

情報可視化

LX5: Mark と Channel

そして vis の心理的な側面

数理・計算科学系

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Mark & Channel

- Mark: 単純な図形でItem や Link を図示するもの
- Channel: Markの見栄えの調整

→ Points



→ Lines



→ Areas



Figure 5.2. Marks are geometric primitives.

Mark & Channel

- Mark: 単純な図形でItem や Link を図示するもの
- Channel: Markの見栄えを調整するもの

④ Position



④ Color



④ Shape



④ Tilt



④ Size

→ Length



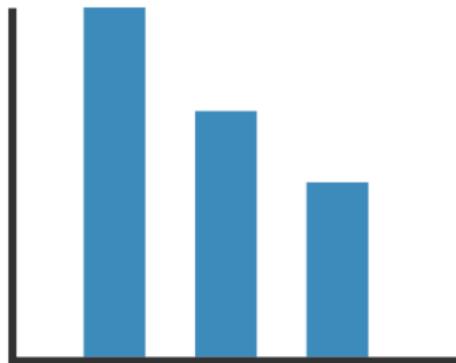
→ Area



→ Volume



MarkとChannelの利用



- 1次元Quantitativeデータを棒グラフ ($C \times Q$)

MarkとChannelの利用



- 2次元Quantitativeデータを散布図で表現 ($Q \times Q$)

MarkとChannelの利用



- 散布図にさらに、色相チャネルを付加してカテゴリー要素を表現 ($Q \times Q \times C$)

MarkとChannel



- 彩色散布図に大きさチャネルを用いてQuantitativeデータを表現 ($Q \times Q \times C \times Q$)

Channel間の独立性

- 一般にChannel間に相互作用が働くため、Channelを無思慮に追加することはできない。
 - 散布図での距離チャネル (No good)
 - 線Markの太さの限度 (Questionable)
 - 棒グラフの長さチャネル (Bad)
 - 点Markの大きさ | 形状 | 色相Channel (Good)

Channel種別

- Identity Channel \Leftrightarrow Categorical Attributes
 - “what something is” or “where it is”
- Magnitude Channel \Leftrightarrow Ordered Attributes

Channelの効力

- Channel の効力は、データ表現において、対象とするデータの型に大きく依存する。

→ Data and Dataset Types

Tables	Networks & Trees	Fields	Geometry	Clusters, Sets, Lists
Items	Items (nodes)	Grids	Items	Items
Attributes	Links	Positions	Positions	Attributes

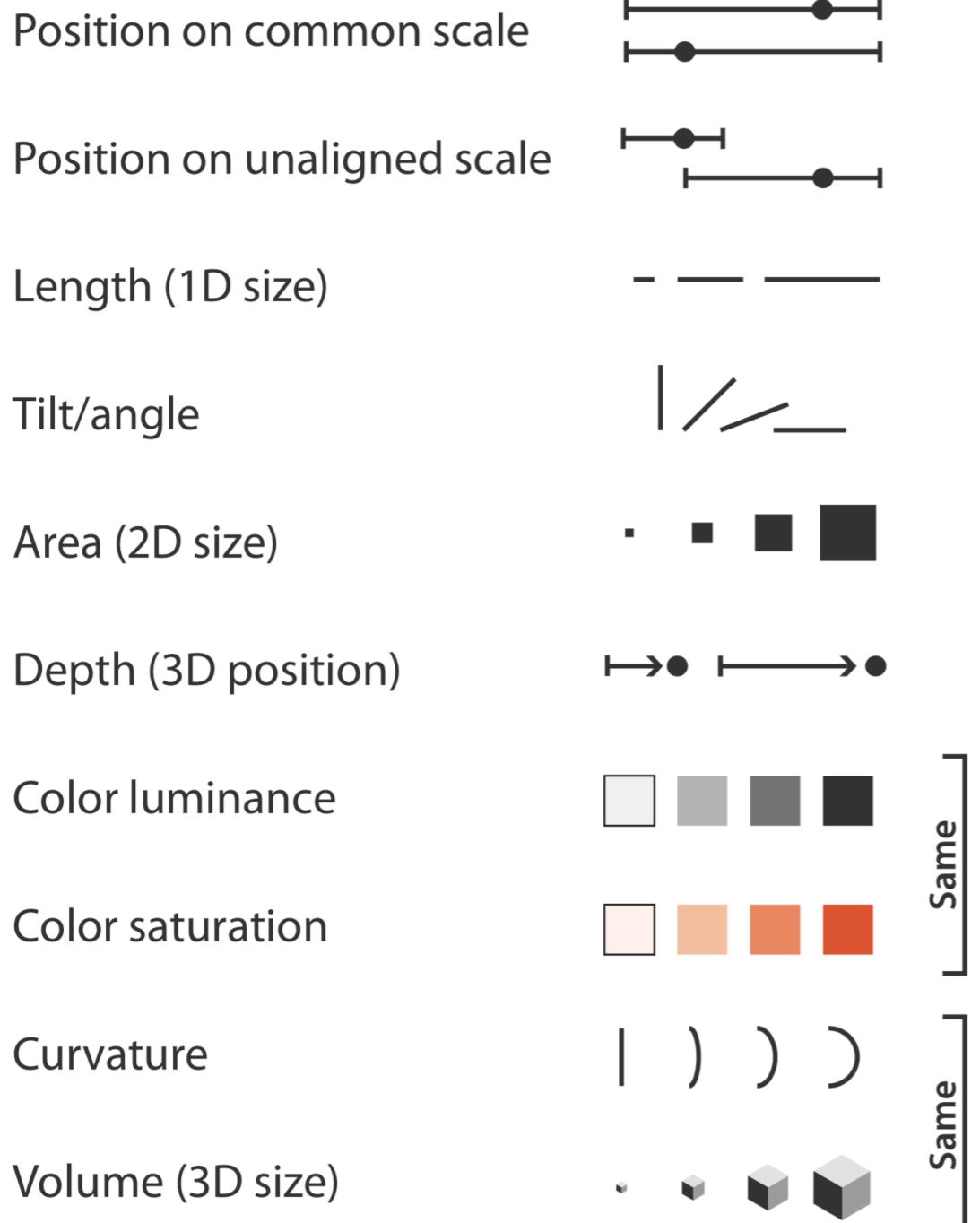
Channelの表現性原理

1. 表現したいデータが目で眺めて読み取れること
2. 図から読み取ることはデータを反映したものであること：見ている人が想定外の「データ」を読み取ってはいけない

Channelの効力ランキ ング

Channels: Expressiveness Types and Effectiveness Ranks

→ Magnitude Channels: Ordered Attributes



→ Identity Channels: Categorical Attributes

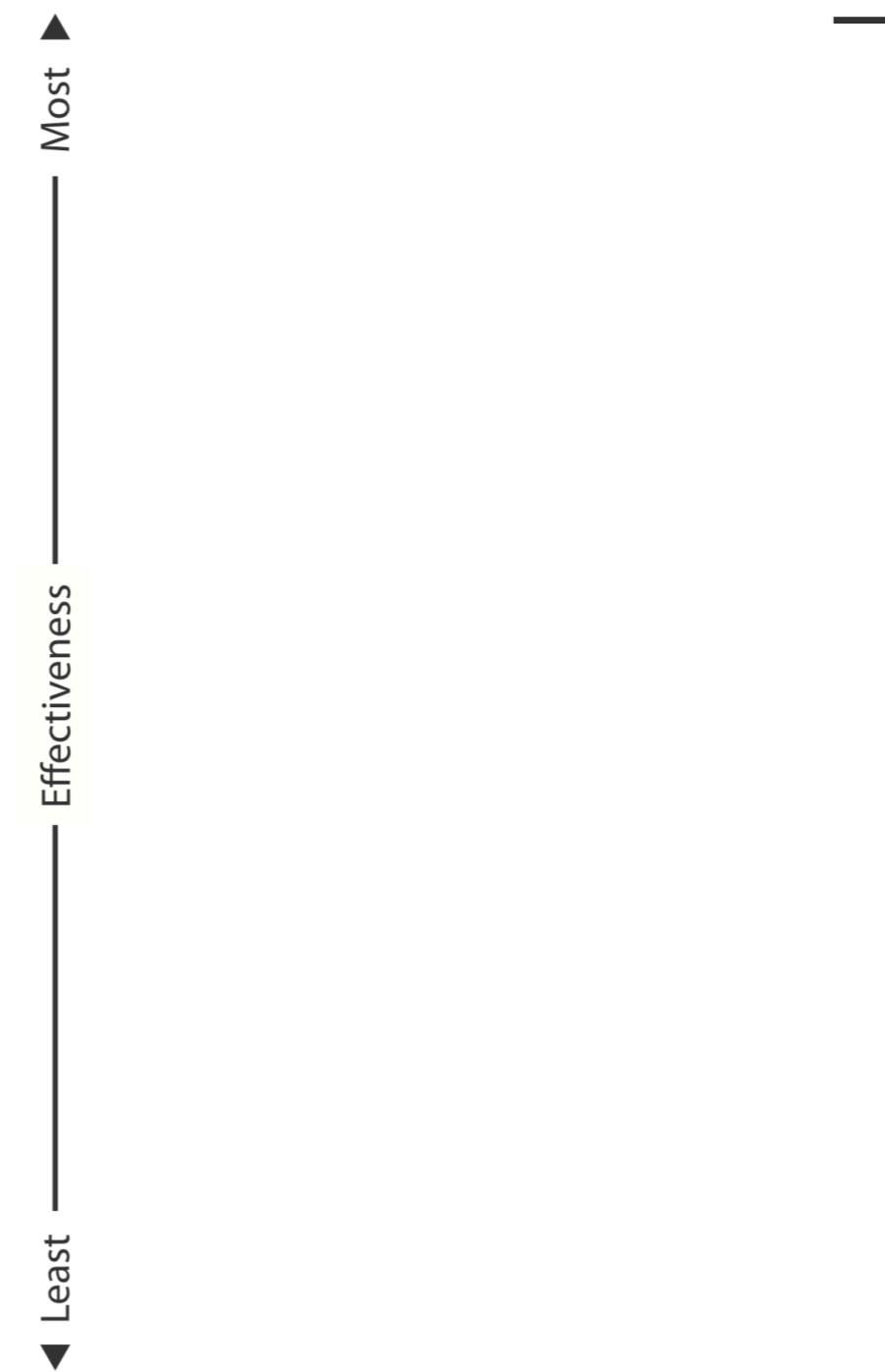
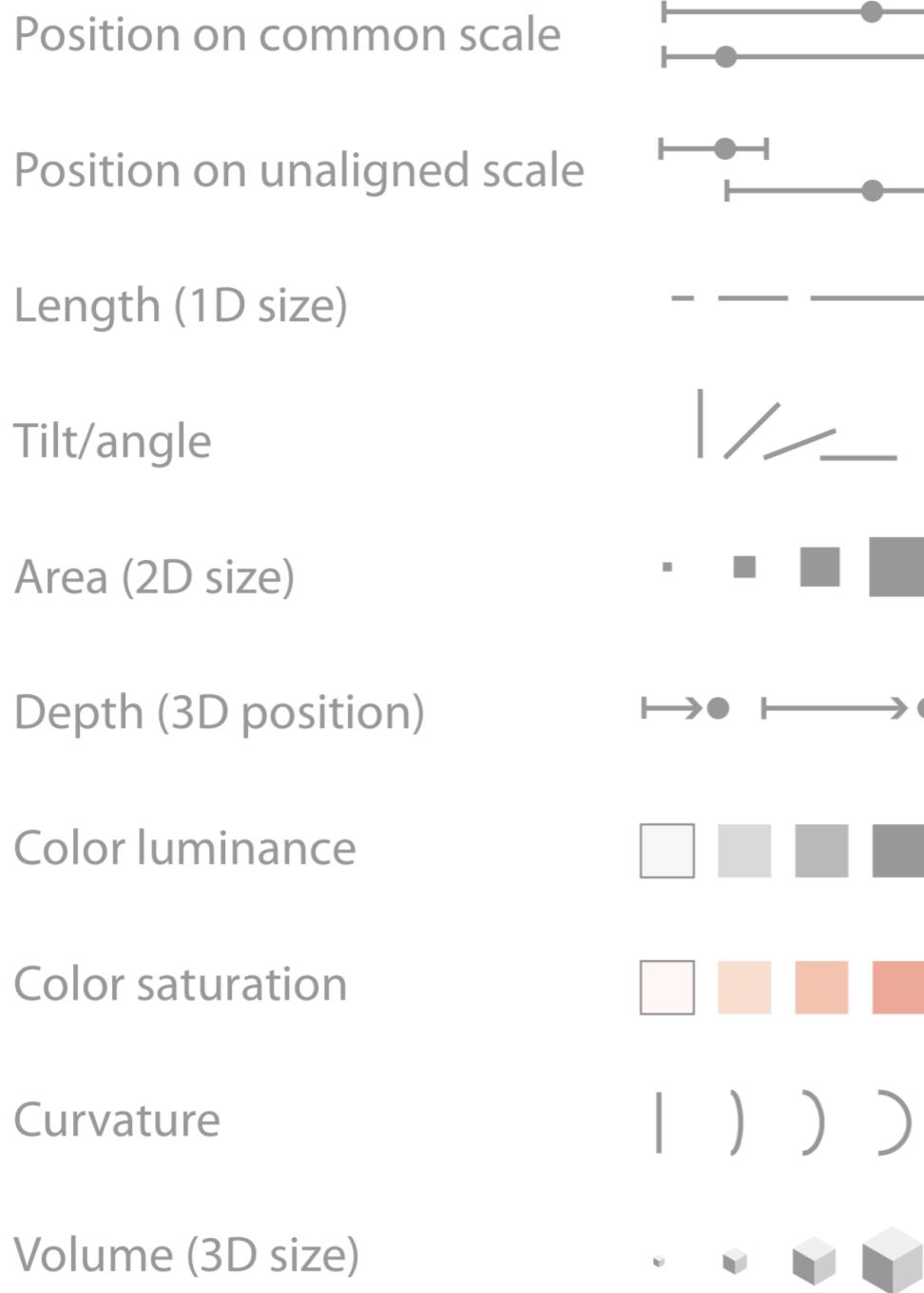


Figure 5.1. The effectiveness of channels that modify the appearance of marks depends on matching the expressiveness of channels with the attributes being encoded.

Channels: Expressiveness Types and Effectiveness Ranks

→ Magnitude Channels: Ordered Attributes



→ Identity Channels: Categorical Attributes

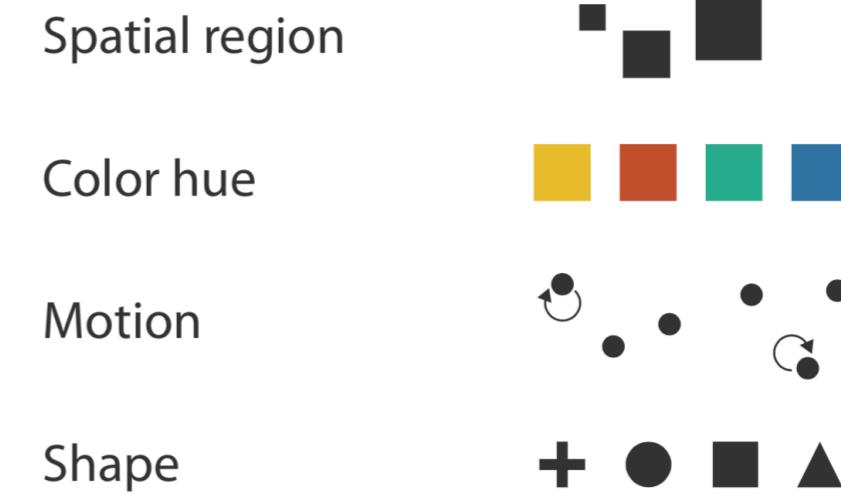


Figure 5.1. The effectiveness of channels that modify the appearance of marks depends on matching the expressiveness of channels with the attributes being encoded.

Channelの効果測定

- 正確性 (Accuracy): Stevensのパワー則
- 判別性 (Discriminability): 何種類のデータを表現できるのか
- 分離性 (Separability): 他のChannelからの影響の分離

Steven's Psychophysical Power Law: $S = I^n$

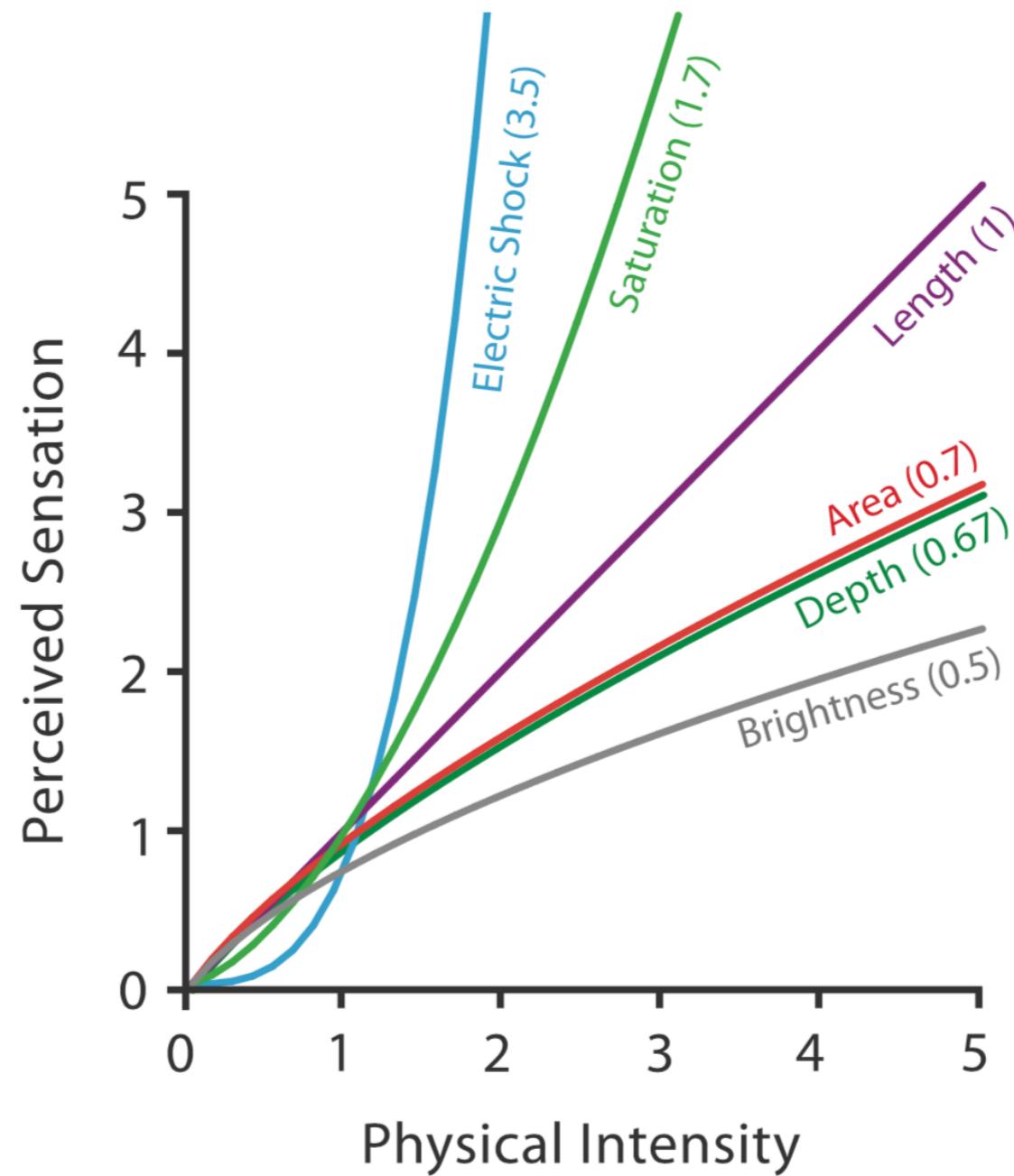
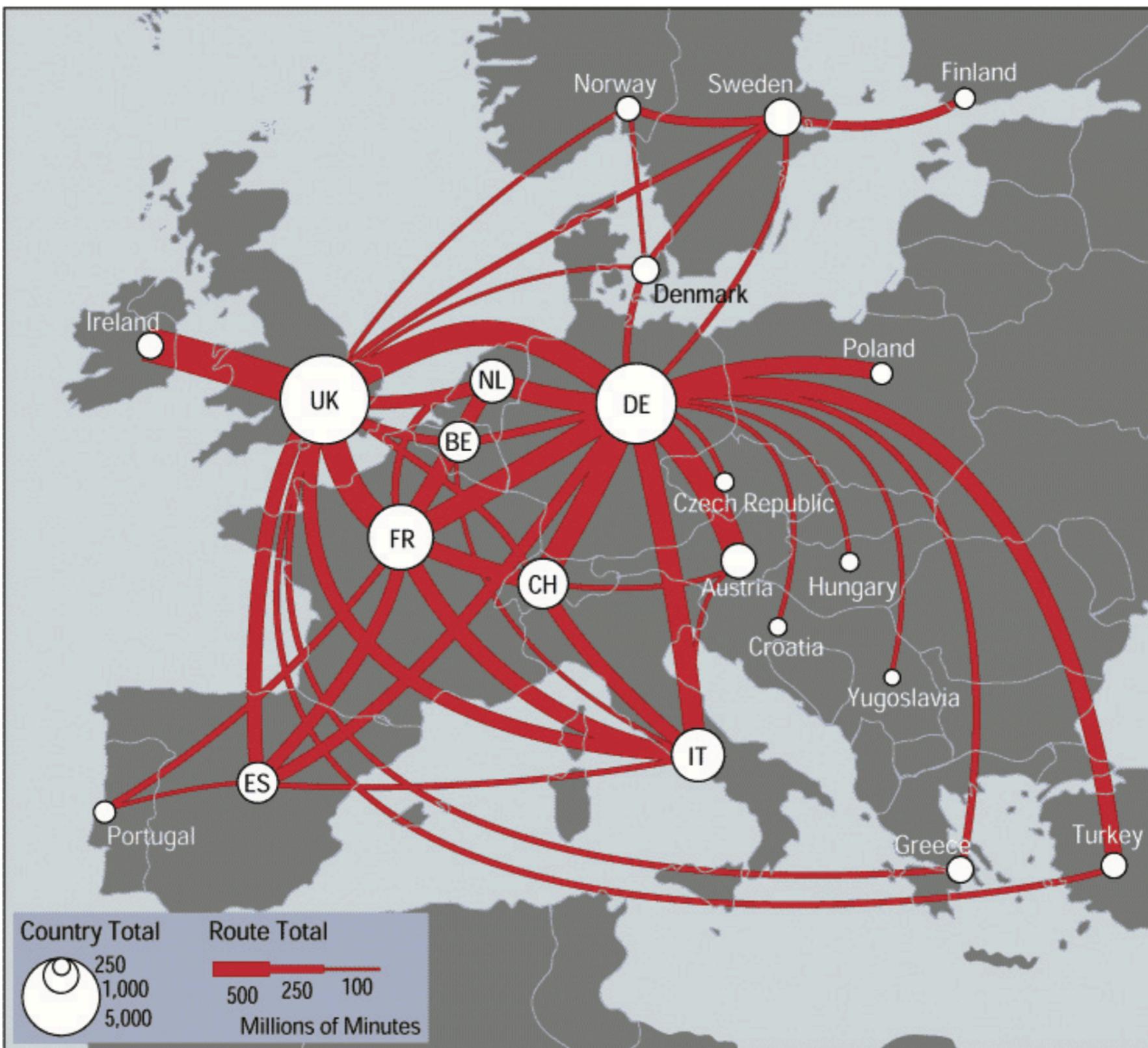


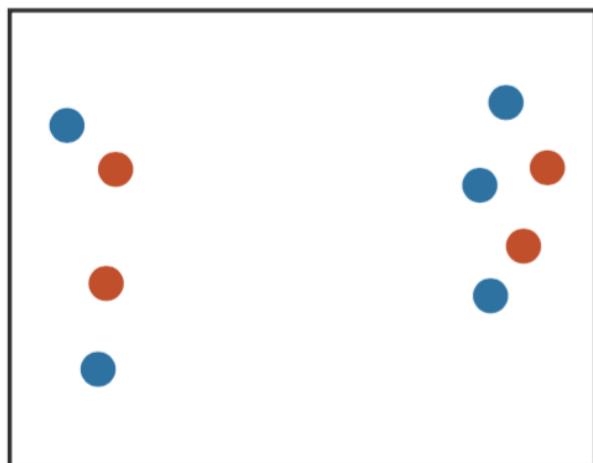
Figure 5.7. Stevens showed that the apparent magnitude of all sensory channels follows a power law $S = I^n$, where some sensations are perceptually magnified compared with their objective intensity (when $n > 1$) and some compressed (when $n < 1$). Length perception is completely accurate, whereas area is compressed and saturation is magnified. Data from Stevens [Stevens 75, p. 15].

Discriminability



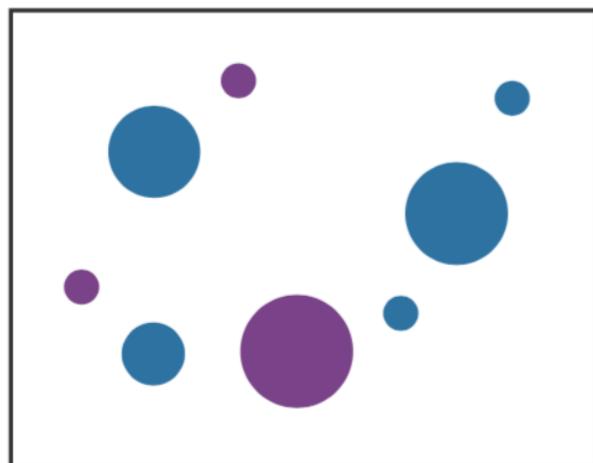
Separability

Position
+ Hue (Color)



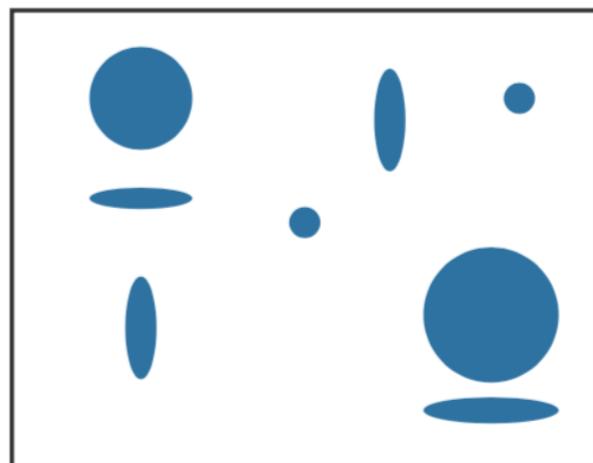
Fully separable

Size
+ Hue (Color)



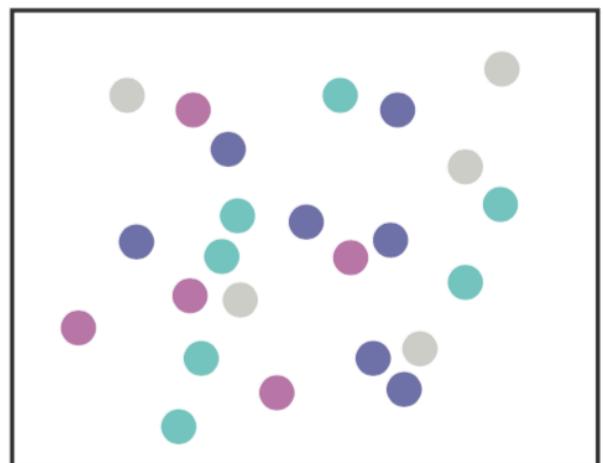
Some interference

Width
+ Height



Some/significant
interference

Red
+ Green



Major interference

Popout

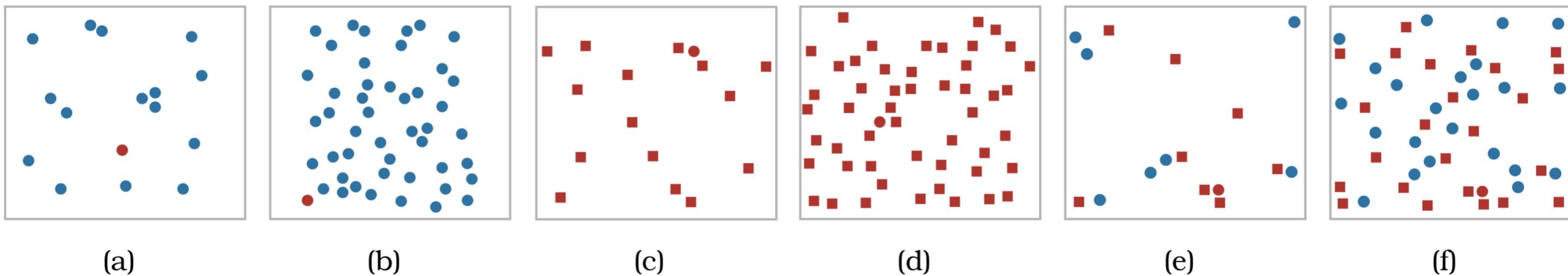


Figure 5.11. Visual popout. (a) The red circle pops out from a small set of blue circles. (b) The red circle pops out from a large set of blue circles just as quickly. (c) The red circle also pops out from a small set of square shapes, although a bit slower than with color. (d) The red circle also pops out of a large set of red squares. (e) The red circle does not take long to find from a small set of mixed shapes and colors. (f) The red circle does not pop out from a large set of red squares and blue circles, and it can only be found by searching one by one through all the objects. After <http://www.csc.ncsu.edu/faculty/healey/PP> by Christopher G. Healey.

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