Effective Visual Encoding

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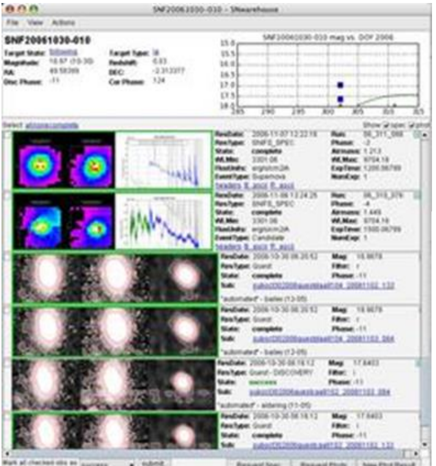
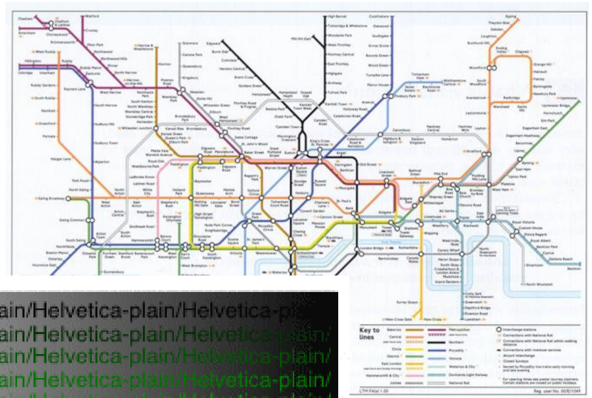
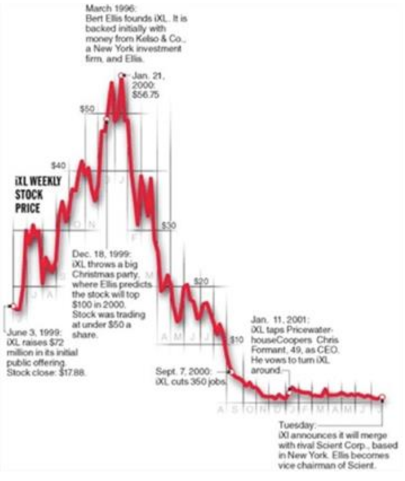




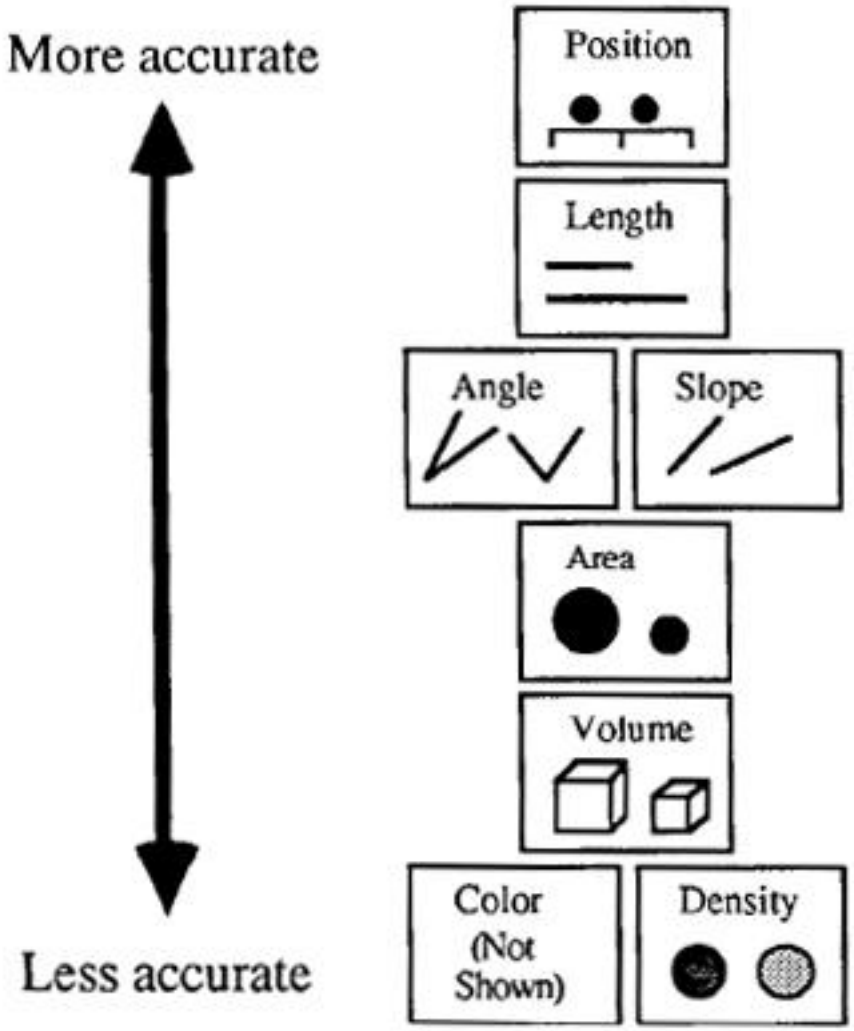


Effective Visual Encoding

- Mapping data to visual attributes:
- Challenge: Pick the best encoding (or mapping) from many possibilities. Consider:
- **Importance Ordering**: Encode the most important information in the most perceptually accurate way
- **Expressiveness**: Depict *all* the data, and *only* the data
- **Consistency**: The properties of the image (visual attributes) should match the properties of the data

Adapted from Mackinlay, APT (A Presentation Tool), 1986

Importance Ordering: Perceptual Properties



Mackinlay, APT (A Presentation Tool), 1986

Mackinlay's Expressiveness Criteria

- A set of facts is expressible in a visual language if:

  the sentences (i.e. the visualizations) in the language express *all* the facts in the set of data, and *only* the facts in the data.

Mackinlay, APT (A Presentation Tool), 1986

Cannot express the facts

- Which color is greater than the other?

Expressing facts not in the data

- A length is interpreted as a quantitative value
- Length of bar says something untrue about data

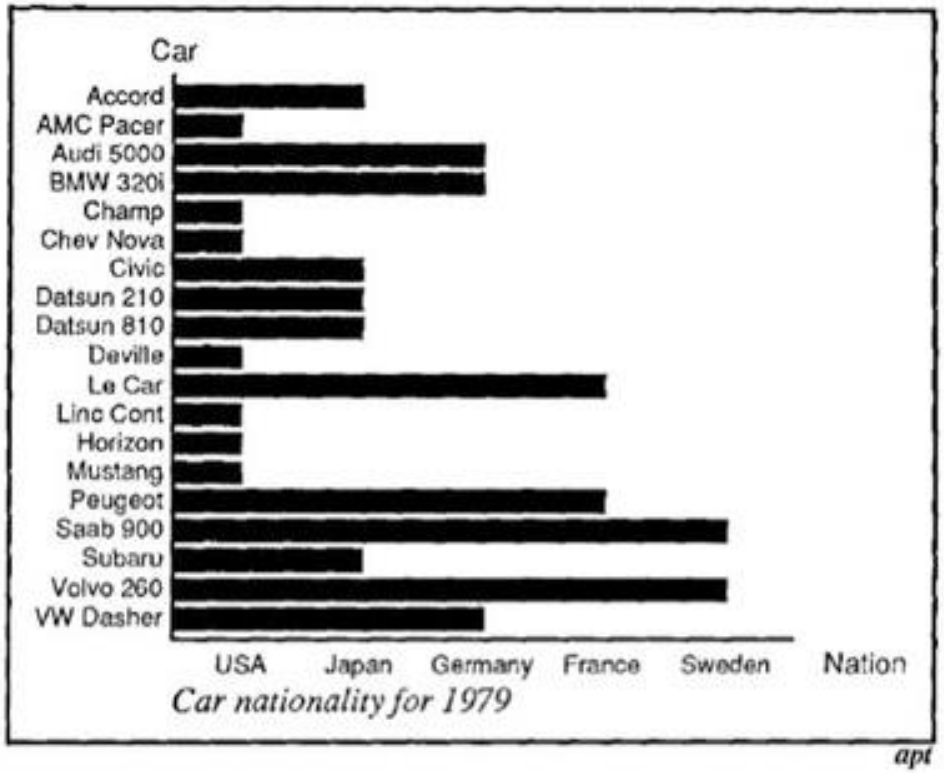
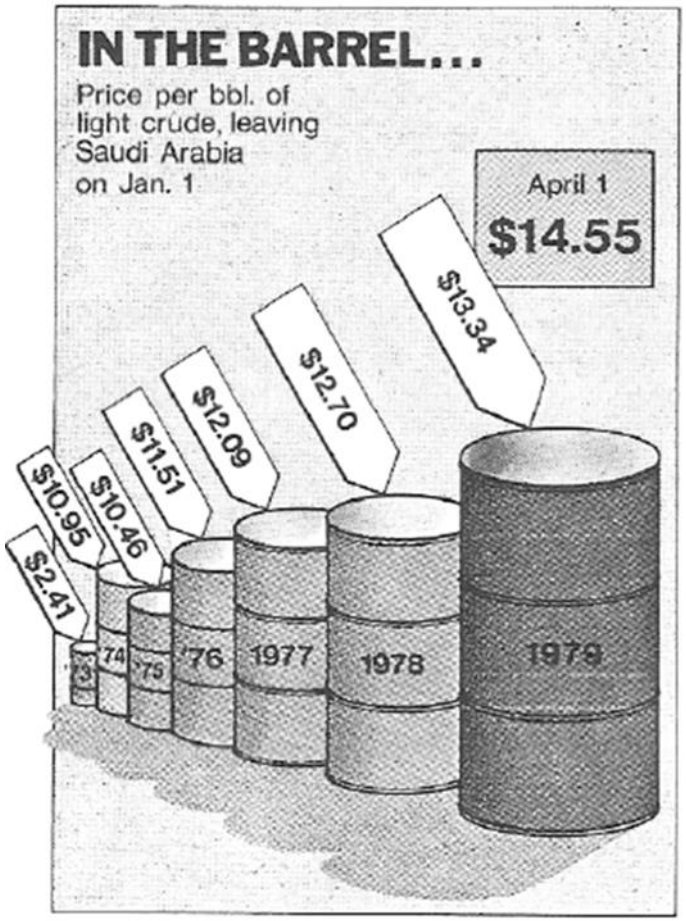


Fig. 11. Incorrect use of a bar chart for the *Nation* relation. The lengths of the bars suggest an ordering on the vertical axis, as if the USA cars were longer or better than the other cars, which is not true for the *Nation* relation.

Mackinlay, APT (A Presentation Tool), 1986

Consistency

- The properties of the image (visual attributes) should match the properties of the data
- E.g. don't map one-dimensional data to two-or three- dimensional representations!



[Tufte, Edward R (1983), *The Visual Display of Quantitative Information,* Graphics Press, from *Time Magazine*, April 9, 1979, p. 57.]

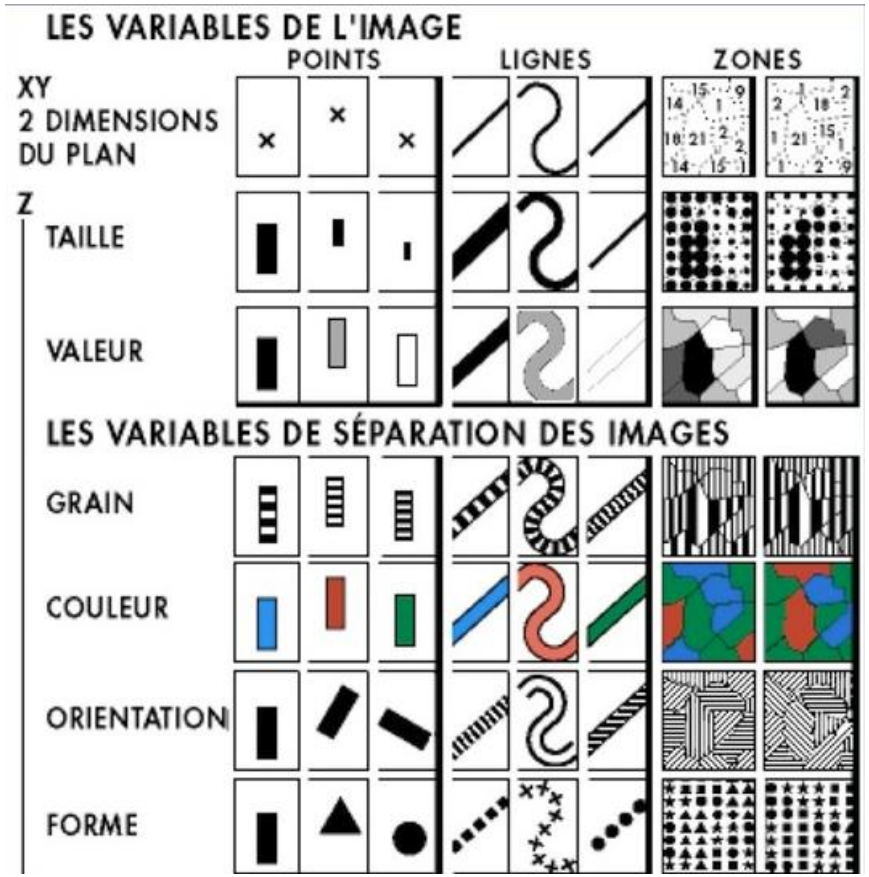
Data Encoding Class Exercise

Model	Origin	Year	Cylinders	Horsepower	MPG	Weight
amc ambassador dpl	US	70	8	190	15	3,850
chevrolet vega (sw)	US	71	4	72	22	2,408
chevrolet vega	US	72	4	90	20	2,408
ford pinto runabout	US	72	4	86	21	2,226
mazda rx2 coupe	Japan	72	3	97	19	2,330
amc matador (sw)	US	72	8	150	15	3,892
ford pinto (sw)	US	72	4	86	22	2,395
dodge coronet custom	US	73	8	150	15	3,777
toyota carina	Japan	73	4	88	20	2,279
chevrolet vega	US	73	4	72	21	2,401
datsun 610	Japan	73	4	94	22	2,379
ford pinto	US	73	4	85	19	2,310
chevrolet chevelle malibu classic	US	74	6	100	16	3,781
buick century	US	75	6	110	17	3,907
chevroelt chevelle malibu	US	75	6	105	16	3,897
plymouth fury	US	75	6	95	18	3,785
amc matador	US	76	8	120	15.5	3,962
mercedes-benz 280s	Europe	76	6	120	16.5	3,820
chevrolet caprice classic	US	77	8	145	17.5	3,880
chevrolet caprice classic	US	79	8	130	17	3,840
mercury grand marquis	US	79	8	138	16.5	3,955
dodge st. regis	US	79	8	135	18.2	3,830
vw rabbit	Europe	80	4	76	41.5	2,144
mazda glc	Japan	80	4	65	46.6	2,110
vw pickup	Europe	82	4	52	44	2,130

[slide adapted from Marti Hearst]

Bertin's Visual Attributes

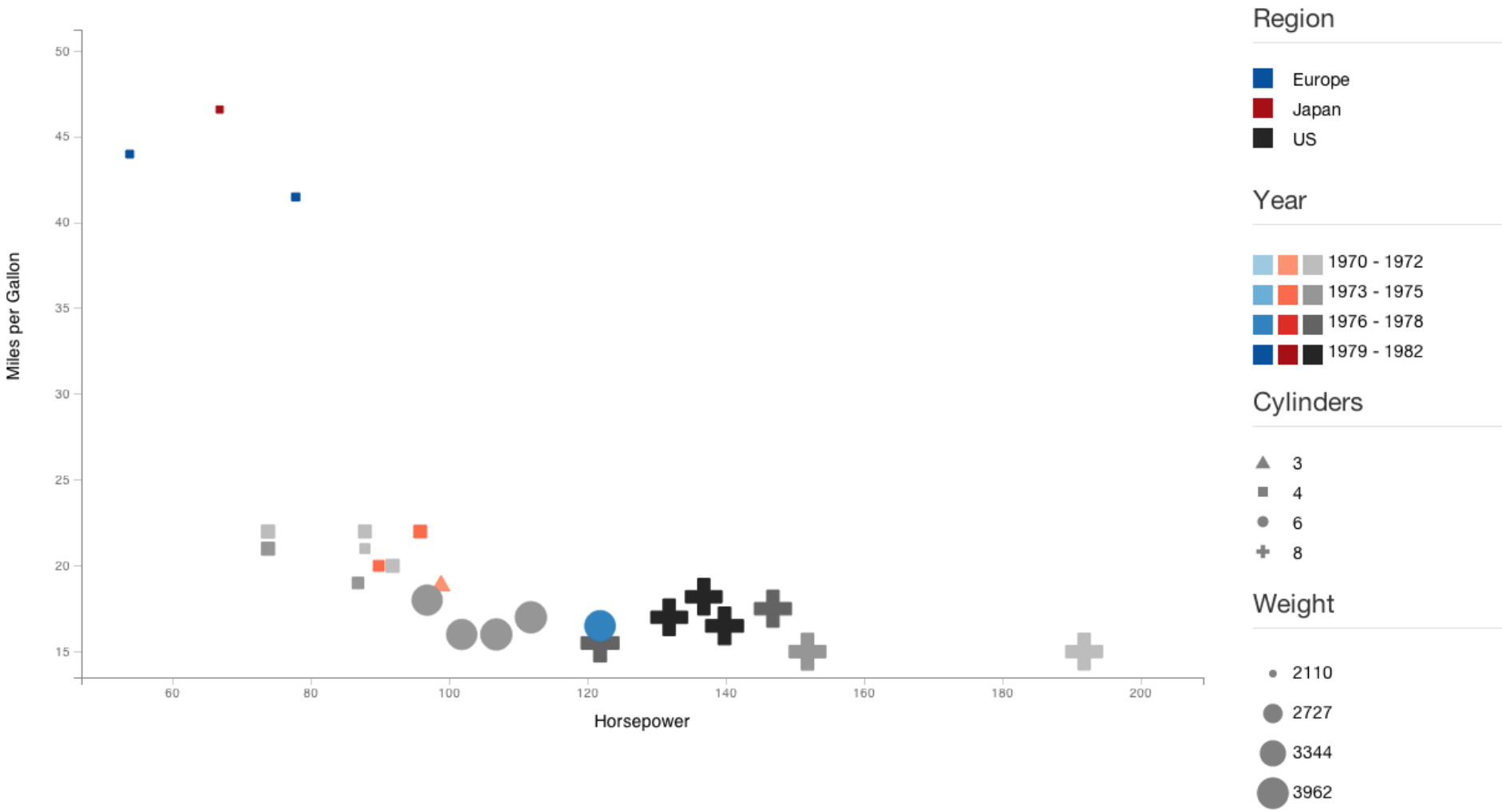
- Position
- Size
- Value
- Texture
- Color
- Orientation
- Shape



Bertin, *Semiology of Graphics*, 83

Done? Here's one attempt:

Cars Dataset – Encoding 7 Variables



[slide by John Robinson]