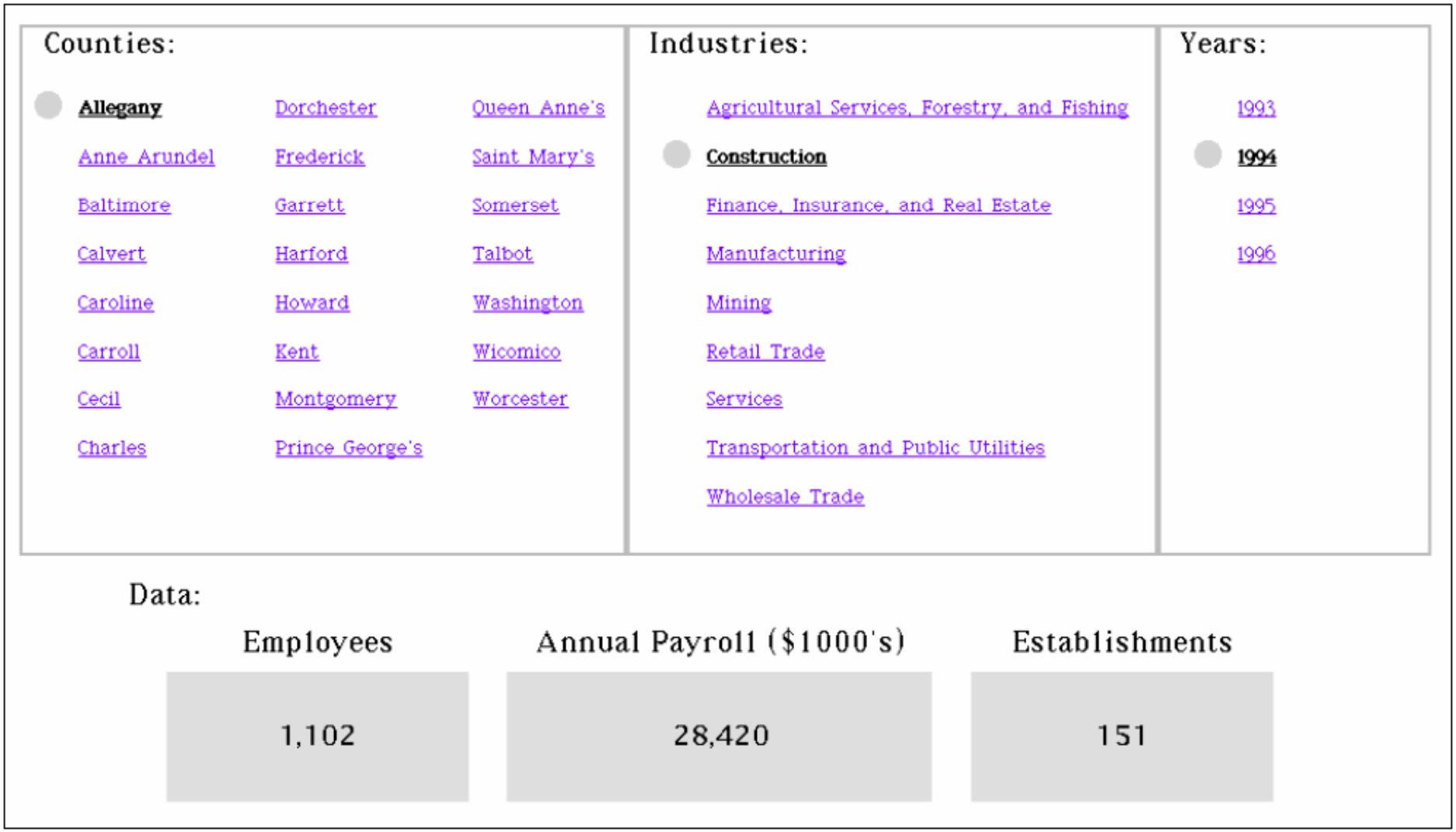
Parallel Pie



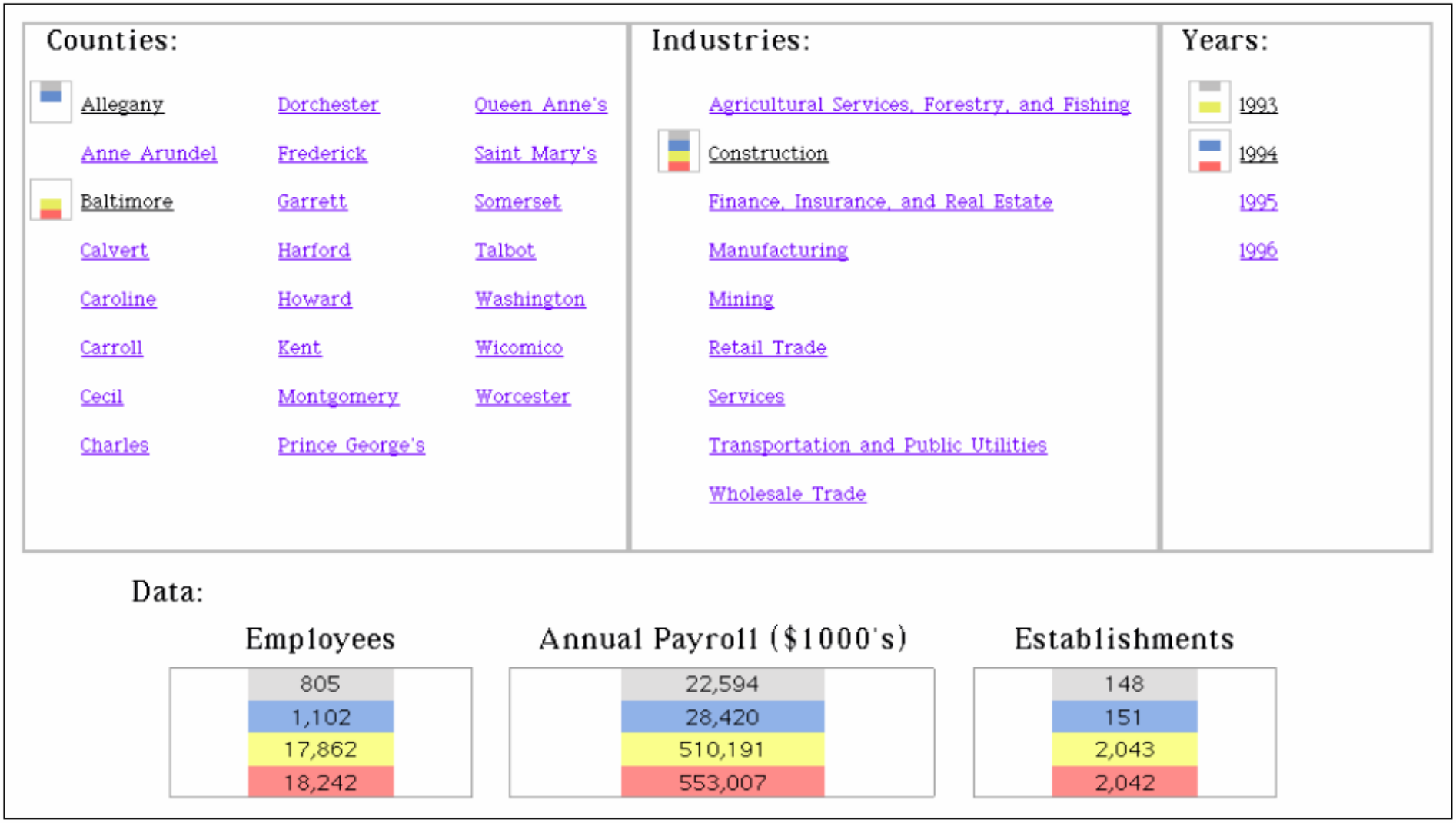
Terry et al,
CHI 2004

Subjunctive Interfaces

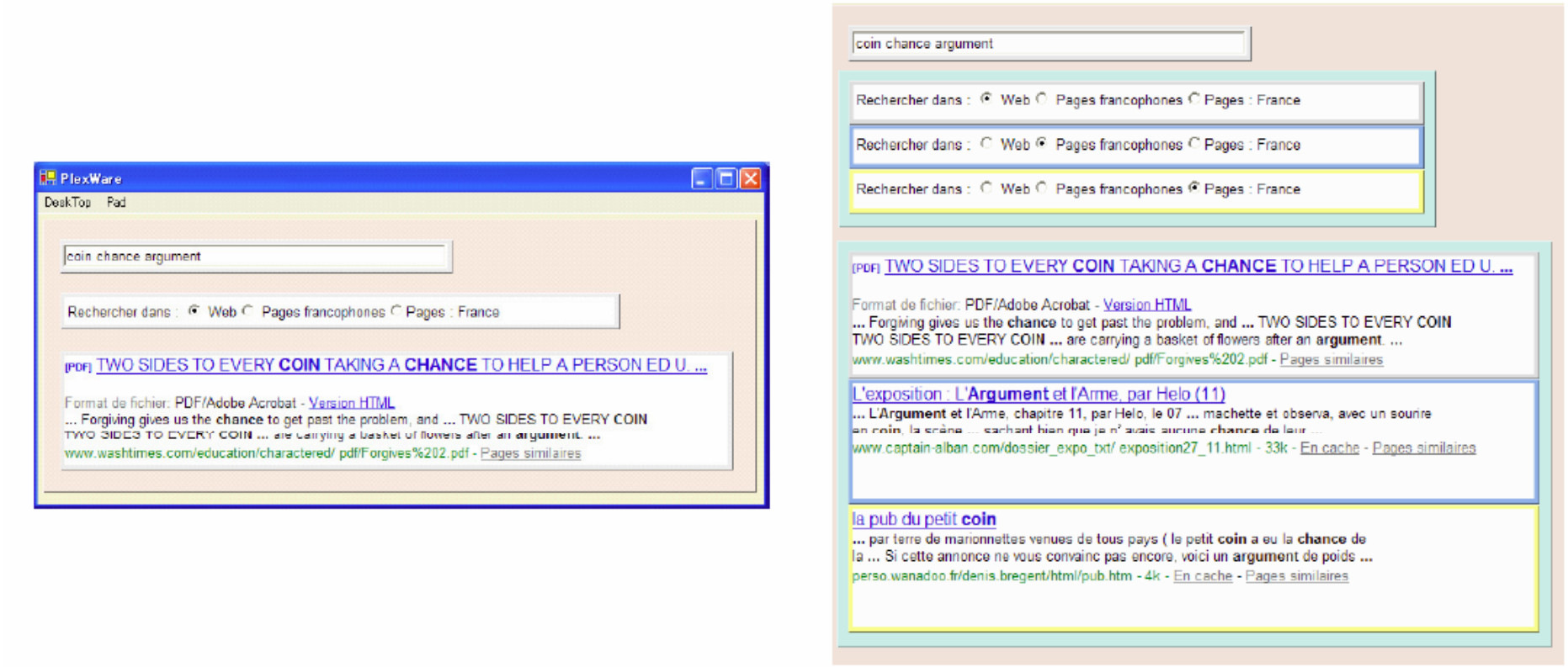
- Domain: Information retrieval (e.g., booking a flight)
- Problem: tasks require many related queries, but only single requests are supported
- Idea:
  - Multiple scenarios can co-exist (e.g., alternative input values)
  - User can view scenarios side-by-side
  - User can adjust scenarios in parallel


Counties:
Allegany
Anne Arundel
Baltimore
Calvert
Caroline
Carroll
Cecil
Charles
Dorchester
Frederick
Garrett
Harford
Howard
Kent
Montgomery
Prince George's
Queen Anne's
Saint Mary's
Somerset
Talbot
Washington
Wicomico
Worcester
Industries:
Agricultural Services, Forestry, and Fishing
Construction
Finance, Insurance, and Real Estate
Manufacturing
Mining
Retail Trade
Services
Transportation and Public Utilities
Wholesale Trade
Years:
1993
1994
1995
1996
Data:
Employees
1,102
Annual Payroll ($1000's)
28,420
Establishments
151

Lunzer, 2004


Counties:
Allegany
Anne Arundel
Baltimore
Calvert
Caroline
Carroll
Cecil
Charles
Dorchester
Frederick
Garrett
Harford
Howard
Kent
Montgomery
Prince George's
Queen Anne's
Saint Mary's
Somerset
Talbot
Washington
Wicomico
Worcester
Industries:
Agricultural Services, Forestry, and Fishing
Construction
Finance, Insurance, and Real Estate
Manufacturing
Mining
Retail Trade
Services
Transportation and Public Utilities
Wholesale Trade
Years:
1993
1994
1995
1996
Data:
Employees
805
1,102
17,862
18,242
Annual Payroll ($1000's)
22,594
28,420
510,191
553,007
Establishments
148
151
2,043
2,042

Lunzer, 2004



Clip Connect Clone

Linked Editing

- Domain: programming
- Problem: code clones:
  tedious to edit, unobservable inconsistencies, overhead to maintain, hard to understand…
- However, “programmers *will write duplicated* code – let’s support the practice and mitigate its disadvantages.”
- Idea: clones are linked together in editor, similarities and differences visualized, editing possible in parallel or individually

Linked Editing

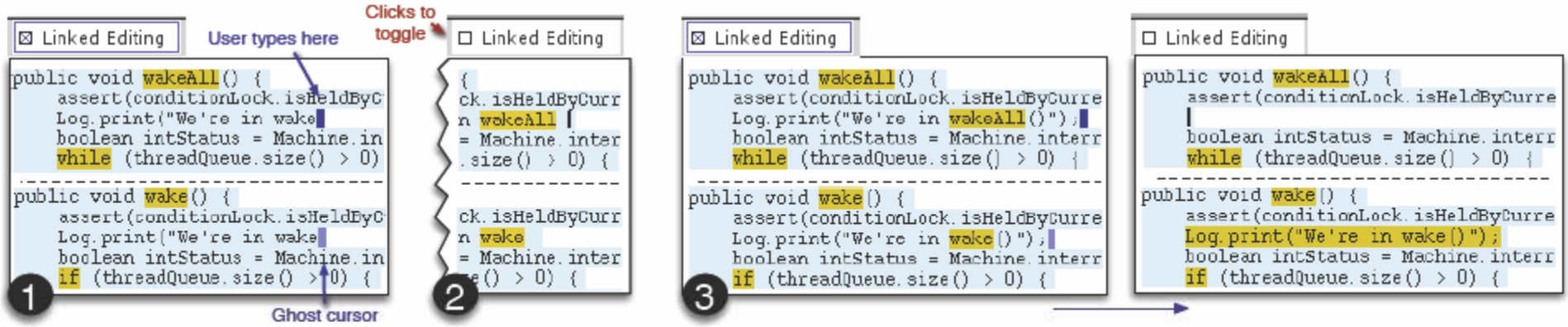


Figure 2. (1) Adding a line to two clones. (2) Modifying one instance. (3) Deleting line in one instance.

Toomim, VL/HCC 2004

Tunables

- Domain: multimedia programming in Processing
- Problem: parameter values have to be set at compile time whose effect can only be observed at runtime
- Examples: rendering style, cv color tracking
- Idea: from source code, automatically generate control interface to let programmers change parameters at runtime; record changes and re-integrate found parameters into source

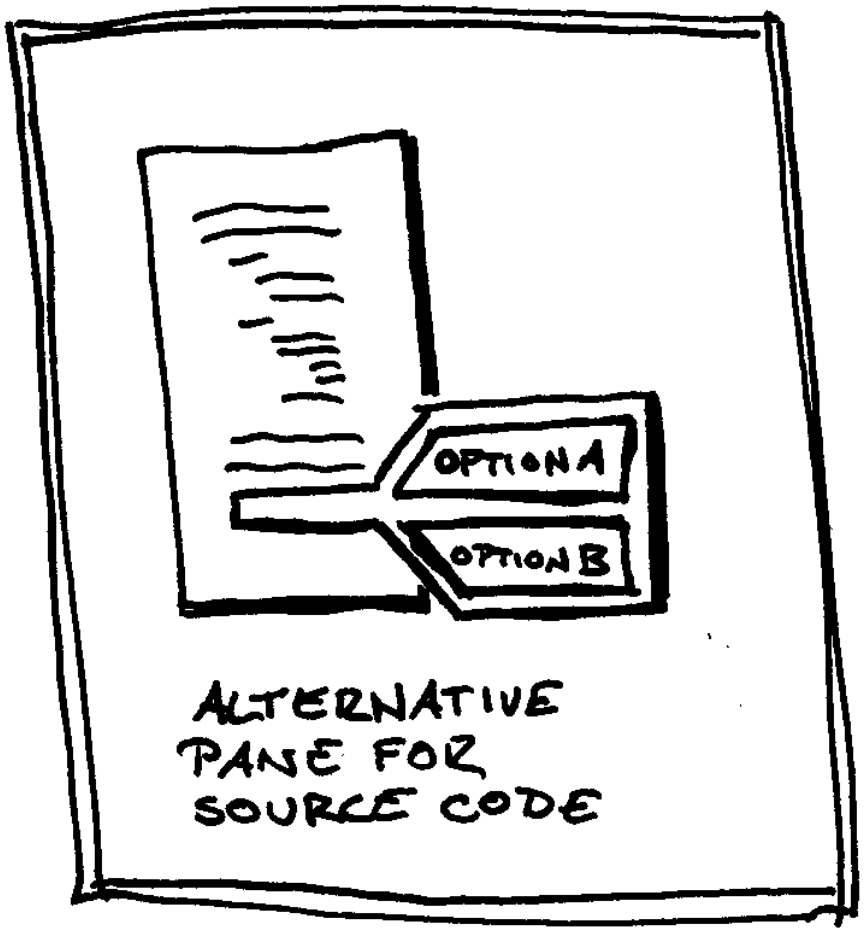
"Enlightened trial and error outperforms the planning of flawless intellect."

- David Kelley,
quoted in Winograd, 2006

Tunables Video

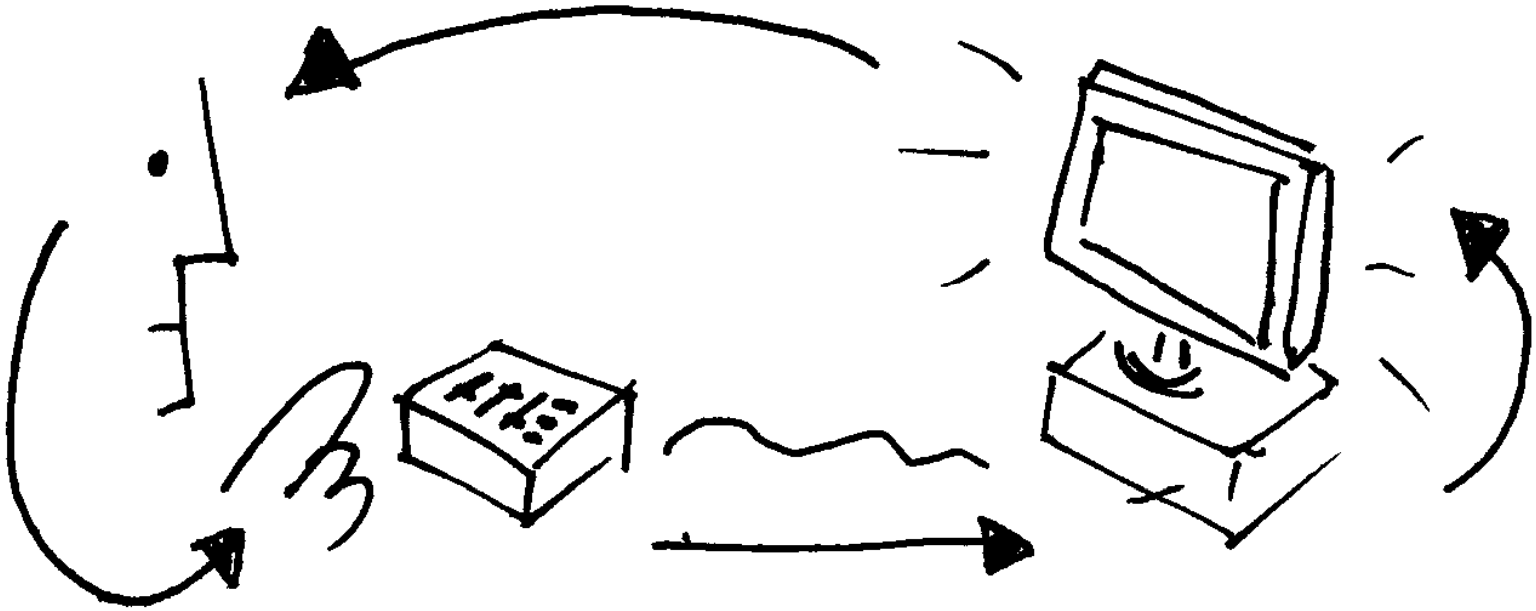
Pilot Study Feedback

- Physical, spatially multiplexed control interface is a big win in terms of attention and parallel control
- Wanted support for parameter **variation**, as well as **alternative** execution paths

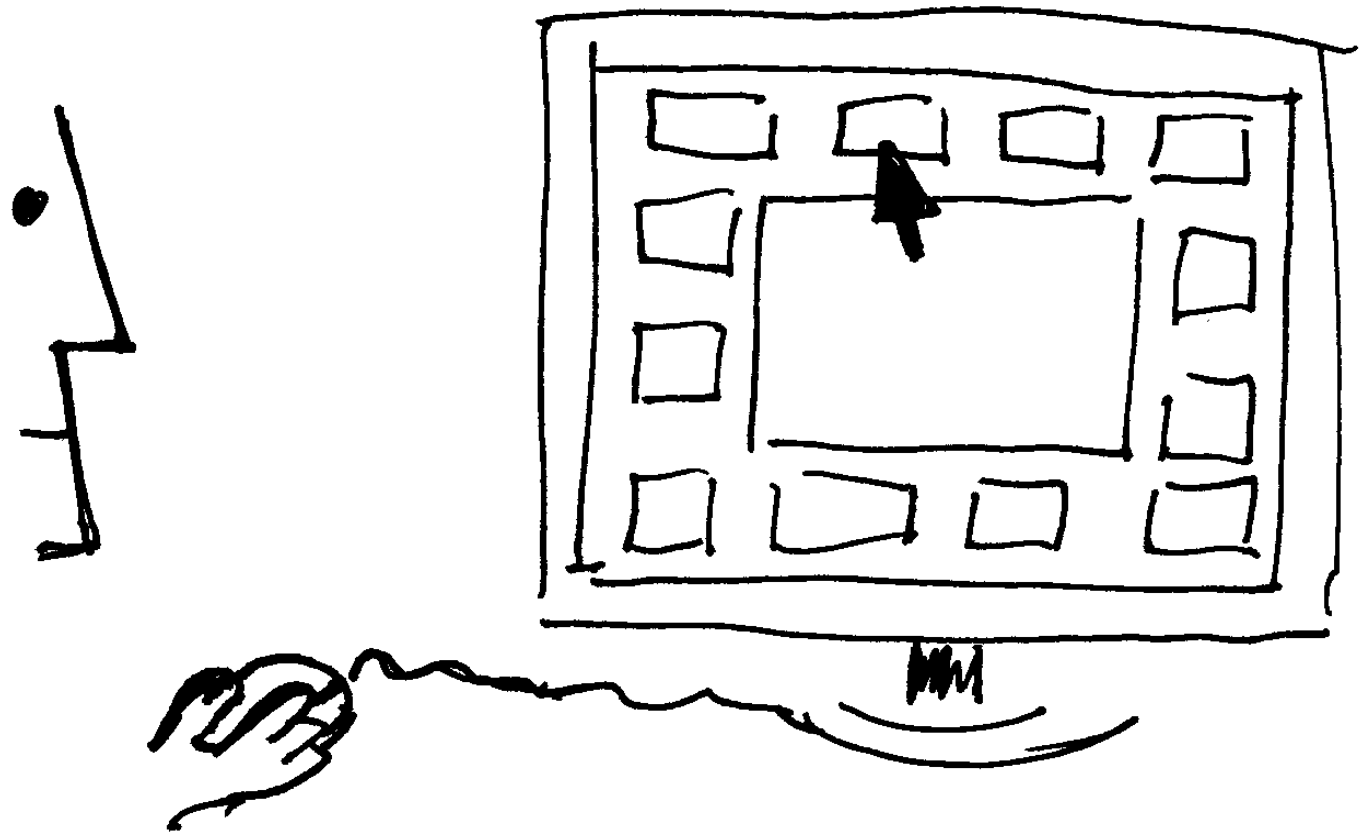

OPTION A
OPTION B
ALTERNATIVE
PANE FOR
SOURCE CODE

Discussion

- DG, Side Views, Tohidi study, Tunables: Human provides “goodness” rating
- Things get interesting when there are multiple variations of multiple parameters
- Do you show alternatives in parallel or in sequence?
- Time to effect changes matters (next slide)



Real-time adjustment (Tunables, SideViews) requires immediate feedback from application



If real-time feedback is not possible, pre-compute and select from options

Where is the opportunity?

- Neither DG nor Side Views nor Subjunctive Interfaces have interactive artifacts at their core – they are based on “documents”
- Relationship of input to output is that of a pipeline, not a feedback system

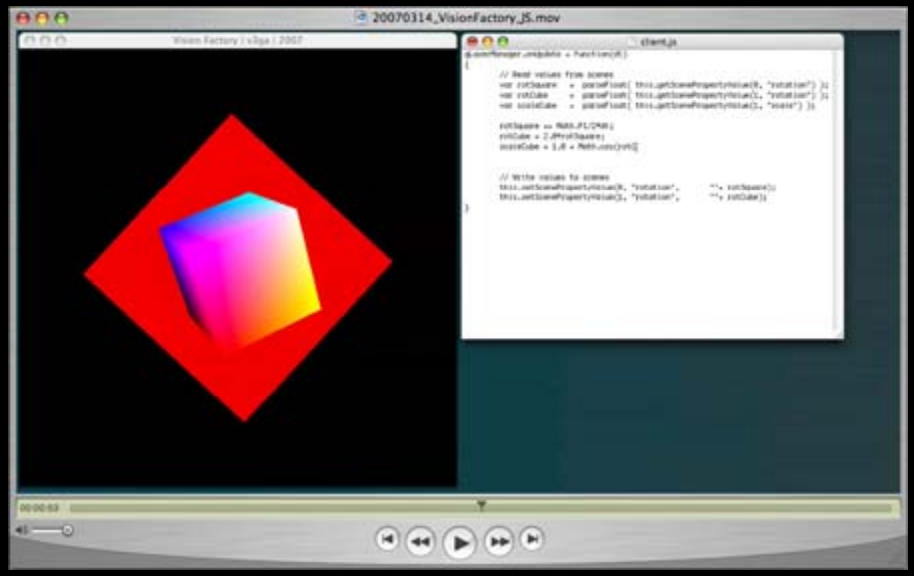
- Defining how the “transitions” of interaction design happen is still programming
- Linked editing is about code, but only about code as text, not about what happens when it runs

Tangent: Coding as Performance

- Examples:
  - ChucK/Audicle (Ge Wang, Princeton, now CCRMA)
  - Impromptu
  - http://hackety.org/2007/05/22/runningWhilstEditing.html (mov)

On-the-fly programming

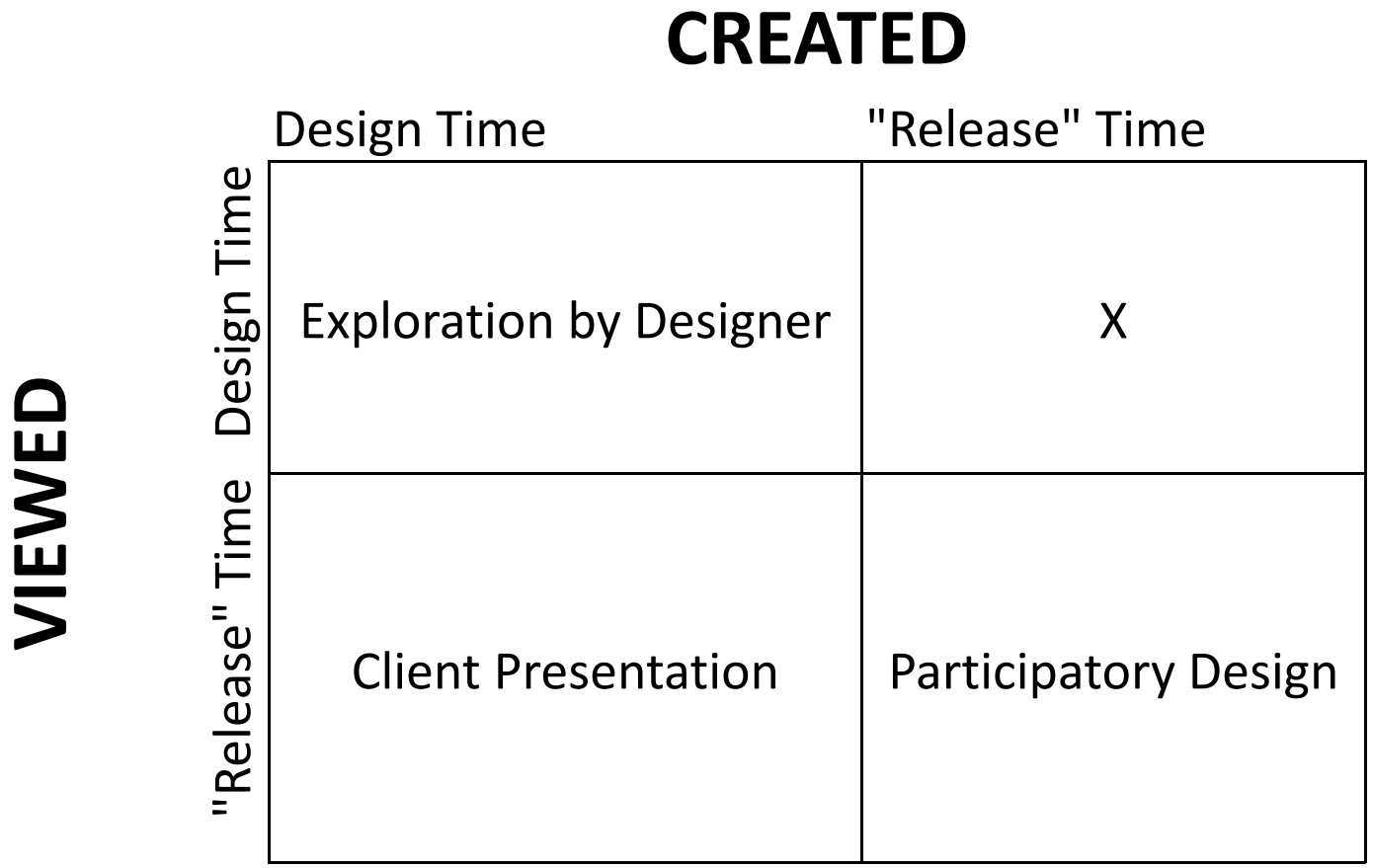
On-the-fly programming (or live coding) is a style of programming in which the programmer/performer/composer augments and modifies the program while it is running, without stopping or restarting, in order to assert expressive, programmable control for performance, composition, and experimentation at run-time.


20070314_VisionFactory_JS.mov
client.js

Where do People matter?

	Aimed at Lone Designer	Aimed at Performer+ Audience	Do people provide real-time input?	Do people create parameter values?	Do people create Input->Output mapping?
Design Galleries	x		No - Document (3D world)	No; Algorithm does	No; expert programs it
Side Views	x		No -Document (Image)	Mixed	Mixed - library implements primitives; people compose
Playing a Synthesizer		x	Human Performance	Yes	No (set in hardware)
Laptop Live Performance		x	No - Document (Score)	Yes	Yes (Beforehand)
"Chucking"		x	No -Document (code)	Yes	Yes (Live)
Tunables for Interaction Design	x	x	Mixed: Document+Human Performance	Yes	Yes (Beforehand)
Tohidi & Buxton Study		x	Yes? Paper prototype	no; separate implementations	

When are alternatives…




http://hci.stanford.edu
PACHINKO
passive gate
entry
Bill: copyright
visualization of license
Scott: a gate that shows
who walked through it last
BU: a gate that measures
ceremonial gates
turnstiles
http://hci.stanford.edu