

ユーザインタフェース

～Information Visualization～

五十嵐 健夫

Schedule

- 6/14 User Interface Design, Evaluation
- 6/21 Information Visualization (課題出題)
- 6/28 Sketching Interfaces
- 7/5 End-user Programming
- 7/12 Real world Computing
- 7/19 Human Robot Interaction
(課題×切 24:00)
- 7/26 課題講評

今回の内容

情報視覚化 (Information Visualization)
情報検索

- Information Visualizer (Xerox PARC)
- Focus + Context, FishEye
- Zooming UI
- HCIL (Shneiderman)
- Tool Glass and Magic Lenses

情報視覚化 (Information Visualization)
情報検索

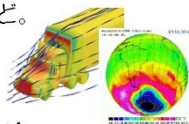
“The use of computer-supported, interactive, visual representations of abstract data to amplify cognition”

Readings in Information Visualization
~Using Vision to Think~

きれいな絵を見せること自体が目的ではない。
インタラクションを通じて、対象を理解することが目標

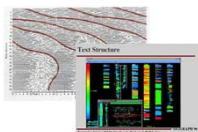
Scientific Visualization

もともと空間的な意味を持つ情報の可視化
流体シミュレーションの結果など。



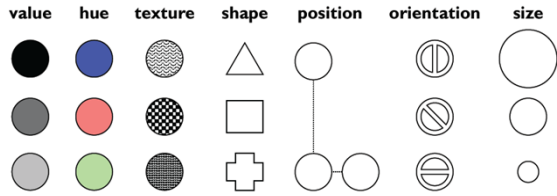
Information Visualization

抽象的な情報の可視化
どう空間へマップするかは自由

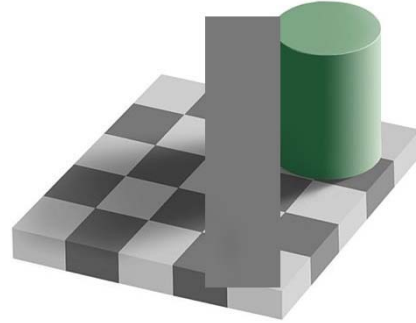


基本

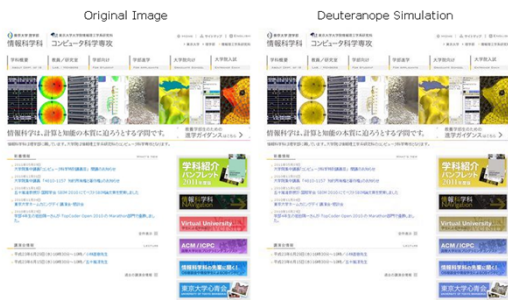
視覚属性による表現



色の知覚

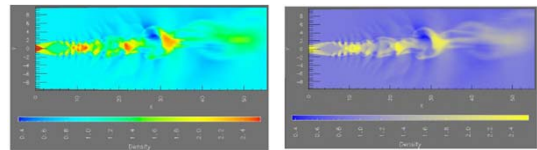


色覚異常



<http://www.vischeck.com/>

カラーマッピング



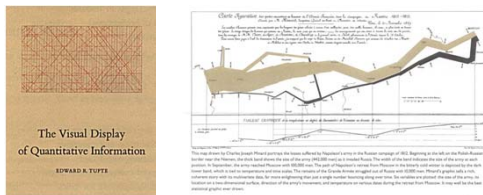
レインボーカラーマップ
低周波成分がわかりやすい

色調による1次元表現
高周波成分がわかりやすい

<http://www.research.ibm.com/people/l/loyd/color/color.HTM>

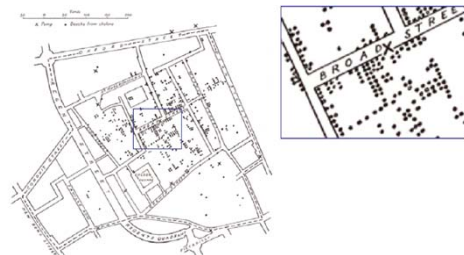
The Visual Display of Quantitative Information

Edward Tufte



情報を効果的に伝えるための技法集

コレラの感染



[Tufte 83]

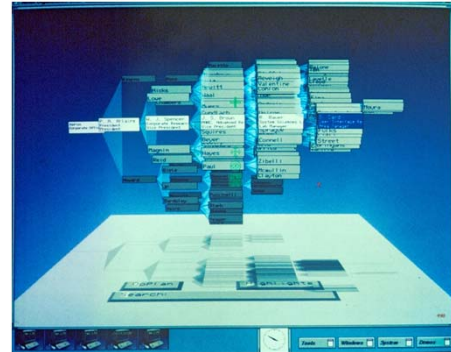
Information Visualizer (Xerox PARC)

- Cone Tree
- Perspective Wall
- Document Lenz
- Hyperbolic Tree

大規模な情報への効率的アクセス
Focus+Context, アニメーション

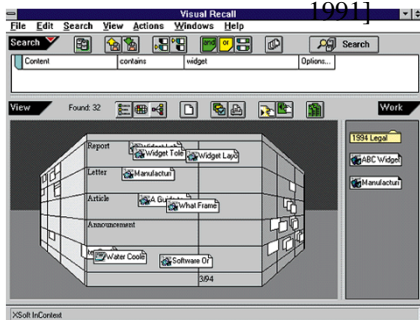
Cone Tree

[Robertson 1991]



Perspective Wall

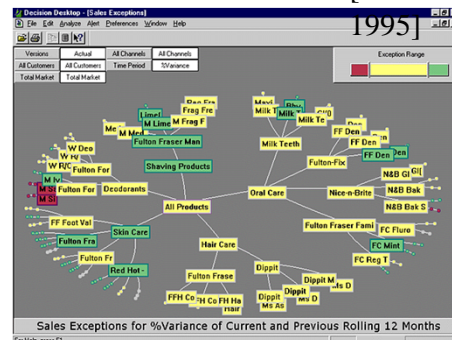
[Mackinlay
1991]



[E:\movies\infoviz\Information Visualizer.mpg](#)

Hyperbolic Tree

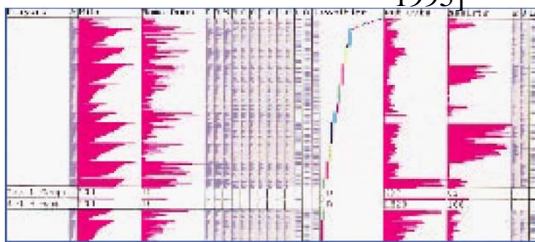
[Rao
1995]



[E:\movies\infoviz\Hyperbolic Tree.mpg](#)

Table Lens

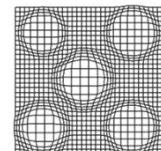
[Rao
1995]



[E:\movies\infoviz\TableLens.mpg](#)

Non linear Magnification Focus + Context views

- Original Fisheye view
- Fisheye lens

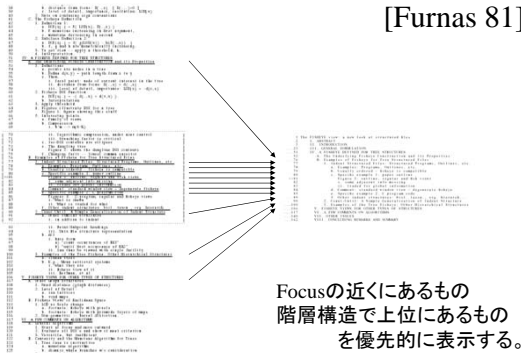


Focus を大きく表示

Context を失わないように小さく表示

Fisheye view

[Furnas 81]



Fisheye view

[Furnas 81]

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1 The FISHEYE view: a new look at structured files
2
3 I. ABSTRACT
4
5 II. INTRODUCTION
6
7 III. GENERAL FORMULATION
8
9 IV. A FISHEYE DEFINED FOR TREE STRUCTURES
10
11 A. The Underlying Fisheye Construction and its Properties
12
13 B. Examples of Fisheye for Tree Structured Files
14
15 1. Indent Structured Files: Structured Programs, Outlines, etc.
16
17 a. Examples: Programs, Outlines, etc.
18
19 b. Usually ordered - fisheye is compatible
20
21 c. Specific example 1: paper outline
22
23 Figure 2: outline, regular and fish views
24
25 i. some adjacent info missing
26
27 ii. traded for global information
28
29 d. Comment: standard window view - degenerate fisheye
30
31 e. Specific example 2: C program code
32
33 f. Other indent structures: biol-taxon.org, hierarch...
34
35 2. Count-Unit: A Simple Generalization of Indent Structure
36
37 3. Examples of the Tree Fisheye: Other Hierarchical Structures
38
39 V. FISHEYE VIEWS FOR OTHER TYPES OF STRUCTURES
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41 VI. A FEW COMMENTS ON ALGORITHMS
42
43 VII. OTHER ISSUES
44
45 VIII. CONCLUDING REMARKS AND SUMMARY
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```

Fisheye view

[Furnas 81]

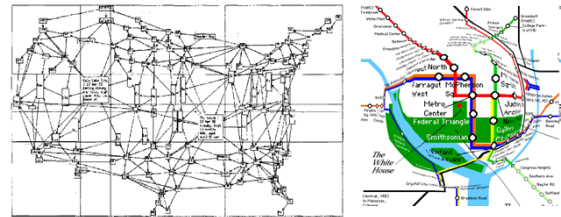
"Degree Of Interest" (DOI) function

1. focal point: f
2. distance from focus: $D(.,x)$ [$D(.,.)=0$]
3. level of detail, importance, resolution: $LOD(x)$

$$DOI(x | .) = f(g(LOD(x)) - h(D(.,x)))$$

Fisheye Graph

[Sarkar 93]



[E:\movies\infoviz\FisheveGraph.mpg](#)

Zooming User Interfaces

- Pad
- Pad++
- Jazz

連続的ズームを中心とした
情報空間のブラウズ・ナビゲーション手法

Pad

[Perlin 93]

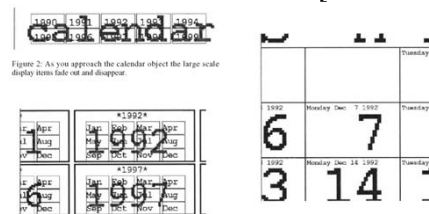


Figure 2: As you approach the calendar object the large scale display items fade out and disappear.

Figure 3: The calendar object generates smaller scale display items only for the area visible on the user's screen. Display items that are off the screen may be garbage collected and destroyed.

Figure 4: The user's annotations are created in ink that also fades out at greater magnifications.

連続ズームで階層構造を表現
ズームすると下の階層が徐々に現れる。

[E:\movies\infoviz\Pad.mpg](#)
[padwish](#)

Jazz [Bederson 00]



Java 版 SceneGraph構造
<http://www.cs.umd.edu/hcil/jazz/>

hinote

Prezi



ズームングプレゼンの製品

prezi

HCIL Maryland Univ

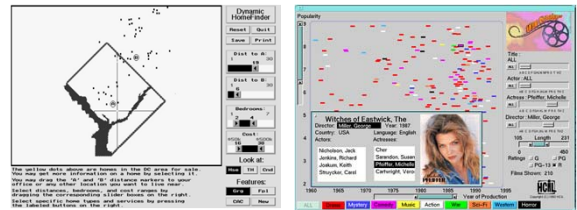
- Film Finder
- TreeMap

“Dynamic Query”

連続的に条件を変化させ結果が追従する

Home Finder, Film Finder

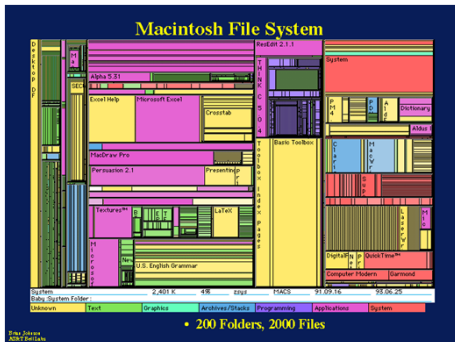
[Williamson 92, Ahlberg 94]



条件をスライダで調整すると連続的に結果が変化する

E:¥movies¥infoviz¥DynamicQuery.avi

Tree Map [Johnson 91]



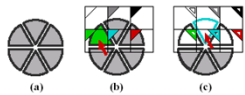
その他

- Magic Lens
- Comic Chat
- RouteMaps

Tool Glass and Magic Lenses

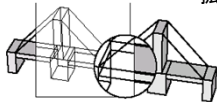
[Bier 1993]

Tool Glass = 半透明のツールパレット。両手操作。



Magic Lenses = 囲まれた範囲の表示が変化する

拡大、透視、など



E:\movies\infoviz\MagicLens.avi

Comic Chat

[Kurlander 1996]

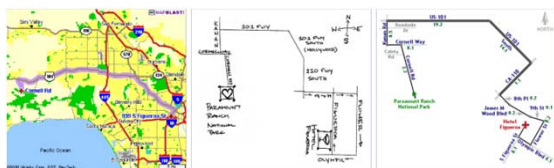


チャットの内容を自動的に漫画にして表示する。

E:\movies\infoviz\ComicChat400kbps.flv

Rendering Effective Route Maps

[Agrawala 2001]



通常の地図表示

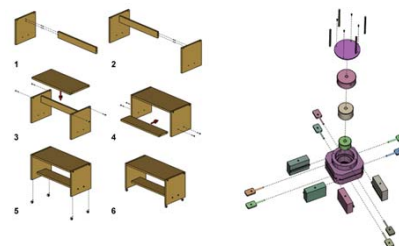
手書きの地図

工夫した地図

間違えそうなところは拡大して、単純なところは縮小して、わかりやすい地図を作成する。

Designing Effective Step-By-Step Assembly Instructions

[Agrawala 2003]



組み立て手順説明図を自動生成する。

Phosphor: Explaining Transitions in the user Interface Using Afterglow Effects

[Baudisch 2006]

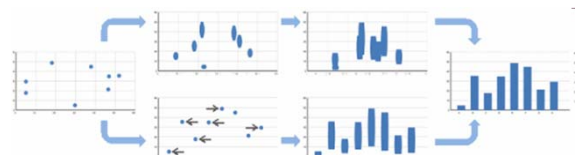


- 残像効果でUndoを支援
- アニメーション効果との比較実験など

E:\movies\infoviz\Phosphor.avi

Animated Transitions in Statistical Data Graphics

[Heer 2007]



- 異なるグラフ表現をアニメーションでつなぐ
- 変化や対応関係がわかりやすい。

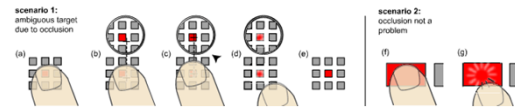
E:\movies\infoviz\AnimatedTransitions.mov

Small Screen

- shift
- escape
- halo

shift

[Vogel and Baudisch 2007]



- 指の下にあるものを拡大表示

E:movies¥infoviz¥Phosphor.avi

Escape: A Target Selection Technique Using Visually-cued Gestures



- 指の動きで選択

escape

halo

[Baudisch 2003]



- 画面の外にあるものを円周で表示

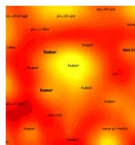
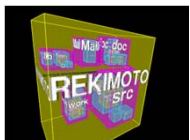
E:movies¥infoviz¥Phosphor.avi

その他

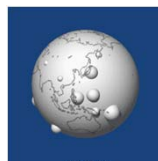
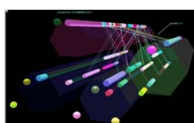
3次元視覚化

グラフィックアウト

アート系



Oh

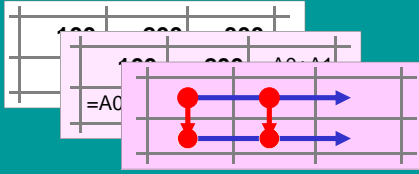


Visual Languages 98

Fluid Visualization of Spreadsheet Structures

Takeo Igarashi (Univ. of Tokyo)
Jock Mackinlay (Xerox PARC),
Bay-Wei Chang (Xerox PARC),
Polle Zellweger (Xerox PARC)

A spreadsheet has an underlying *dataflow graph* in addition to the surface numerical view.

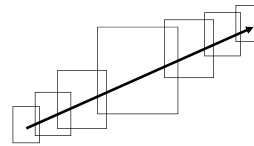


We visualize these structures using animation and interaction techniques.

www.takeo-igarashi.com/video/fluid.mpg

移動速度に応じた自動ズームによる効率的ナビゲーション

UIST 00



五十嵐 健夫 (東京大学)
Ken Hinckley (Microsoft Research)

[autozoom](http://www.microsoft.com/research/kenhinckley)

Bubble Clusters

An Interface for Manipulating Spatial Aggregation of Graphical Objects

Nayuko Watanabe, Motoi Washida,
Takeo Igarashi
(The University of Tokyo)

Target Task



Object manipulation in spatial layouts

[bubble ink](http://www.bubbleink.com)

Ninja Cursors



Masatomo Kobayashi
Takeo Igarashi

[ninja_cursors.mov](http://www.ninjacursors.com)

参考文献

Readings in Information Visualization: Using Vision to Think

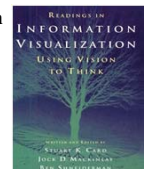
S.K. Card, J.D. MacKinlay, B.Shneiderman

情報視覚化の会社 (InXight)

<http://www.inxight.com/>

情報視覚化のチュートリアル (増井俊之)

<http://www.csl.sony.co.jp/person/masui/Visualization/>



まとめ

情報視覚化・検索システムを紹介した。

- キーコンセプト
- Focus + Context
 - Animated transition
 - Degree of Interest
 - Zooming Interfaces
 - Dynamic Query