Introduction to Augmented Reality & Virtual Reality

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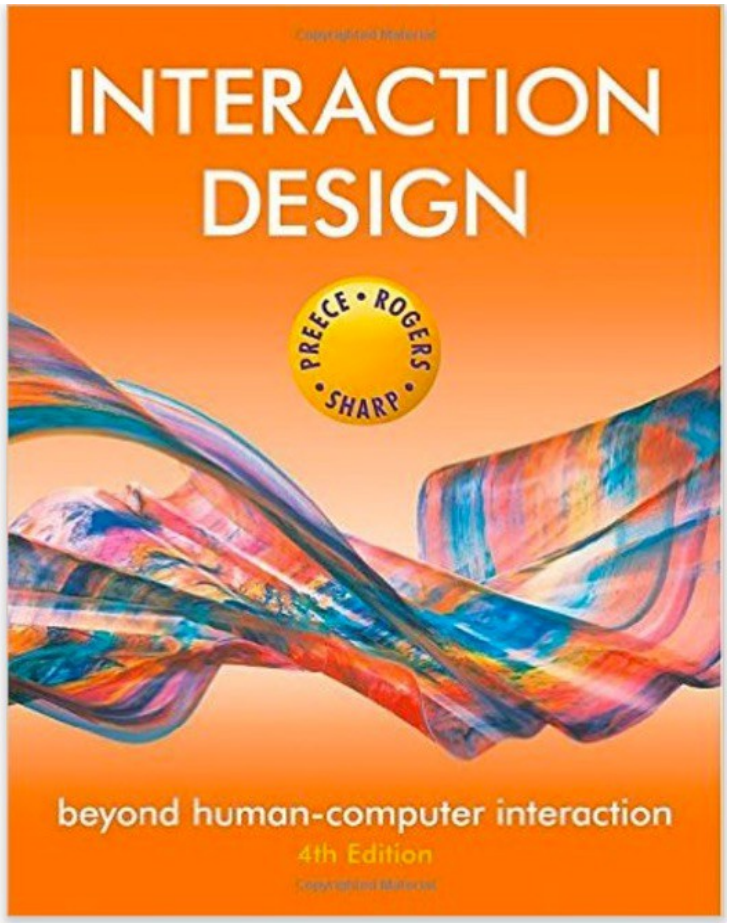
Interaction Design for AR/VR

How Can we Design AR/VR experiences that meet real needs?

What is Interaction Design ?

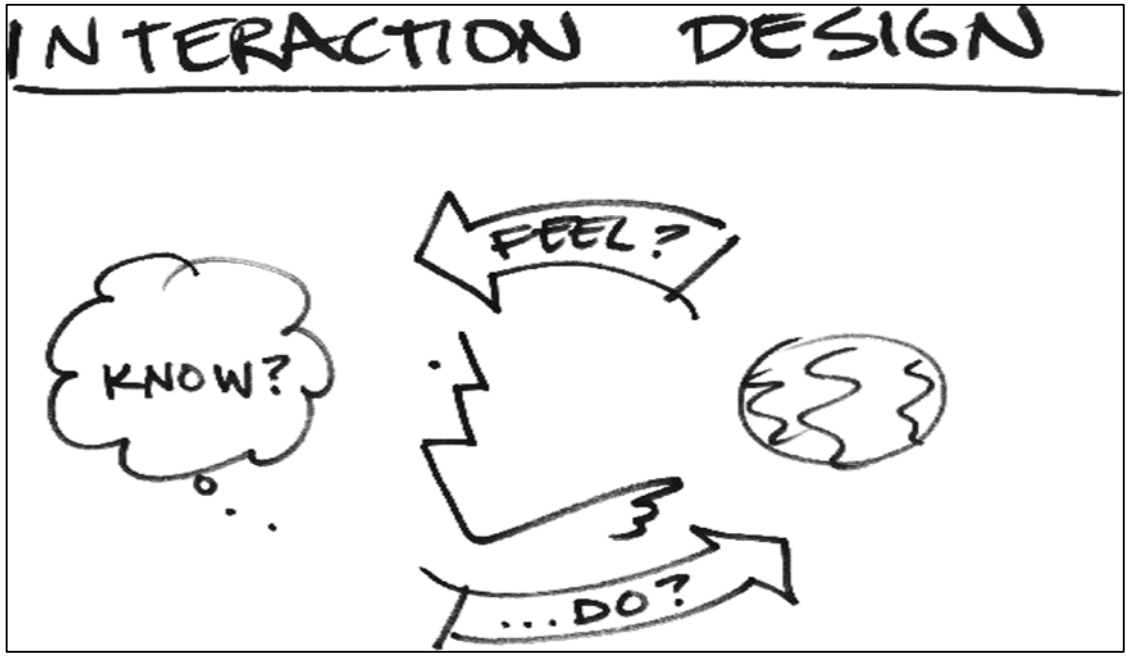


“Designing interactive products to support people in their everyday and working lives”

(J. Preece, Interaction Design, 2002)

Interaction Design is the design of user-experience with technology

Interaction Design involves answering three questions:

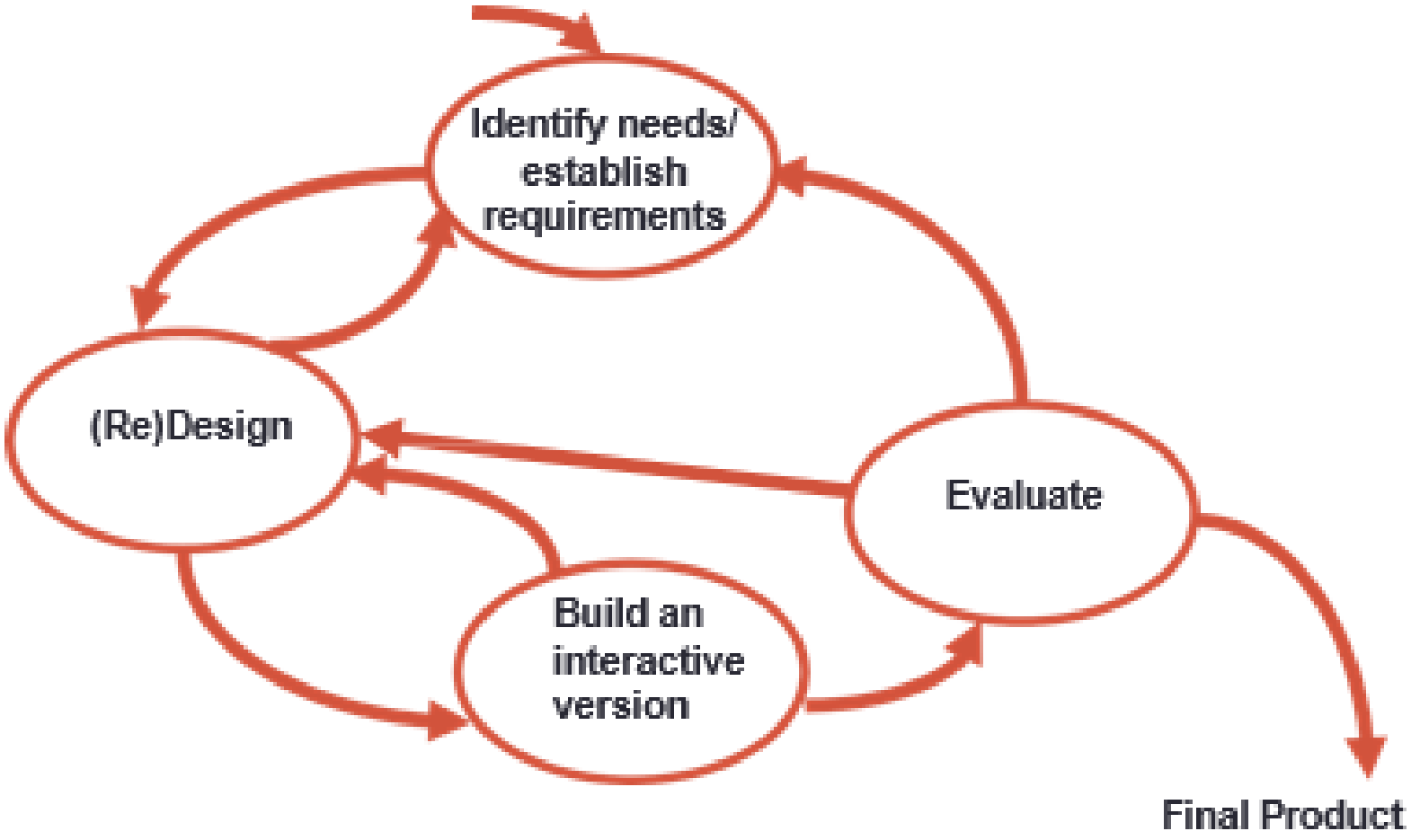


What do you do? – How do you affect the world?

What do you feel? – What do you sense of the world?

What do you know? – What do you learn?

The Interaction Design Process



Identify Needs

Needs Analysis Goals

- Create a deep understanding of the user and problem space
- Understand how AR/VR can help address the user needs

Key Questions

Who is the user?

- Different types of users

What are the user needs?

- Understand the user, look for insights

Can AR/VR address those needs?

- VR cannot solve all problems

Who are the Users?

Primary: people regularly using the AR/VR system

Secondary: people providing tech support/developing system

Tertiary: people providing funding/space for AR/VR system

Methods for Identifying User Needs

Learn from people

Learn from Experts

Learn from analogous settings

Immersive yourself in context

Learn from People

Learn from target users by:

- Questionnaires and interviewing
- Running focus groups
- Observing people performing target tasks

Learn from Experts

Experts have in-depth knowledge about topic

- Can give large amount of information in short time
- Look for existing process/problem documentation

Choose participants with domain expertise

- Expertise, radical opinion, etc.

Immersive yourself in Context

Put yourself in the position of the user

- Role playing, a day in the life of a user, cultural probes
- Observing the problem space around you – how do you feel?

Take notes and capture your observations

Seek Inspiration in Analogous Setting

- Inspiration in different context than problem space
- Similar scenarios in different places

Identifying User Needs

From understanding the user, look for needs

- Human emotional or physical necessities.
- Needs help define your design

Needs are Verbs not Nouns

- Verbs (activities and desires)
- Nouns (solutions)

Identify needs from the user traits you noted, or from contradictions between information

- disconnect between what user says and what user does

Is AR/VR the Best Solution?

Not every problem can be solved by AR/VR

Problems Ideal for AR/VR have:

- visual elements
- 3D spatial interaction
- physical manipulation
- procedural learning

Is AR/VR the Best Solution?

Problems Not ideal for AR/VR, have:

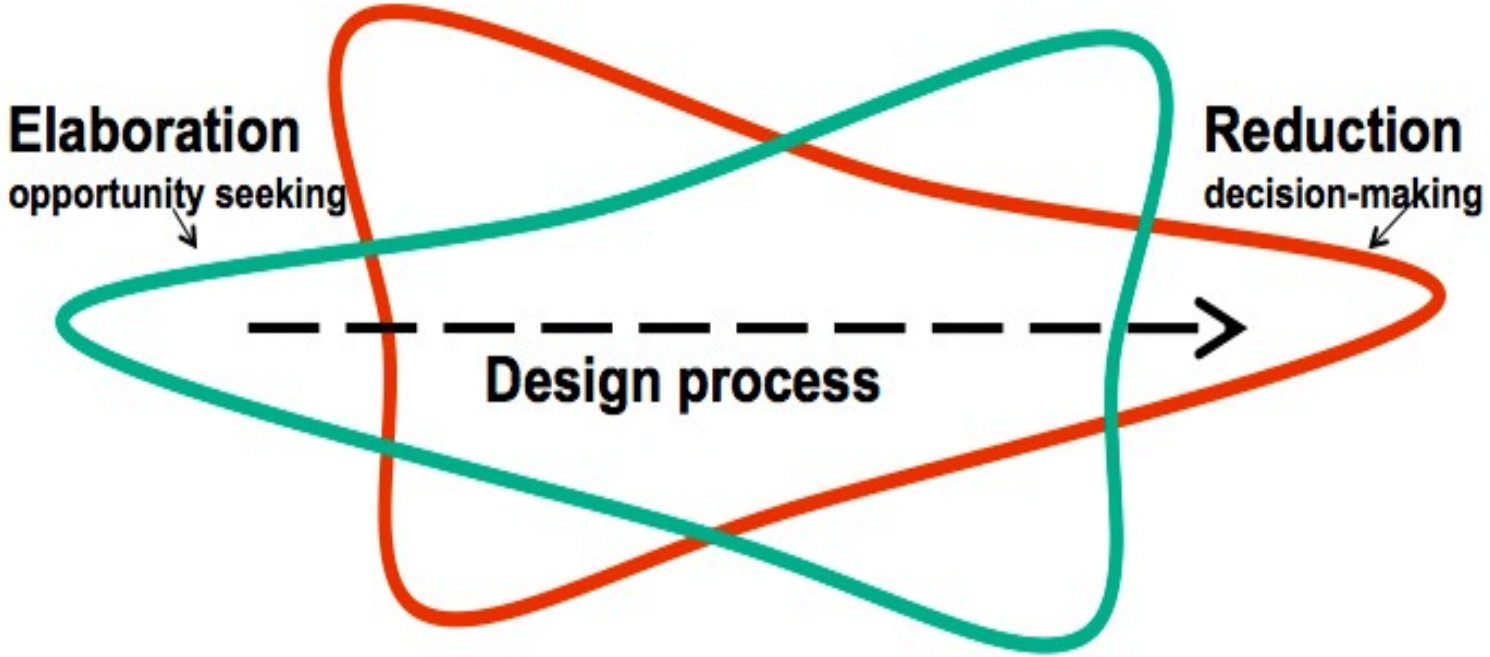
- heavy reading, text editing
- many non visual elements
- non spatial tasks

Design

Idea Generation

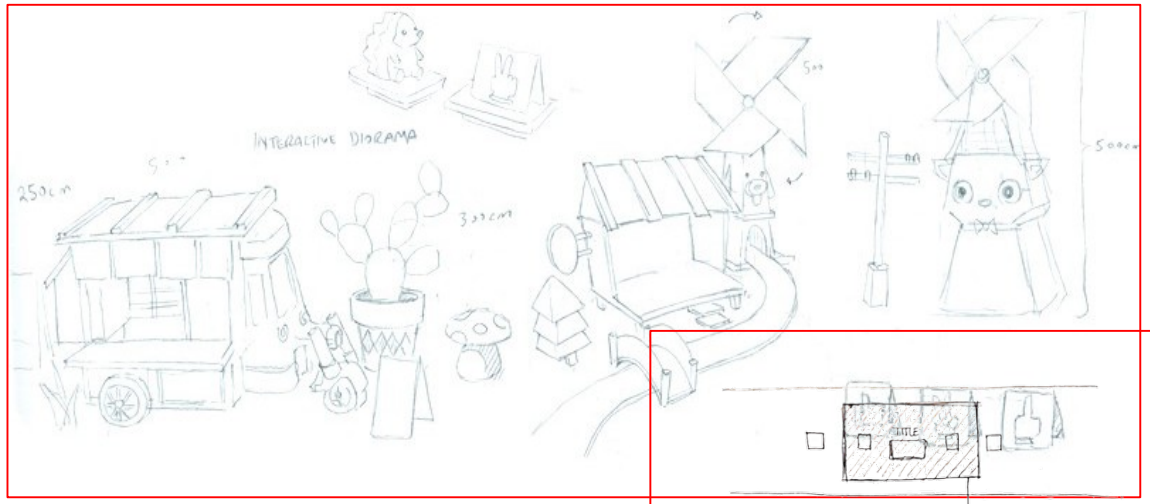
- Brainstorming
- Lateral thinking
- Ideal storming
- Formal problem solving

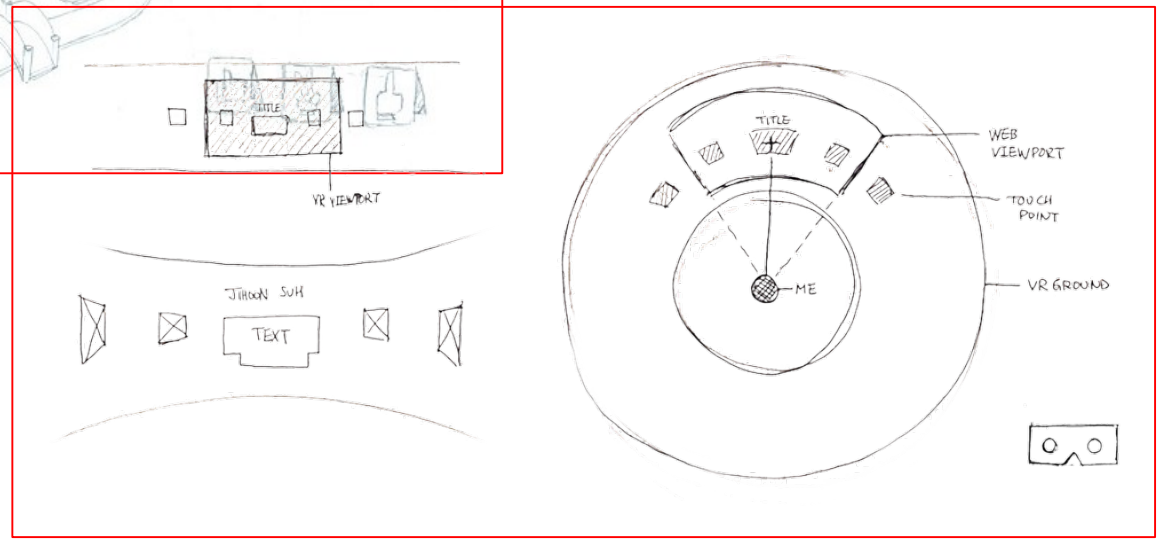
Elaboration and Reduction



- Elaborate on Ideas and Reduce to Final Design Direction
- Elaborate - generate solutions. These are the opportunities.
- Reduce - decide on the ones worth pursuing
- Repeat - elaborate and reduce again on those solutions

Interface Design Sketches

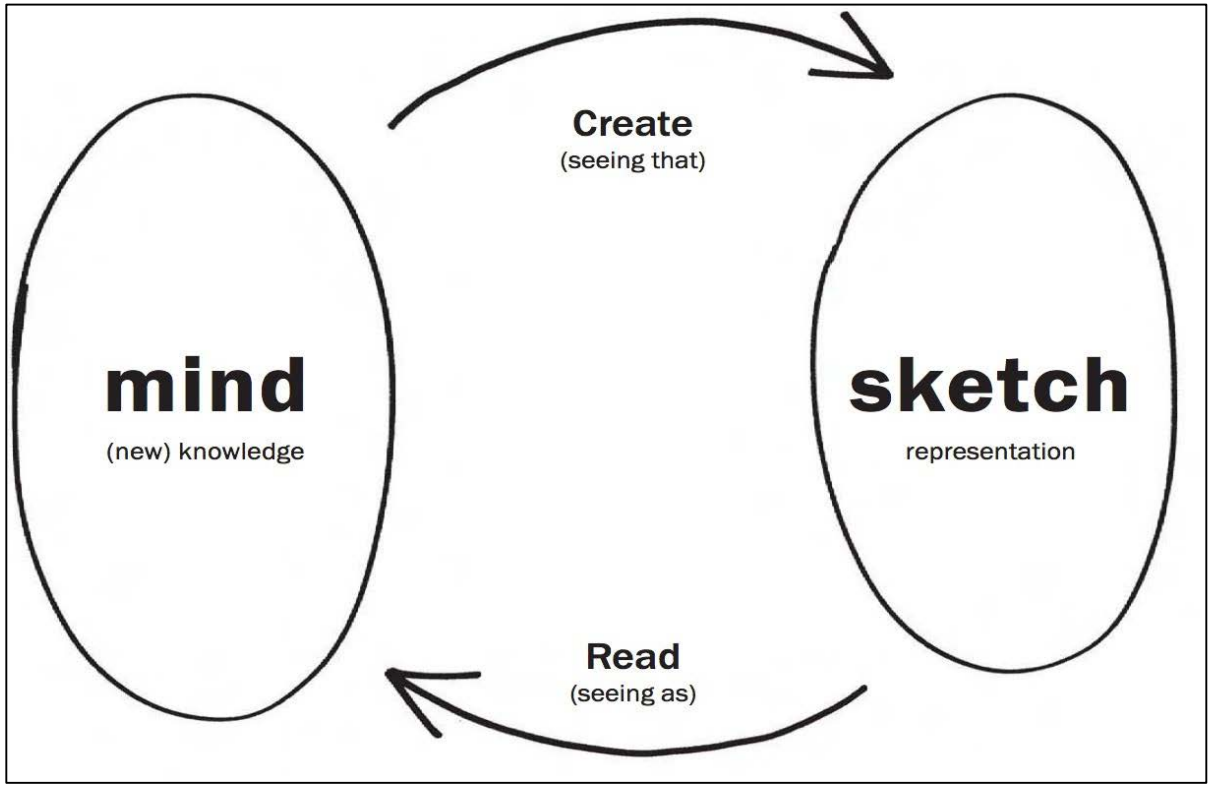




Role of Sketching

Use sketching as way to communicate and create new ideas

"Sketching is about the activity not the result" (Bill Buxton)



Why is Sketching Useful?

- Early ideation
- Think through ideas
- Force you to visualize how things come together
- Communicate ideas to inspire new designs
- Ideal for active brainstorming
- Beginning of prototyping process

AR/VR Design Considerations

Use UI Best Practices

- Adapt know UI guidelines to AR/VR

Use of Interface Metaphors/Affordances

- Decide best metaphor for VR application

Design for Humans

- Use Human Information Processing model

Design for Different User Groups

- Different users may have unique needs

Design for the Whole User

- Social, cultural, emotional, physical cognitive

Use UI Best Practices

General UI design principles can be applied to AR/VR

E.g. Shneiderman’s UI guidelines

- Strive for consistency (utilizing familiar icons, colors, menu hierarchy, etc.)
- Enable frequent users to use shortcuts
- Offer informative feedback
- Design dialogue to yield closure
- Offer simple error handling
- Permit easy reversal of actions
- Support internal locus of control
- Reduce short-term memory load

Use Interface Metaphors

A user-interface metaphor provides a visual or action pattern that leverages a user's knowledge of another domain.

For example: files, folders, tabs, stick-on notes are common user-interface metaphors based on a user's knowledge of office environments.

Benefits

- Makes learning interface easier and more accessible
- Users understand underlying conceptual model

Typical AR/VR Interface Metaphors

Direct Manipulation

- Reach out and directly grab objects

Ray Casting

- Select objects through ray from head/hand

Vehicle Movement

- Move through VR environment through vehicle movement

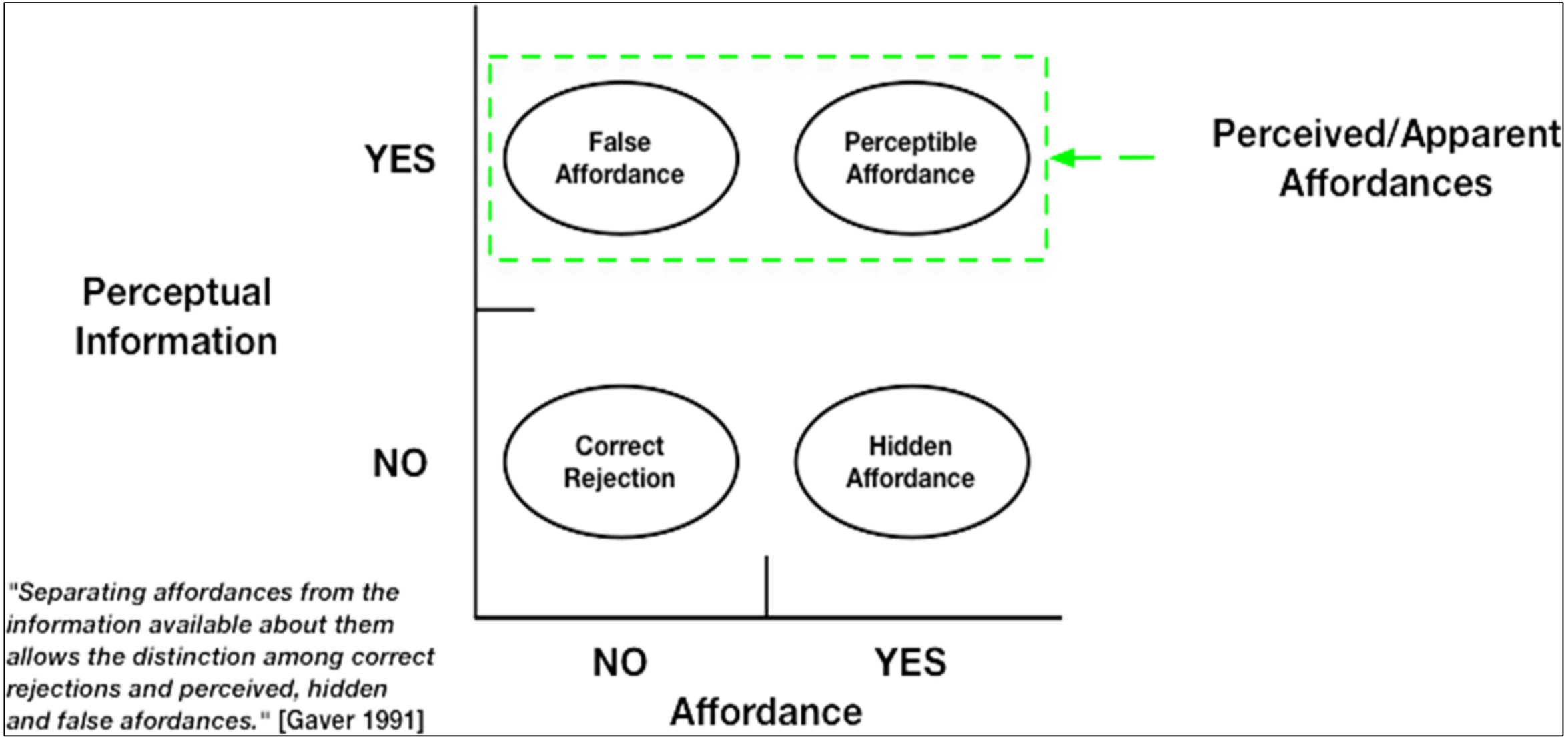
Affordances

”… the **perceived and actual properties** of the thing, primarily those fundamental properties that determine just how the thing could possibly be used.

[...]

Affordances provide strong clues to the operations of things.”

Perceived vs. Actual Affordances



"Separating affordances from the information available about them allows the distinction among correct rejections and perceived, hidden and false afordances." [Gaver 1991]

Physical vs. Virtual Affordances

Physical Affordance

- Look and feel of real objects
- Shape, texture, color, weight, etc.
- Industrial Design

Virtual Affordance

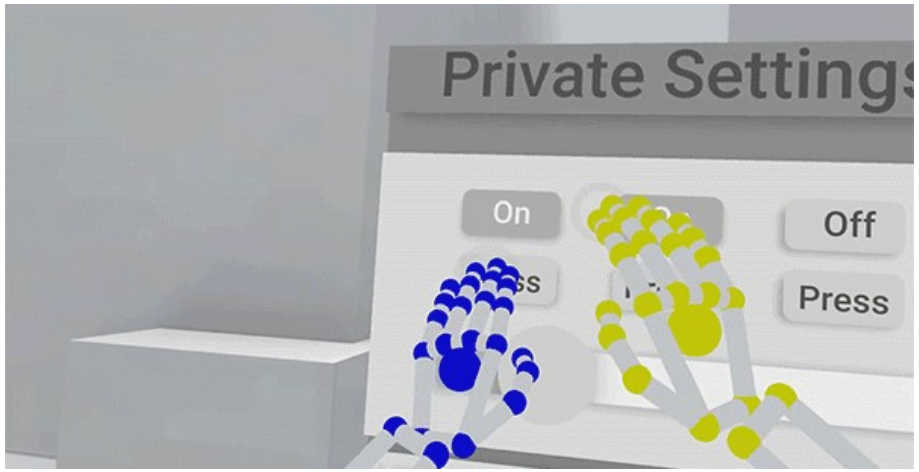
- Look of virtual objects
- Copy real objects
- Interface Design

Affordances in AR/VR

Design interface objects to show how they are used

- Use visual cues to show possible affordances
- Perceived affordances should match actual affordances
- Good cognitive model - map object behavior to expected

Examples of Affordances in AR/VR

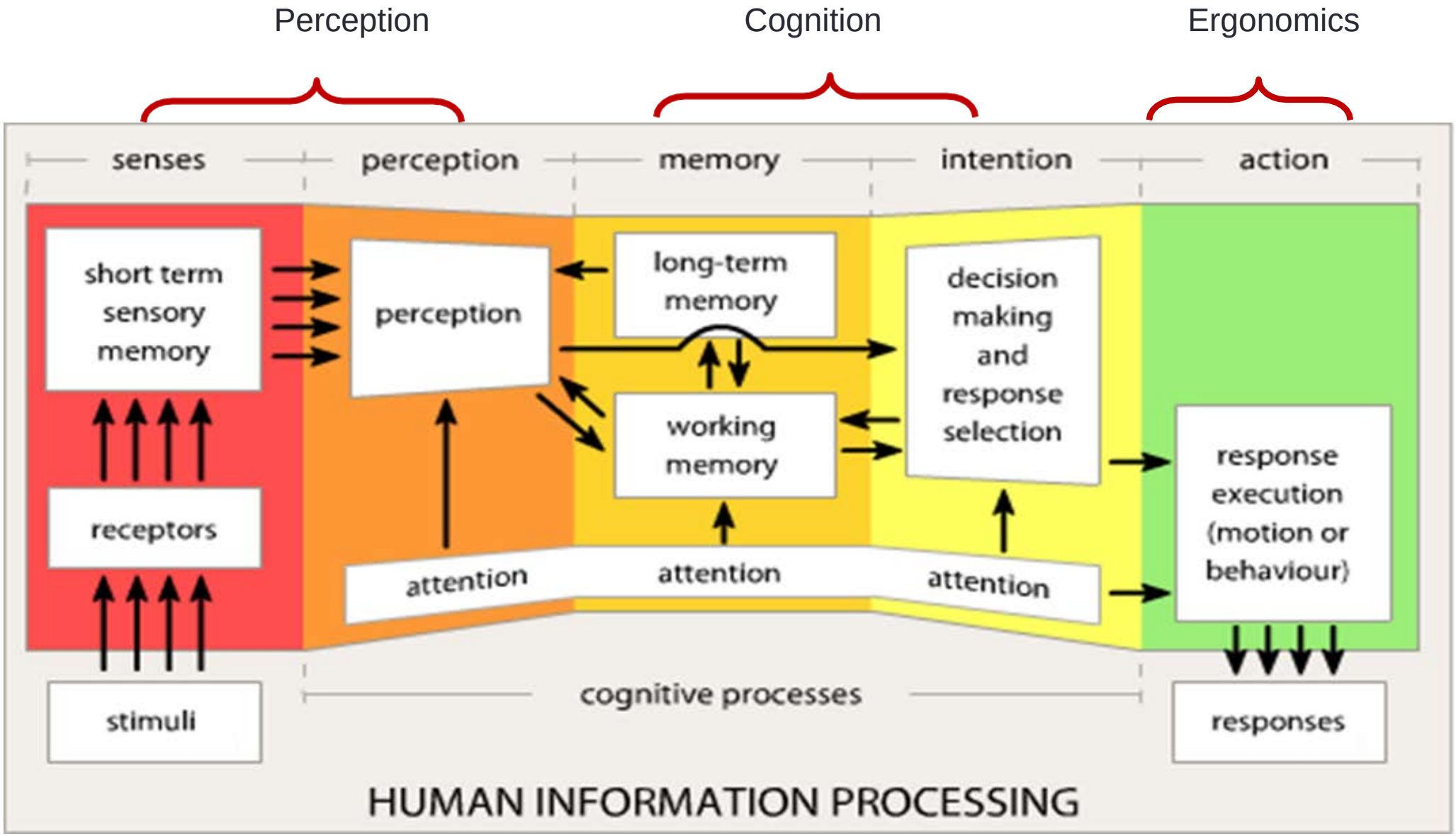


Virtual buttons can be pushed

Virtual doors can be walked through

Virtual objects can be picked up

Human Information Processing



Design for Perception

Visual perception

- Many types of visual cues (stereo, oculomotor, etc.)

Auditory system

- Binaural cues, vestibular cues

Somatosensory

- Haptic, tactile, kinesthetic, proprioceptive cues

Chemical Sensing System

- Taste and smell

Design for Cognition

Design for Working and Long term memory

Working memory

- Short term storage, Limited storage (~5-9 items)

Long term memory

- Memory recall trigger by associative cues

Design for Physical Ergonomics

Design for the human motion range

- Consider human comfort and natural posture

Design for hand input

- Coarse and fine scale motions, gripping and grasping
- Avoid “Gorilla arm syndrome” from holding arm pose

Designing for Different User Groups

Design for Difference Ages

- Children require different interface design than adults
- Older uses have different needs than younger

Prior Experience with VR systems

- Familiar with HMDs, VR input devices

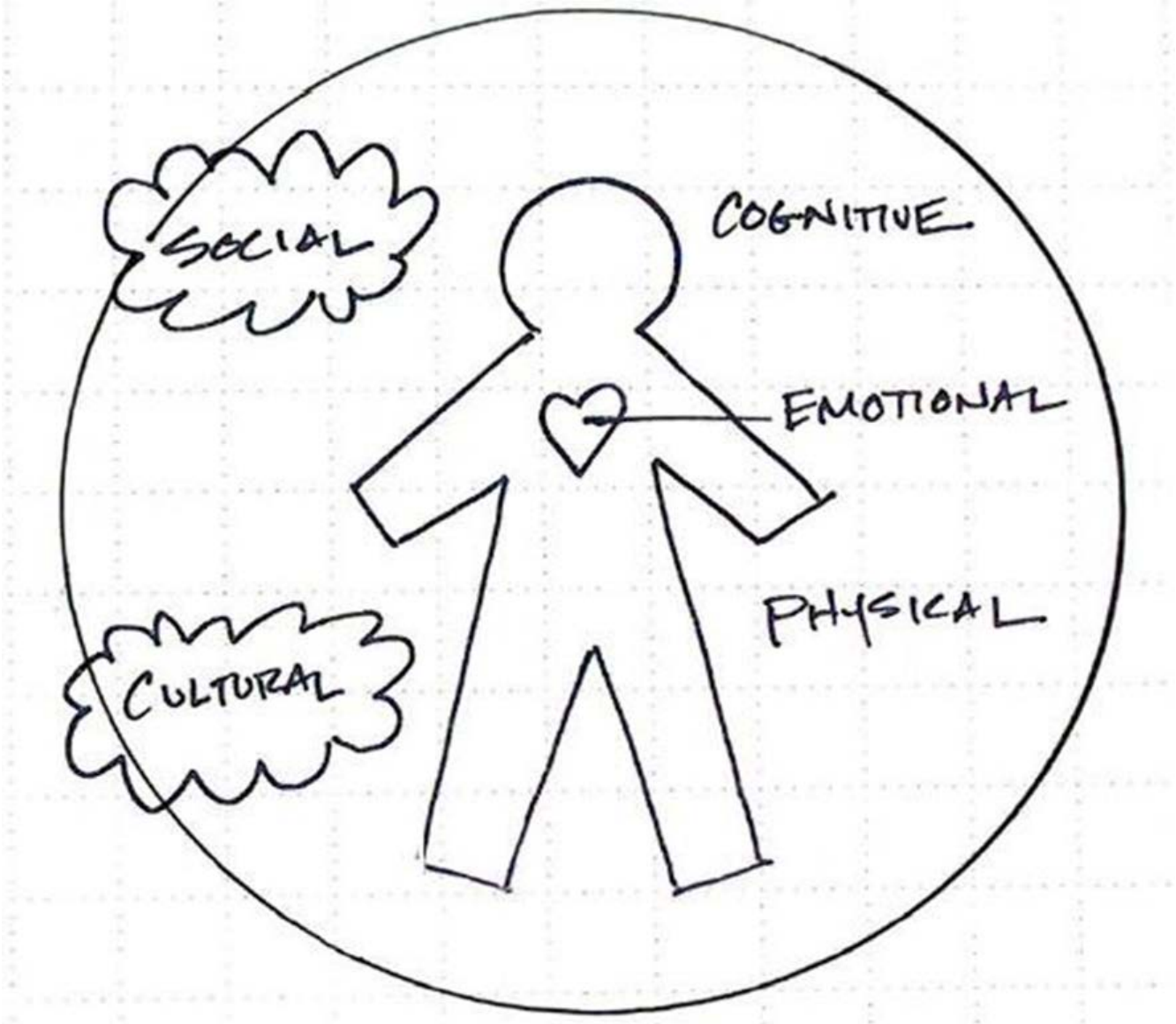
People with Different Physical Characteristics

- Height and arm reach, handedness

Perceptual, Cognitive and Motor Abilities

- Color perception varies between people
- Spatial ability, cognitive or motor disabilities

Consider the Whole User Needs

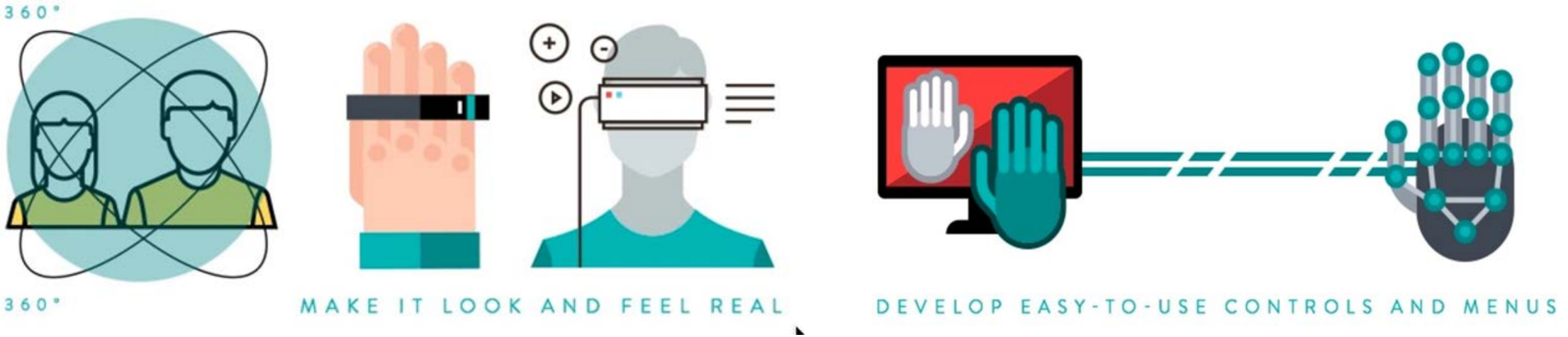


UX Guidelines for VR

The Four Cores of UX Design for VR

- Make interface Interactive and Reactive
- Design for Comfort and Ease
- Use usable Text and Image Scale
- Include position audio and 3D sound

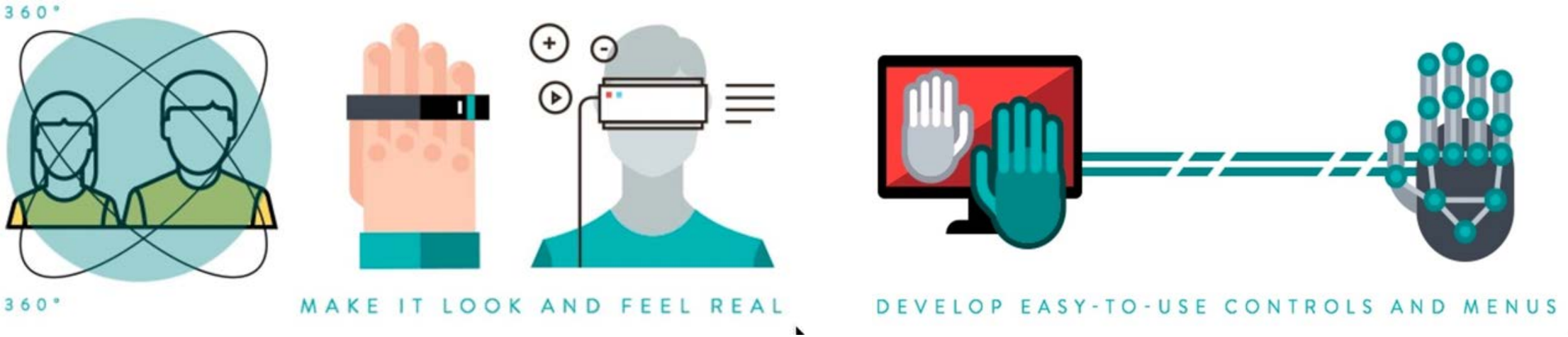
UX Challenges



Problems to be Addressed

- Keep the user safe
- Make it look and feel real
- Make sure users don’t get simulation sickness
- Develop easy-to-use controls and menus

UX Challenges



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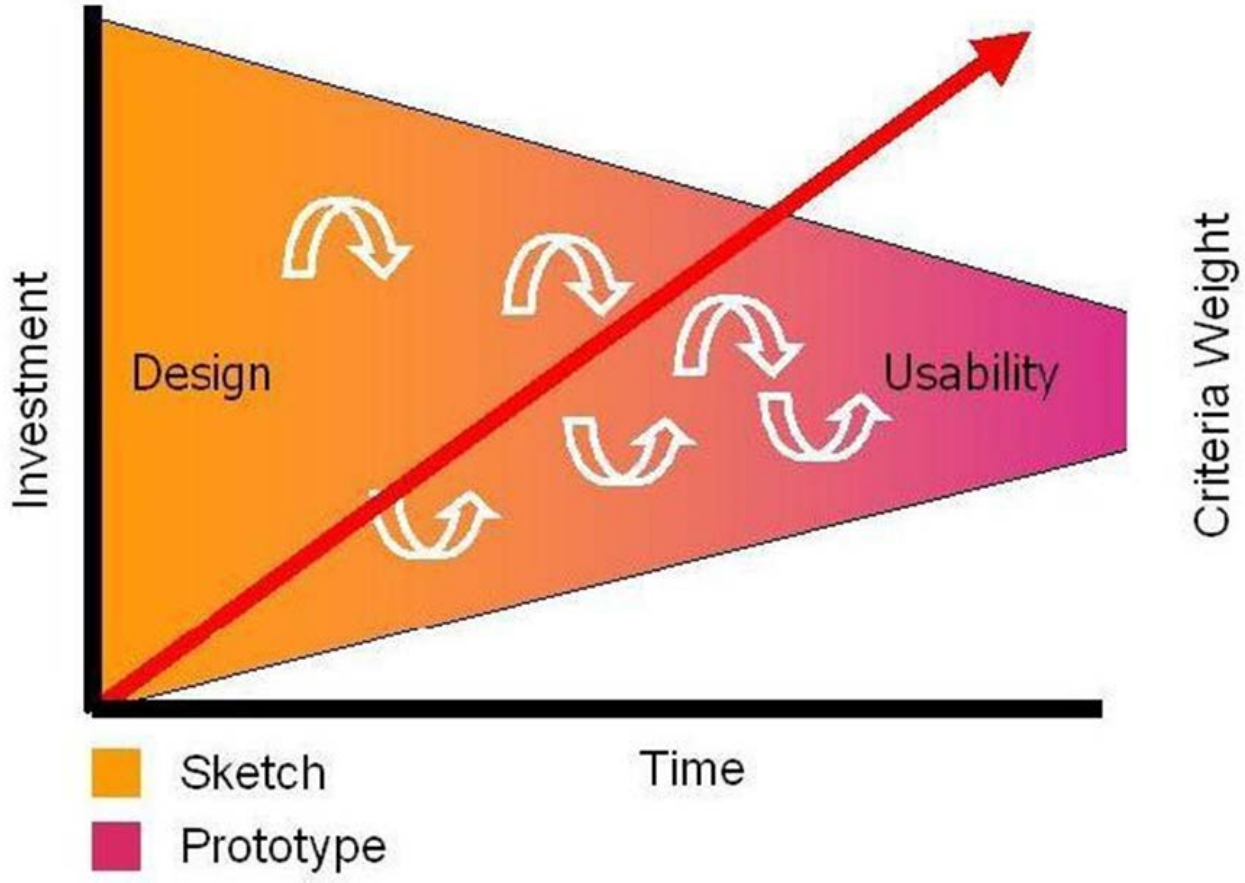
Prototyping

Why Prototype?

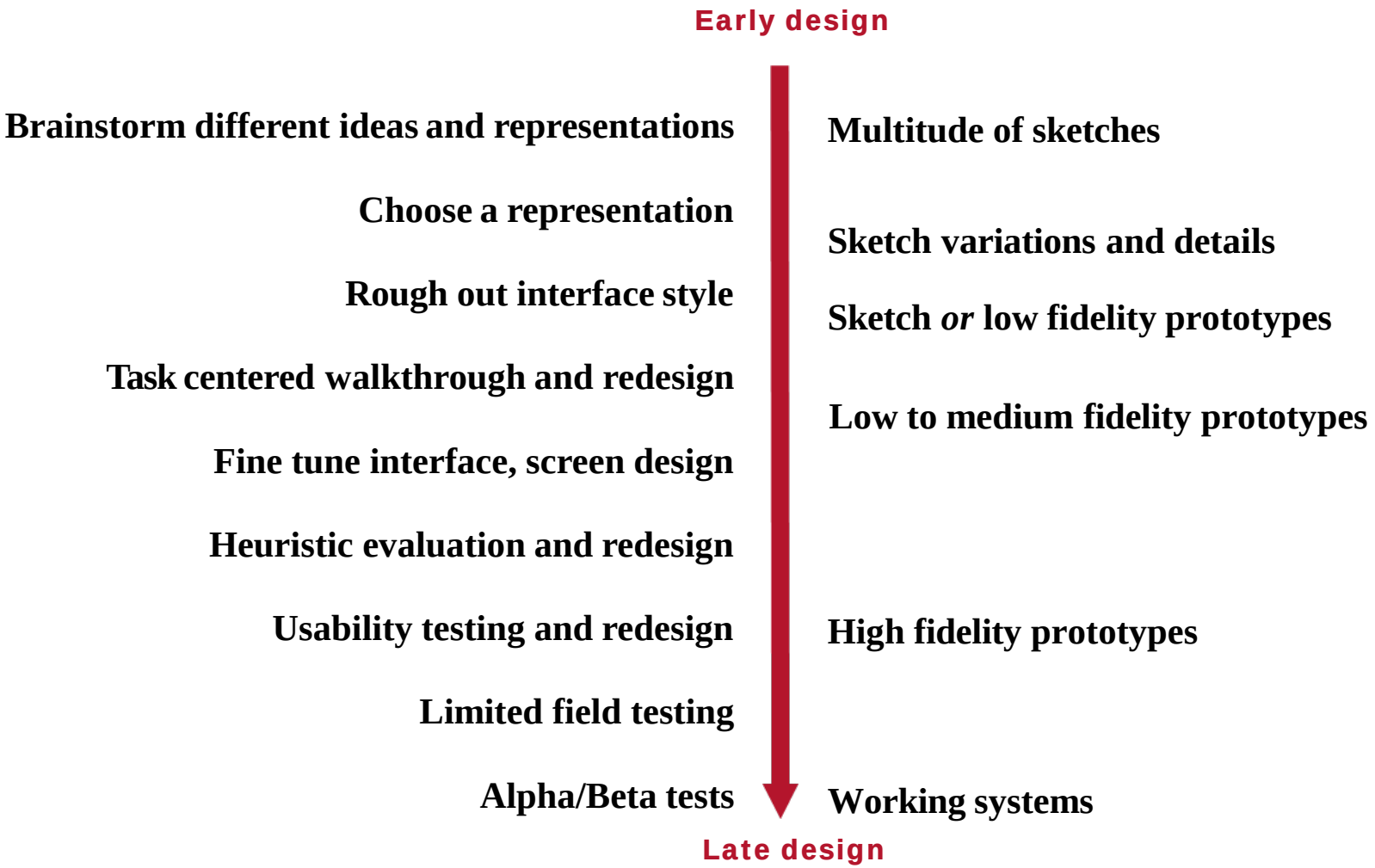
- Quick visual design
- Capture key interactions
- Focus on user experience
- Communicate design ideas
- Learn by doing/experiencing

From Sketches to Prototypes

- Sketches: early ideation stages of design
- Prototypes: capturing /detailing the actual design



From Sketches to Prototypes



Typical Development Steps

Sketching

Storyboards

UI Mockups

Interaction Flows

Video Prototypes

Interactive Prototypes

Final Native Application

Increased Fidelity & Interactivity

Typical Prototyping Tools

Static/Low fidelity

Sketching

User interface templates

Storyboards/Application flows

Interactive/High fidelity

Wireframing tools

Mobile prototyping

Native Coding

Evaluation

What is evaluation?

Evaluation is concerned with **gathering data** about the **usability** of a **design or product** by a specified group of users for a particular activity within a specified environment or work context.

Four Evaluation Paradigms

- quick and dirty
- usability testing (including lab studies)
- field studies
- predictive evaluation

DECIDE: A framework to guide evaluation

- **D**etermine the goals the evaluation addresses.
- **E**xplore the specific questions to be answered.
- **C**hoose the evaluation paradigm and techniques to answer the questions.
- **I**dentify the practical issues.
- **D**ecide how to deal with the ethical issues.
- **E**valuate, interpret and present the data.