UNIVERSITY OF TORONTO
VISUALIZATION DISCUSSION GROUP

MULTIFUNCTIONING DATA ELEMENTS

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MAXIMIZING DATA-INK RATIO

$$\text{Data-ink ratio} = \frac{\text{data-ink}}{\text{total ink used to print the graphic}}$$

$$= \text{proportion of a graphic's ink devoted to the non-redundant display of data-information}$$

$$= 1.0 - \text{proportion of a graphic that can be erased without loss of data-information.}$$

Tufte: *The Visual Display of Quantitative Information*

MAXIMIZING DATA-INK RATIO

Mobilize every graphical element, perhaps several times over, to show the data.

Tufte: *The Visual Display of Quantitative Information*

MULTIFUNCTIONING DATA ELEMENTS

What are the pros and cons of using them?

Pros

- Less reliance on other elements
- Conveying more information
- Adding data elements that reinforce the story

Cons

- More reliance if you can’t decode it
- Being too complicated
- Possibility of adding data elements that contradict the story

MAXIMIZING DATA-INK RATIO

The Danger: Creating Graphical Puzzles

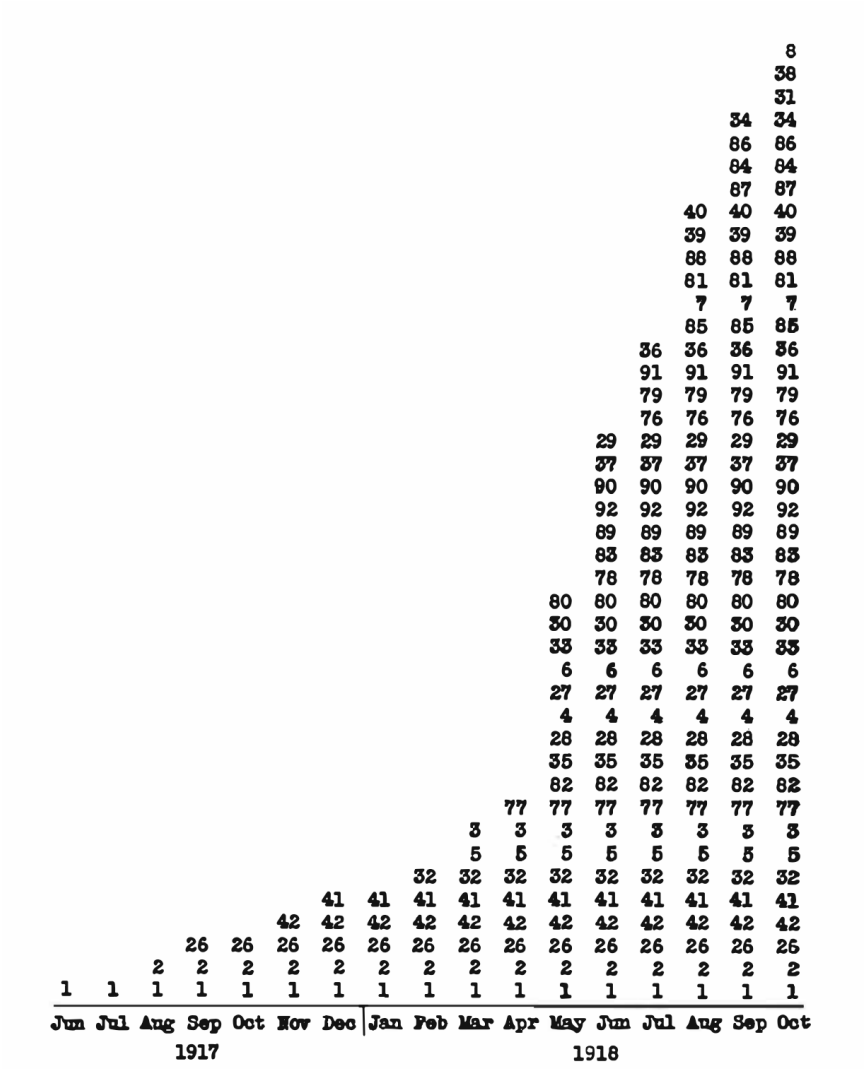
Tufte: *The Visual Display of Quantitative Information*

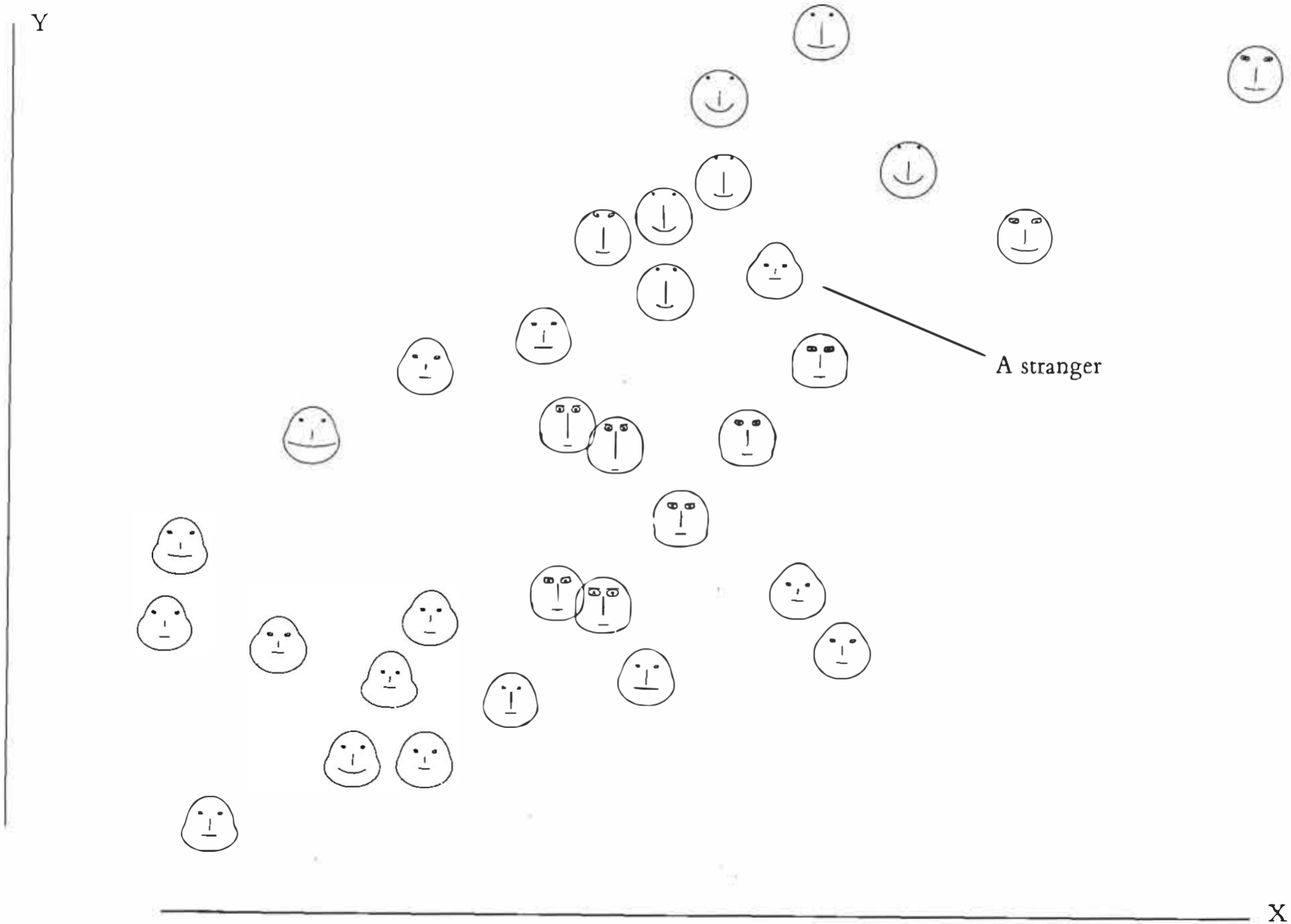
0 | 9 = 900 feet

Stem-and-leaf displays:
heights of 218 volcanoes, unit 100 feet.

19 | 3 = 19,300 feet

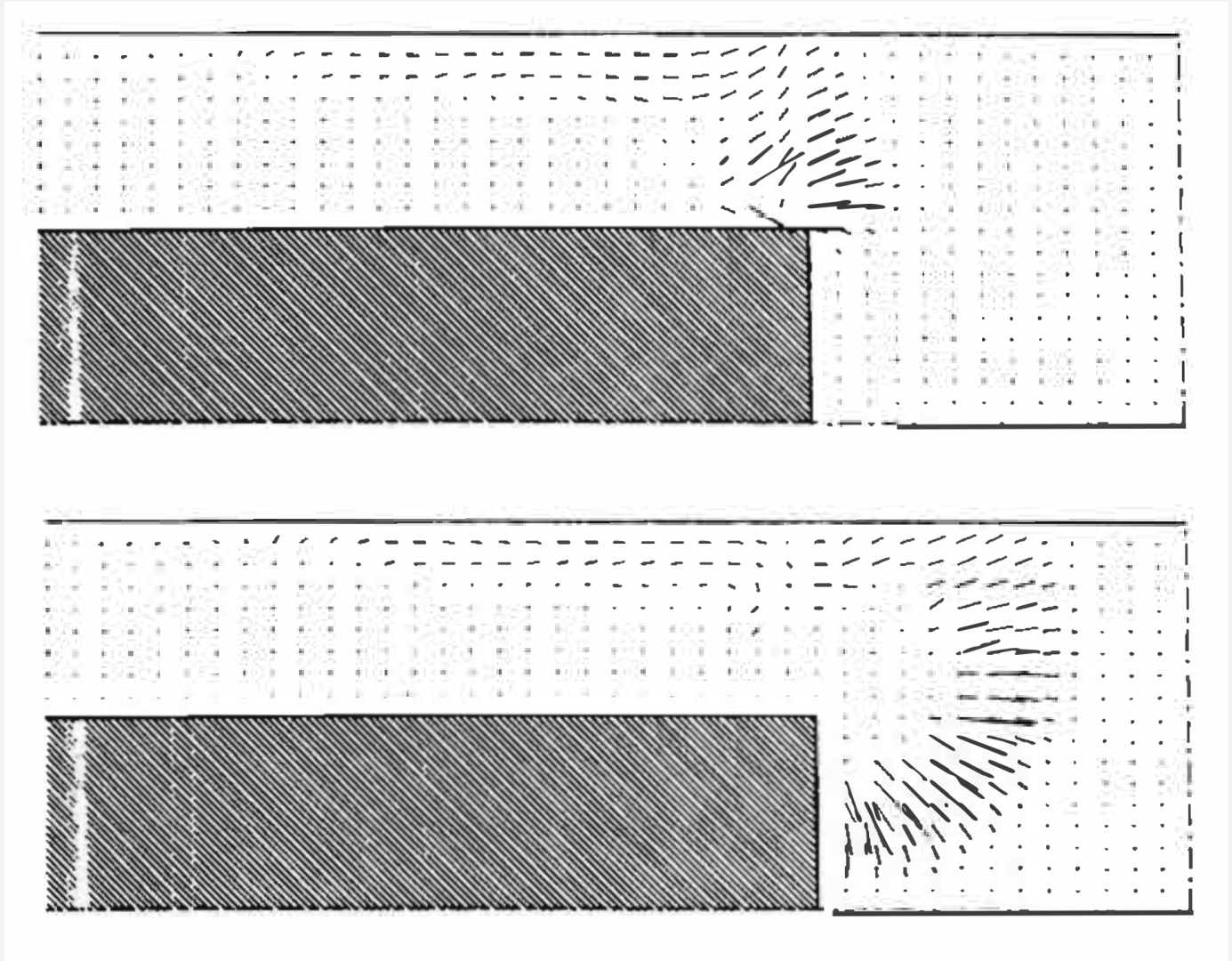
0	98766562
1	97719630
2	699877665444222 11009850
3	8766554 12099551426
4	99988443319294333 61107
5	97666666554422210097731
6	89866544 1077761065
7	98855431 100652108073
8	653322122937
9	377655421000493
10	0984433165212
11	4963201631
12	45421164
13	47830
14	00
15	676
16	52
17	92
18	5
19	39730


8
38
31
34 34
86 86
84 84
87 87
40 40 40
39 39 39
88 88 88
81 81 81
7 7 7
85 85 85
36 36 36 36
91 91 91 91
79 79 79 79
76 76 76 76
29 29 29 29
37 37 37 37 37
90 90 90 90 90
92 92 92 92 92
89 89 89 89 89
83 83 83 83 83
78 78 78 78 78
80 80 80 80 80 80
30 30 30 30 30 30
33 33 33 33 33 33
6 6 6 6 6 6
27 27 27 27 27 27
4 4 4 4 4 4
28 28 28 28 28 28
35 35 35 35 35 35
82 82 82 82 82 82
77 77 77 77 77 77 77
3 3 3 3 3 3 3
5 5 5 5 5 5 5
32 32 32 32 32 32 32
41 41 41 41 41 41 41
42 42 42 42 42 42 42
26 26 26 26 26 26 26
2 2 2 2 2 2 2
1 1 1 1 1 1 1
Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
1917
1918

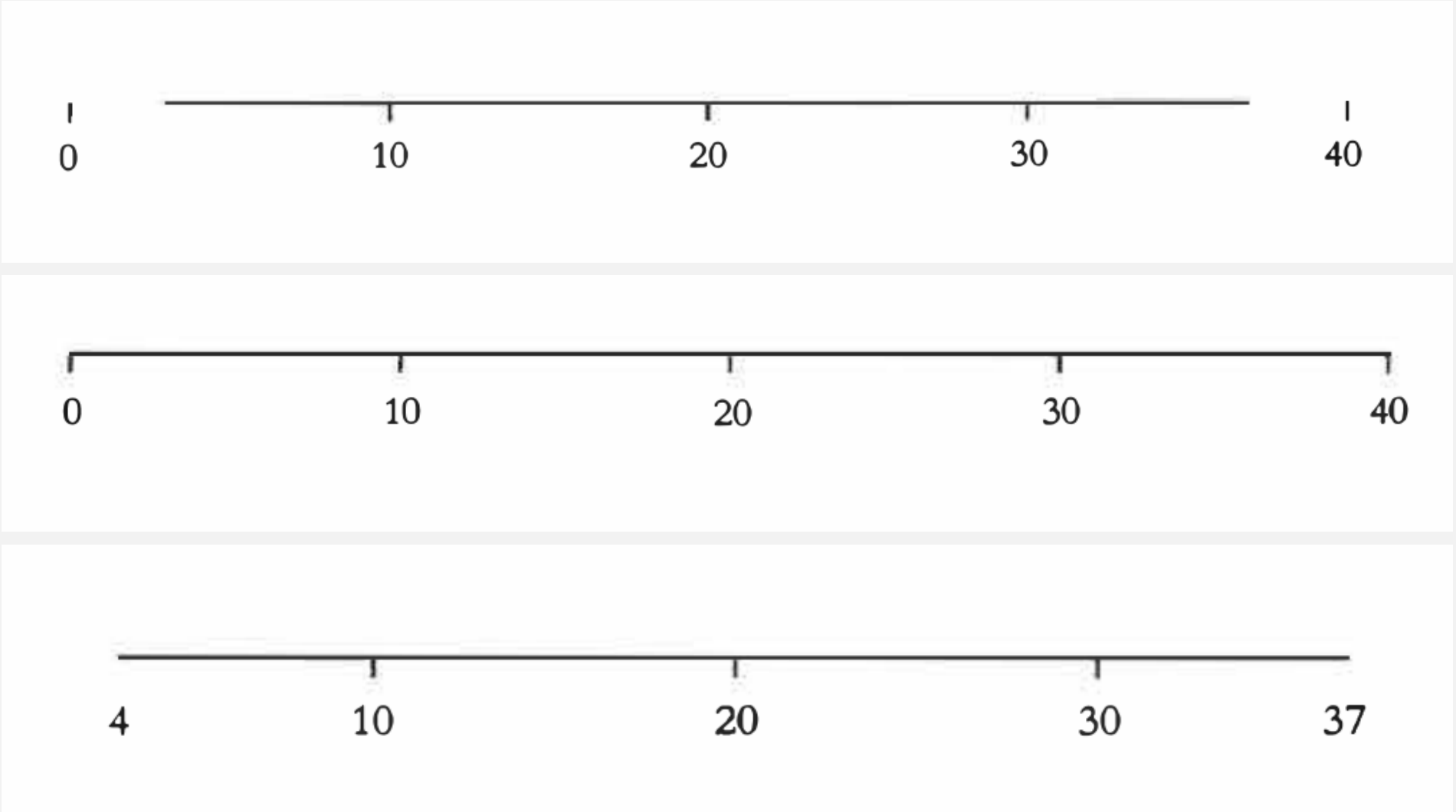

Y
A stranger
X

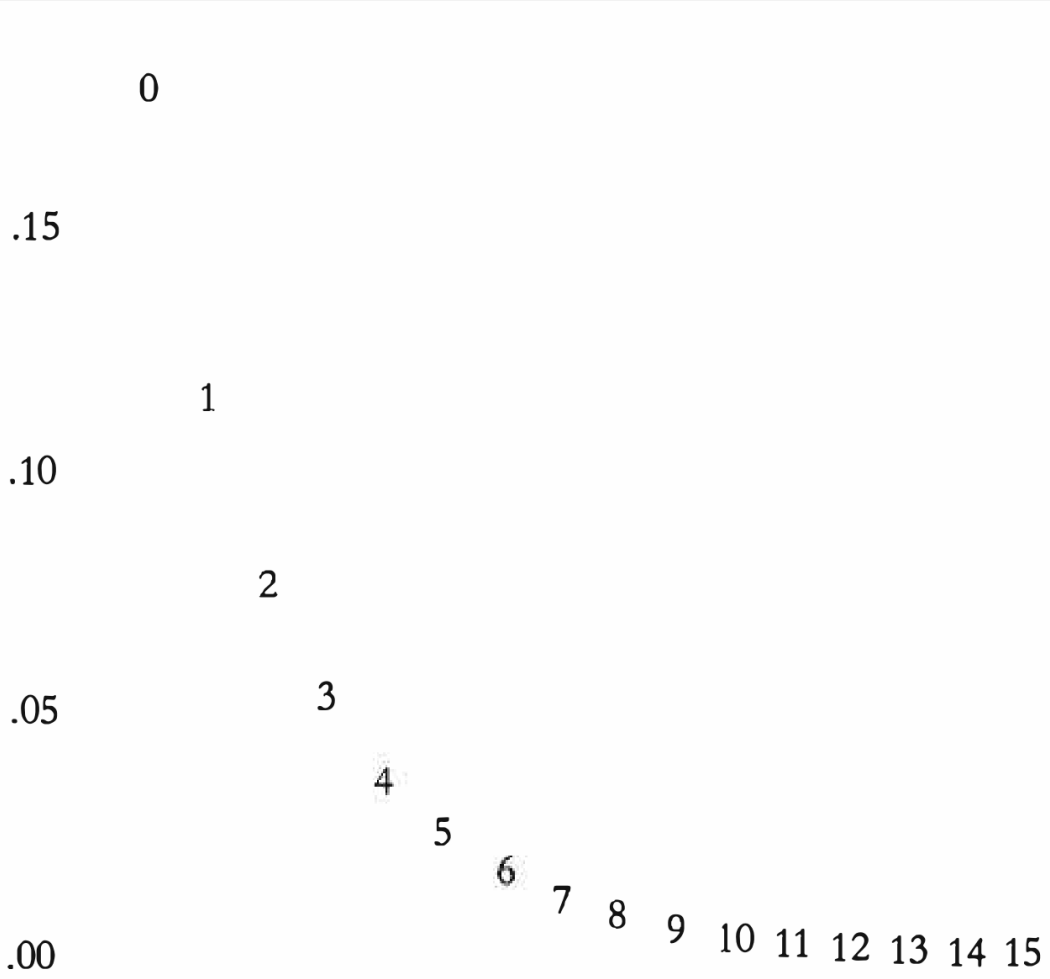
THE
NORMAL
LAW OF ERROR
STANDS OUT IN THE
EXPERIENCE OF MANKIND
AS ONE OF THE BROADEST
GENERALIZATIONS OF NATURAL
PHILOSOPHY ◆ IT SERVES AS THE
GUIDING INSTRUMENT IN RESEARCHES
IN THE PHYSICAL AND SOCIAL SCIENCES AND
IN MEDICINE AGRICULTURE AND ENGINEERING ◆
IT IS AN INDISPENSABLE TOOL FOR THE ANALYSIS AND THE
INTERPRETATION OF THE BASIC DATA OBTAINED BY OBSERVATION AND EXPERIMENT

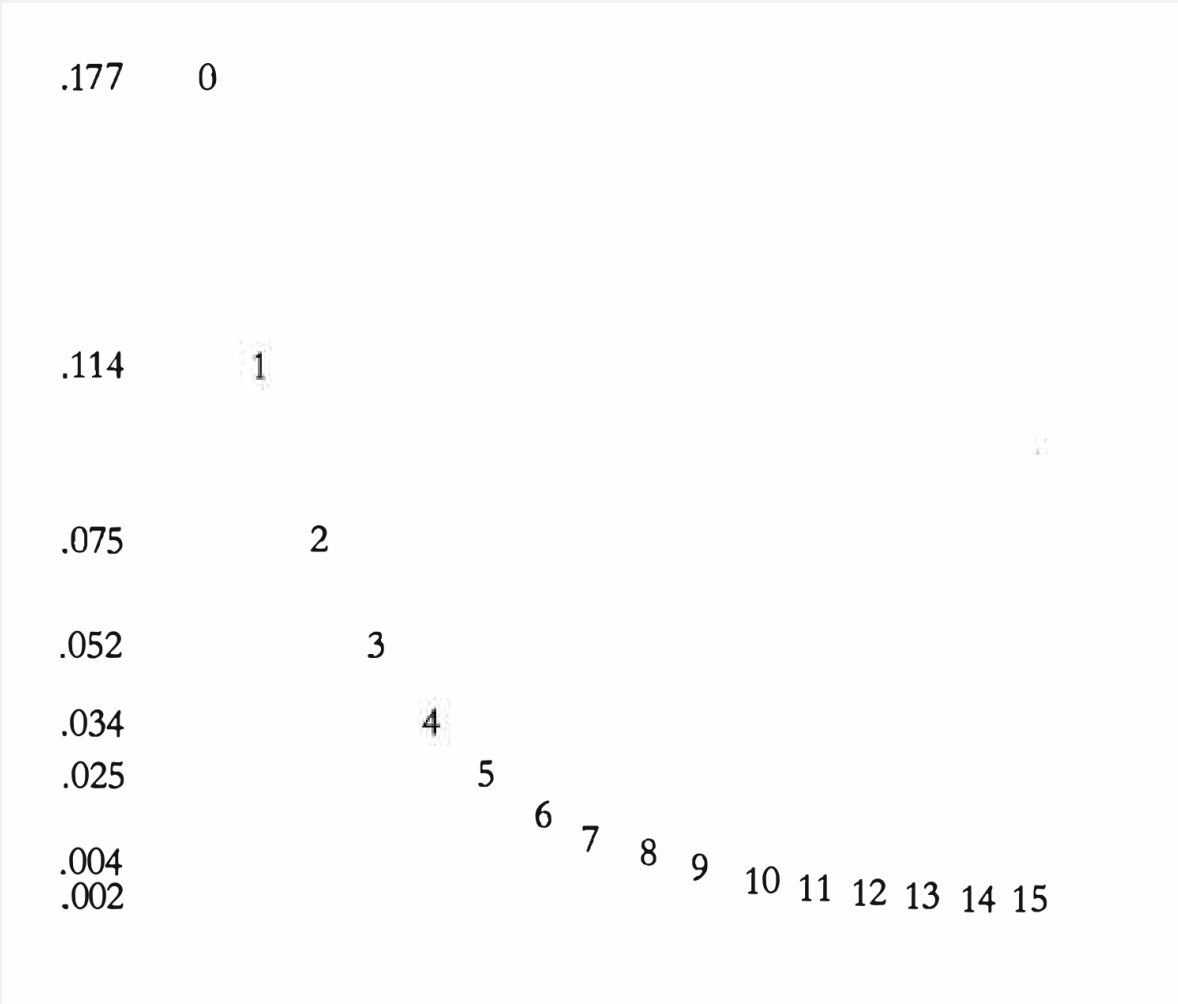
DATA-BASED GRIDS



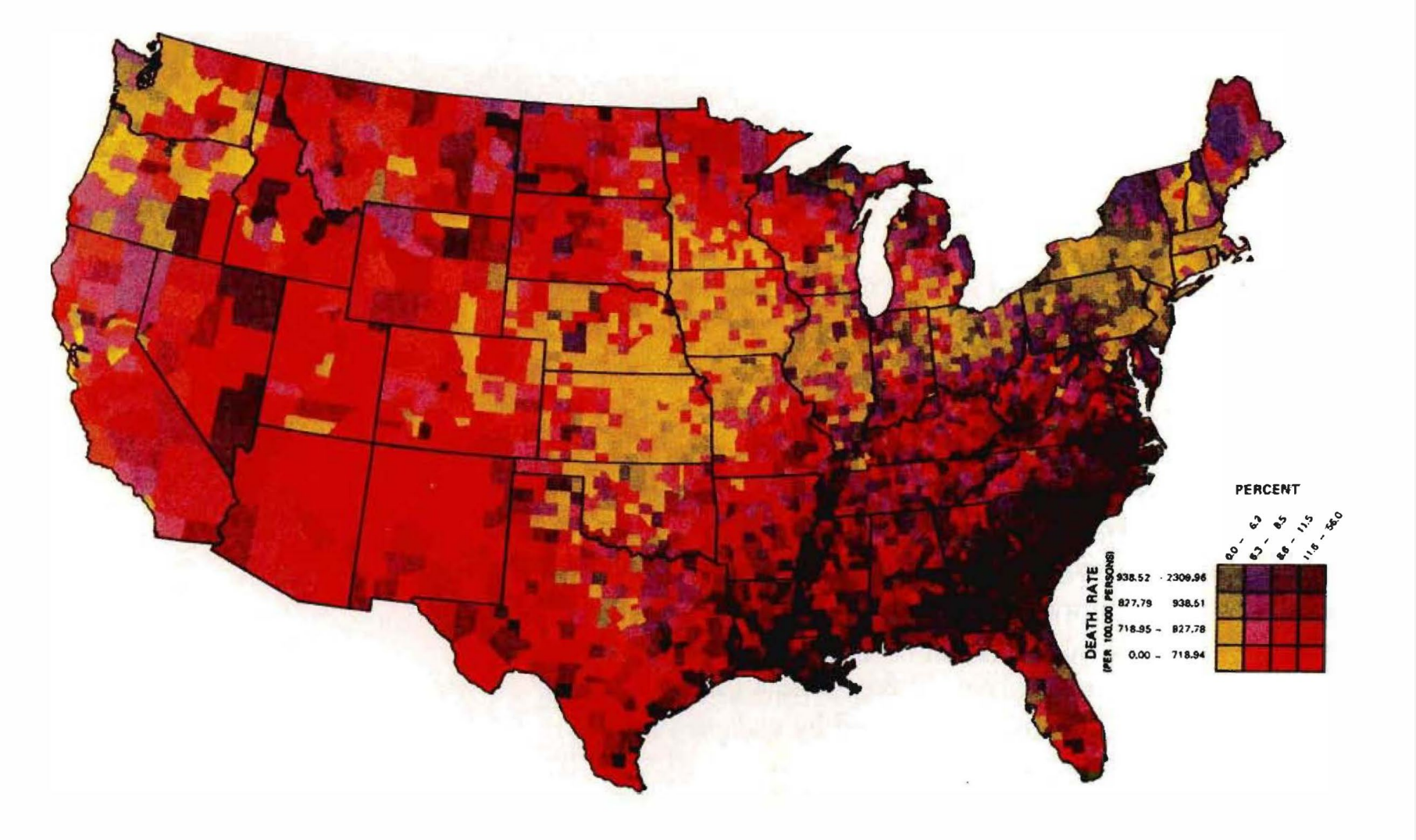
DOUBLE FUNCTIONING LABELS




0
.15
1
.10
2
3
.05
4
5
6
7
8
9
10
11
12
13
14
15
.00


.177
0
.114
1
.075
2
.052
3
.034
4
.025
5
6
7
8
9
10
11
12
13
14
15
.004
.002

GRAPHICAL PUZZLES



MULTIPLE VIEWING DEPTHS

Graphics can be designed to have at least three viewing depths:

(1) what is seen from a distance, an overall structure usually aggregated from an underlying microstructure;

(2) what is seen up close and in detail, the fine structure of the data; and

(3) what is seen implicitly, underlying the graphic-that which is behind the graphic.

MULTIPLE VIEWING DEPTHS