A Day with ET

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UXISP

March 16, 2011

The World According to Tufte

- Edward Tufte
  - Writes, designs, and self-publishes his books on analytical design.
  - "The Visual Display of Quantitative Information"
  - More than 40 awards for content and design.
  - Professor Emeritus at Yale.
- Notes from a one day class, Mar 6th
  - The class was entirely academics.
  - Focus was on presenting research/data.
  - I'll adapt some of his points to user interaction.

Key Points

- Your job is to facilitate comparison
- and to illustrate causality.
- "Do whatever it takes"
- Use "Supergraphics"
  - *Add* information to clarify.
  - Implicit — trust in the information consumer.
- (Tufte would hate this slide.)

Sparklines: Intense, Simple, Word-Sized Graphics

A typical data display is a noun and a value, usually the current value:

glucose 128

Often, the current value is better understood the context. Is it rising? falling? steady? A "sparkline" address that need, in very little space:

 glucose 128

Tying the current reading to the graph with color makes the connection more apparent:

 glucose 128

Added embellishments specific to the data (in this case, a "normal range") offer a great deal of information in a word-sized space:

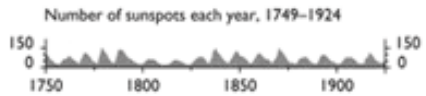
 glucose 128

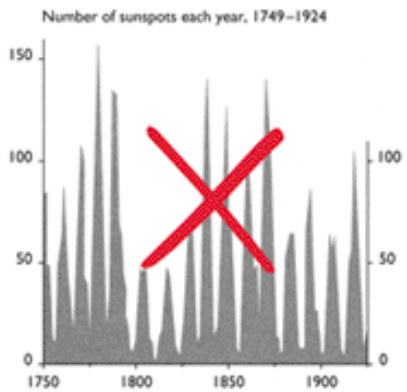
Scales & Aspect Ratio

		1999.1.1	65 months	2004.4.28	low	high		2003.4.28	12 months	2004.4.28	low	high
Euro foreign exchange	$	1.1608		1.1907	.8252	1.2858	$	1.1025		1.1907	1.0783	1.2858
Euro foreign exchange	¥	121.32		130.17	89.30	140.31	¥	132.54		130.17	124.80	140.31
Euro foreign exchange	£	0.7111		0.6665	.5711	0.7235	£	0.6914		0.6665	0.6556	0.7235

- Highs and lows help with Y-axis scaling.
- Tradeoff – consistent scaling, human perception

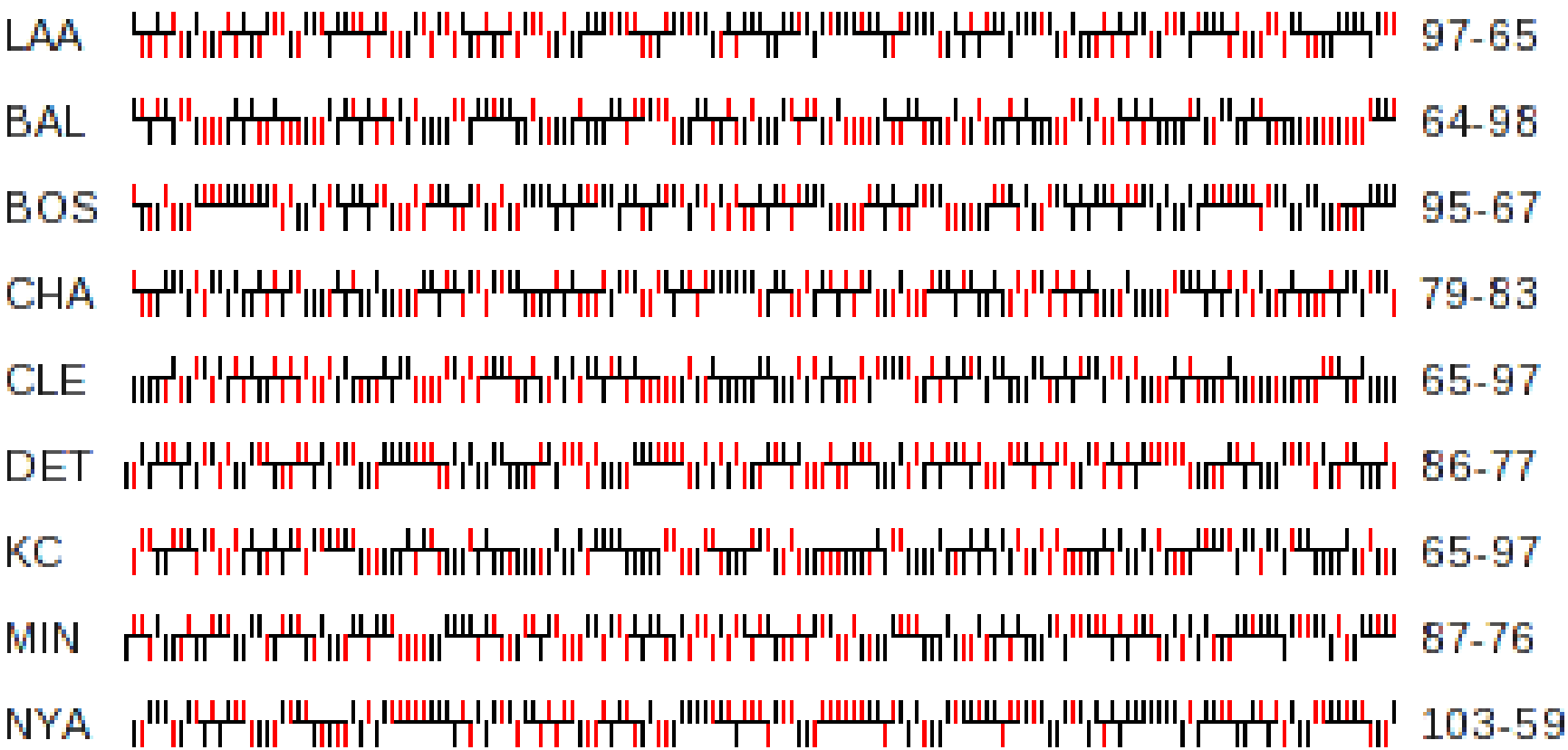
That is, variations in slopes are best detected when the slopes are around 45°, uphill or downhill.[4] To put this idea informally, the aspect ratio should be such that time-series graphics tend toward a lumpy profile (below) rather than a spiky profile (at right) or a flat profile. Both graphs here show the same data. The aspect ratio for the lumpy graphic is chosen in accord with the 45° rule.





Baseball Sparklines — Seasons at a glance?

Key: Upward bars = wins, downward bars = losses, underline = home game



Cancer Mortality, as Reported

	Relative survival rate, % (SE)			
	5 years	10 years	15 years	20 years
Cancer site				
Oral cavity and pharynx	56·7 (1·3)	44·2 (1·4)	37·5 (1·6)	33·0 (1·8)
Oesophagus	14·2 (1·4)	7·9 (1·3)	7·7 (1·6)	5·4 (2·0)
Stomach	23·8 (1·3)	19·4 (1·4)	19·0 (1·7)	14·9 (1·9)
Colon	61·7 (0·8)	55·4 (1·0)	53·9 (1·2)	52·3 (1·6)
Rectum	62·6 (1·2)	55·2 (1·4)	51·8 (1·8)	49·2 (2·3)
Liver and intrahepatic bile duct	7·5 (1·1)	5·8 (1·2)	6·3 (1·5)	7·6 (2·0)
Pancreas	4·0 (0·5)	3·0 (0·5)	2·7 (0·6)	2·7 (0·8)
Larynx	68·8 (2·1)	56·7 (2·5)	45·8 (2·8)	37·8 (3·1)
Lung and bronchus	15·0 (0·4)	10·6 (0·4)	8·1 (0·4)	6·5 (0·4)
Melanomas	89·0 (0·8)	86·7 (1·1)	83·5 (1·5)	82·8 (1·9)
Breast	86·4 (0·4)	78·3 (0·6)	71·3 (0·7)	65·0 (1·0)
Cervix uteri	70·5 (1·6)	64·1 (1·8)	62·8 (2·1)	60·0 (2·4)
Corpus uteri and uterus, NOS	84·3 (1·0)	83·2 (1·3)	80·8 (1·7)	79·2 (2·0)
Ovary	55·0 (1·3)	49·3 (1·6)	49·9 (1·9)	49·6 (2·4)
Prostate	98·8 (0·4)	95·2 (0·9)	87·1 (1·7)	81·1 (3·0)
Testis	94·7 (1·1)	94·0 (1·3)	91·1 (1·8)	88·2 (2·3)
Urinary bladder	82·1 (1·0)	76·2 (1·4)	70·3 (1·9)	67·9 (2·4)
Kidney and renal pelvis	61·8 (1·3)	54·4 (1·6)	49·8 (2·0)	47·3 (2·6)
Brain and other nervous system	32·0 (1·4)	29·2 (1·5)	27·6 (1·6)	26·1 (1·9)
Thyroid	96·0 (0·8)	95·8 (1·2)	94·0 (1·6)	95·4 (2·1)
Hodgkin's disease	85·1 (1·7)	79·8 (2·0)	73·8 (2·4)	67·1 (2·8)
Non-Hodgkin lymphomas	57·8 (1·0)	46·3 (1·2)	38·3 (1·4)	34·3 (1·7)
Multiple myeloma	29·5 (1·6)	12·7 (1·5)	7·0 (1·3)	4·8 (1·5)
Leukaemias	42·5 (1·2)	32·4 (1·3)	29·7 (1·5)	26·2 (1·7)

Rates derived from SEER 1973–98 database (both sexes, all ethnic groups).[12]
NOS=not otherwise specified.

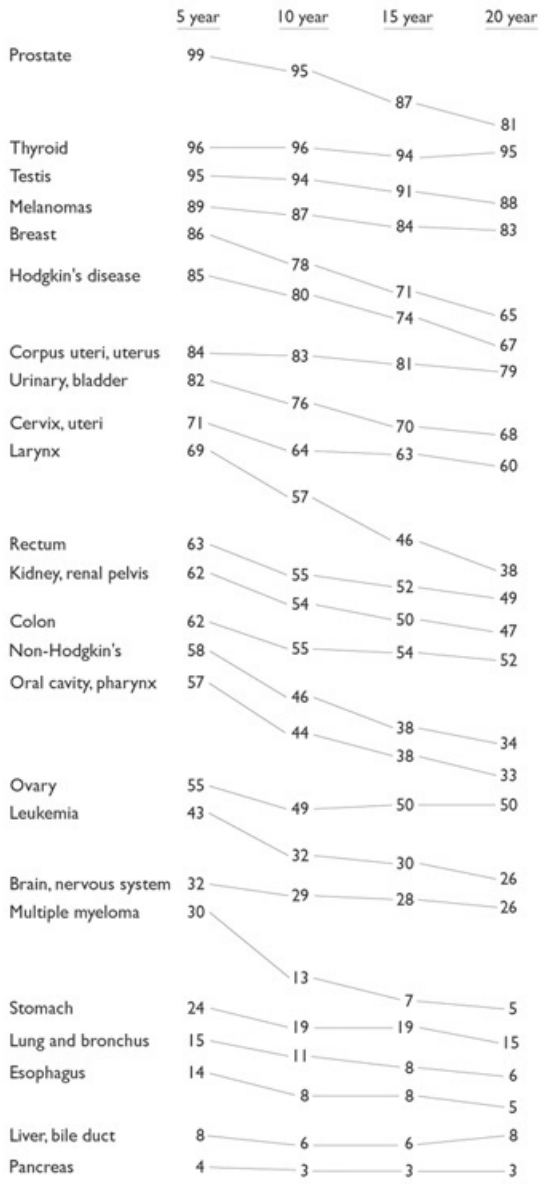
Table 4: **Most recent period estimates of relative survival rates, by cancer site**

Cancer Mortality, improved

Estimates of relative survival rates, by cancer site

	% survival rates and standard errors							
	5 year		10 year		15 year		20 year	
Prostate	98.8	0.4	95.2	0.9	87.1	1.7	81.1	3.0
Thyroid	96.0	0.8	95.8	1.2	94.0	1.6	95.4	2.1
Testis	94.7	1.1	94.0	1.3	91.1	1.8	88.2	2.3
Melanomas	89.0	0.8	86.7	1.1	83.5	1.5	82.8	1.9
Breast	86.4	0.4	78.3	0.6	71.3	0.7	65.0	1.0
Hodgkin's disease	85.1	1.7	79.8	2.0	73.8	2.4	67.1	2.8
Corpus uteri, uterus	84.3	1.0	83.2	1.3	80.8	1.7	79.2	2.0
Urinary, bladder	82.1	1.0	76.2	1.4	70.3	1.9	67.9	2.4
Cervix, uteri	70.5	1.6	64.1	1.8	62.8	2.1	60.0	2.4
Larynx	68.8	2.1	56.7	2.5	45.8	2.8	37.8	3.1
Rectum	62.6	1.2	55.2	1.4	51.8	1.8	49.2	2.3
Kidney, renal pelvis	61.8	1.3	54.4	1.6	49.8	2.0	47.3	2.6
Colon	61.7	0.8	55.4	1.0	53.9	1.2	52.3	1.6
Non-Hodgkin's	57.8	1.0	46.3	1.2	38.3	1.4	34.3	1.7
Oral cavity, pharynx	56.7	1.3	44.2	1.4	37.5	1.6	33.0	1.8
Ovary	55.0	1.3	49.3	1.6	49.9	1.9	49.6	2.4
Leukemia	42.5	1.2	32.4	1.3	29.7	1.5	26.2	1.7
Brain, nervous system	32.0	1.4	29.2	1.5	27.6	1.6	26.1	1.9
Multiple myeloma	29.5	1.6	12.7	1.5	7.0	1.3	4.8	1.5
Stomach	23.8	1.3	19.4	1.4	19.0	1.7	14.9	1.9
Lung and bronchus	15.0	0.4	10.6	0.4	8.1	0.4	6.5	0.4
Esophagus	14.2	1.4	7.9	1.3	7.7	1.6	5.4	2.0
Liver, bile duct	7.5	1.1	5.8	1.2	6.3	1.5	7.6	2.0
Pancreas	4.0	0.5	3.0	1.5	2.7	0.6	2.7	0.8

Cancer Mortality, "Do whatever it takes."



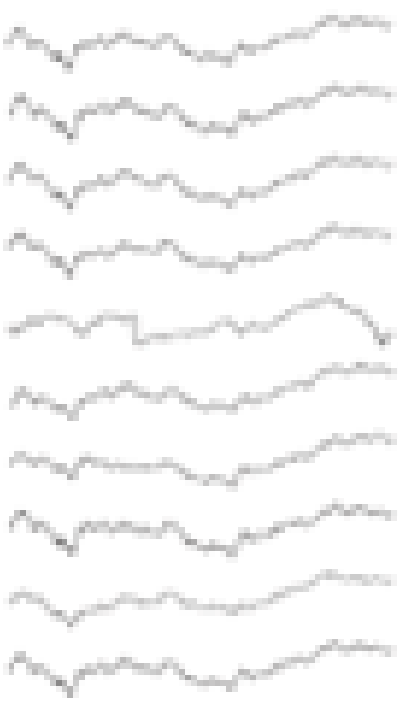
Which fund should you buy?

Popular mutual funds, based on assets under management.

ASSETS (MIL.)	FUND	RETURN 4 WKS.	2003	3-YR.	5-YR.
$64,368	Vanguard Index 500 Index	– 2.0%	+12.2%	– 11.7%	– 0.8%
62,510	Fidelity Magellan	– 2.1	+11.3	– 12.9	– 0.2
50,329	Amer A Invest Co of Am	– 1.2	+ 9.4	– 3.9	+ 4.0
47,355	Amer A WA Mutual Inv	– 1.5	+ 9.9	+ 0.8	+ 3.0
40,500	PIMCO Instl Tot Return	– 2.3	+ 2.4	+ 9.4	+ 7.6
37,641	Amer A Grow Fd of Amer	– 2.9	+14.1	– 11.0	+ 7.4
31,161	Fidelity Contrafund	– 1.0	+10.7	– 6.5	+ 3.0
28,296	Fidelity Growth & Inc	– 1.8	+ 8.2	– 8.7	– 0.1
25,314	Amer A Inc Fund of Amer	– 0.5	+ 9.9	+ 5.5	+ 5.4
24,155	Vanguard Instl Index	– 2.0	+12.3	– 11.6	– 0.7

Looks like a tough decision.

Small Multiples allow comparison



$64,368	Vanguard 500 Index	−2.0%	+12.2%	−11.7%	−0.8%
62,510	Fidelity Magellan	−2.1	+11.3	−12.9	−0.2
50,329	AmerA Invest Co Am	−1.2	+ 9.4	− 3.9	+4.0
47,355	Amer A WA Mutual Inv	−1.5	+ 9.9	+ 0.8	+3.0
40,500	PIMCO InstlTot Return	−2.3	+ 2.4	+ 9.4	+7.6
37,641	Amer A Grow Fd Amer	−2.9	+14.1	−11.0	+7.4
31,161	Fidelity Contrafund	−1.0	+10.7	− 6.5	+3.0
28,296	Fidelity Growth & Inc	−1.8	+ 8.2	− 8.7	−0.1
25,314	Amer A Inc Fund Amer	−0.5	+ 9.9	+ 5.5	+5.4
24,155	Vanguard Instl Index	−2.0	+12.3	−11.6	−0.7

They're all pretty much the same.

Micro / Macro

"If we're going to make a mark, it might as well be a meaningful one." – John Tukey

Stem & Leaf Plots

5	8
6	34
7	2337
8	33679
9	344

Digits take the place of an empty bar. You get a histogram to show distributions, the exact data, *and* you've saved 15 characters compared to a table.

Shouldn't we simplify?

"Clutter and confusion are failures of design, not attributes of information."

- Words (information) become easier to read when individual characters (data elements) are distinguished, not simplified.
- THIS TEXT IS DIFFICULT TO READ.
- This text can be read more easily.

Laying & Separation

- How can we present more information without confusion.
- Layering – but beware the interaction of layers
- Use color subtly.
- Use gridlines sparingly (if at all).
- Beware of "$1 + 1 = 3$" effects.

Annotation

Annotation is a powerful way to indicate causality.

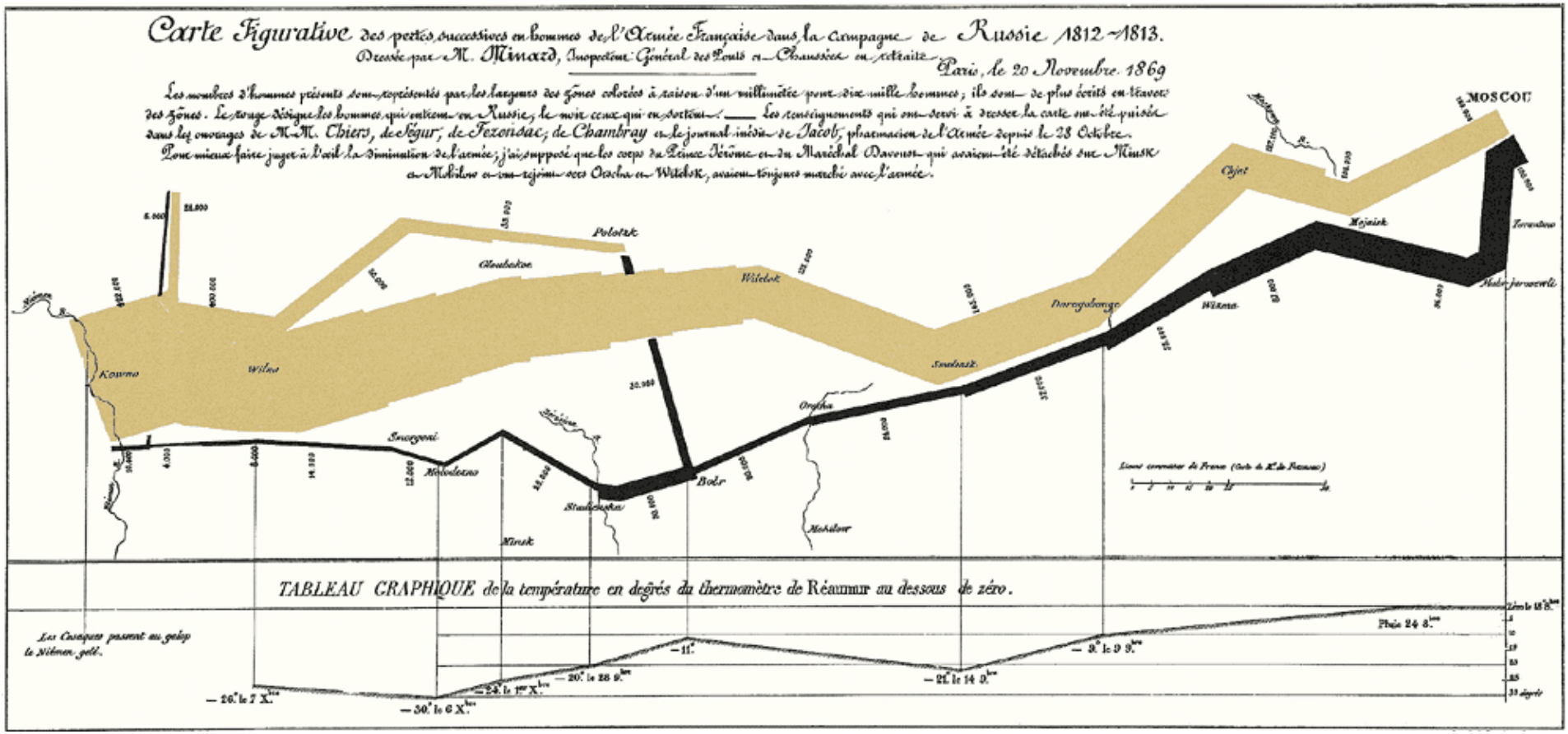
- In presentations
  - Add labeled arrows.
  - Circle anomalies.
  - Put explanations near the data.
- In interfaces
  - Hover text explanations.
  - Overlay help information.
    - Separate help text is *so* much easier.
    - Do whatever it takes.

Cursed Treasue Tutorial

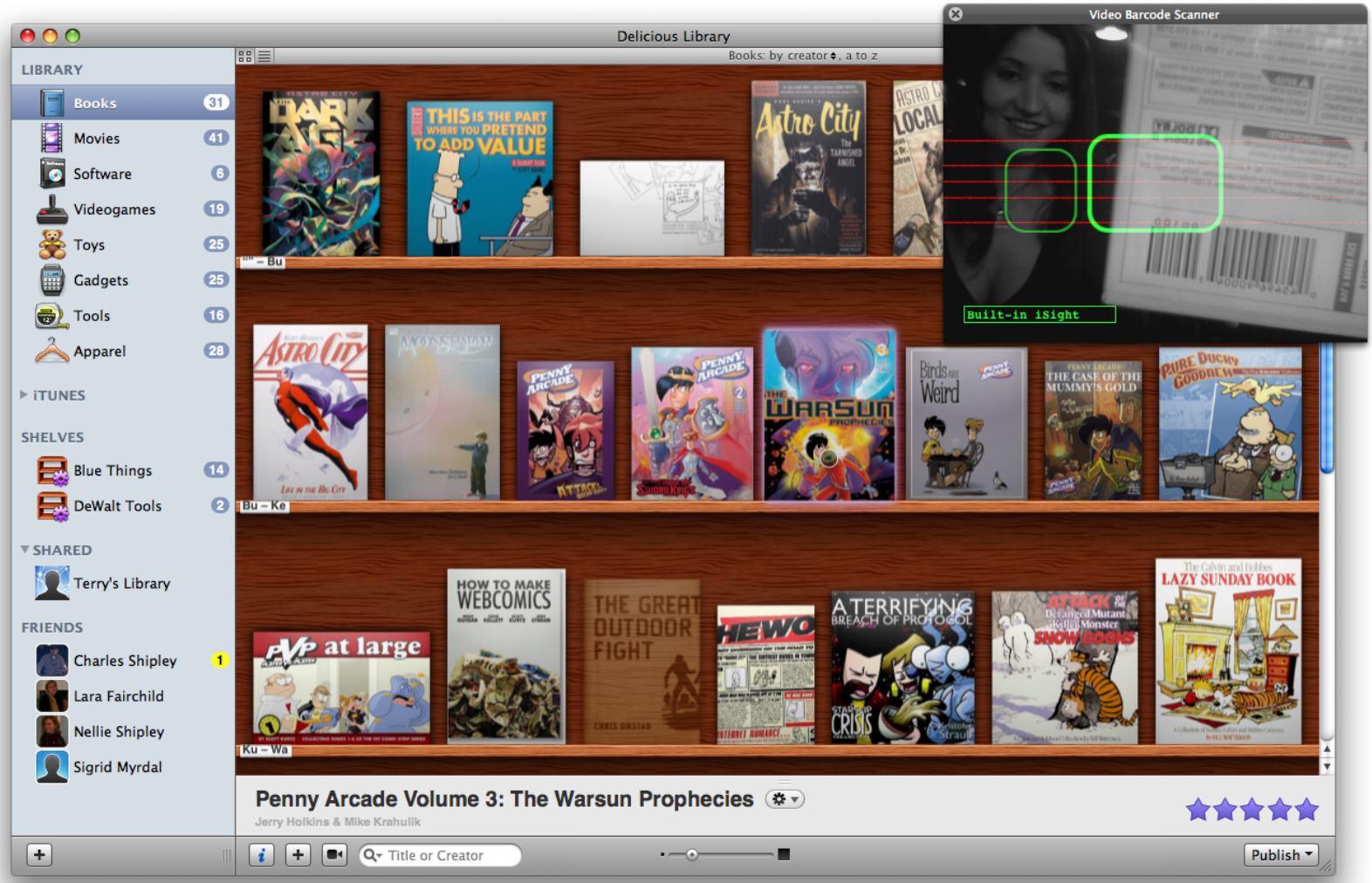
Find your "Supergraphic"

- Applies equally well to GUI design.
- Applications convey information to facilitate understanding and choice.
- How can you present your applications's core information in an understandable way? An *interesting* way?

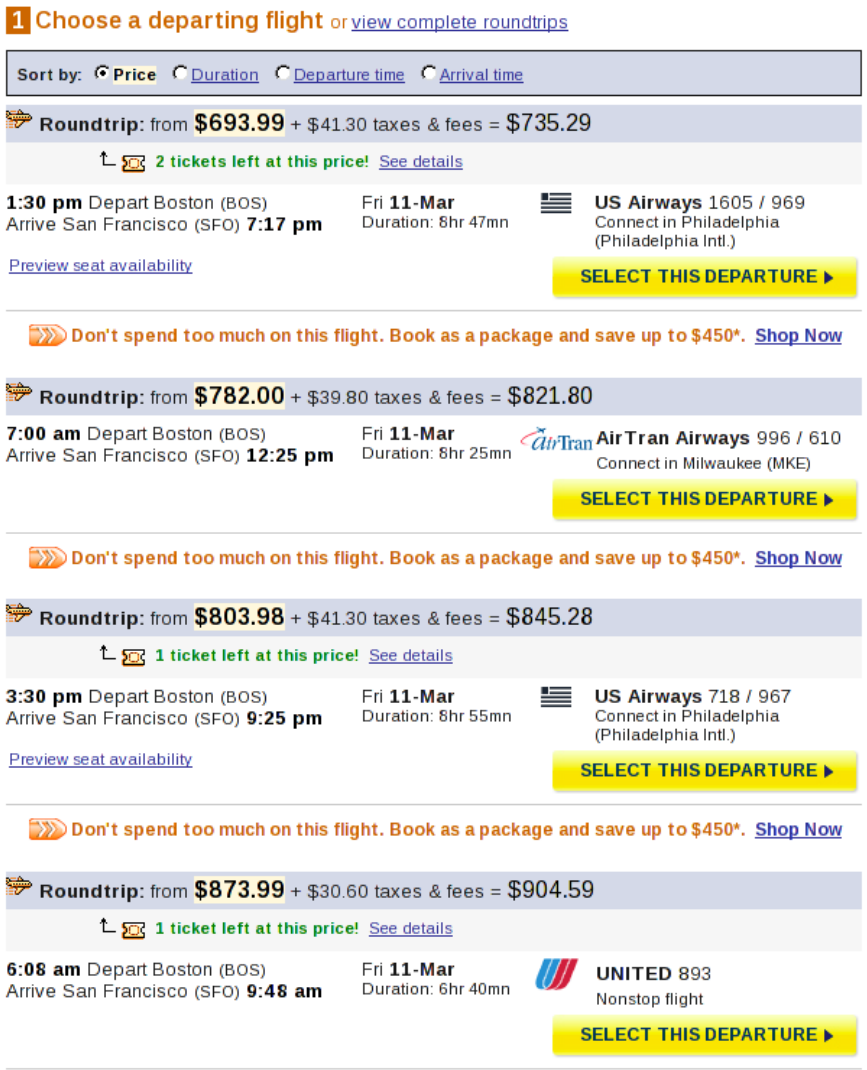
Napolean's Disastrous Retreat



Delicious Library



Expedia's list is not a supergraphic.



Monotonous, uncomparable.

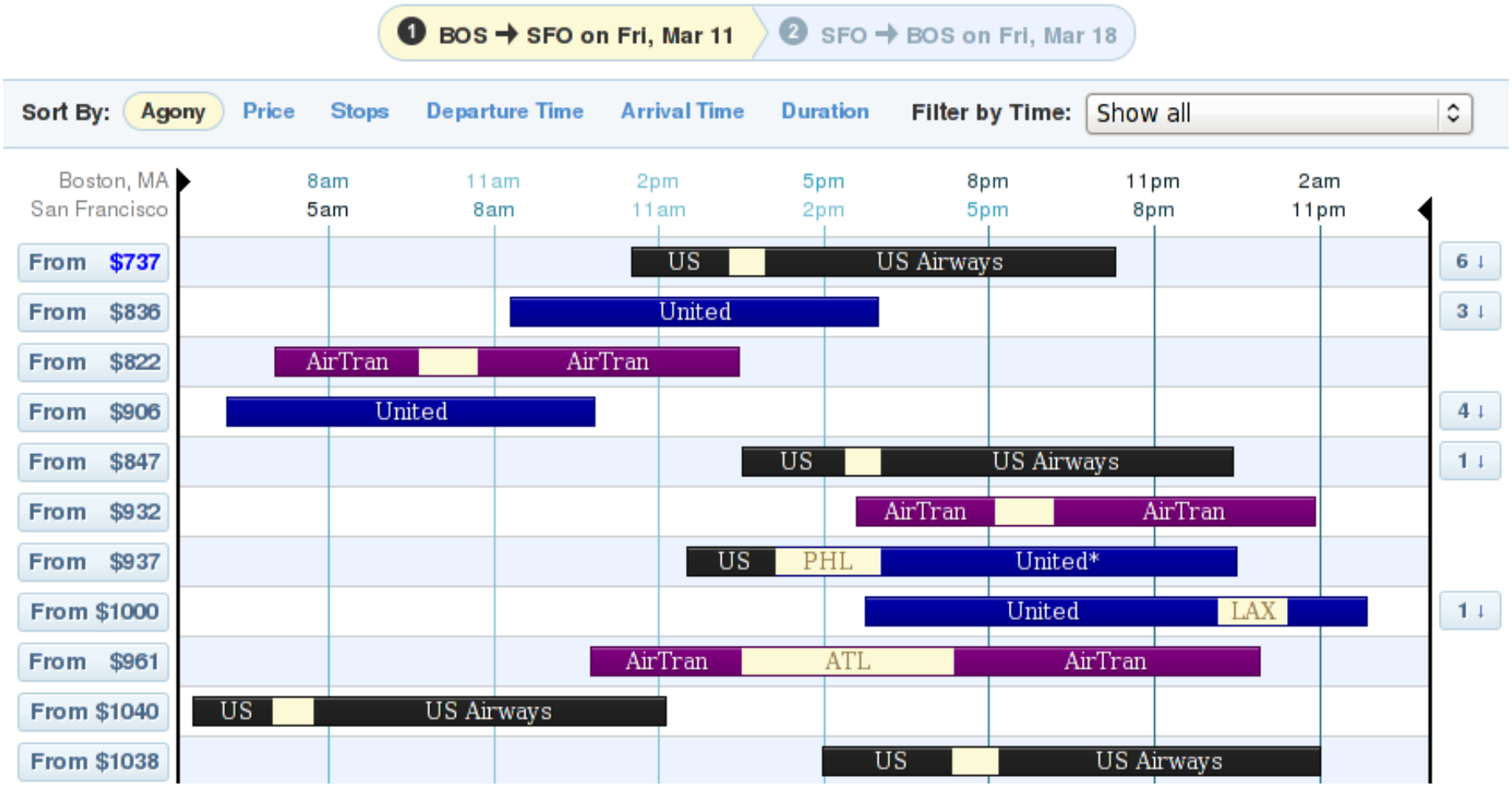
The chart is a bit better...

	Mix & Match Airlines	US Airways	AirTran Airways	UNITED	Delta	
Nonstop	from **$1,268** $1,289 total	---	---	---	---	
1 stop	from **$693** $735 total	from **$693** $735 total	from **$782** $821 total	from **$990** $1,022 total	from **$1,215** $1,257 total	
2+ stops	from **$780** $827 total	from **$780** $827 total	---	from **$960** $1,003 total	from **$1,098** $1,148 total	

Show mo

But it presumes price and airline are all that matters.

Hipmunk has a supergraphic.



Conveys more information. Sorts by "Agony."

Advice on input

Touch any item for more information.

English | Español | Deutsch | Français | Italiano | 中文 | 日本語

INFORMATION

art information
bookstores
calendar
copyrights
film programs
gallery talks
guides
hours
photography
security
slide lectures
special programs
Sunday concerts
tours
wheelchairs/strollers

FACILITIES

cascade espresso bar
checkroom
concourse buffet
elevators
facility for disabled
first aid
garden cafe
lost and found
restrooms
stairways
telephones
terrace cafe

PERMANENT WORKS

American Painting
British Painting
Dutch Painting
European Sculpture and Decorative Arts, 14th–19th century
Flemish Painting
French Painting and Sculpture
German Painting
Information Design
Italian Painting and Sculpture
Netherlandish Painting
Spanish Painting
Twentieth-century Painting and Sculpture

SPECIAL EXHIBITIONS, NOVEMBER 2004

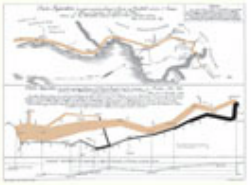

Architectural Designs of Humphry Repton


Henri Matisse: *Les periennes*, 1919


Henri Rousseau: French Winged Confections

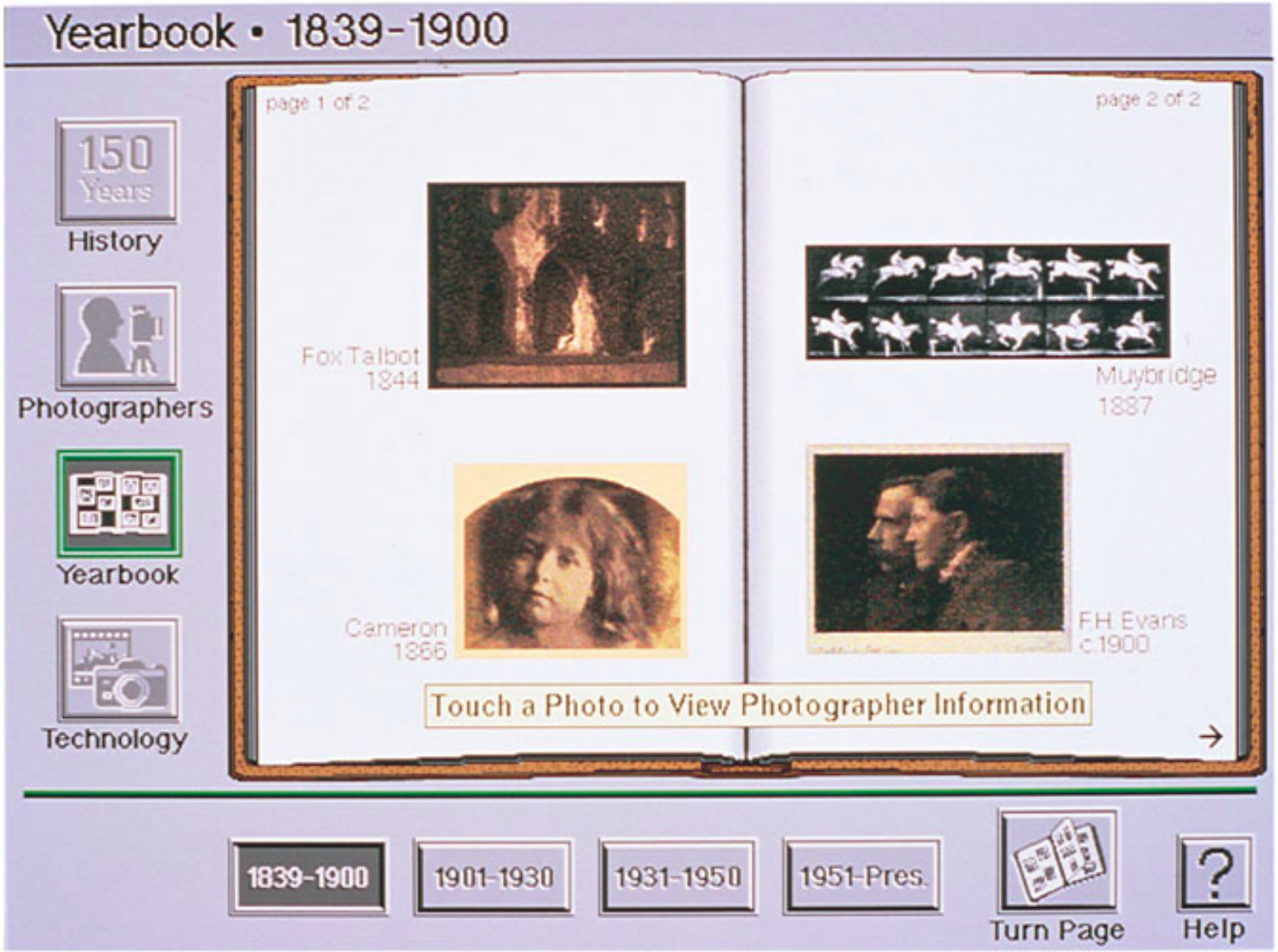

Susan Rothenberg: Recent Paintings


The Great Age of Tedious British Watercolors: 1750 to 1880


Information Designs of Charles Joseph Minard

Use your resolution. Use wide/flat hierarchy.

Eliminate the interface



For more...

- `http://www.edwardtufte.com`
- Strongly moderated forums — lots of useful ideas/information
- A few that seem pertinent to HCI
  - iPhone interface design
  - Windows phone interface design
  - Sparklines: Theory and Practice
  - Election Data Displays
  - Links, Causal Arrows, Networks
  - Analog gauges and the user interface
  - Interface Hall of Fame/Shame