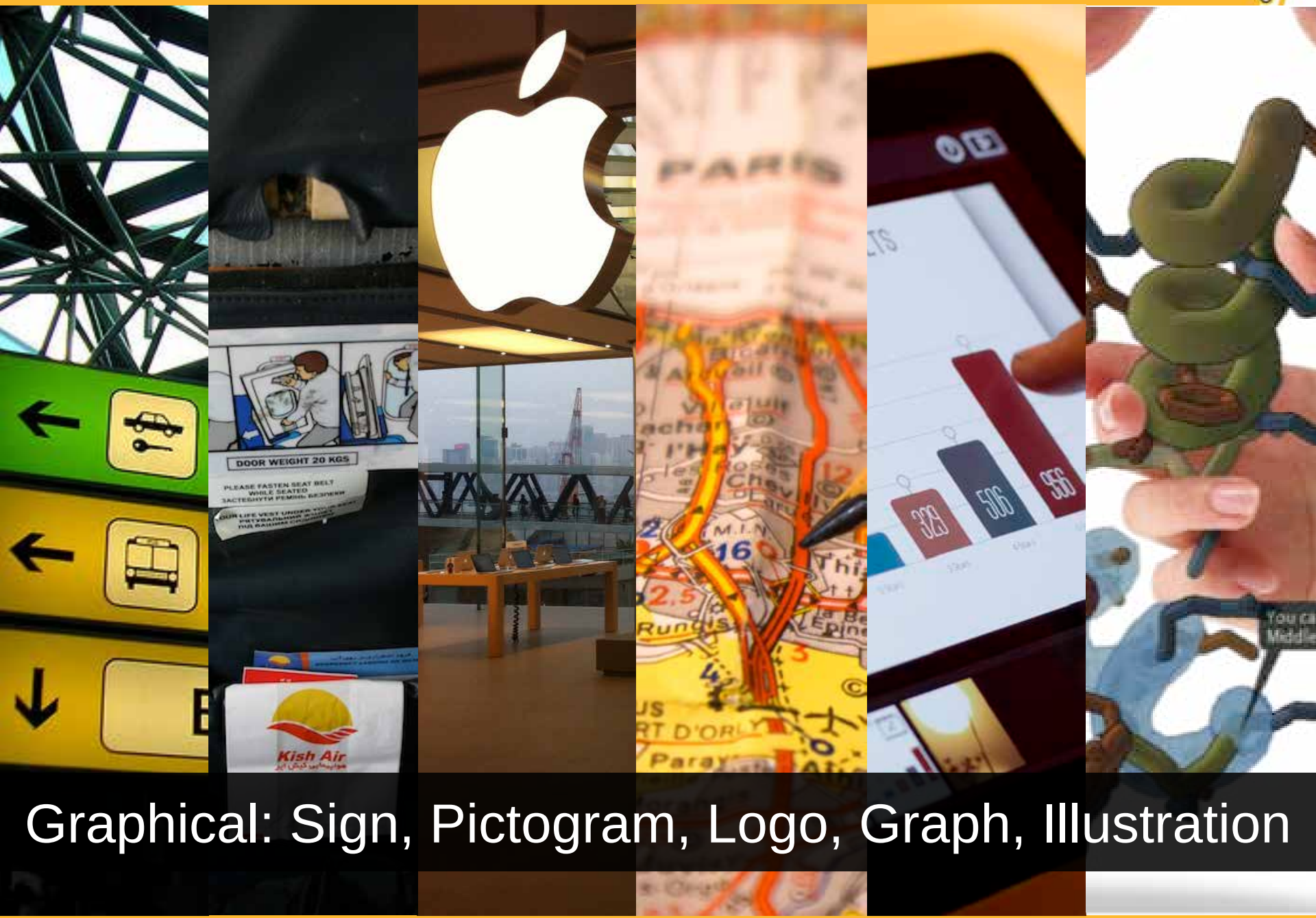
¾ The Magic of Visual Communication in HCI

Xiaojuan Ma
mxj@cse.ust.hk

Picture is Worth a Thousand Words

What is Visual Communication?

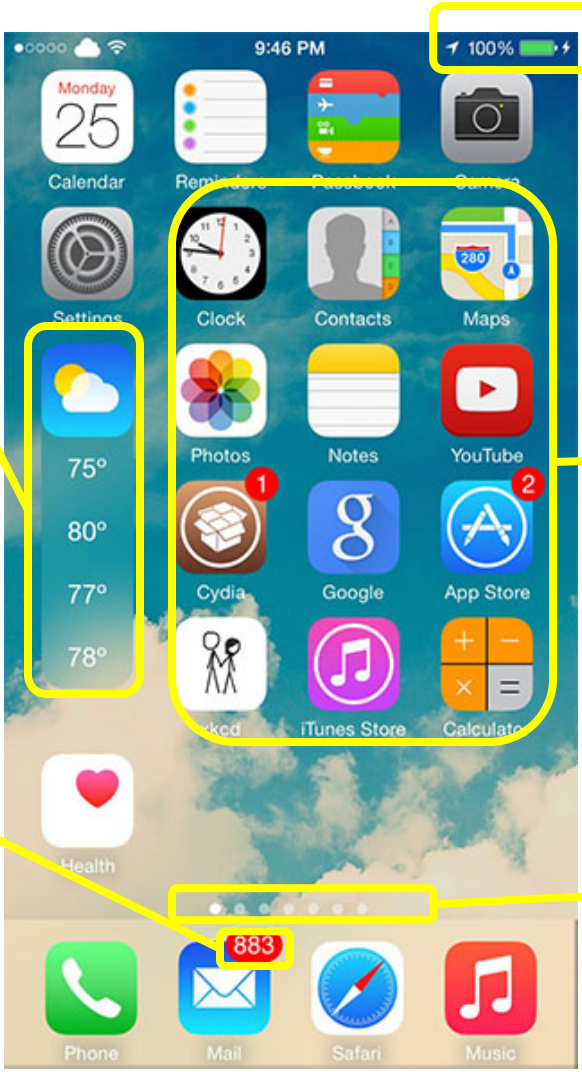
- Visual communication is ''communication'' through **visual aid** and is described as the **conveyance of ideas and information** in forms that can be read or looked upon.



Graphical: Sign, Pictogram, Logo, Graph, Illustration

Pictorial: Media and Art

What does Visual Communication have to do with HCI?



Information

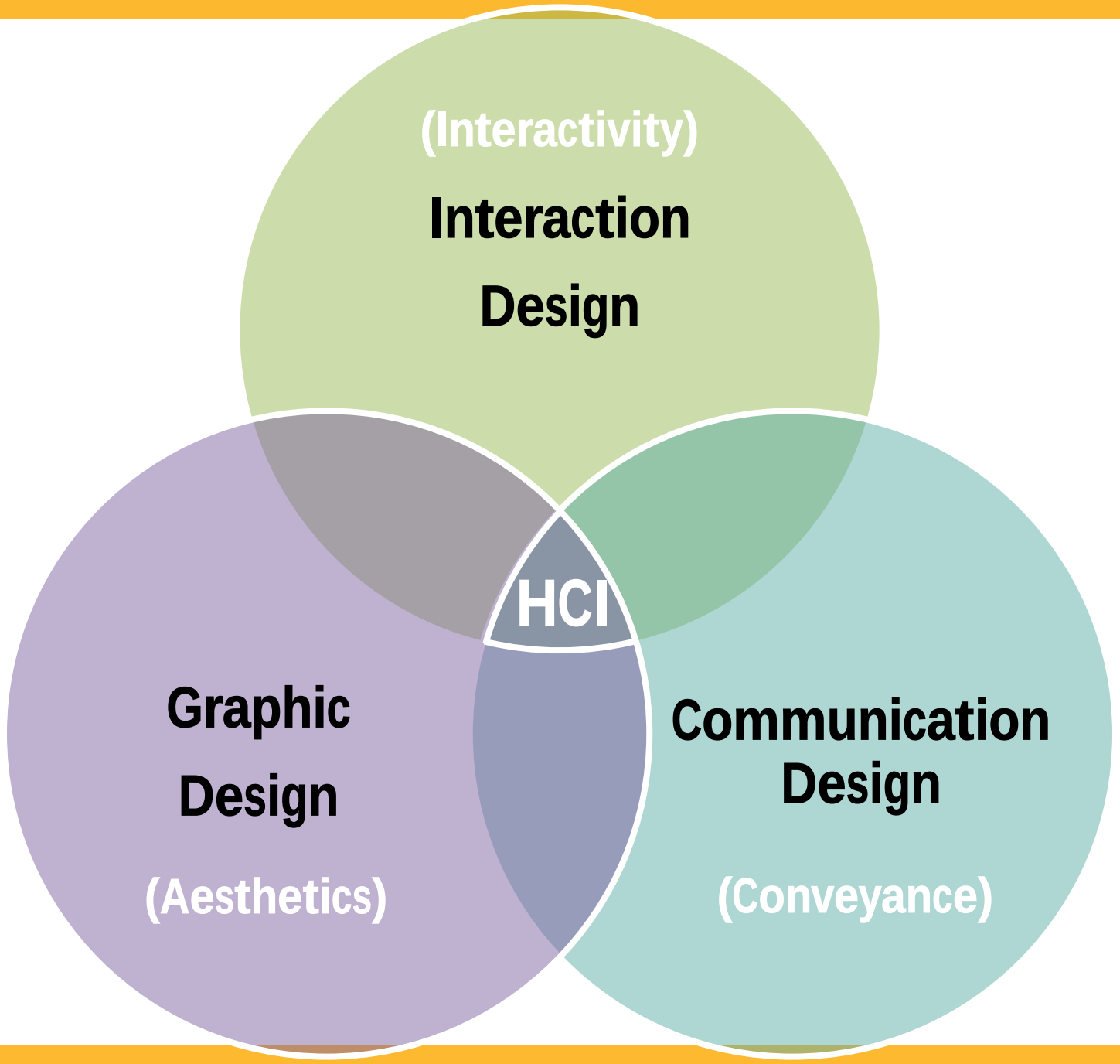
Notification

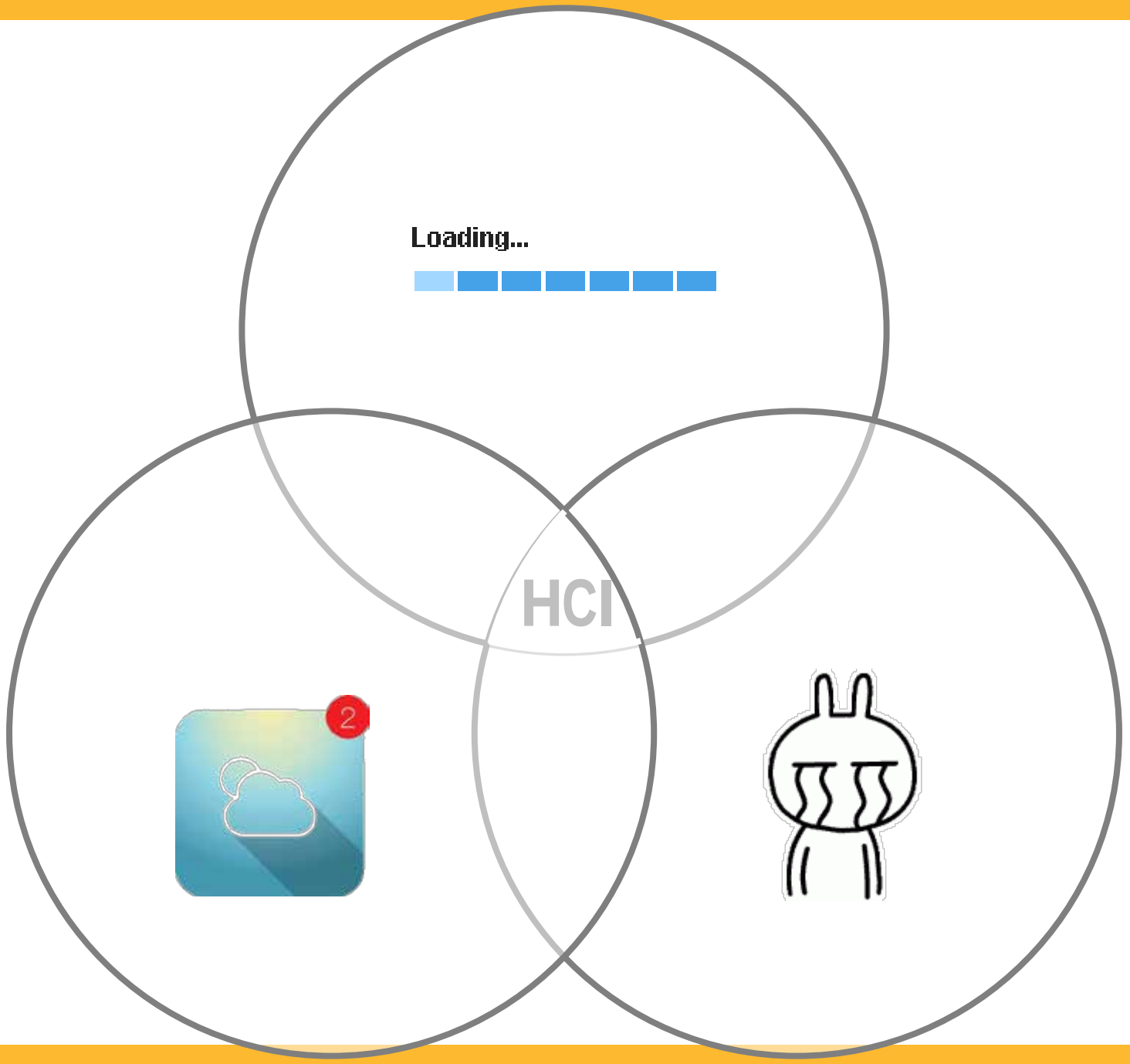
Status

Content
Function

Operation
Navigation

Tabs, Pads, and Boards


(Interactivity)
Interaction
Design
HCI
Graphic
Design
(Aesthetics)
Communication
Design
(Conveyance)


Loading...
HCI
2

Linguistic Communication Breakdowns

Disability

Degeneration

Low Language Skills

Low Literacy

Cultural Differences

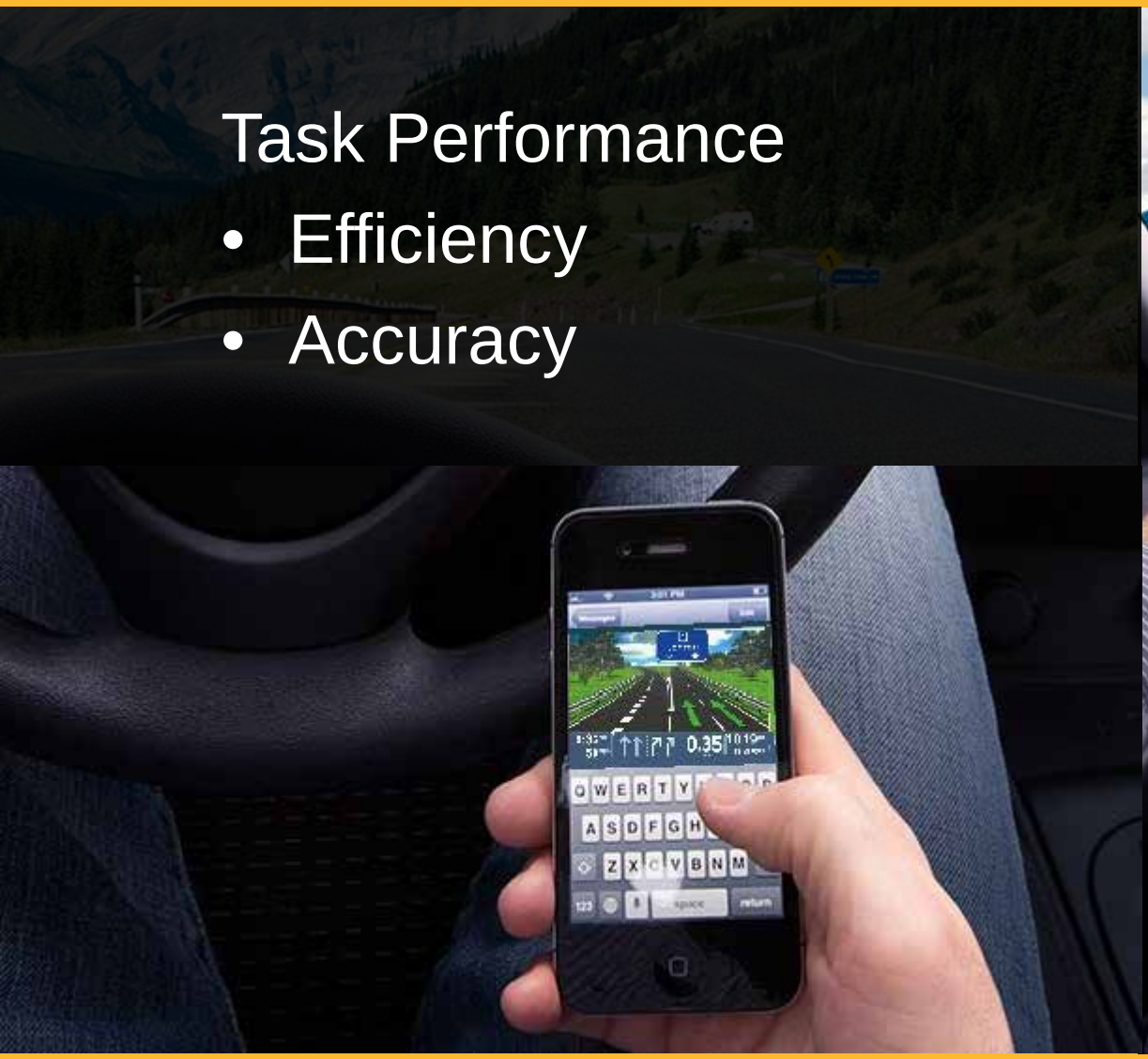
New / Abstract Info

When Words are More Than Enough...

Limitations on

- Time
- Space
- Field of View
- Attention Span
- Cognitive Power

What is good about Visual Communication?



Task Performance

- Efficiency
- Accuracy

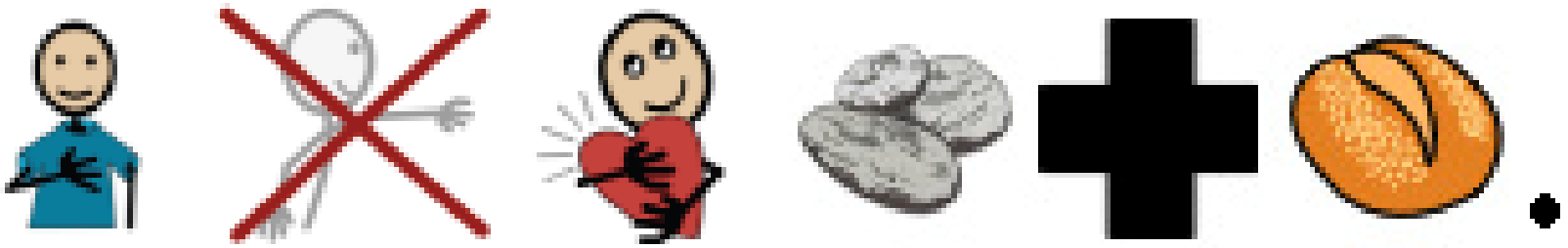
What is good about Visual Communication?

User Experiences

- Physical
- Psychological

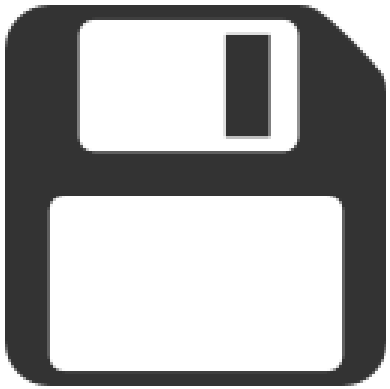
Limitations of Visual Communication

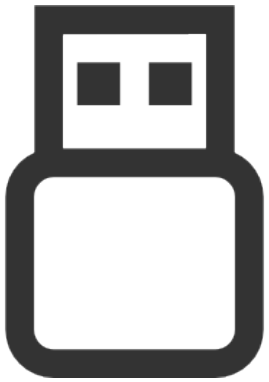
- Ambiguity
- Non-imageable Concepts
- Sensitivity to Individual Differences



I do not like rock and roll.

Age, Culture, ... Differences





:-)

What color is the light for a HK vacant Taxi?

What Color is the ↑ in JP Stock Market?

Visual Communication

Convey information via graphical and/or pictorial representations

E.g. GUI and information visualization in HCI

When

Advantages

What

Definition

Visual Communication

When words are not enough or more than enough

Improve task performance and user experiences

Why Advantages

When Advantages

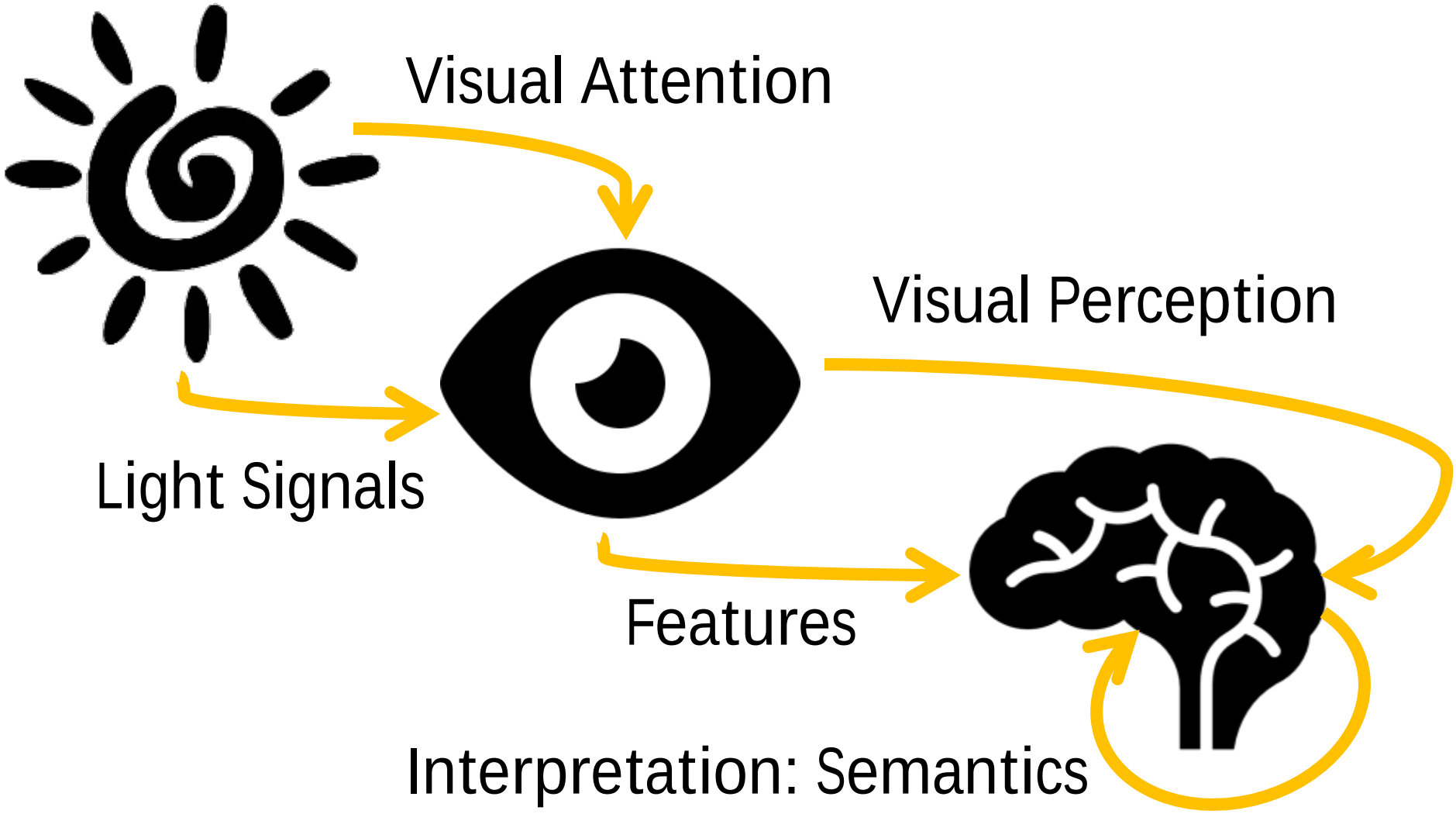
What Definition

Visual Attention
Visual Perception

Why could visual communication work?

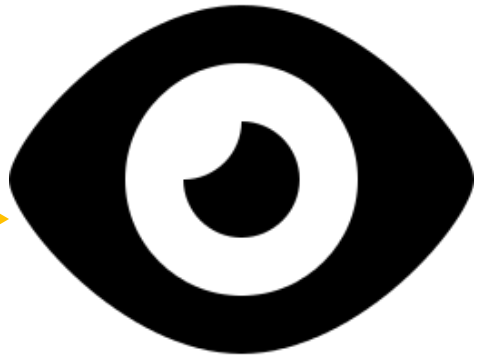
Why do we need to care about the fundamentals?

Why Visual Communicate Works?



Passive Visual Communicate

Visual Attention



Visual Perception

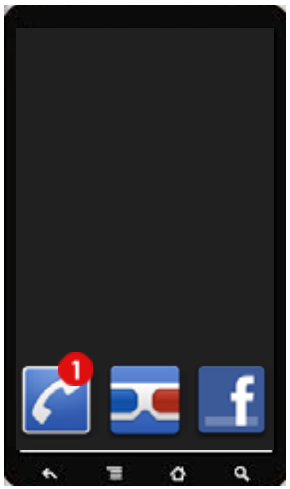
Light Signals

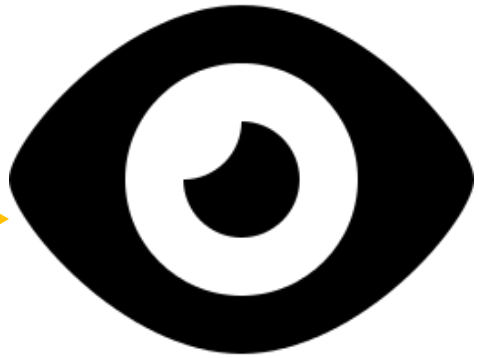
Color, Shape, Symbol

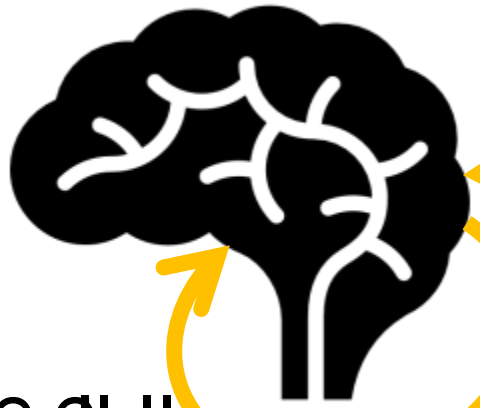
Feature

Interpretation: Semantic

Proactive Visual Communicate







Visual Attention

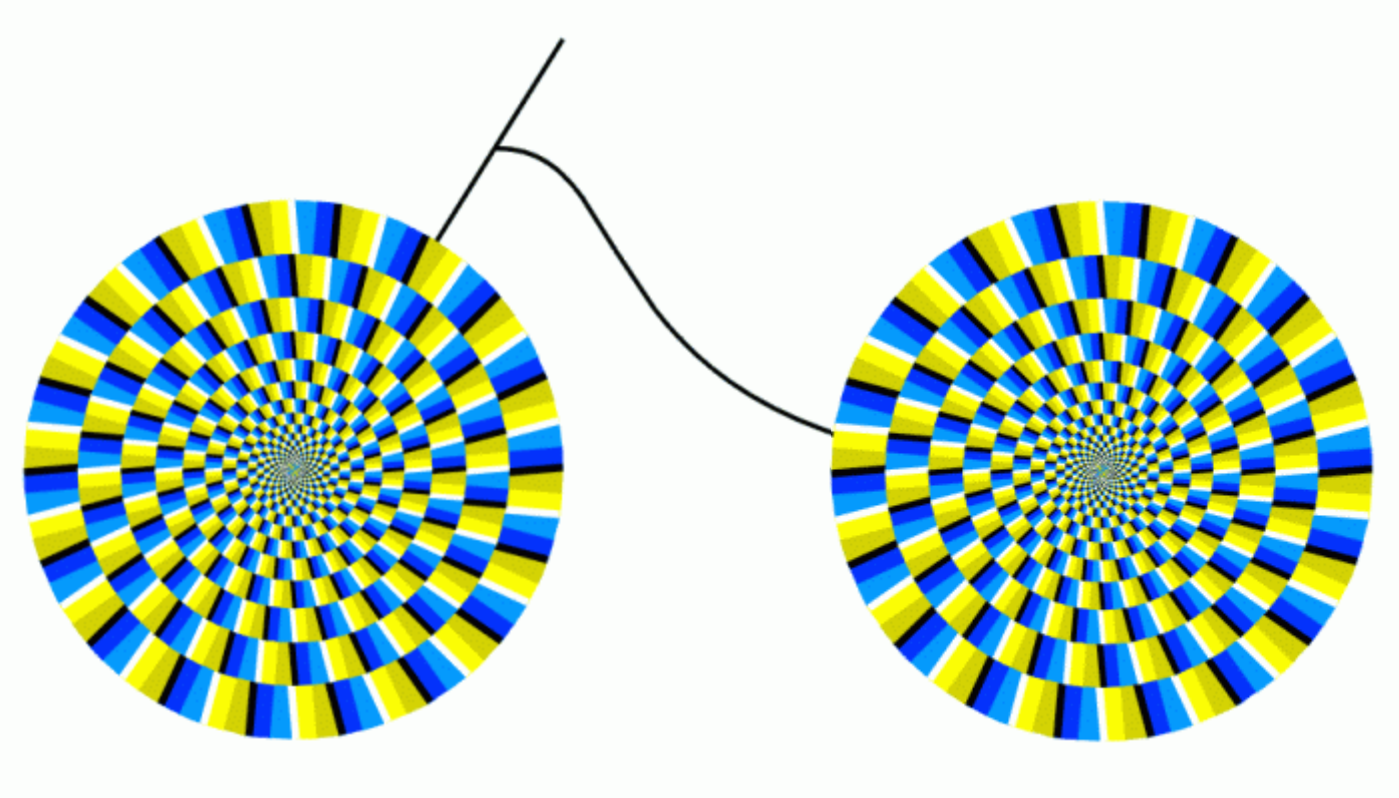
Visual Perception

Light Signals

Color, Shape, Symbol

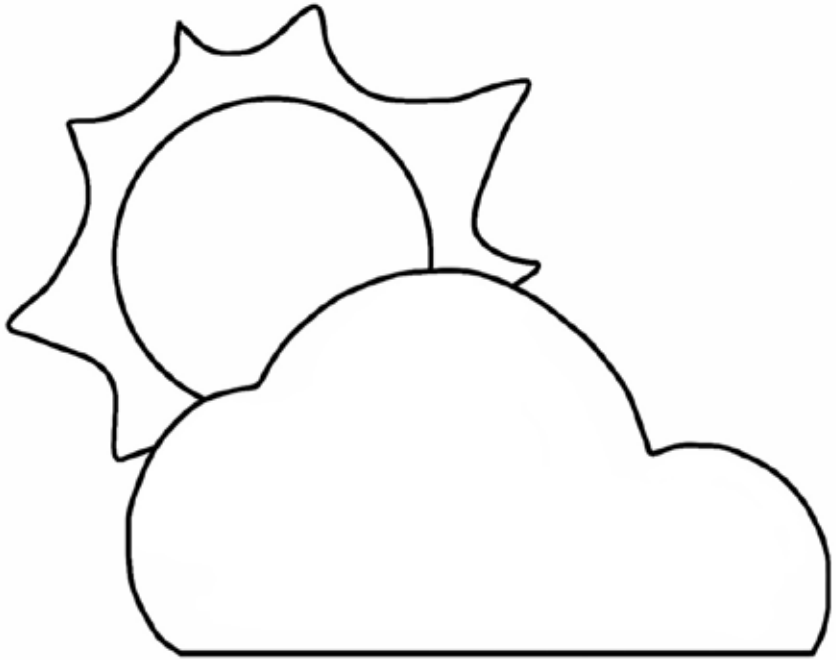
Interpretation: Recall

Features and Semantics



Visual Perception – Contour

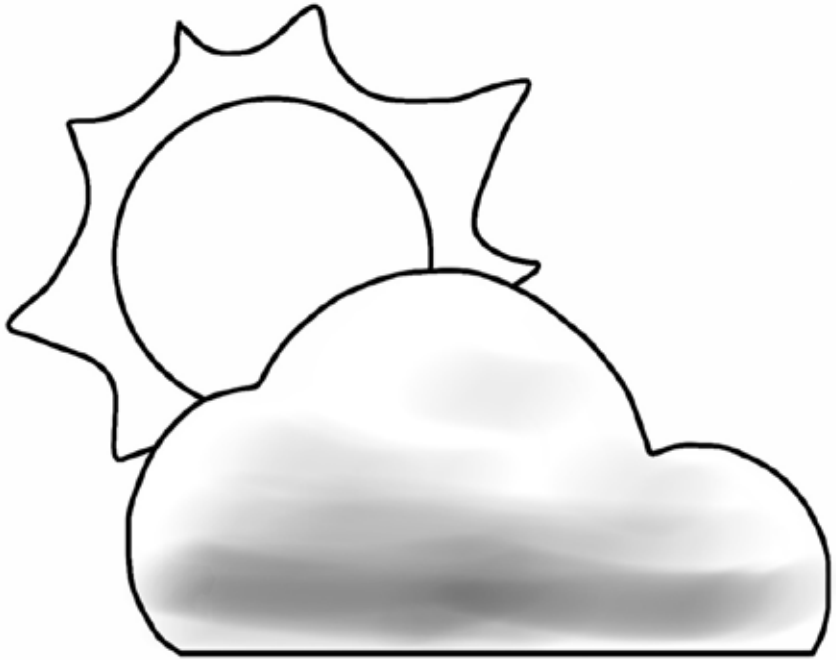
- Contour
  - Shape
  - Size
- Occlusion
  - Depth
  - Spatial Relationship



(Rubin, 1958; Hochberg, 1962)

Visual Perception – Texture, Shading

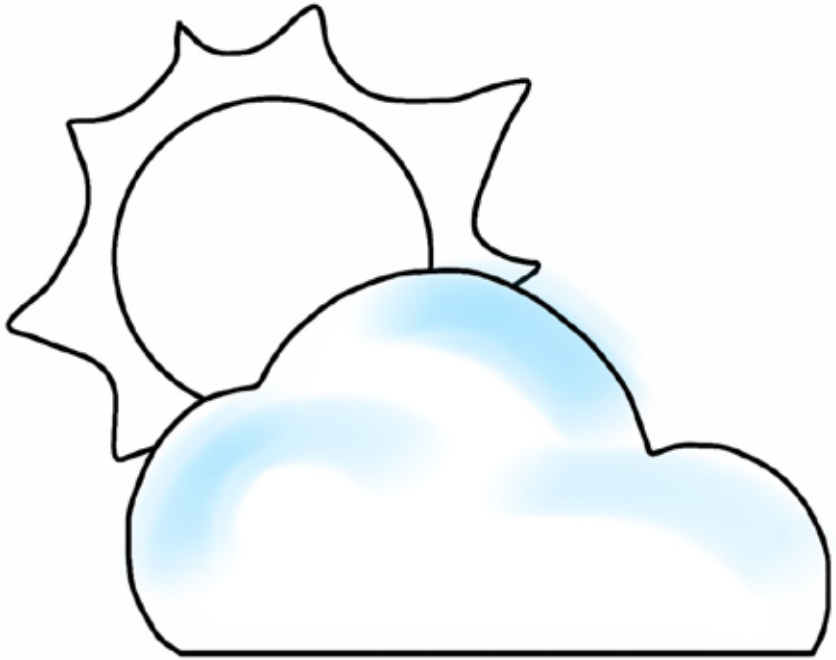
- Texture
  - Material
  - Surface Condition
- Shading
  - Volume
  - Position
  - Lighting



(Gibson, 1950)

Visual Perception – Color

- Color
  - Material and Texture
  - Subtle Information

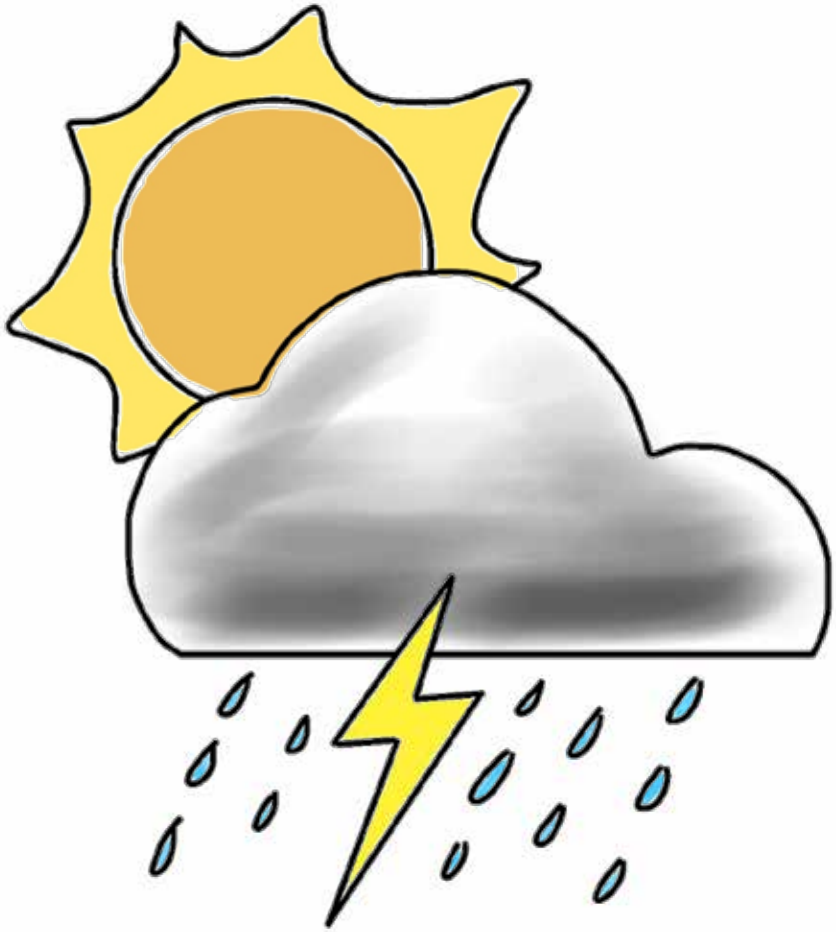


(Pettersson, 1981; Kjelldahl, 2003)

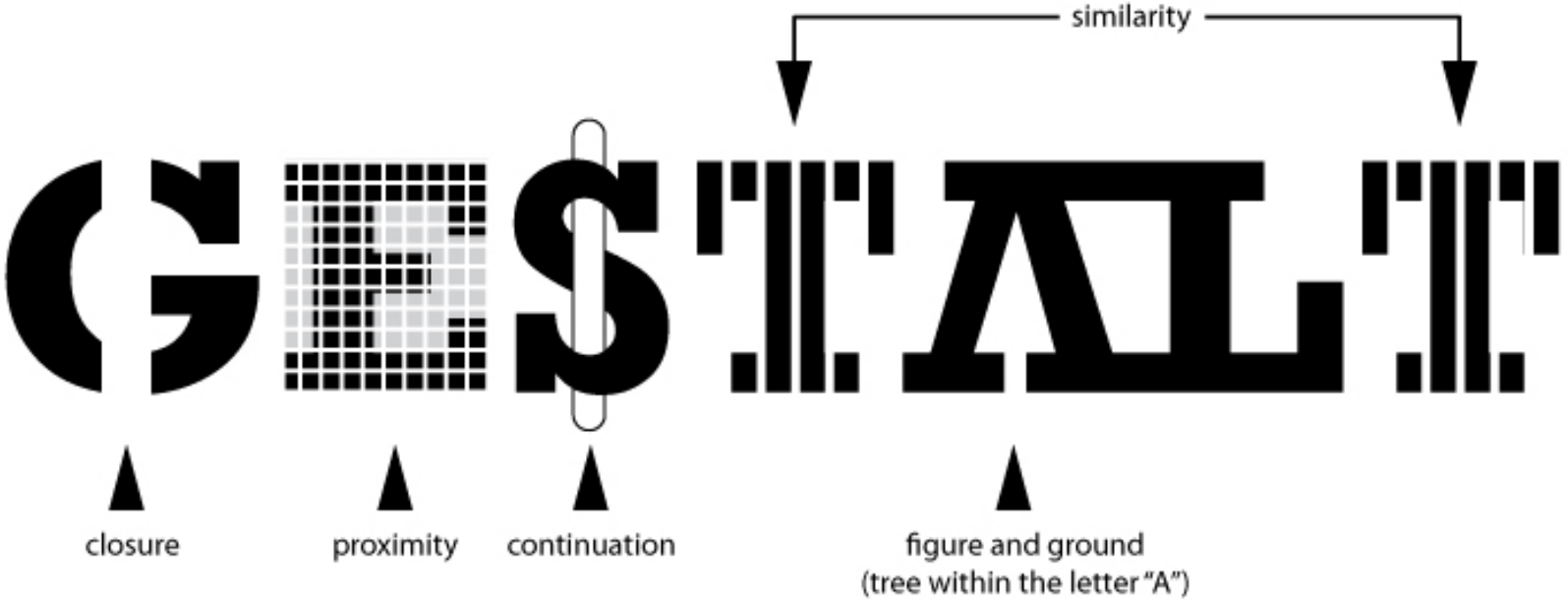
Visual Perception – Symbols

- Symbols
  - Abstract Information
  - Complicated Information

Visual Perception – Combination



Gestalt Theory



PROXIMITY

Most people see rows on the left and columns on the right.

SIMILARITY

Most people see a larger group containing a sub-group.

FIGURE GROUND

Most people first see a vase or a face then flip between the two.

Examples:

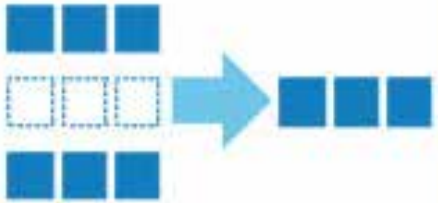
CONTINUATION

Most people see 2 rows crossing rather than for lines meeting at a single point.

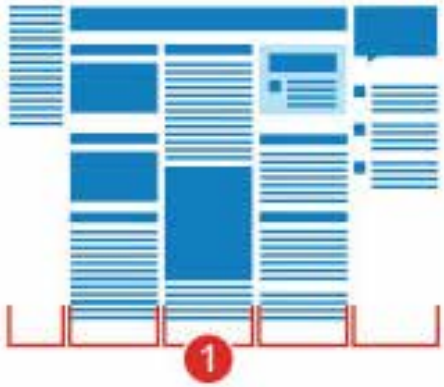
CLOSURE

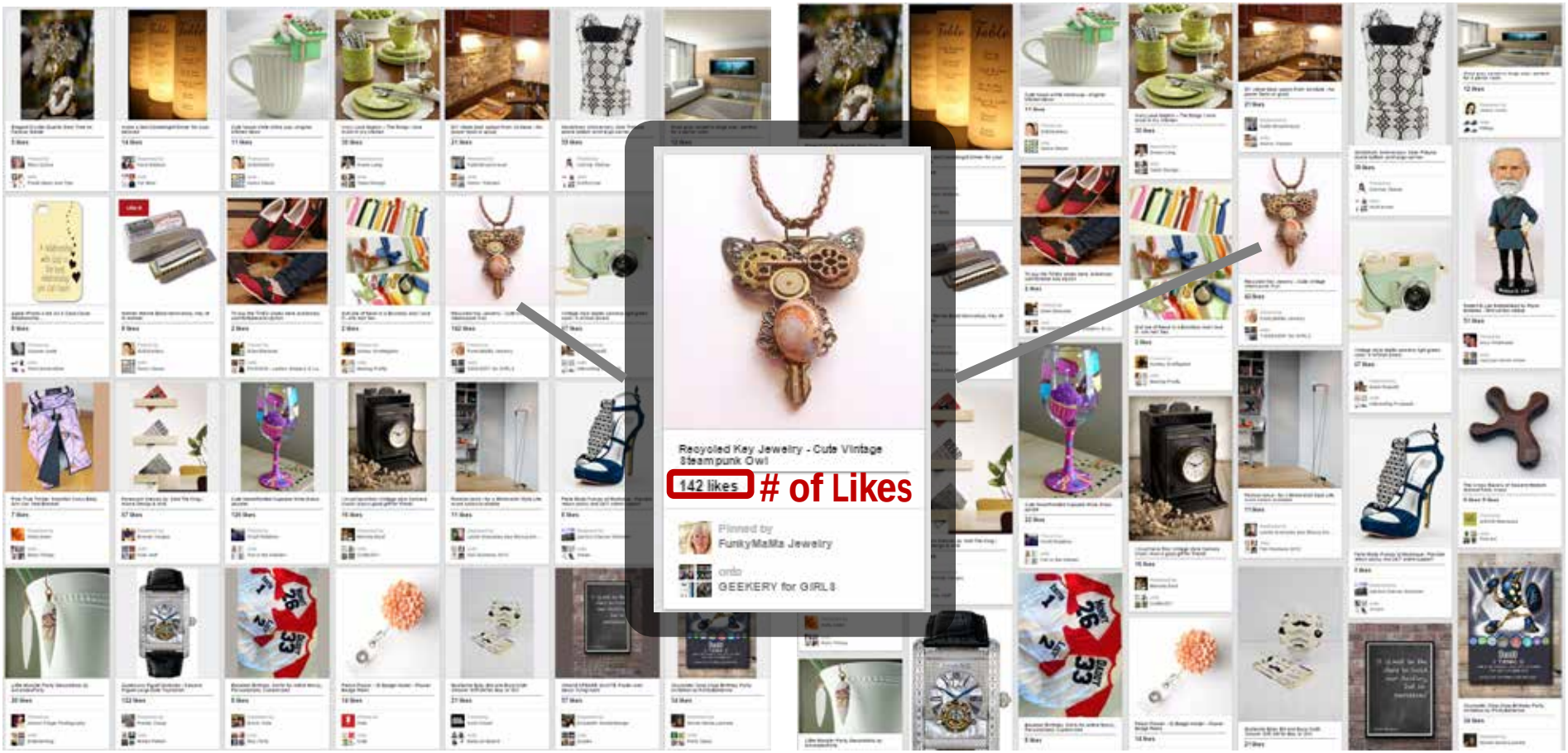
Most people see the white triangle not the 3 circles with segments missing.

COMMON FATE



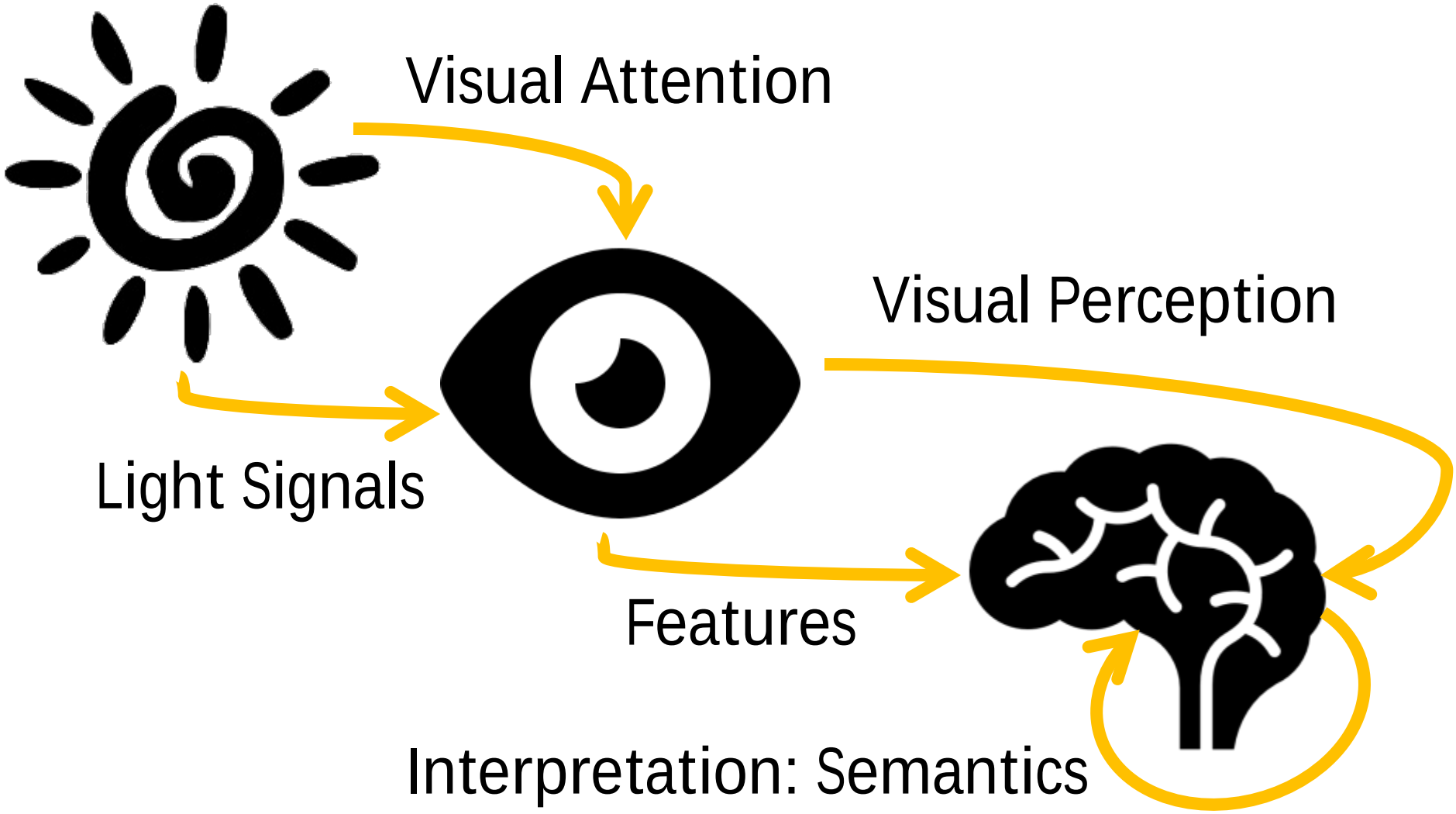
Objects moving in a similar direction are percieved as belonging together.





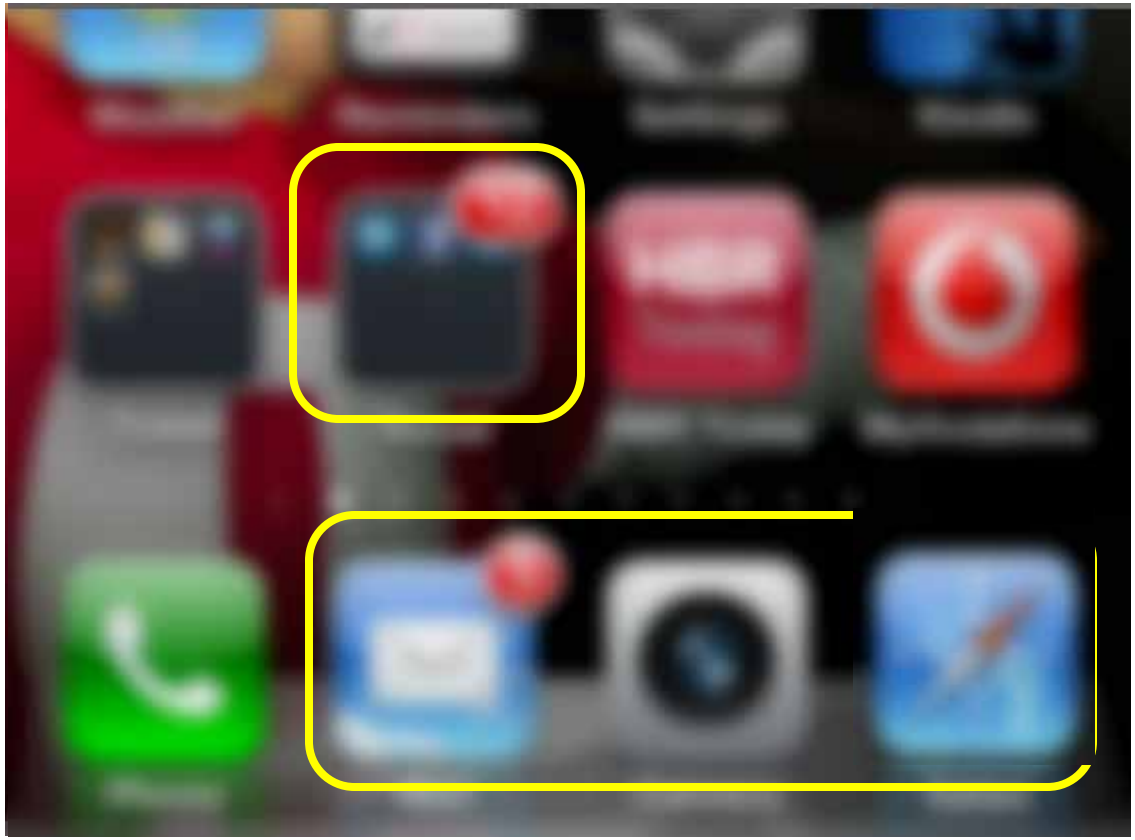
"Influence of Content Layout and Motivation on Users' Herd Behavior in Social Discovery" (to appear in CHI2016)

Why Visual Communicate Works?



Visual Attention – Process

- Pre-attentative
  - £ 10ms (object)
  - £ 500ms (task)
  - Parallel processing
- “Squint Test”
- Pop-out effect
  - Static features, e.g. color and shape
  - Dynamic features



Visual Attention – Process

- Attentative
  - > 10ms (object)
  - > 500ms (task)
  - Sequential
- Selective Attention
  - Bottom-up: feature
  - Top-down: goal
- Fixation-Saccade

Visual Attention – Variables

- Distractor
  - Too salient
  - Too similar to the target
- Load
  - Perception Load "too hard to see"
  - Cognitive Load "too hard to think"

(a) Distraction by color in iOS

Target:

Distractor:

Saliency

Similarity

App Searching Time

Interface		Common apps	Never-seen apps
iOs	Normal	5.17s	10.06s
	Folder	10.78s	16.17s
	Dock	4.28s	8.56s
Android	Normal	6.56s	11.67s
	Folder	12.50s	18.67s
Windows	Small	7.56s	10.88s
	Medium	6.33s	8.28s
	Large	3.78s	5.39s

How to Recommend Predicted App?

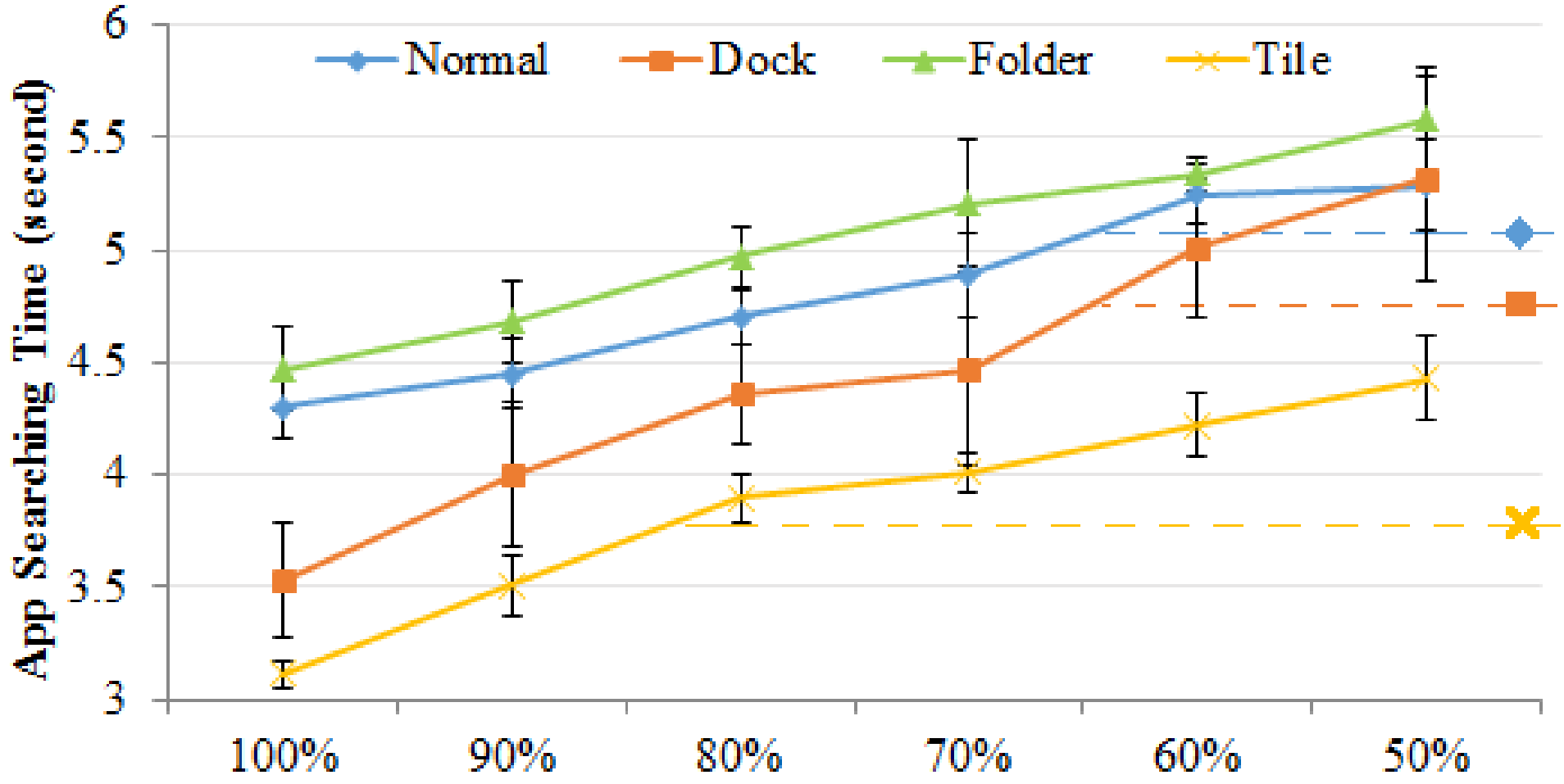
(a) Highlight on normal screen

(b) Animation on dock

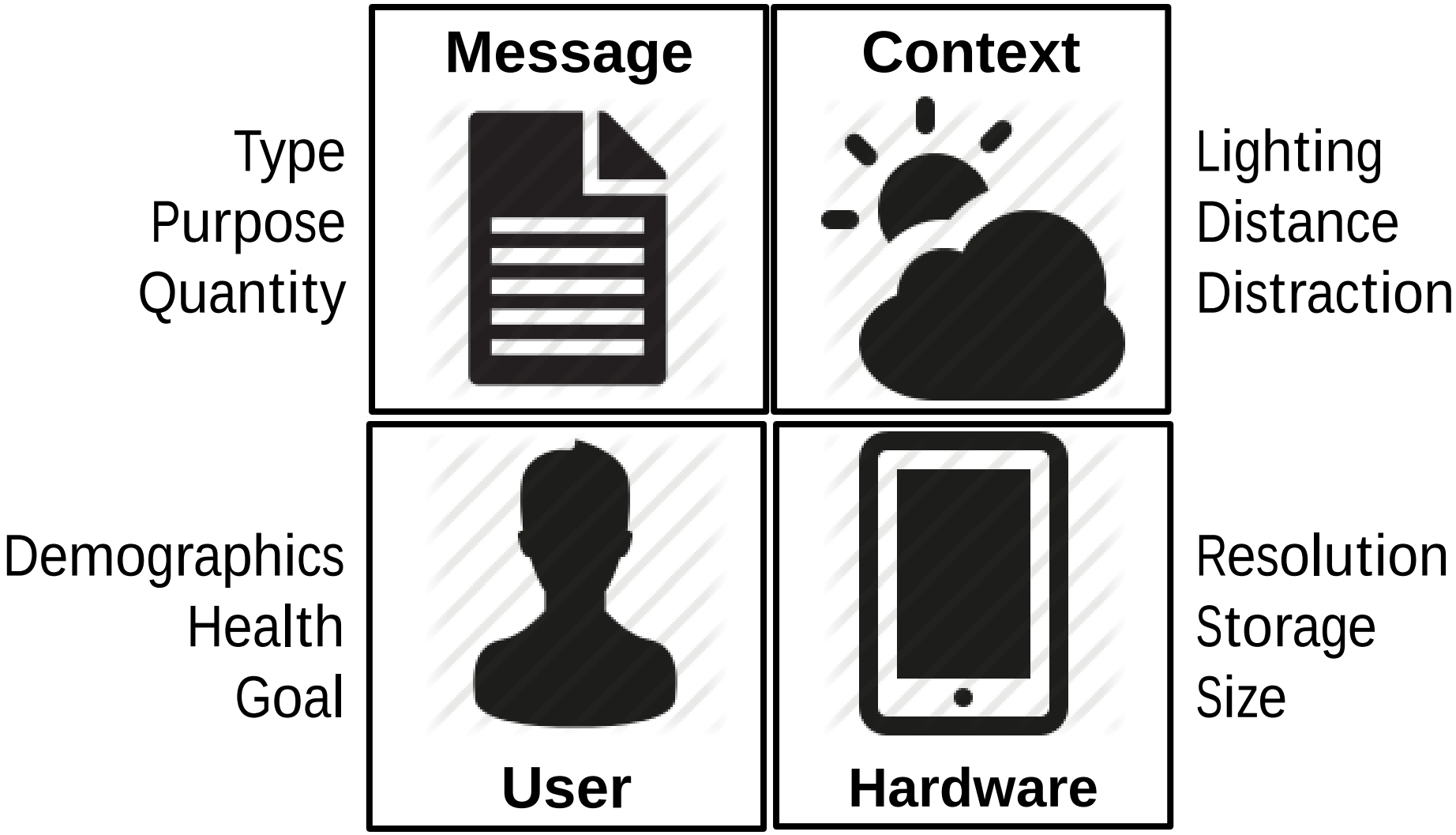
(c) Animation on folder

(d) Blinking large tile

What if the Prediction is Wrong?



What Affects Visual Communication?



Why Grounds

When Advantages

What Definition

Visual Attention
Visual Perception

Humans have the ability to attend to and perceive visual information

Studying the mechanisms enhances our understanding of message to exchange, users, hardware, and context of use

How Methods

Why Grounds

When Advantages

What Definition

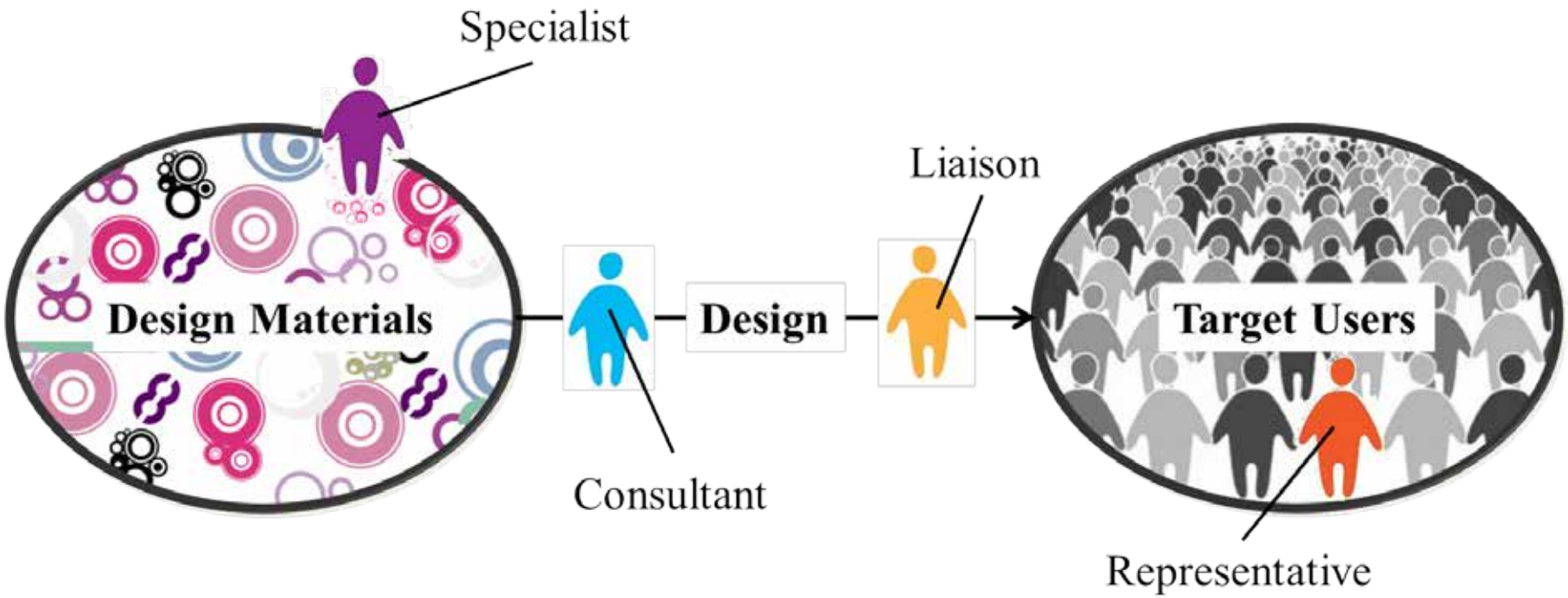
Design & Evaluation of Visual Communication

How do we design good visual communication?

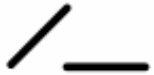
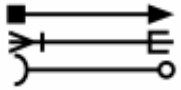
How do we evaluate our visual communication design?

Rule-based vs. Metric-based

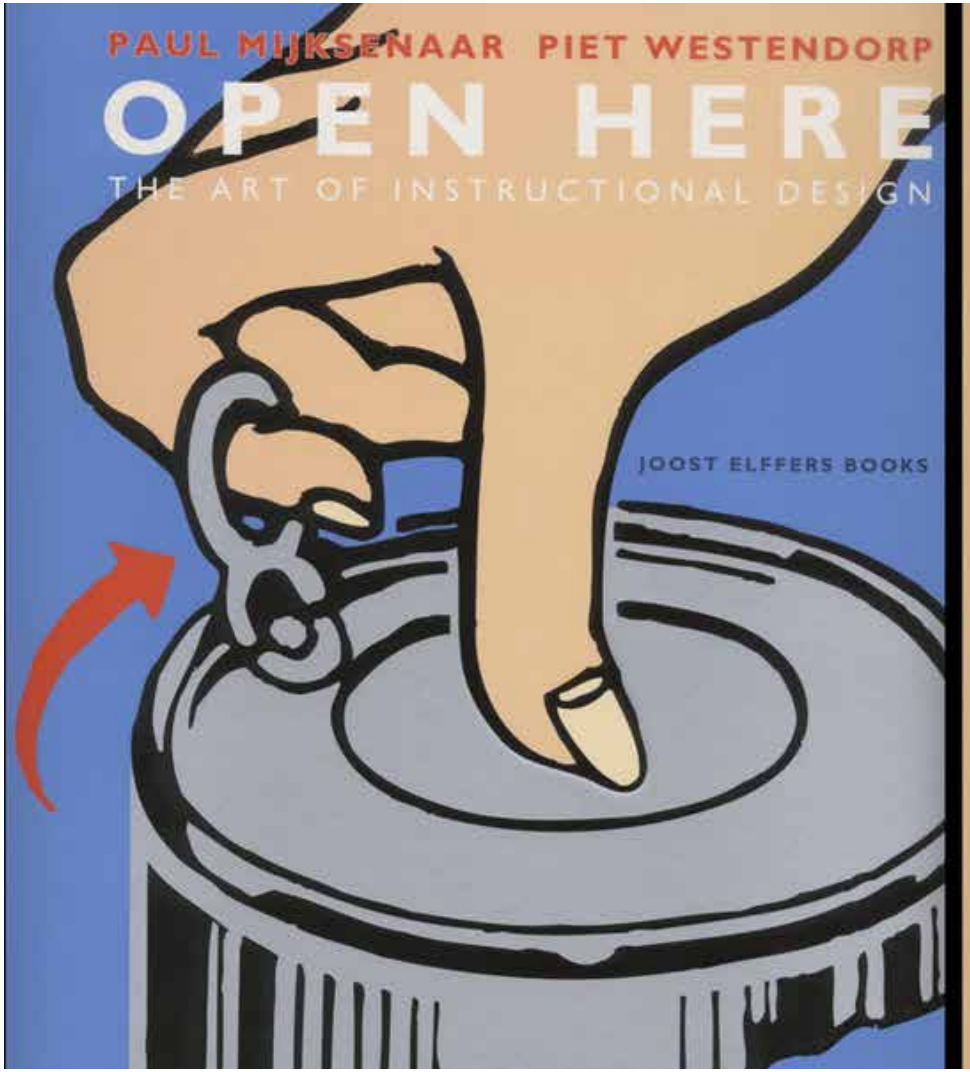
- Rule-based Design
- Metric-based Design



Properties and Best Uses of Visual Encodings

Example	Encoding	Ordered	Useful values	Quantitative	Ordinal	Categorical	Relational
	position, placement	**yes**	**infinite**	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	**optional** (alphabetical or numbered)	**infinite**	Good	Good	Good	Good
	length	**yes**	**many**	Good	Good		
	size, area	**yes**	**many**	Good	Good		
	angle	**yes**	medium/few	Good	Good		
	pattern density	**yes**	few	Good	Good		
	weight, boldness	**yes**	few		Good		
	saturation, brightness	**yes**	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	**infinite**			Good	Good
	line pattern	no	few				Good
	line endings	no	few				Good
	line weight	**yes**	few		Good		

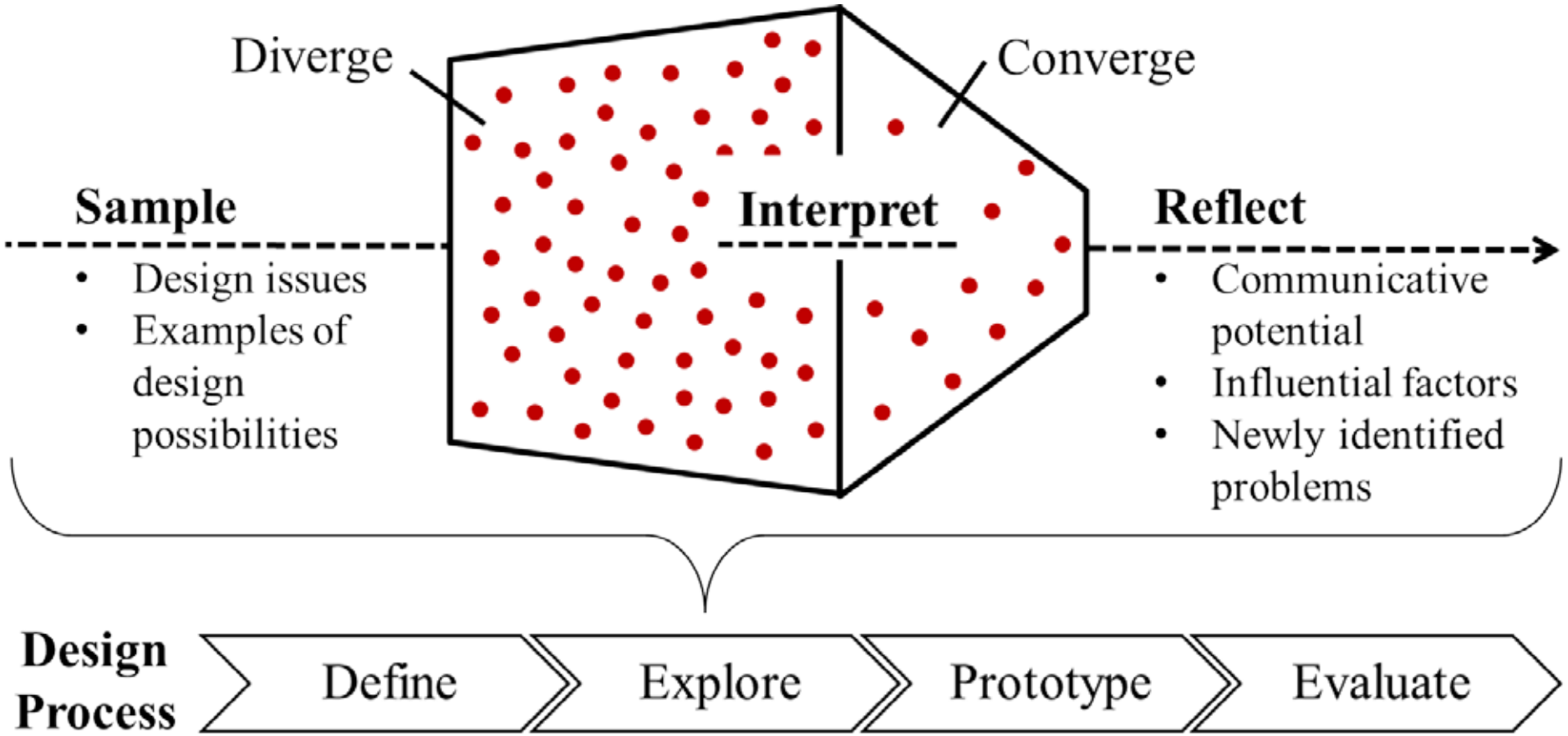
Noah Iliinsky • ComplexDiagrams.com/properties • 2012-06

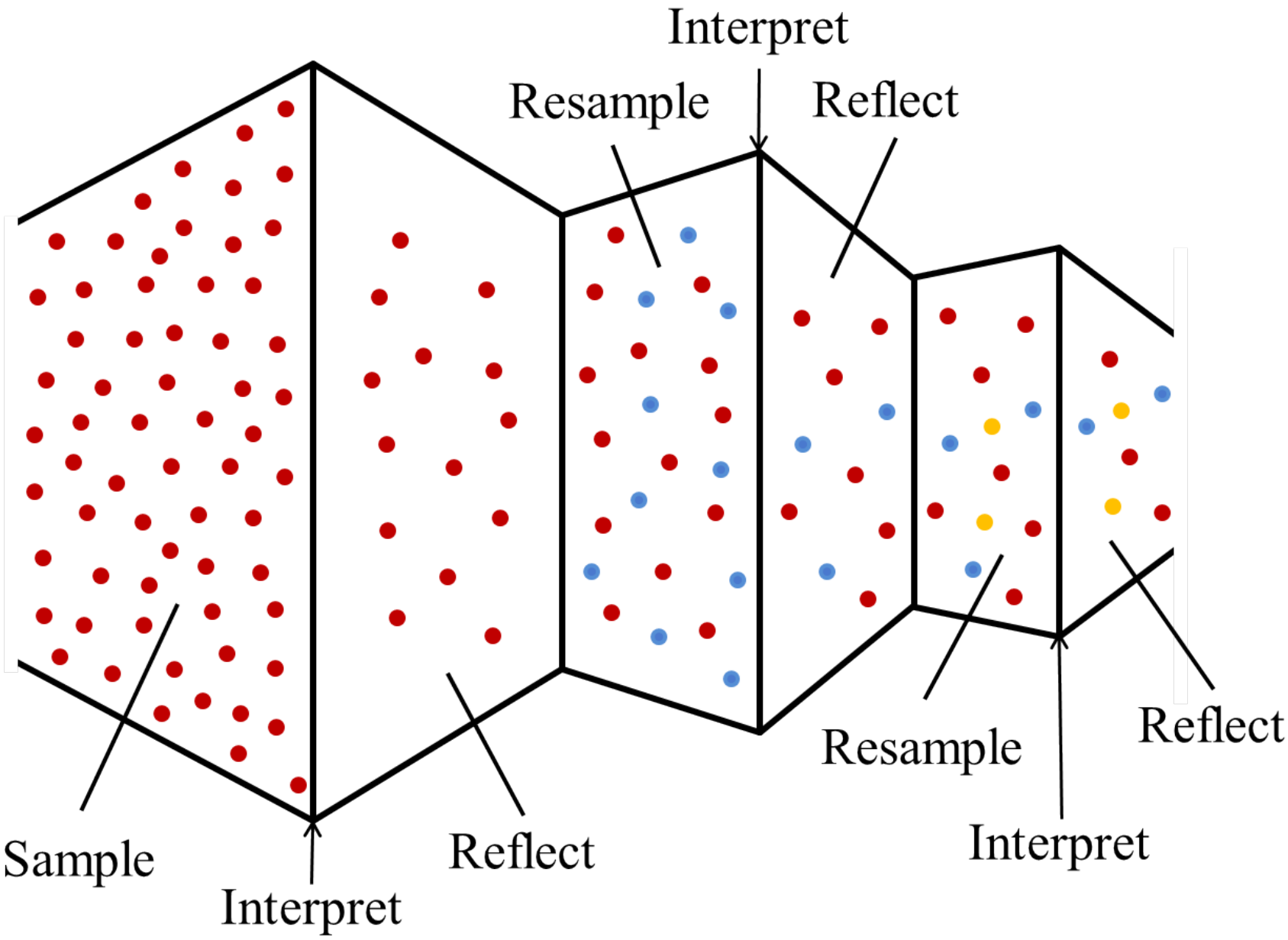


This book presents an entertaining array of the most ingenious, frustrating, beautiful and terrible visual solutions that designers and illustrators have invented to help us handle modern technology and everyday products. It shows us how to floss our teeth properly, where to insert the printer cartridge, which button to press to transfer a phone call, how to use chopsticks, how to open a milk carton and where to exit the plane in case of emergency landing.

Open Here: The Art of Instructional Design traces the history of visual instructions and considers how our reluctant dependence upon them increases by the minute. But it also presents a variety of clever concepts and solutions designers have used to show us how to do what we need to do. It includes an overview of the basic elements of visual instructions: the baffling yet remarkable drawings, cartoons and symbols that tell us where to cut, when to twist, how to repeat or how not to do all the above.


How
Do
You
Design
How
do
you
design?
AMBIDEXTROUS
where design meets
from every side
mult
i-han
dedn
ess?
ambi
dext
rous
The multi-handed design process magazine
ambidextrous
the journal of design and design process
ambi
dext
rous
magazine
a forum for design researchers, professionals, and thinkers


Diverge
Converge
Sample
Interpret
Reflect
• Design issues
• Examples of design possibilities
• Communicative potential
• Influential factors
• Newly identified problems
Design Process
Define
Explore
Prototype
Evaluate


Interpret
Resample
Reflect
Sample
Interpret
Reflect
Resample
Interpret
Reflect

Design & Evaluation of Visual Communication

How Methods

Why Grounds

When Advantages

What Definition

Take both the designer's and the user's perspectives;

Involve many target users in the field evaluation

Use Cases of Visual Communication in HCI

Who

Examples

How

Methods

Why

Grounds

When

Advantages

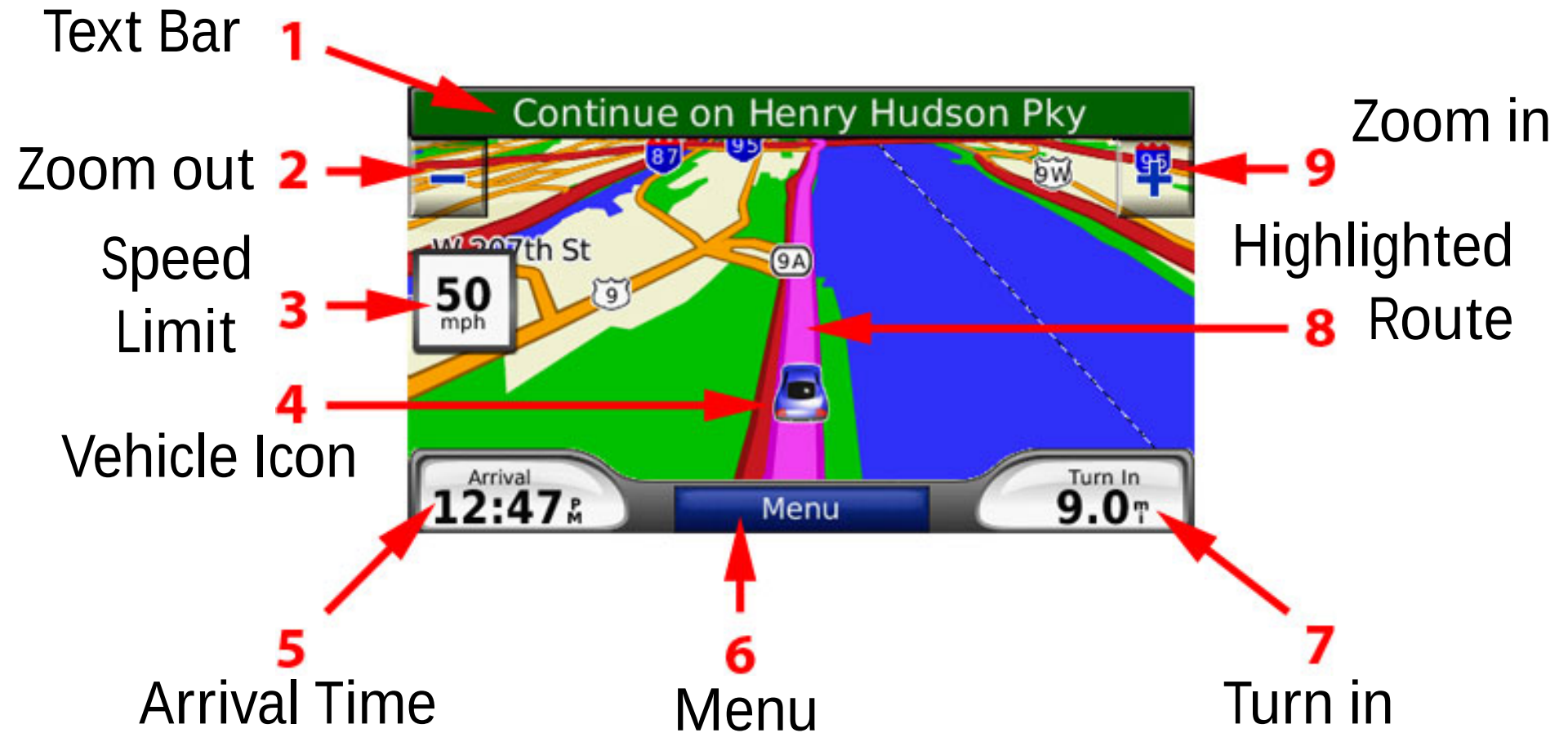
What

Definition

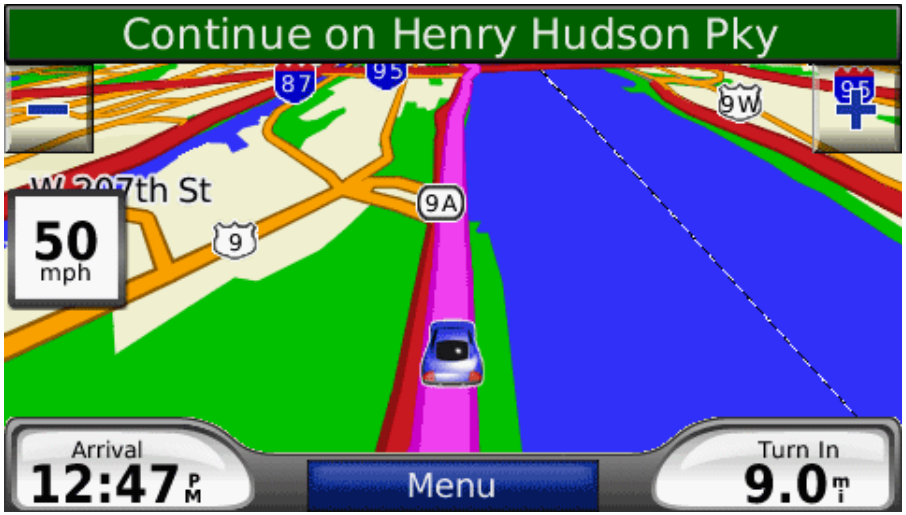
Who may benefit from visual communication in HCI?

Who may be interested in this research area?

Rule-based GPS Map Design



Cursor + Map

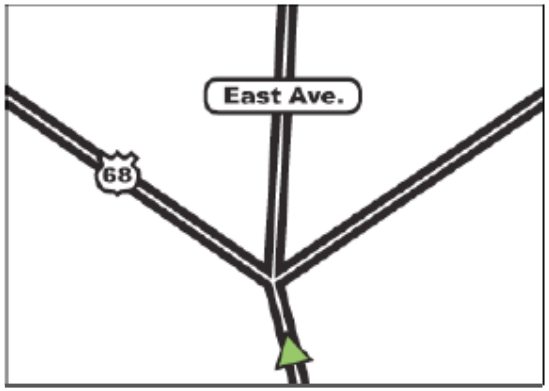

Continue on Henry Hudson Pky
50 mph
Arrival
12:47 PM
Menu
Turn In
9.0 mi


50 m
Kjørbotunnelen
E 16
Demo
480 km
19:01
Solhaugveien
Jongsåsveien
Ringeriksveien
Odden
Claude Monets Alle
Sandvikselva
Leif Larsens Vei
Sandvika
Kadettangen
Folangerveien
Engervannsveien
607
618
E 18
90
km/t


111 kph
163
24
Map Scale
100%
SANTA BARBARA
Sanctuary Cove
Dreamworld
Coomera
Hope Island
Upper Coomera
OXENFORD
EAGLE HEIGHTS
Warner Bros. Movie World
Wet 'n' Wild Water World
Coombabah Lake
Southport Aerodrome
HELENSVALE
McCoys
WONGAWALLAN MTN


Great George Street
FLEET STREET
CITY OF LONDON
SOUTHWARK
BLACKFRIARS
WATERLOO
A3211
Cenotaph
River Thames
LONDON
CITY OF WESTMINSTER
A3212
A302
Westminster Abbey
Central Hall Westminster
Dean's Yard
Tothill Street
Victoria Street, London
Sygic
04:33
3.7 mi
230
yards
24 mi
9 min

Metric-based GPS Map Design



A	B	C	D	E
				
F	G	H	I	J
				West Ave.
K	L	M	N	
East Ave.				

Joonhwan Lee, Jodi Forlizzi, & Scott E. Hudson (2007). "Iterative Design of MOVE: A Situationally Appropriate Vehicle Navigation System," International Journal of Human-Computer Studies.

Metric-based GPS Map Design

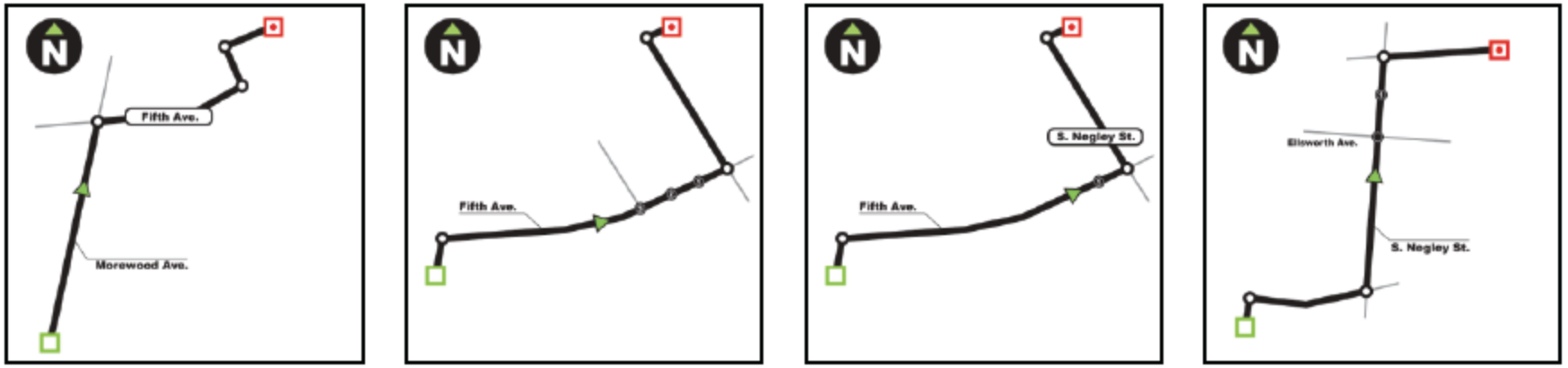


Figure 3.15 Zoom in Context (ZC)

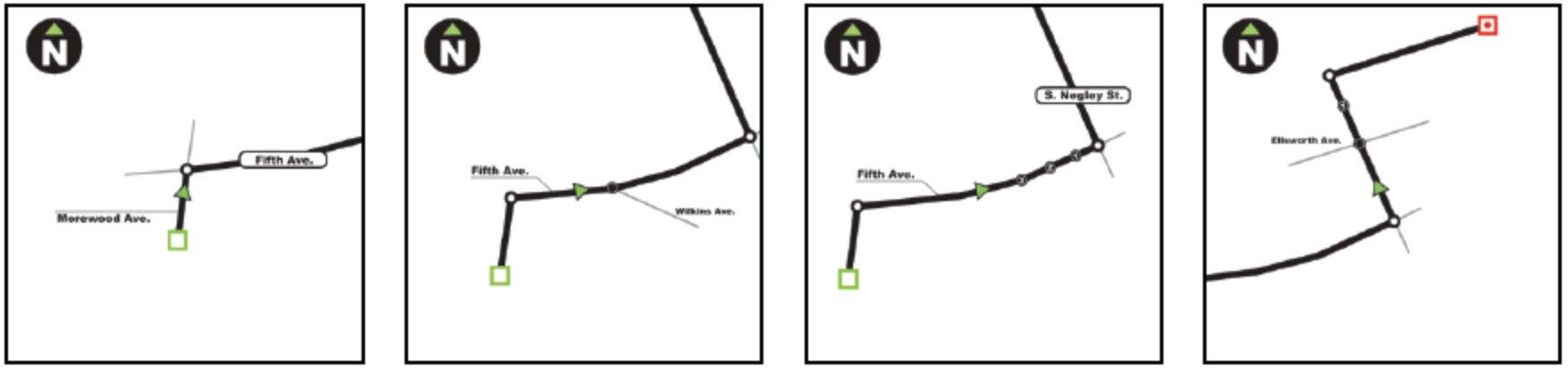


Figure 3.16 Route Scrolling (R)

Metric-based GPS Map Design

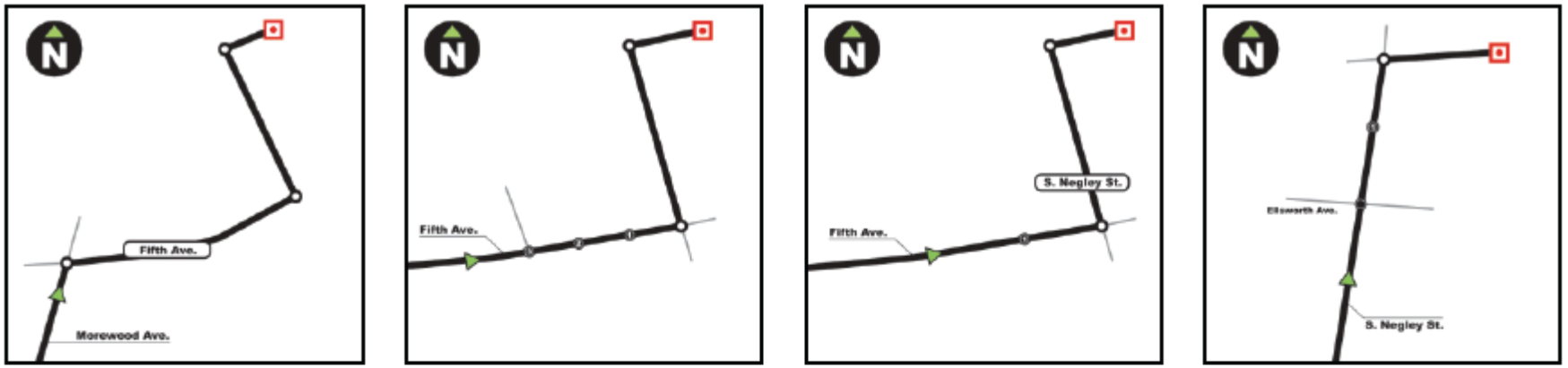


Figure 3.17 Zoom in Context + Route Scrolling (ZC+R)

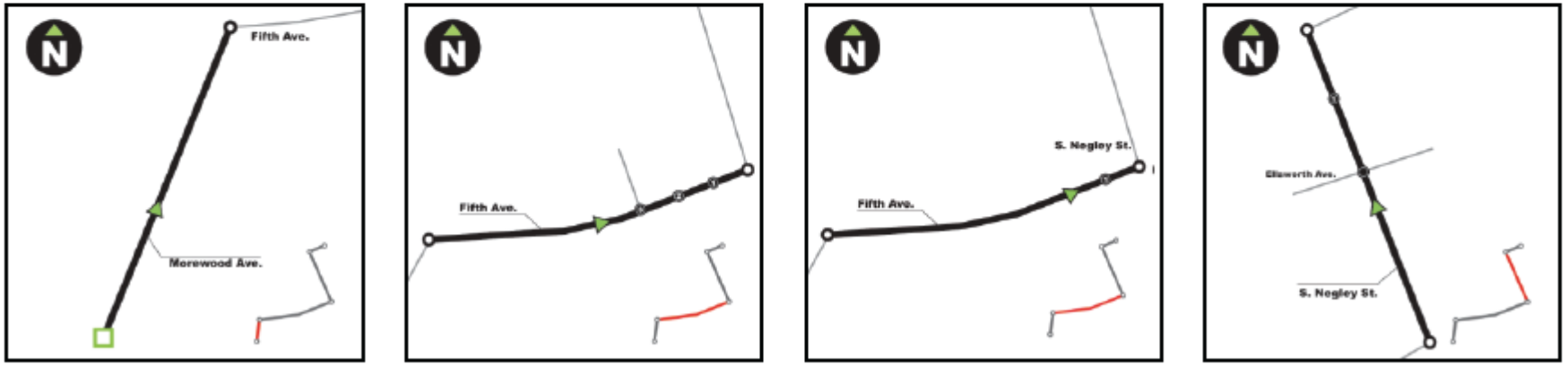
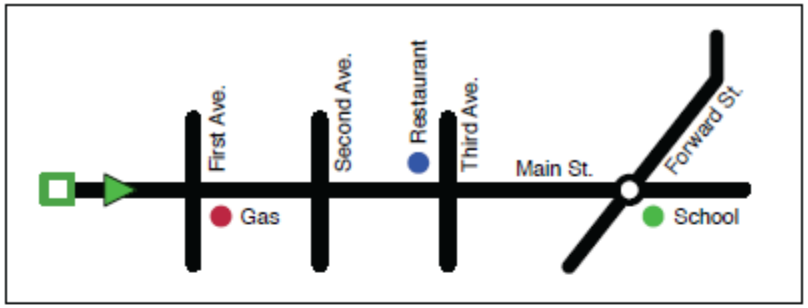
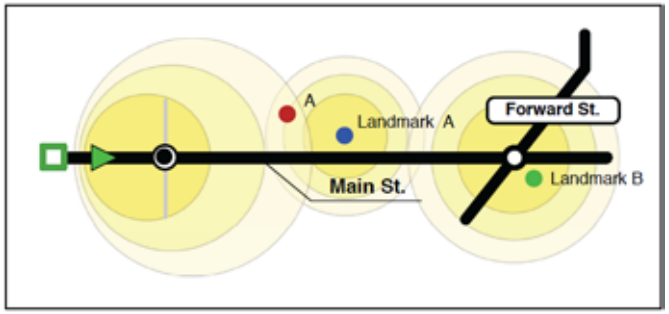
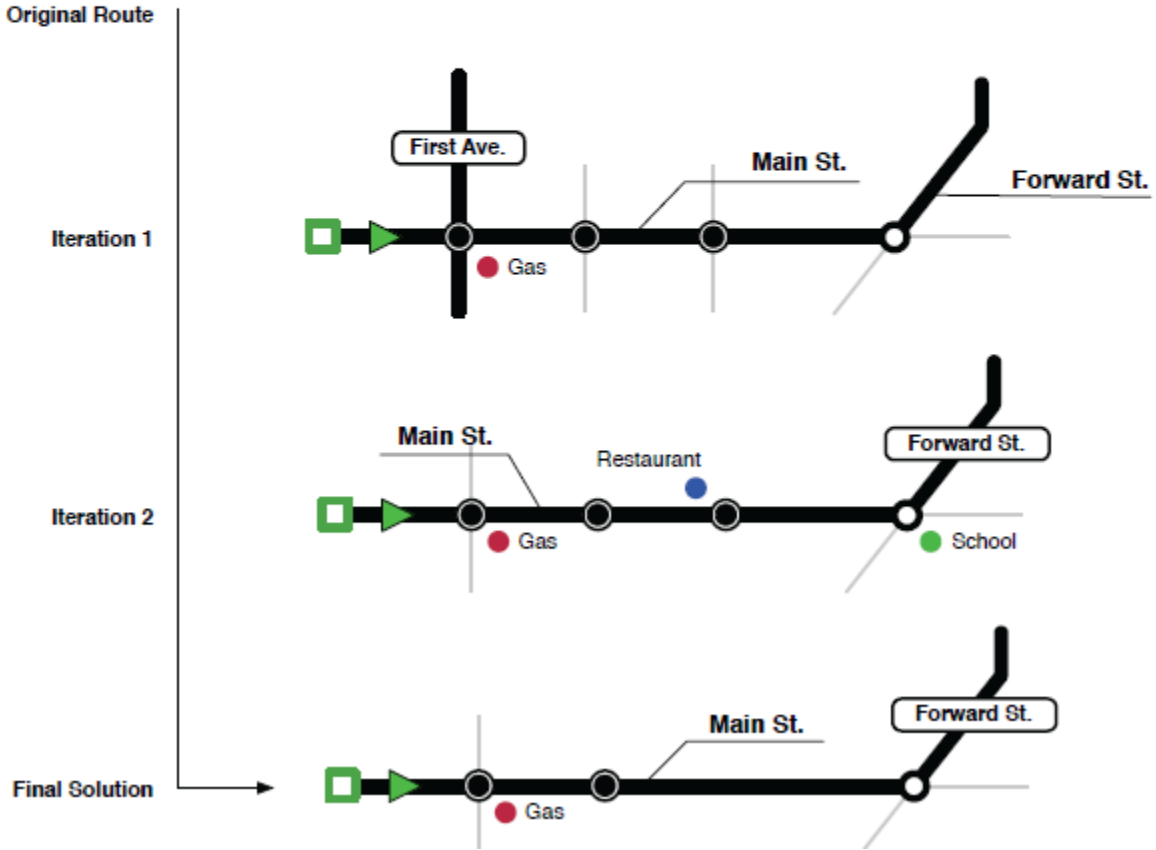
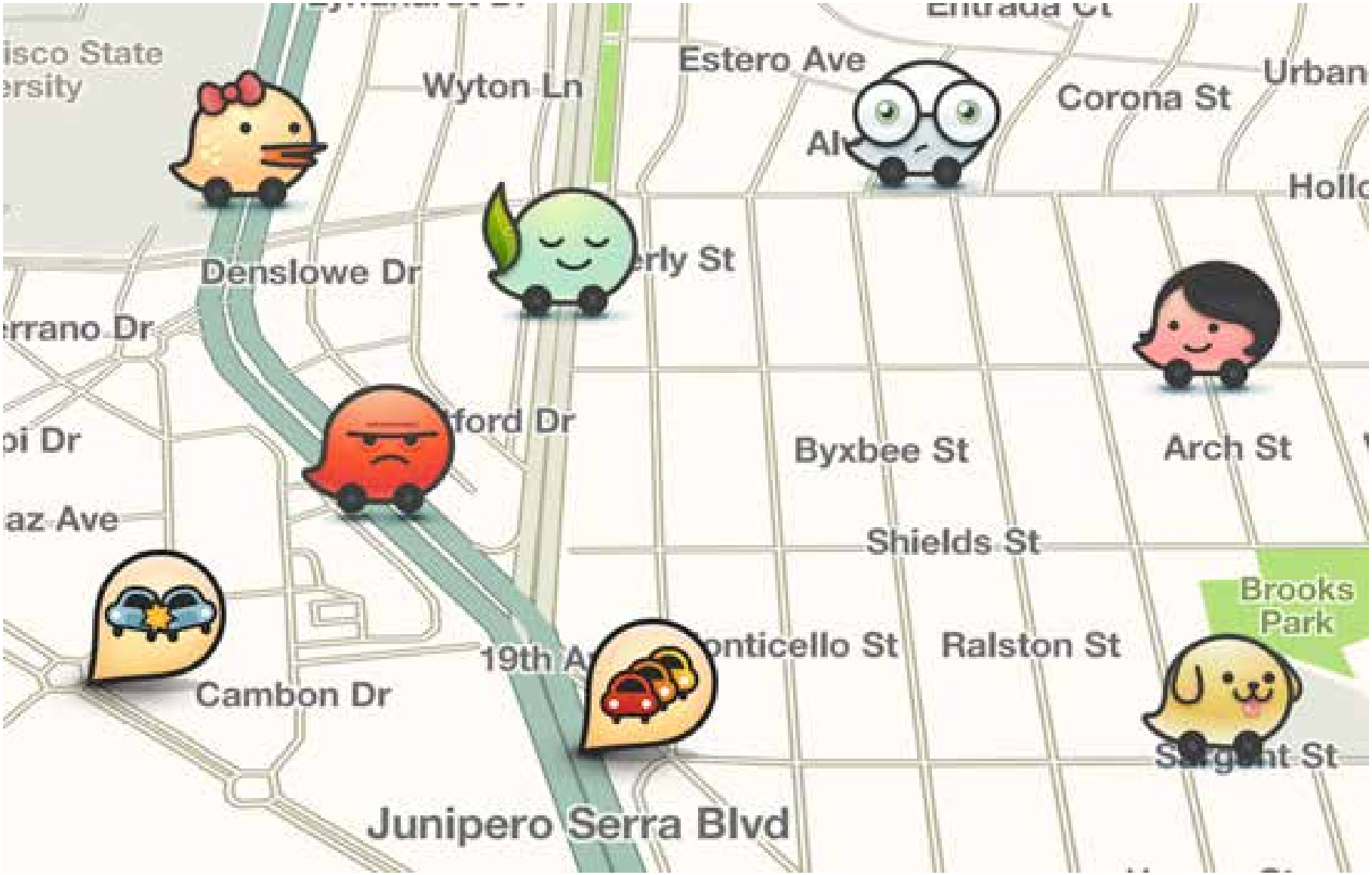


Figure 3.18 Zoom in Context + Small Overview (ZC+O)


First Ave.
Second Ave.
Restaurant
Third Ave.
Main St.
Forward St.
Gas
School


A
Landmark A
Forward St.
Main St.
Landmark B


Original Route
Iteration 1
First Ave.
Main St.
Forward St.
Gas
Iteration 2
Main St.
Restaurant
Forward St.
Gas
School
Final Solution
Main St.
Forward St.
Gas



https://www.waze.com/

Who Examples

How Methods

Why Grounds

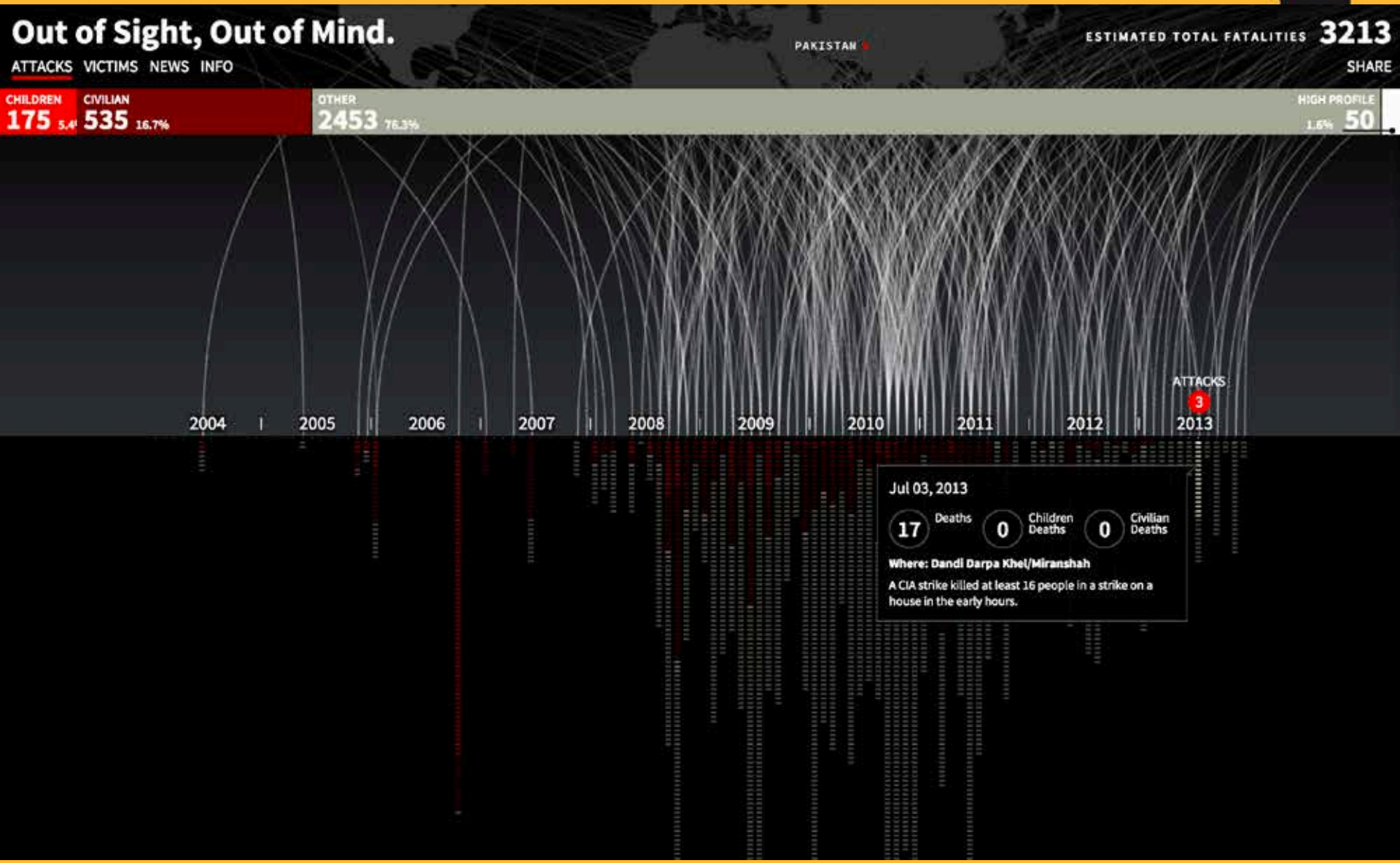
When Advantages

What Definition

Recap

The definition visual communication, the mechanism behind it, and how it relates to Human-Computer Interaction, especially in the context of pervasive computing

Out of Sight, Out of Mind



Thank you J

Xiaojuan Ma
mxj@cse.ust.hk