The Science of Human graphical

Lecture5

The communication process

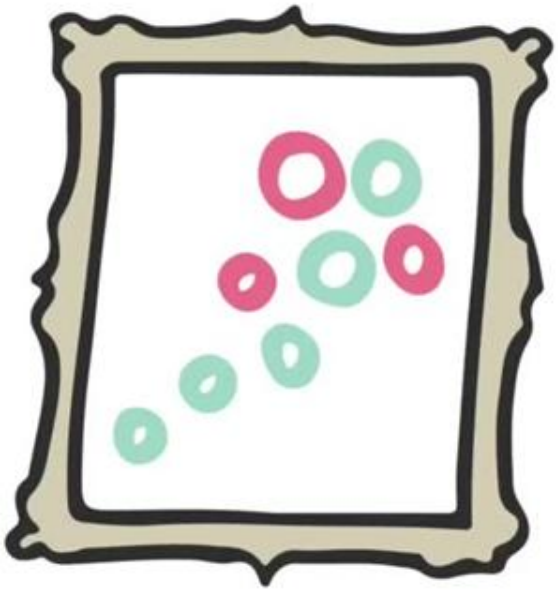
X	Y	Z
0	2	3
-4	5	6
10	4.1	8.5

Data

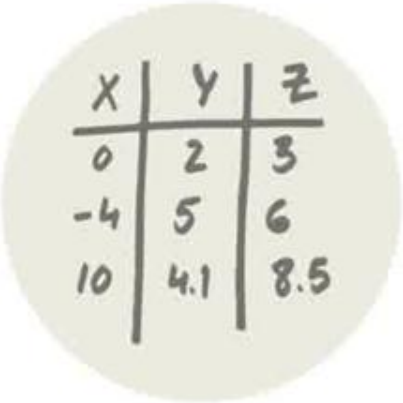
Message

Data

Message

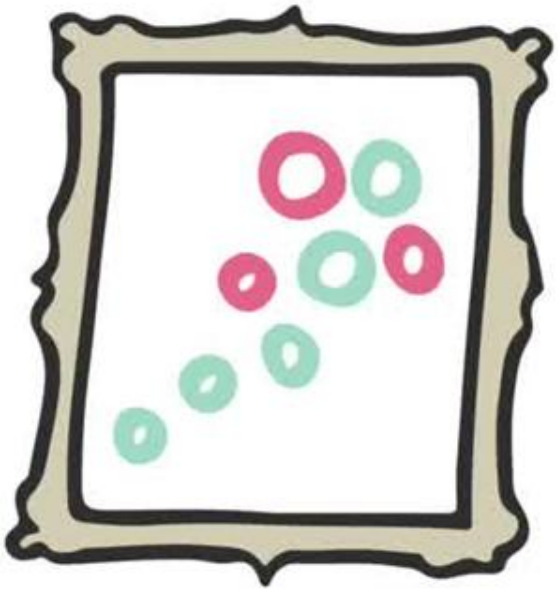


Visualization



Data

Message



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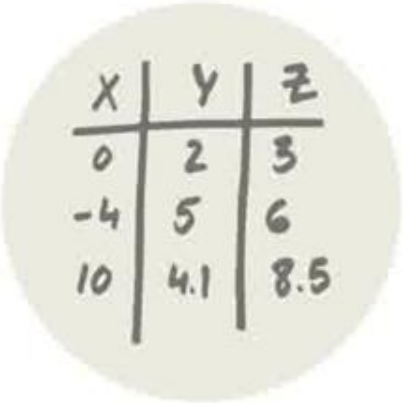

Data

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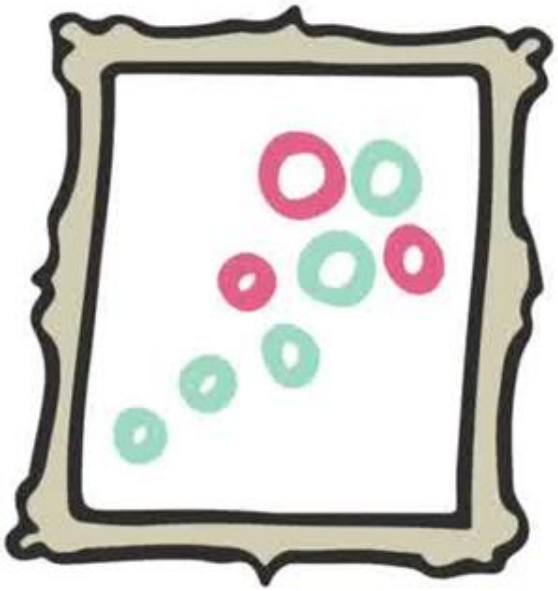

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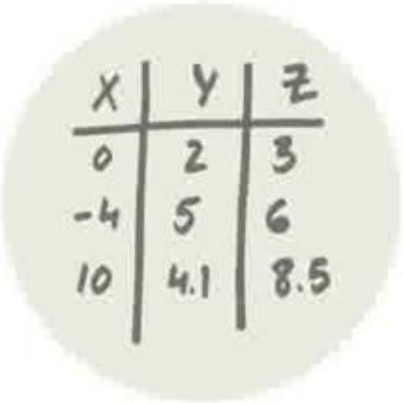

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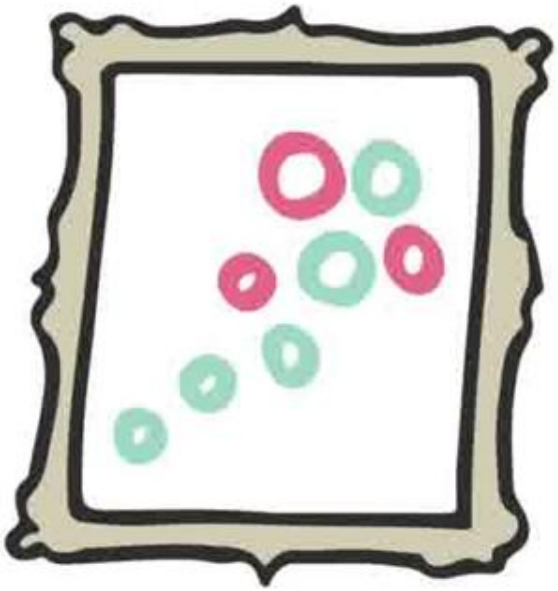

Visualization

Data

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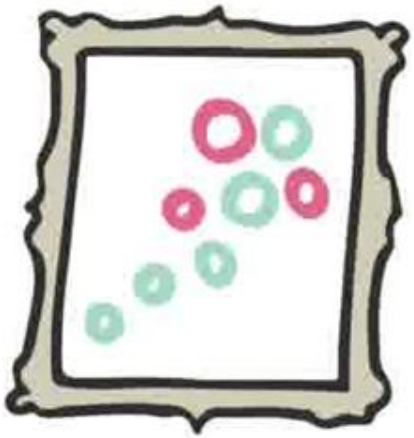
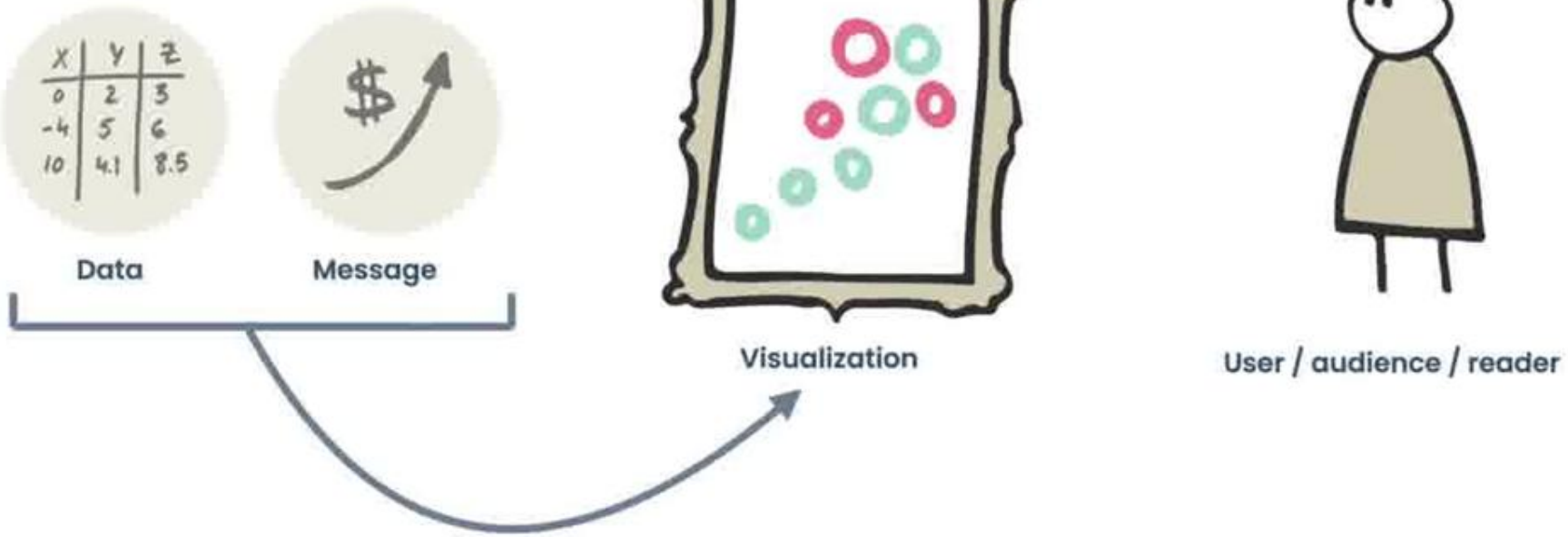


Visualization

User / audience / reader


X Y Z
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Data
Message
Visualization
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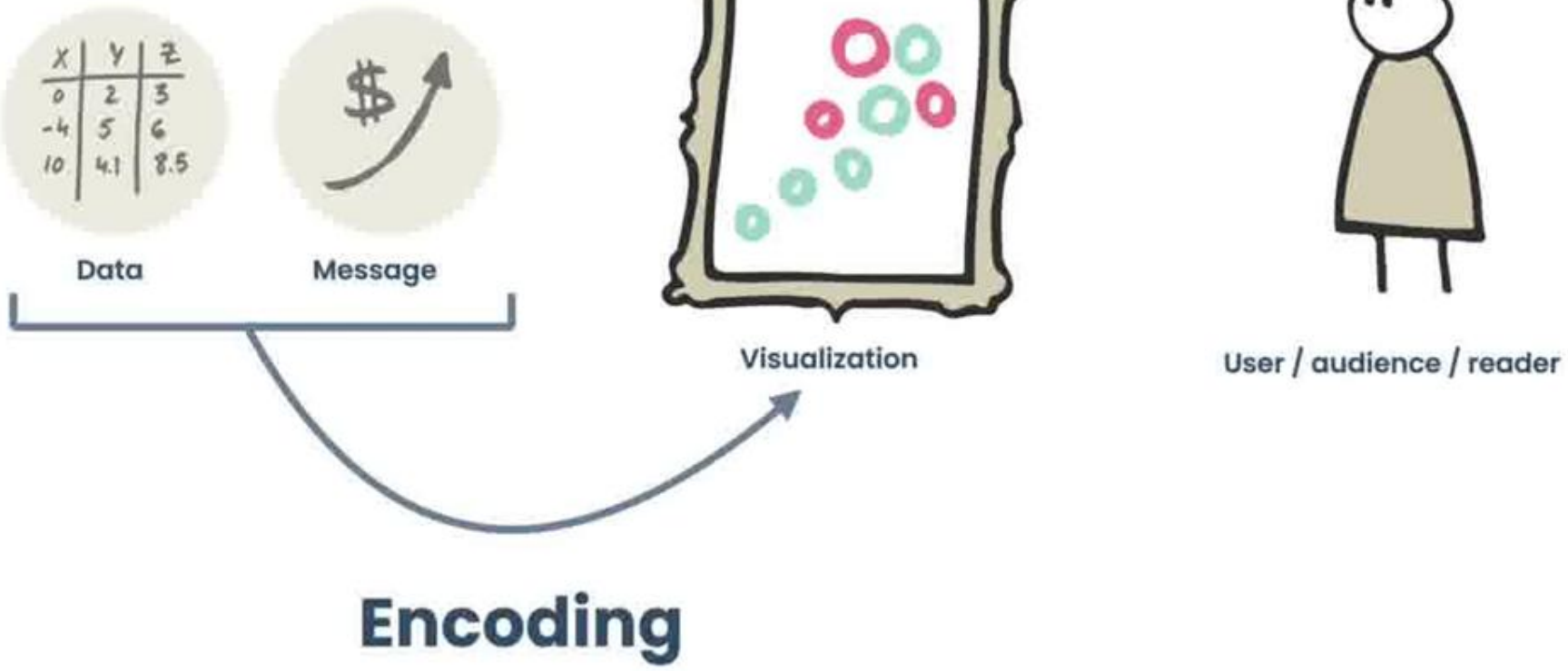
X Y Z
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Data
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Visualization
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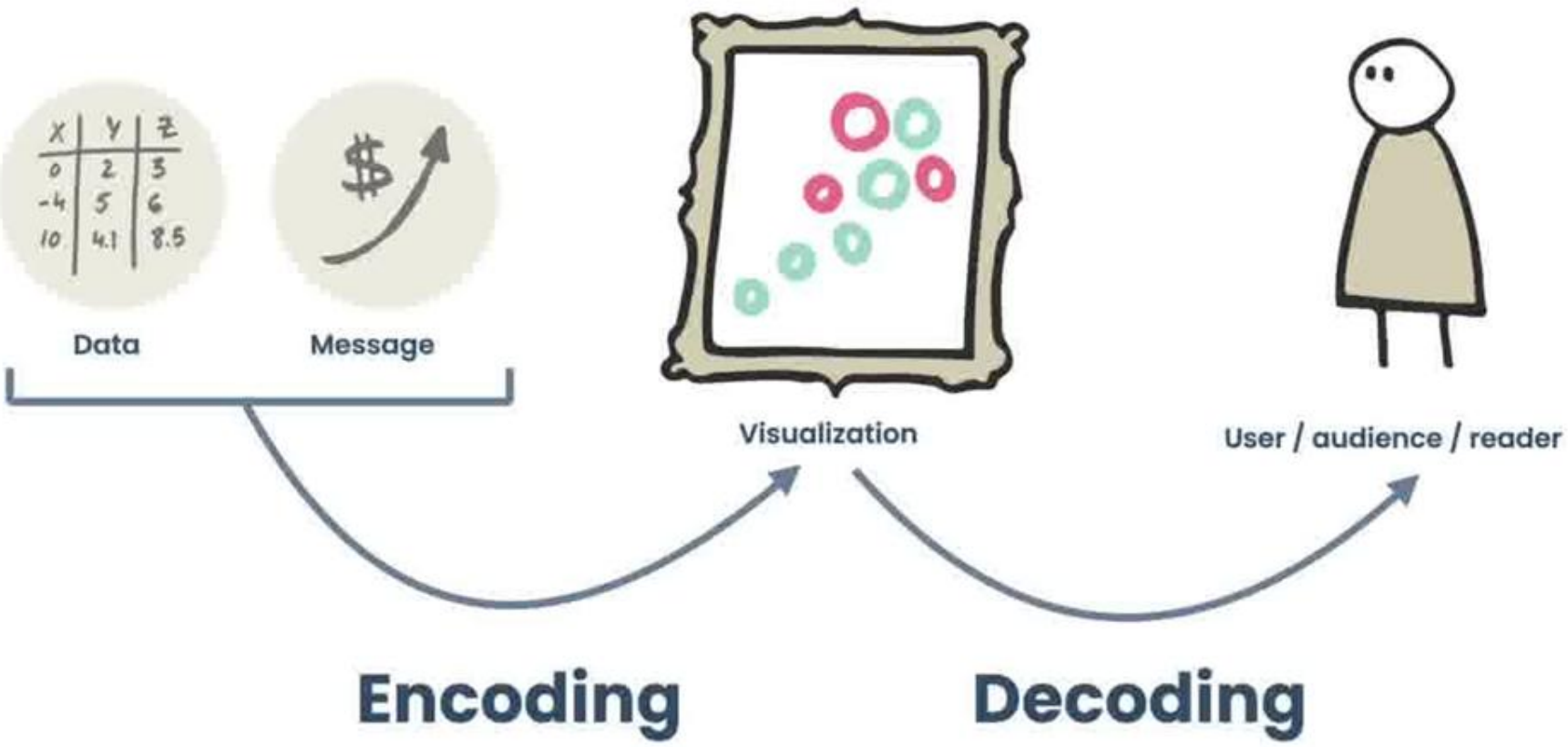
Encoding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Message
Visualization
User / audience / reader
Encoding
Decoding

No matter how clever
the choice of the information,
and no matter how
technologically impressive the encoding,
a visualization fails if the decoding fails.

"The Elements of Graphing Data", William S. Cleveland

How to make sure the decoding does not fail?

How to make sure the decoding does not fail?

Speak in your audience's "language"

How to make sure the decoding does not fail?

Speak in your audience's "language"

- We need to analyze what is the most **natural way to decode information** and to design the graph accordingly

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> *e.g. if I know the user is going to decode the message in English, I should make sure that when I write the message, I do it in English.*

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> *e.g. if I know the user is going to decode the message in English, I should make sure that when I write the message, I do it in English.*

Visual language

How to make sure the decoding does not fail?

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- We need to analyze what is the most **natural way to decode information** and to design the graph accordingly

> *e.g. if I know the user is going to decode the message in English, I should make sure that when I write the message, I do it in English.*

Visual language

- How do I know which graphical features are more easily decoded by humans?

How to make sure the decoding does not fail?

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- We need to analyze what is the most **natural way to decode information** and to design the graph accordingly

e.g. if I know the user is going to decode the message in English, I should make sure that when I write the message, I do it in English.

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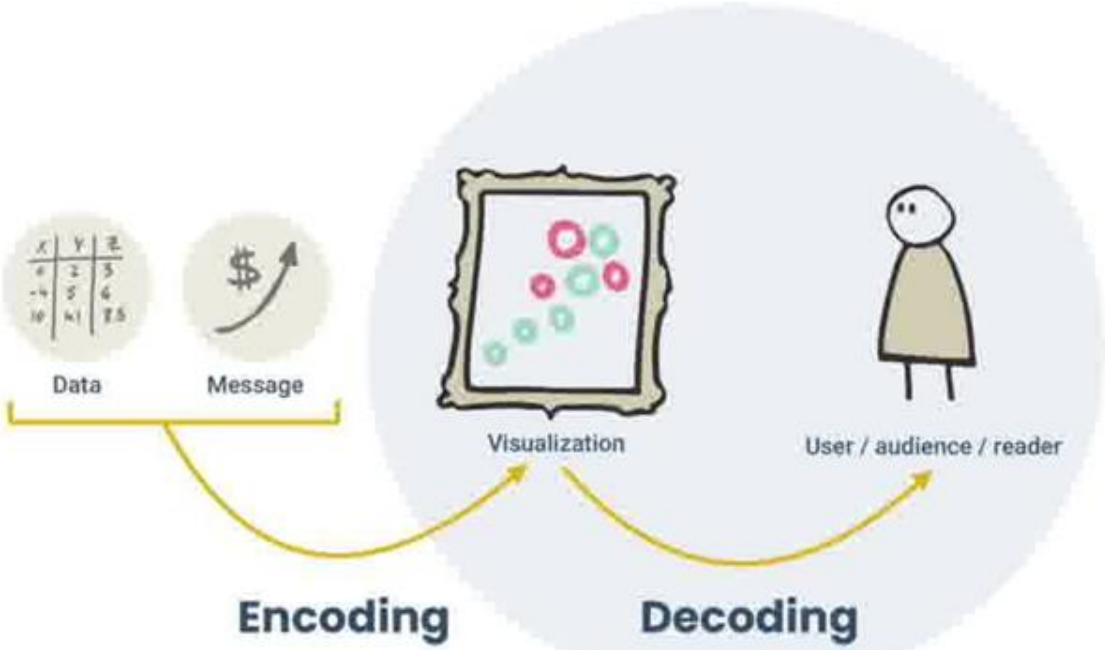
- How do I know which graphical features are more easily decoded by humans?

Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods.
William S. Cleveland & Robert McGill
Journal of the American Statistical Association
Vol. 79, No. 387 (Sept 1984), PP. 531-554

Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods

WILLIAM S. CLEVELAND and ROBERT McGILL*

CLEVELAND & MCGILL (1984)



Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods

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The goal of studying

human graphical perception

#1

IDENTIFICATION OF THE ESSENTIAL PERCEPTUAL TASKS

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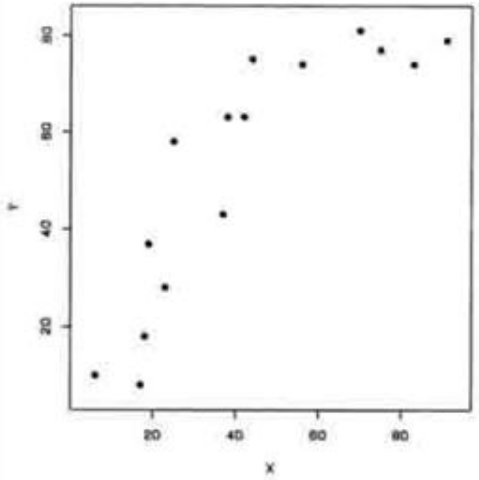

Position

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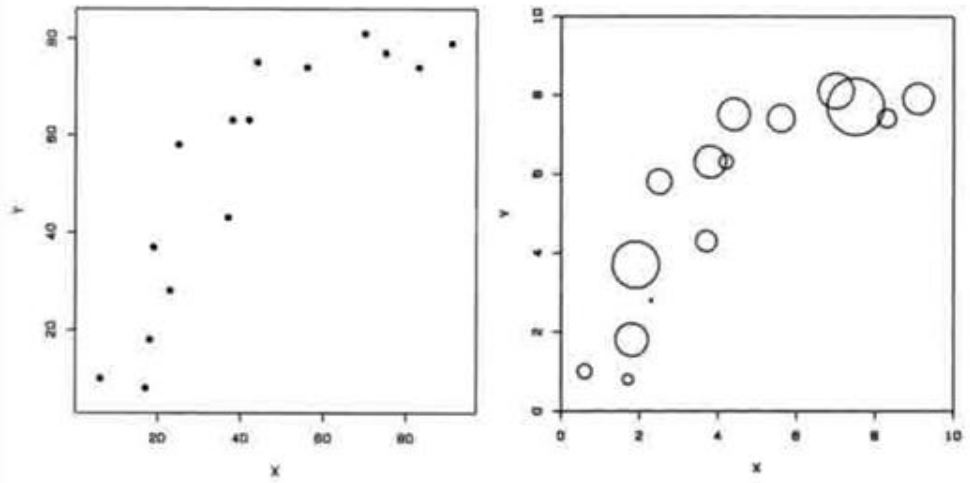

CLEVELAND & MCGILL (1984)
FIGURE 7 AND 9

Position

Position + Area

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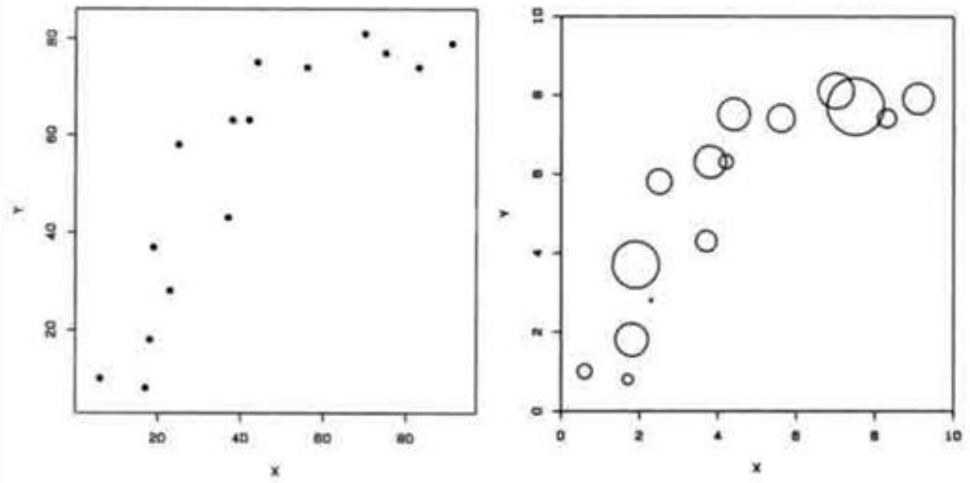

CLEVELAND & MCGILL (1984)
FIGURE 7 AND 9

Position

Position + Area

THE 10 ELEMENTARY PERCEPTUAL TASKS

#1

IDENTIFICATION OF THE ESSENTIAL PERCEPTUAL TASKS

" ...that are carried out when people extract quantitative information from graphs "

#2

RANKING

#1

IDENTIFICATION OF THE ESSENTIAL PERCEPTUAL TASKS

"...that are carried out when people extract quantitative information from graphs."

#2

RANKING

"Producing an ordering of the tasks on the basis of how accurately people perform them."

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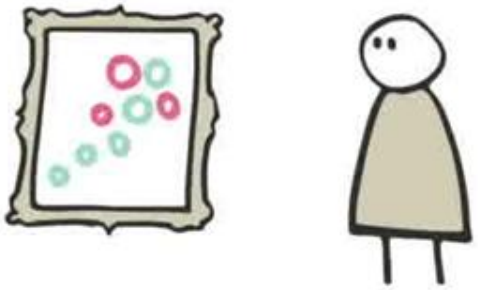
"Producing an ordering of the tasks on the basis of how accurately people perform them."

Generally, when a user is trying to decode the information in the graph, one or more of these elementary tasks have to be performed.



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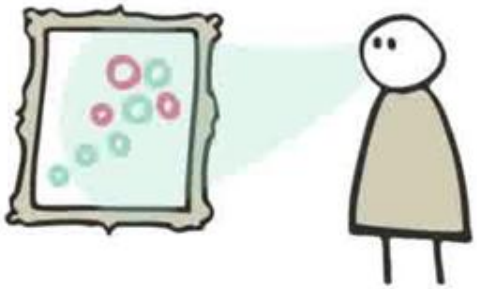

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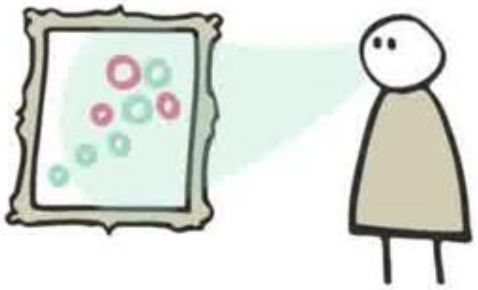

Some of these tasks are **easier** to perform than others

Some of these tasks yield to more **accurate** perceptions of the numerical quantities depicted

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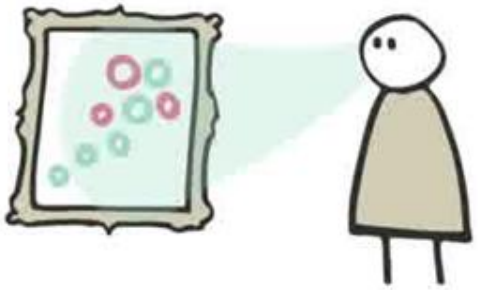

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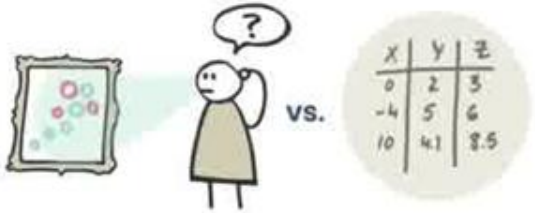

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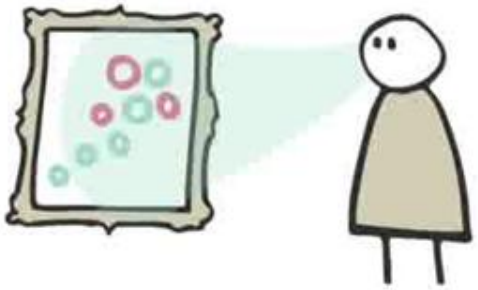

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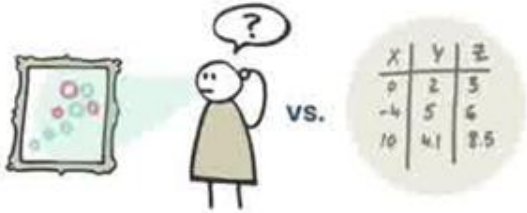

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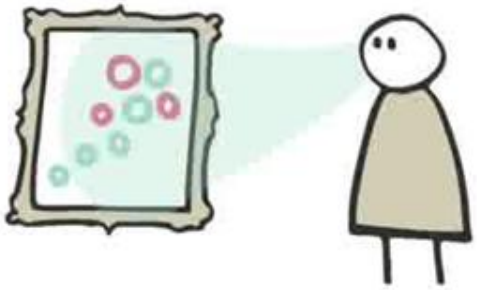

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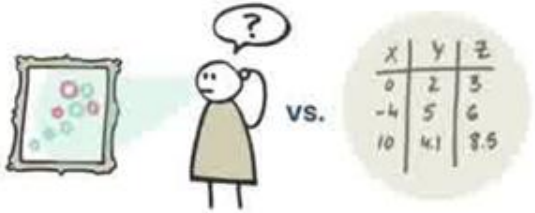

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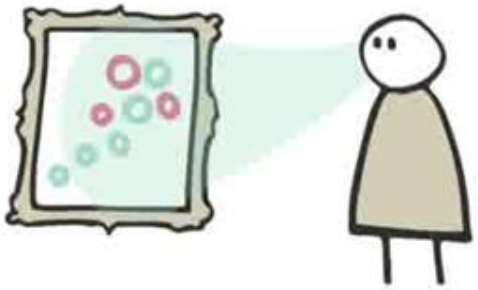

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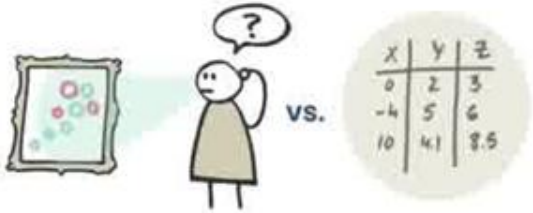

RANKING OF THE ELEMENTARY PERCEPTUAL TASKS

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REDESIGN OLD GRAPHICAL FORMS AND DESIGN NEW ONES

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"The goal is to construct a graph that uses tasks as high in the ranking as possible. Applying this to the current charts, the conclusion is that radical surgery on these popular types of graphs is needed."

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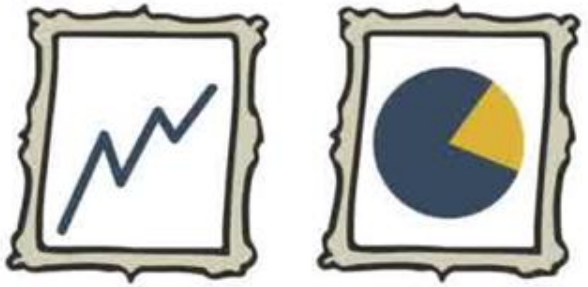

SIMPLE COMPLEX

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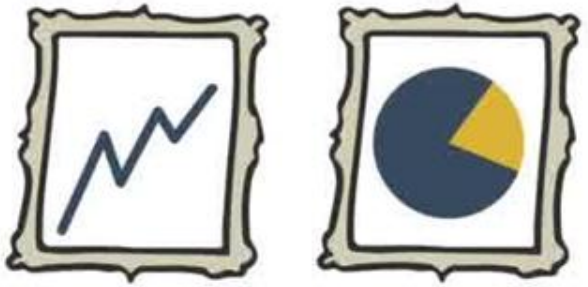

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REDESIGN OF THE TRADITIONAL PLOTS

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