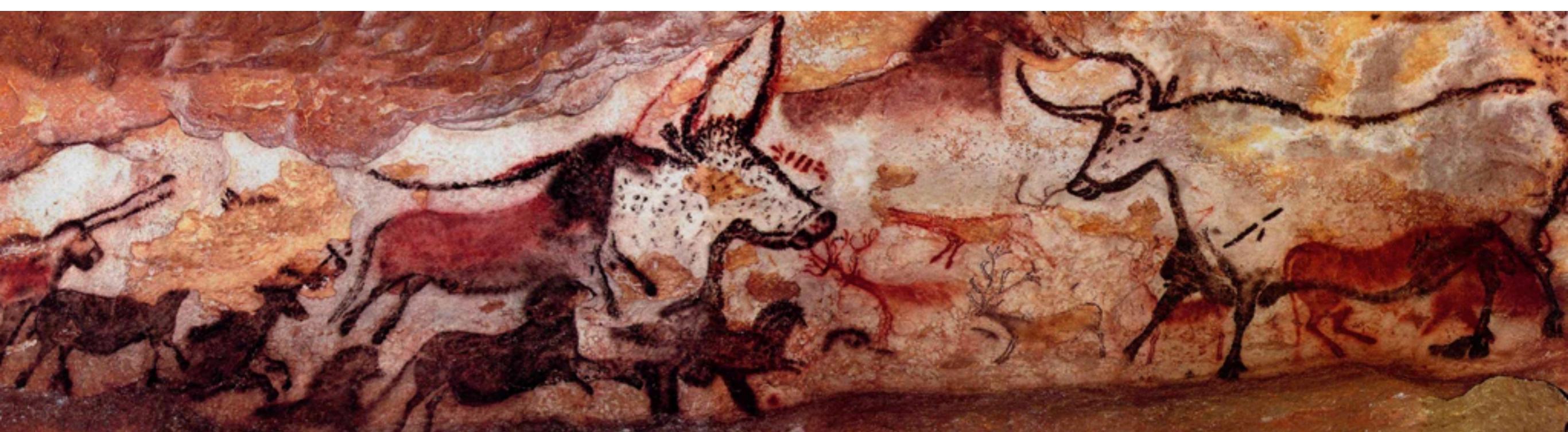


Rethinking Data Visualization: From Dynamic Illustration to Analytic Narrative

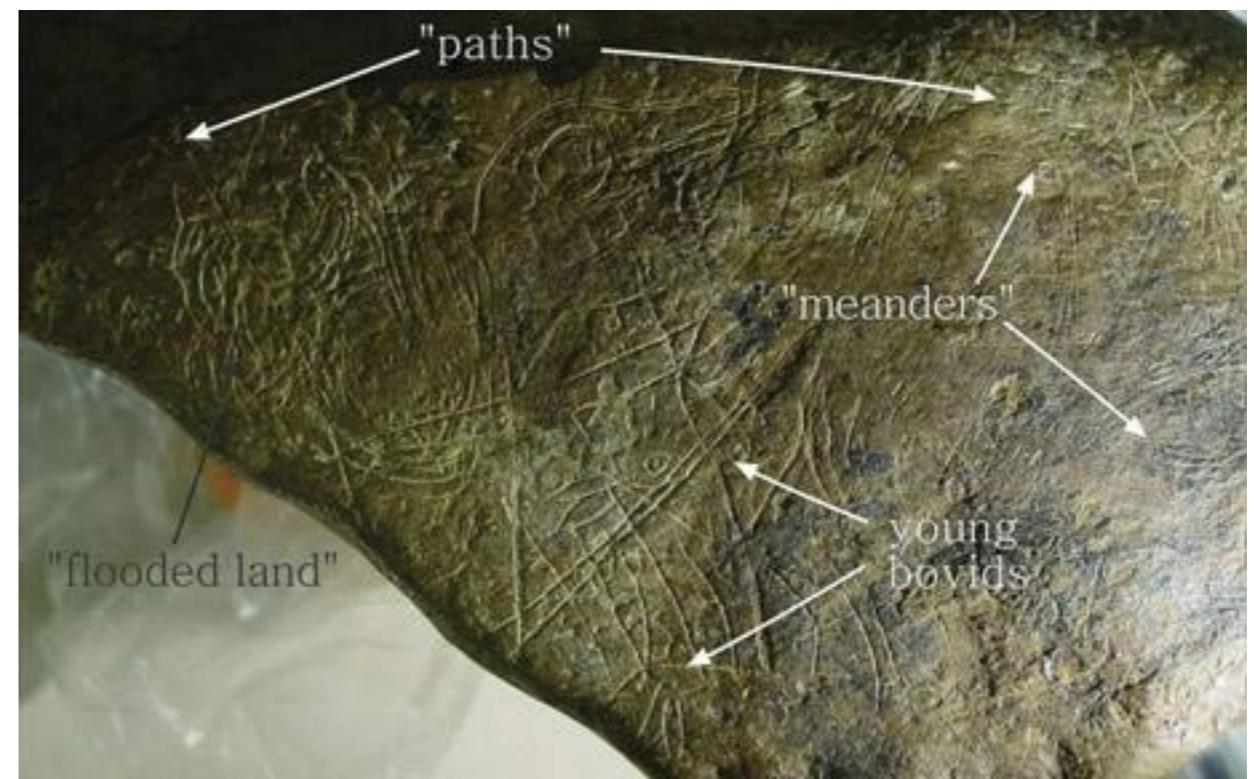
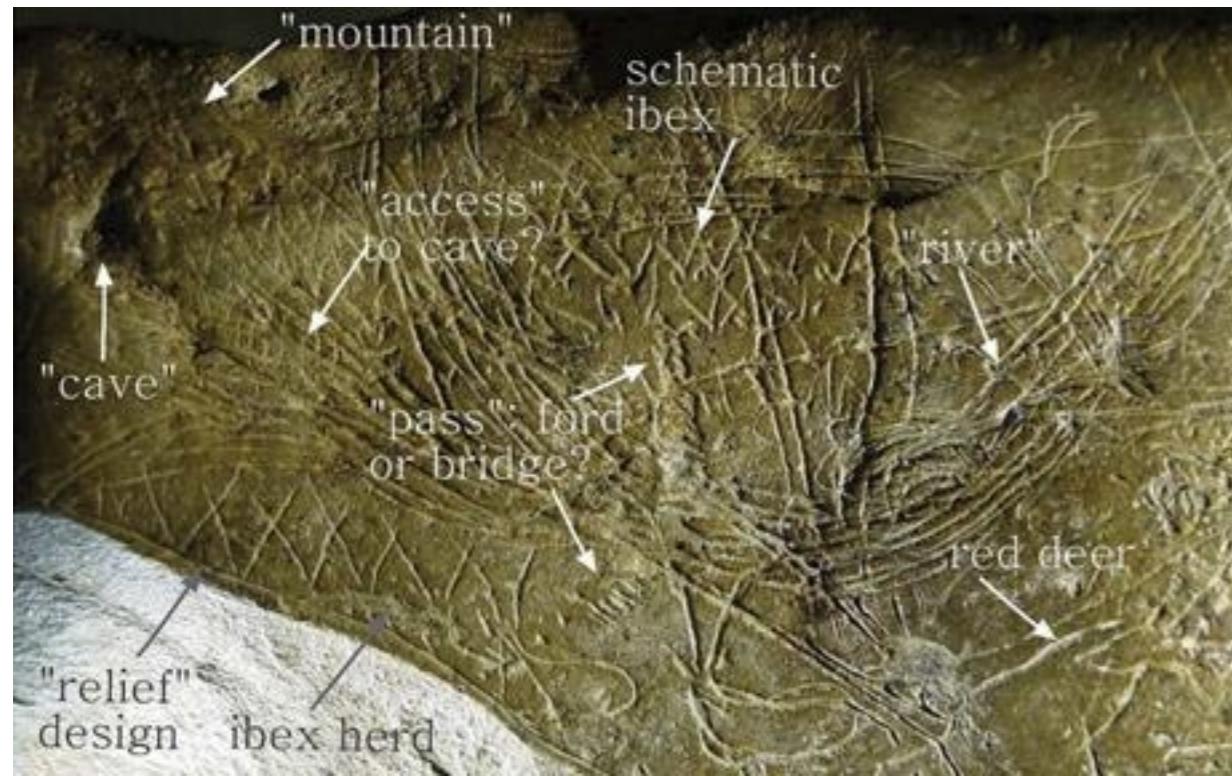
Ruben R. Puentedura, Ph.D.

Beginnings







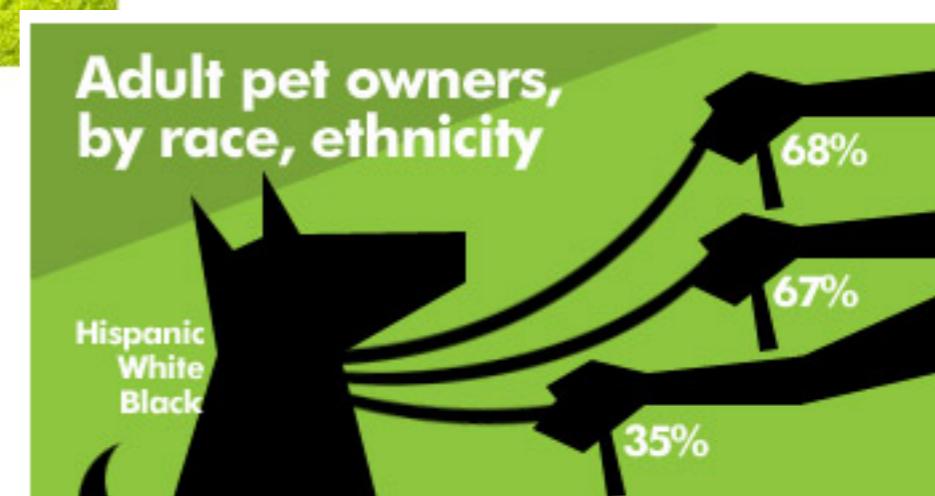
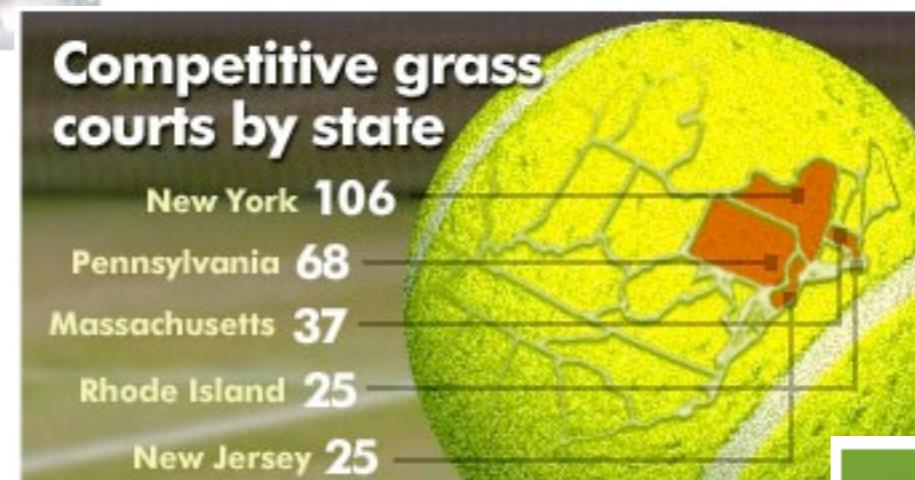
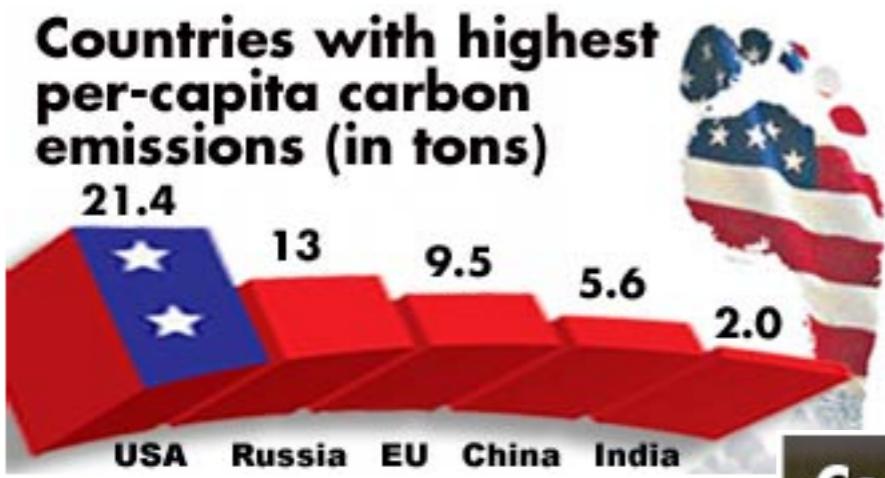


Thoughts from Tufte

Integrity

- No more dimensions than the data contains;
- No deceptiveness in proportionality of representation to content;
- No data out of context;
- No unlabeled data.

What Not To Do



What To Aspire To

Figurative Map of the successive losses in men of the army that Hannibal led from Spain to Italy while crossing the Gauls (according to Polybius).

Drawn up by M. Minard, Inspector General of Bridges and Roads in retirement.
Paris, November 20, 1869.

Legend.

The numbers of men remaining with Hannibal are represented by the width of the colored zones at a rate of one millimeter for ten thousand men; they are further written across the zones.

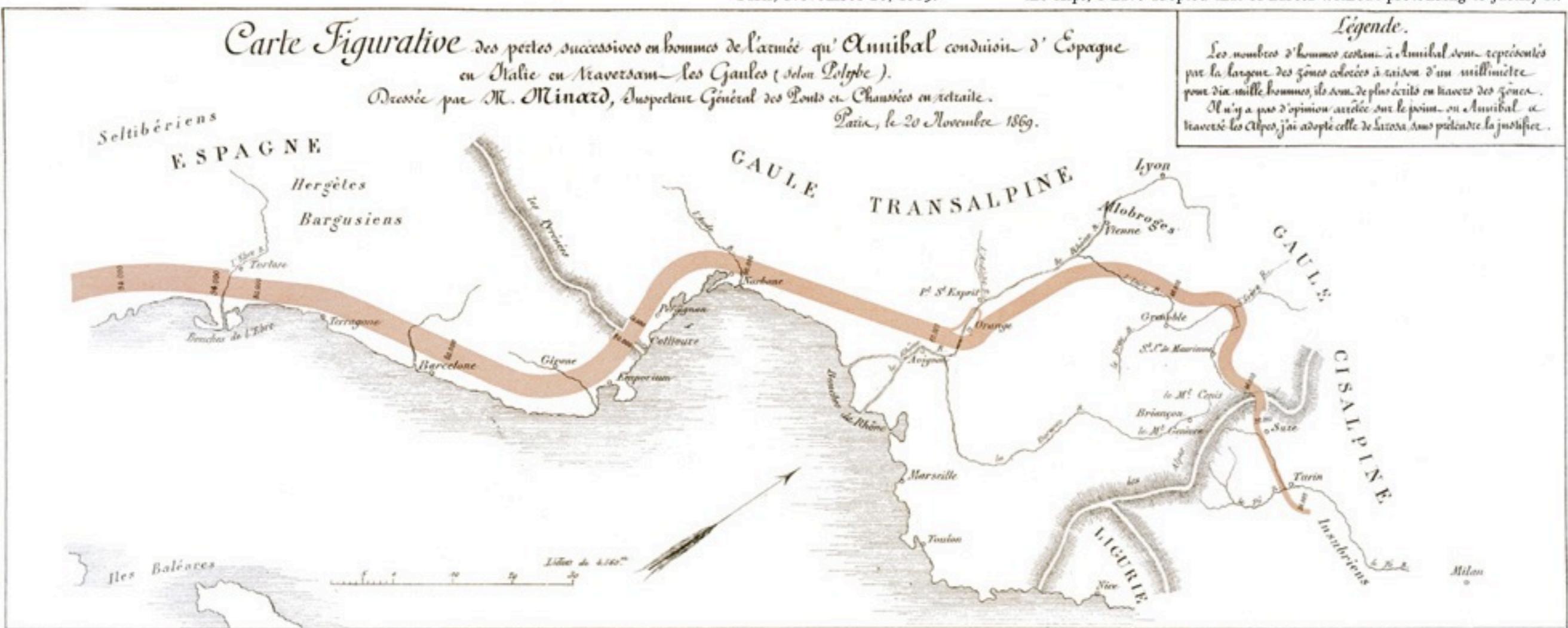
There is no final opinion on the point where Hannibal crossed the Alps; I have adopted that of Larosa without pretending to justify it.

*Carte Figurative des pertes successives en hommes de l'armée qu'Hannibal conduisit d'Espagne en Italie en traversant les Gaules (selon Polybe).
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.
Paris, le 20 Novembre 1869.*

Légende.

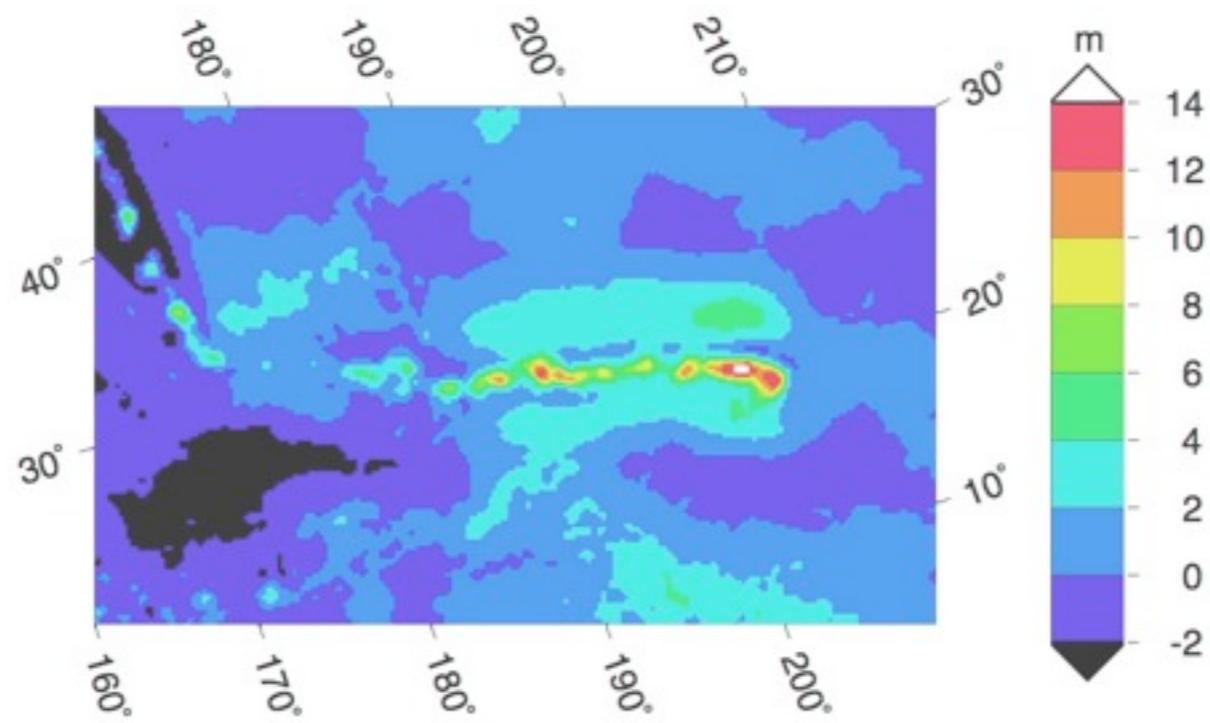
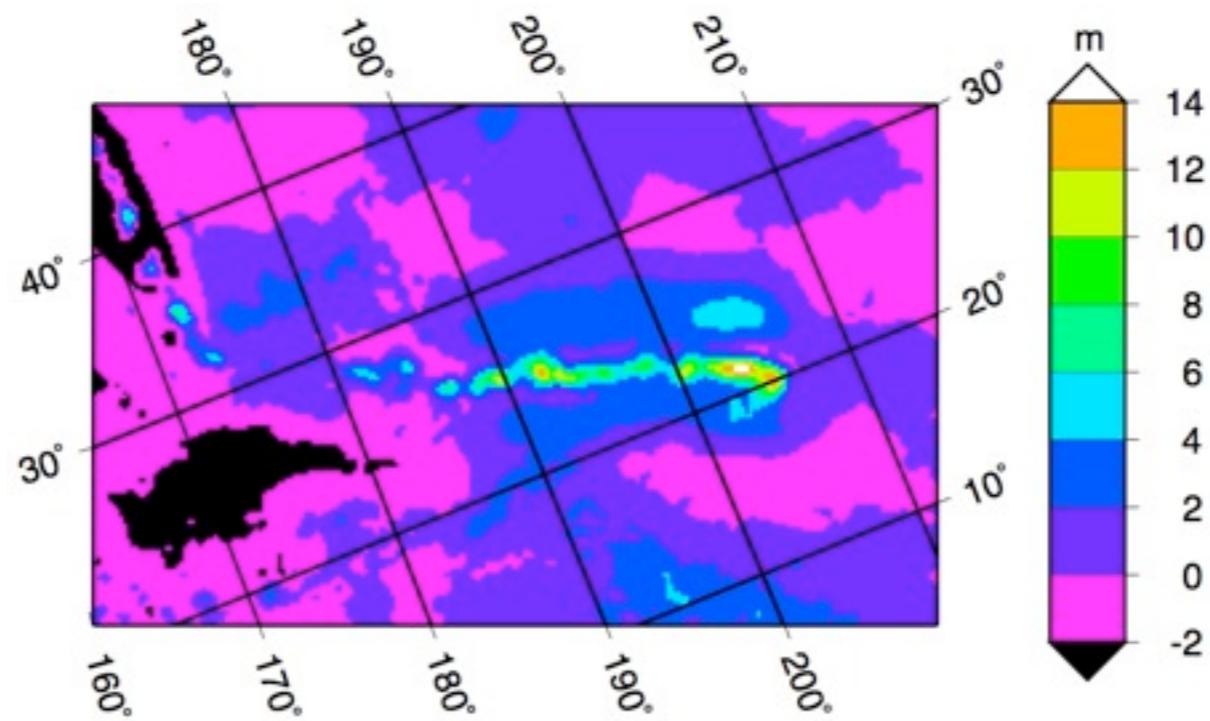
Les nombres d'hommes restants à Annibal sont représentés par la largeur des zones colorées à raison d'un millimètre pour dix mille hommes, ils sont de plus écrits en travers des zones.

Il n'y a pas d'opinion arrêtée sur le point où Annibal a traversé les Alpes, j'ai adopté celle de Larosa sans prétendre la justifier.



Excellence

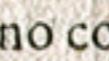
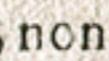
- Avoid chartjunk;
- Maximize the data-to-ink ratio;
- Look for multifaceted representations.
 - In particular: look for small multiples.



2000: State-level support (orange) or opposition (green) on school vouchers, relative to the national average of 45% support

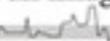
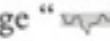


Orange and green colors correspond to states where support for vouchers was greater or less than the national average. The seven ethnic/religious categories are mutually exclusive. "Evangelicals" includes Mormons as well as born-again Protestants. Where a category represents less than 1% of the voters of a state, the state is left blank.

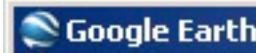
cogniti à noi, mà da ogni nostra immaginazione. Ma quella che pone Apelle del mostrarsi Saturno hora oblongo , & hor' accompagnato con due stelle à i fianchi , creda pur V. S. ch'è stata imperfezione dello strumento, ò dell'occhio del riguardante, perche sendo la figura di Saturno così  , come mostrano alle perfette viste i perfetti strumenti , doue manca tal perfezione apparisce così  non si distinguendo perfettamente la separazione , e figura delle tre stelle ; ma io che mille volte in diuersi tempi con eccellente strumento l'ho riguardato, posso assicurarla , che in esso non si è scorta mutazione alcuna, e la ragione stessa fondata sopra l'esperienze, che hauia-

*Diuersità
nel veder
Saturno
cagionata
da diesso*

ra di Saturno così  , come i perfetti strumenti , doue manca tal perfezione apparisce così  non si distinguendo perfettamente la separazione , e figura delle tre stelle ; ma io che mille volte in diuersi tempi con eccellente strumento l'ho riguardato, posso assicurarla , che in esso non si è scorta mutazione alcuna, e la ragione stessa fondata sopra l'esperienze, che hauia-

Wordlike sparklines should often be embedded in text and tables, which in turn may provide a helpful context for interpreting the rather free-floating sparklines. Text and data surrounding the quantitatively inexact sparkline may now and then show more precise numbers and scaling information in an image/text/number format, as we saw for the glucose sparkline:  glucose 128 . Of course the wordlike quality of sparklines creates the wonderful possibility of *writing with data graphics*. Thus the image “  ” means like a word and shows like a graphic “the last 80 readings of glucose, compared to normal limits, with the most recent reading indicated by red.”

The Rise of Interactivity



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Global Awareness



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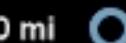
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If research organizations and journals linked the raw data behind papers to social software tools such as Swivel and Many Eyes, it would have considerable value to the scientific community as a whole. — Declan Butler, Nature

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franco moretti

**GRAPHS
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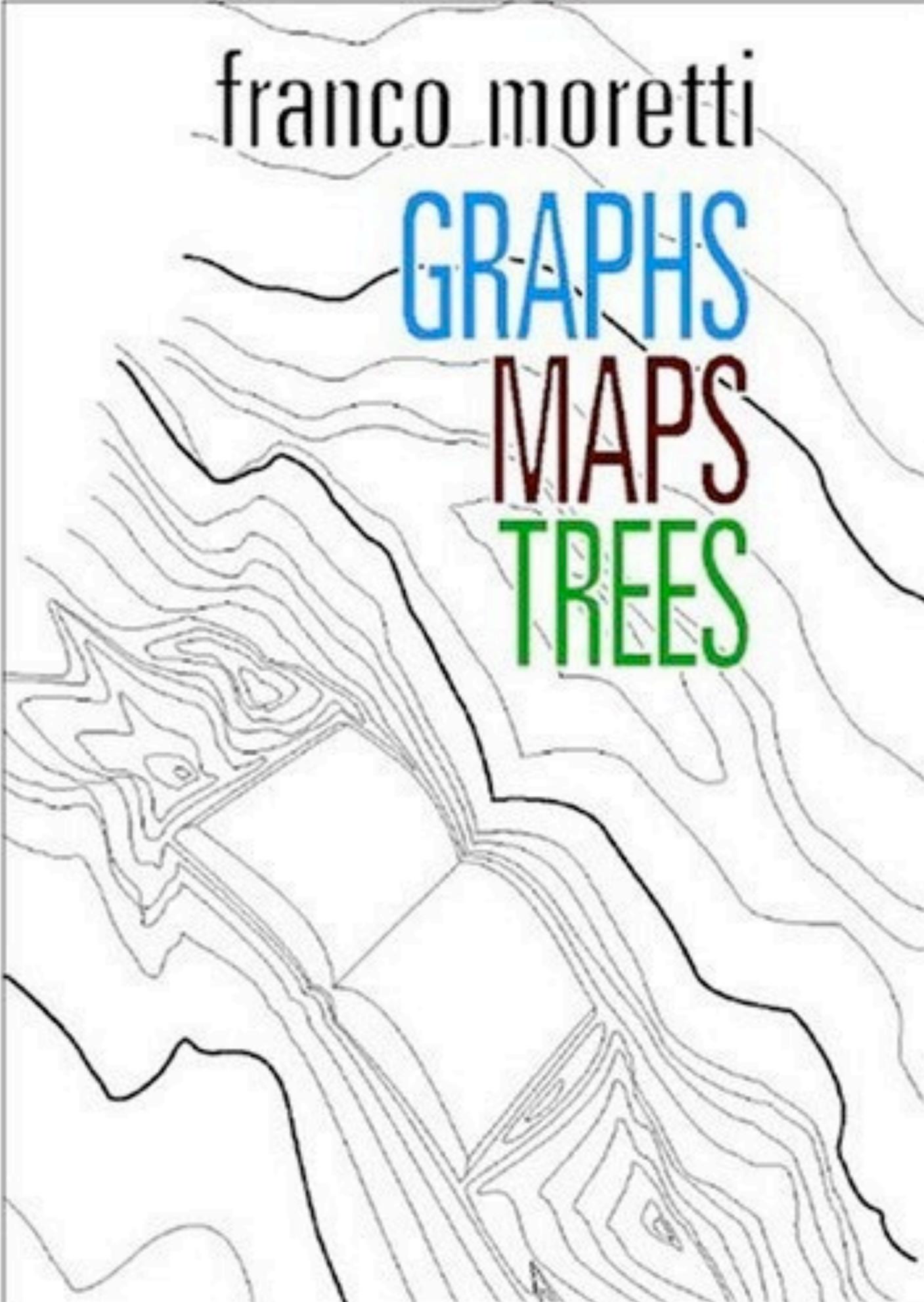


FIGURE 10: *Protagonists of Parisian novels, and objects of their desire*



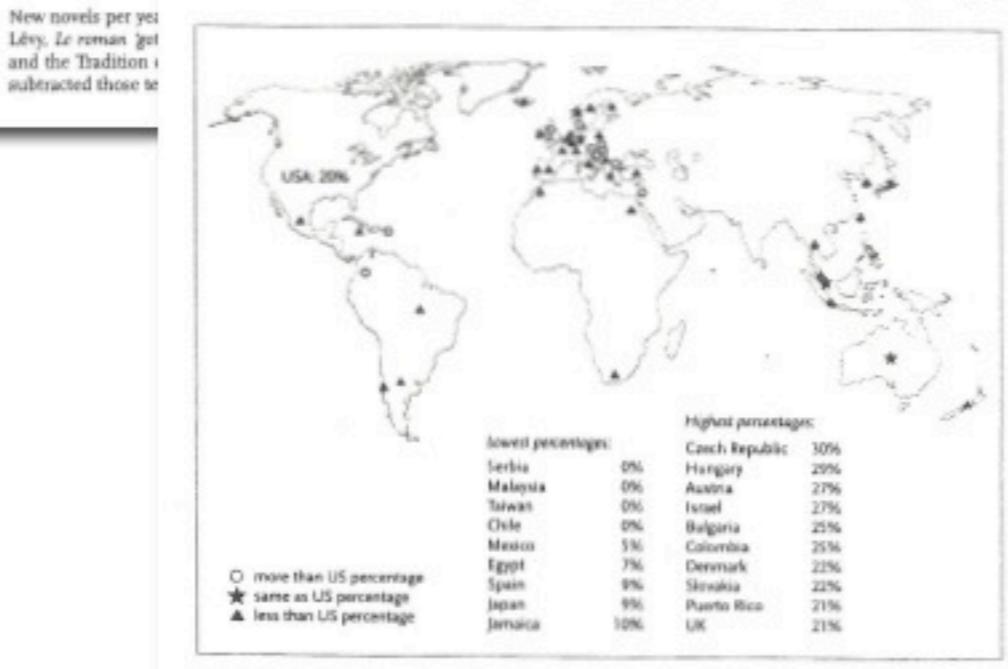
FIGURE 9: British novelistic genres, 1740–1900



FIGURE 7: British hegemonic forms, 1760–1850



FIGURE 11: US comedies as a percentage of top five box office hits, 1986–95



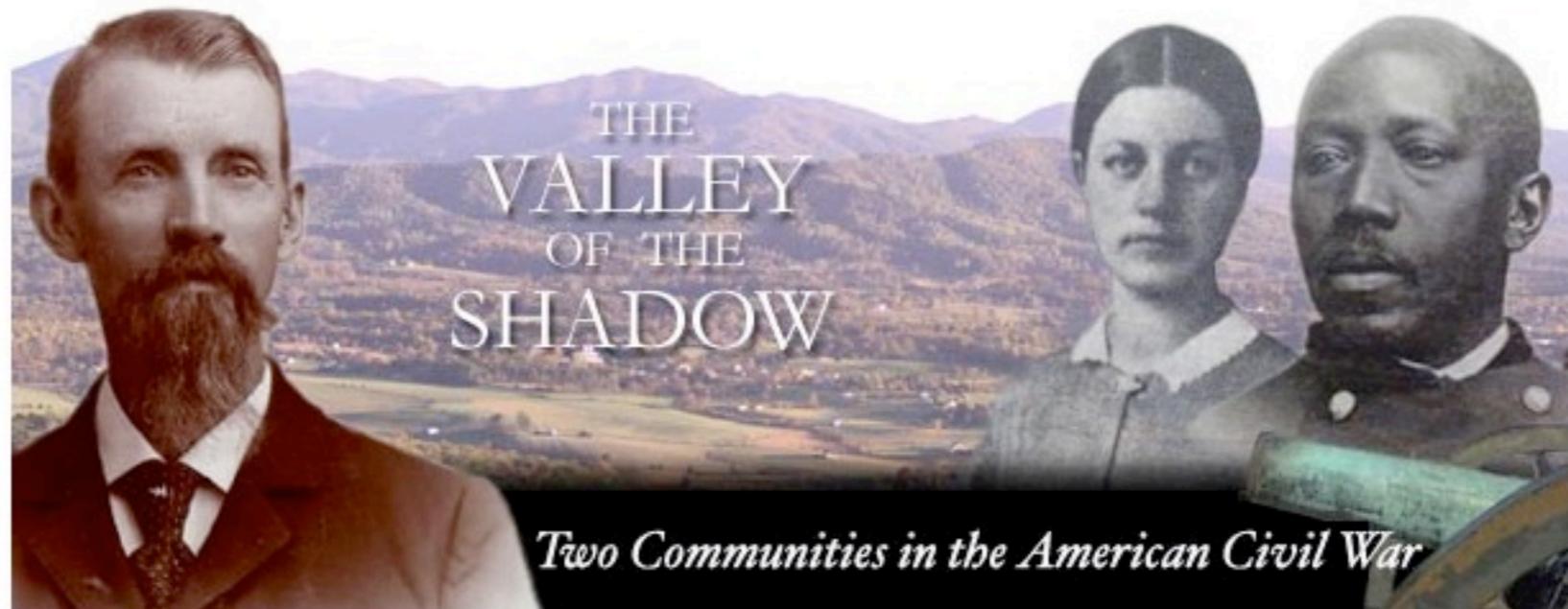
a. For the gothic novel: Maurice Schöwerling (*Sir Walter Scott Middle Ages*, Stuttgart 1989), and *A Novel*, 1740–1850.

1840

Anti-Jacobin novel
Gothic novel
Jacobin novel
Ramble novel
Spy novel
Sentimental novel
Romantic novel
Tale

1750 1800 1850 1900

For sources, see 'A Note on the Taxonomy of the Forms', page 31.

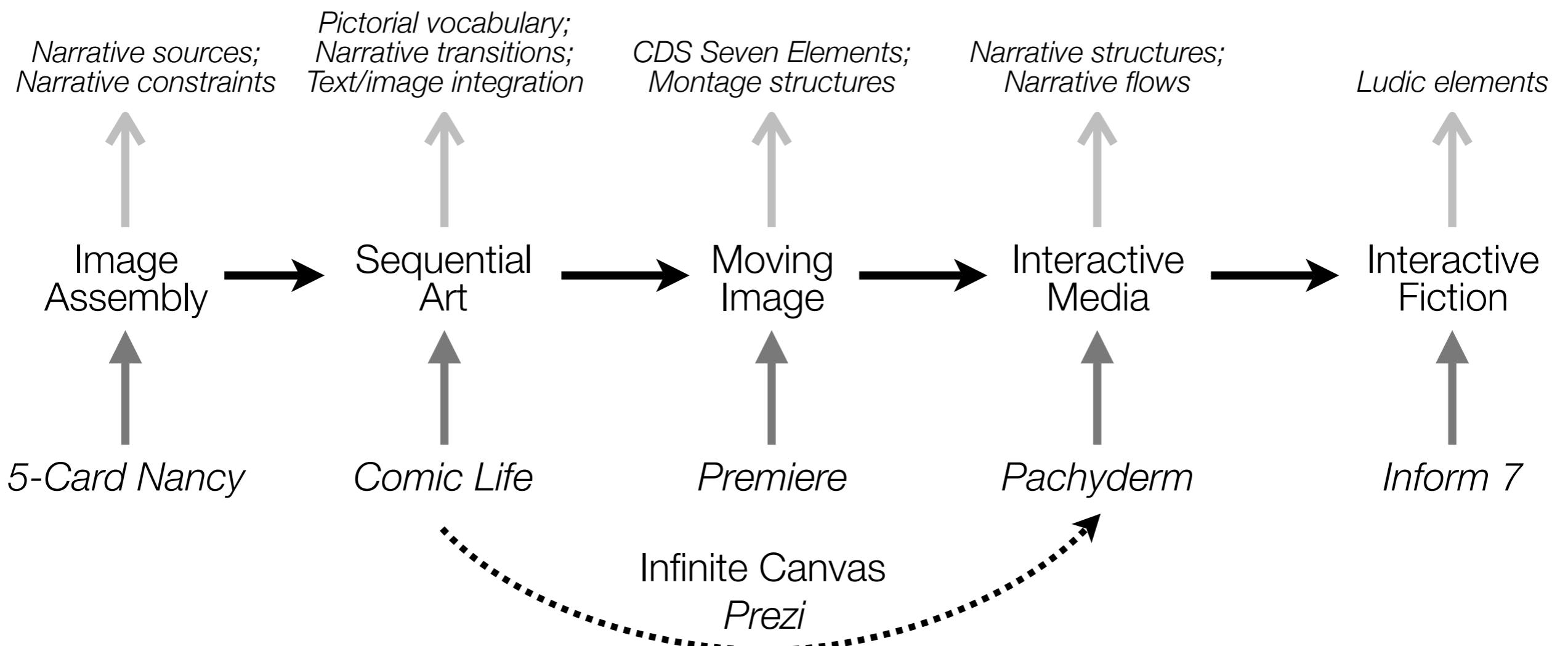


The Valley Project details life in two American communities, one Northern and one Southern, from the time of John Brown's Raid through the era of Reconstruction. In this digital archive you may explore thousands of original letters and diaries, newspapers and speeches, census and church records, left by men and women in Augusta County, Virginia, and Franklin County, Pennsylvania. Giving voice to hundreds of individual people, the Valley Project tells forgotten stories of life during the era of the Civil War.

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The Landscape of Digital Storytelling



Analytic Narrative



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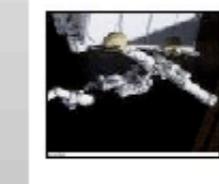
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• 20-11-1998 Zarya (Functional Cargo Block)
• 4-12-1998 Unity Node1, PMA 1 and 2
• 11-6-2000 Zvezda
• 14-10-2000 Z 1 truss (Zenith) and PMA 3 added


• 7-2-2001 PIRs
• 7-2-2001 US lab Destiny
• 15-7-2001 Quest
• 8-4-2002 SO truss
• 8-4-2002 S1 truss
• 23-11-2002 Canadarm 2
• 3-12-2002 P1 Truss


• 9-9-2006 P5 truss
• 9-9-2006 P3 and P4 truss
• 23-10-2007 Harmony
• 8-6-2007 S3 and S4 truss
• 8-8-2007 S5 truss
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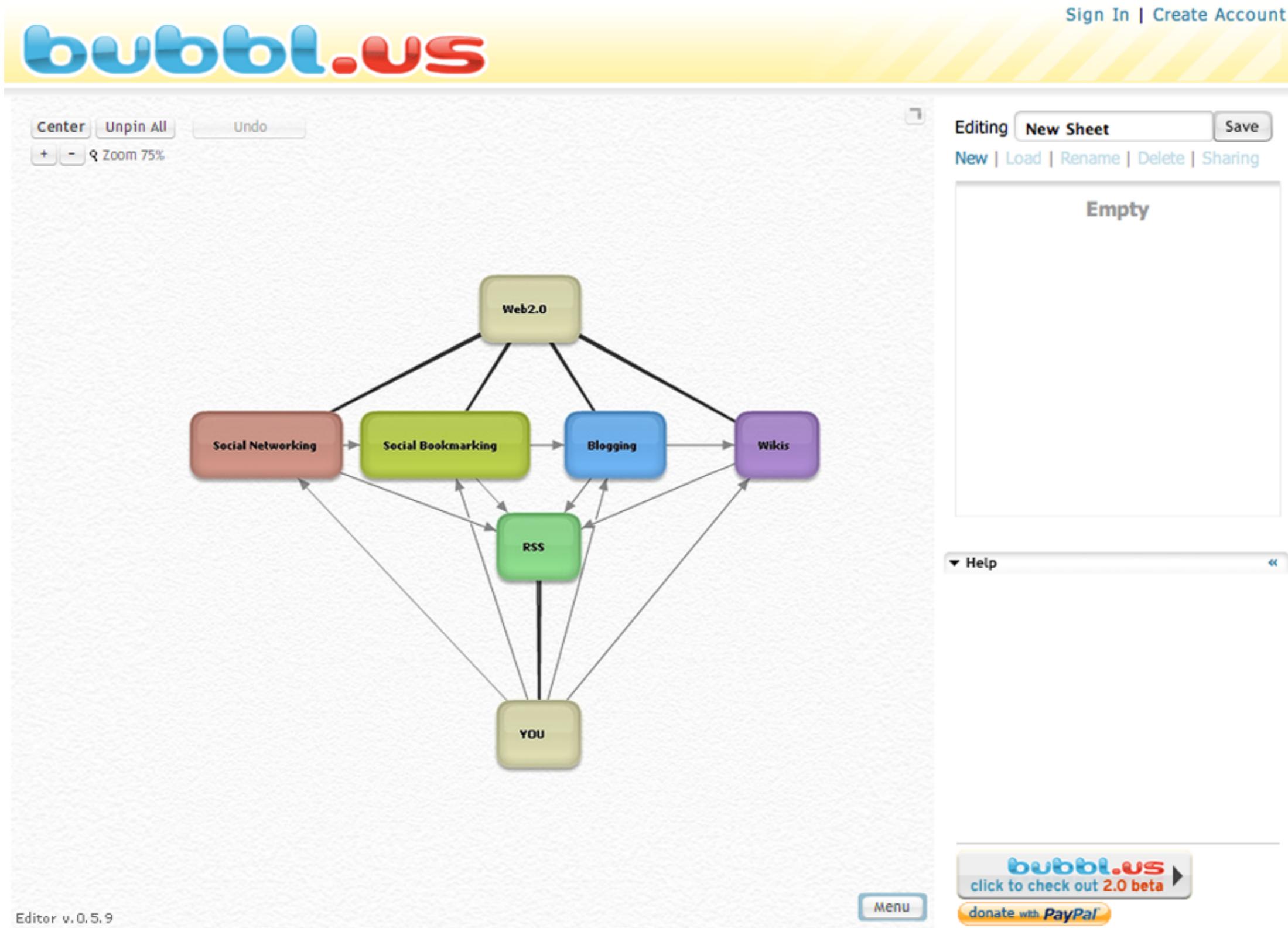
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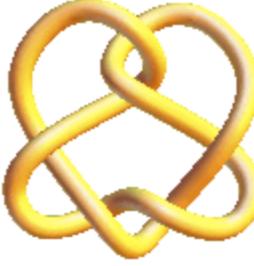
WolframAlpha™ computational knowledge engine

Stevedore knot, figure eight knot

Input interpretation: Stevedore knot | figure eight knot

Mathematica form

Images:

Stevedore knot	figure eight knot
	

Notations:

	Stevedore knot	figure eight knot
Alexander–Briggs notation	6_1	4_1
Conway notation	42	22
Dowker notation	$4 \ 8 \ 12 \ 10 \ 2 \ 6$	$4 \ 6 \ 8 \ 2$

Braid representations:

	Stevedore knot	figure eight knot
braid word	$\sigma_1^{-1} \sigma_2 \sigma_1^{-1} \sigma_3 \sigma_2^{-1} \sigma_3 \sigma_2$	$\sigma_1 \sigma_2^{-1} \sigma_1 \sigma_2^{-1}$

New to Wolfram|Alpha?

A few things to try:

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june 23, 1988
- enter any city (e.g. a home town)
new york
- enter any two stocks
IBM Apple
- enter any calculation
 $\$250 + 15\%$
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 $x^2 \sin(x)$

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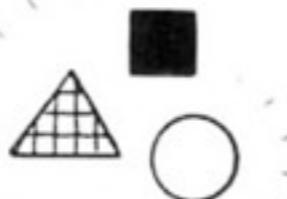
Q▼ Stevedore knot, figure eight ...

The Literary Analytic Story

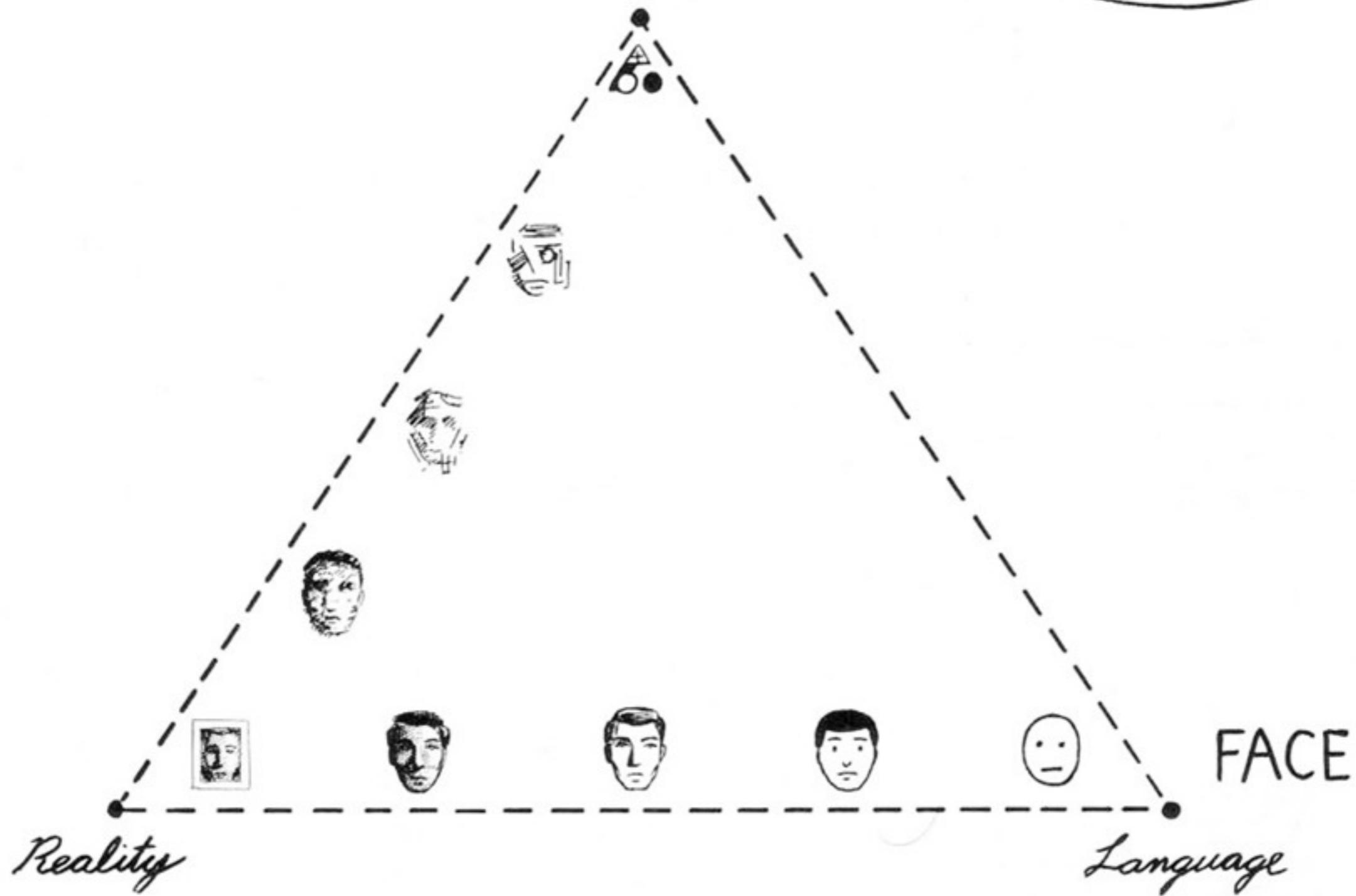
Three Key Frameworks from Scott McCloud

THIS IS
THE REALM OF THE
ART OBJECT, THE
PICTURE PLANE, WHERE
SHAPES, LINES AND
COLORS CAN BE
THEMSELVES AND
NOT PRETEND
OTHERWISE.

The Picture Plane



Below me,
THE AREA DESCRIBED
BY THESE 3 VERTICES--
"REALITY", LANGUAGE AND
THE PICTURE PLANE--
REPRESENTS THE TOTAL
PICTORIAL VOCABULARY
OF COMICS OR OF ANY
OF THE VISUAL
ARTS.



MOST PANEL-TO-PANEL TRANSITIONS IN COMICS CAN BE PLACED IN ONE OF SEVERAL DISTINCT CATEGORIES. THE FIRST CATEGORY—WHICH WE'LL CALL **MOMENT-TO-MOMENT**—REQUIRES VERY LITTLE CLOSURE.



1.



2.



3.

THE NEXT TYPE TAKES US FROM SUBJECT-TO-SUBJECT WHILE STAYING WITHIN A SCENE OR IDEA. NOTE THE DEGREE OF READER INVOLVEMENT NECESSARY TO RENDER THESE TRANSITIONS MEANINGFUL.



4.



DEDUCTIVE REASONING IS OFTEN REQUIRED IN READING COMICS SUCH AS IN THESE **SCENE-TO-SCENE** TRANSITIONS, WHICH TRANSPORT US ACROSS SIGNIFICANT DISTANCES OF TIME AND SPACE.



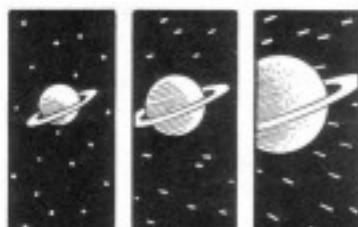
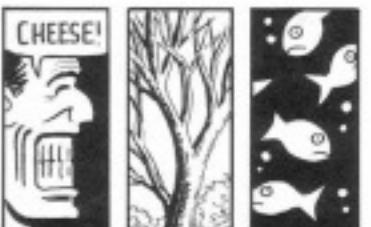
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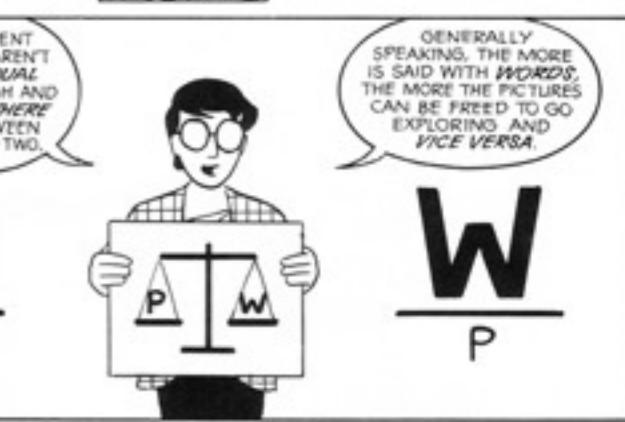
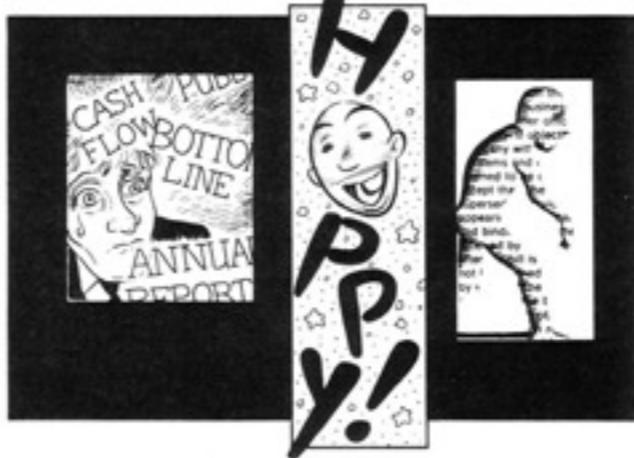
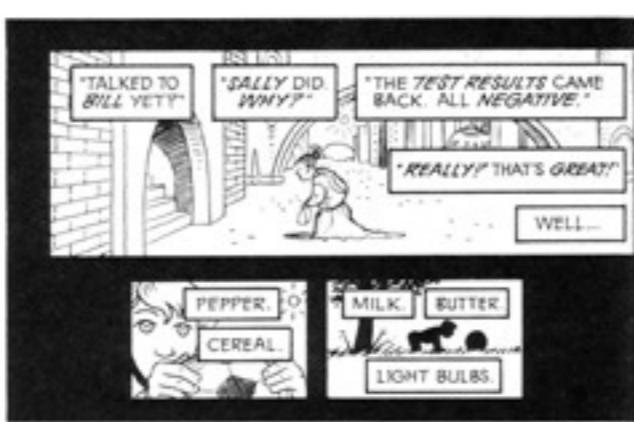
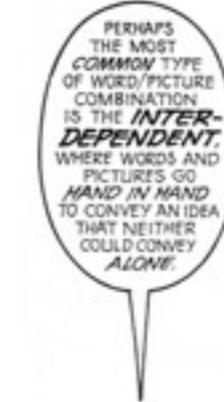


A FIFTH TYPE OF TRANSITION, WHICH WE'LL CALL **ASPECT-TO-ASPECT**, BYPASSES TIME FOR THE MOST PART AND SETS A WANDERING EYE ON DIFFERENT ASPECTS OF A PLACE, IDEA, OR MOOD.



6.





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Analytic Narrative Examples and Tools

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 - MapLib.net: <http://maplib.net/>
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