

Human-Computer Interaction (HCI)

DECO2500/7250

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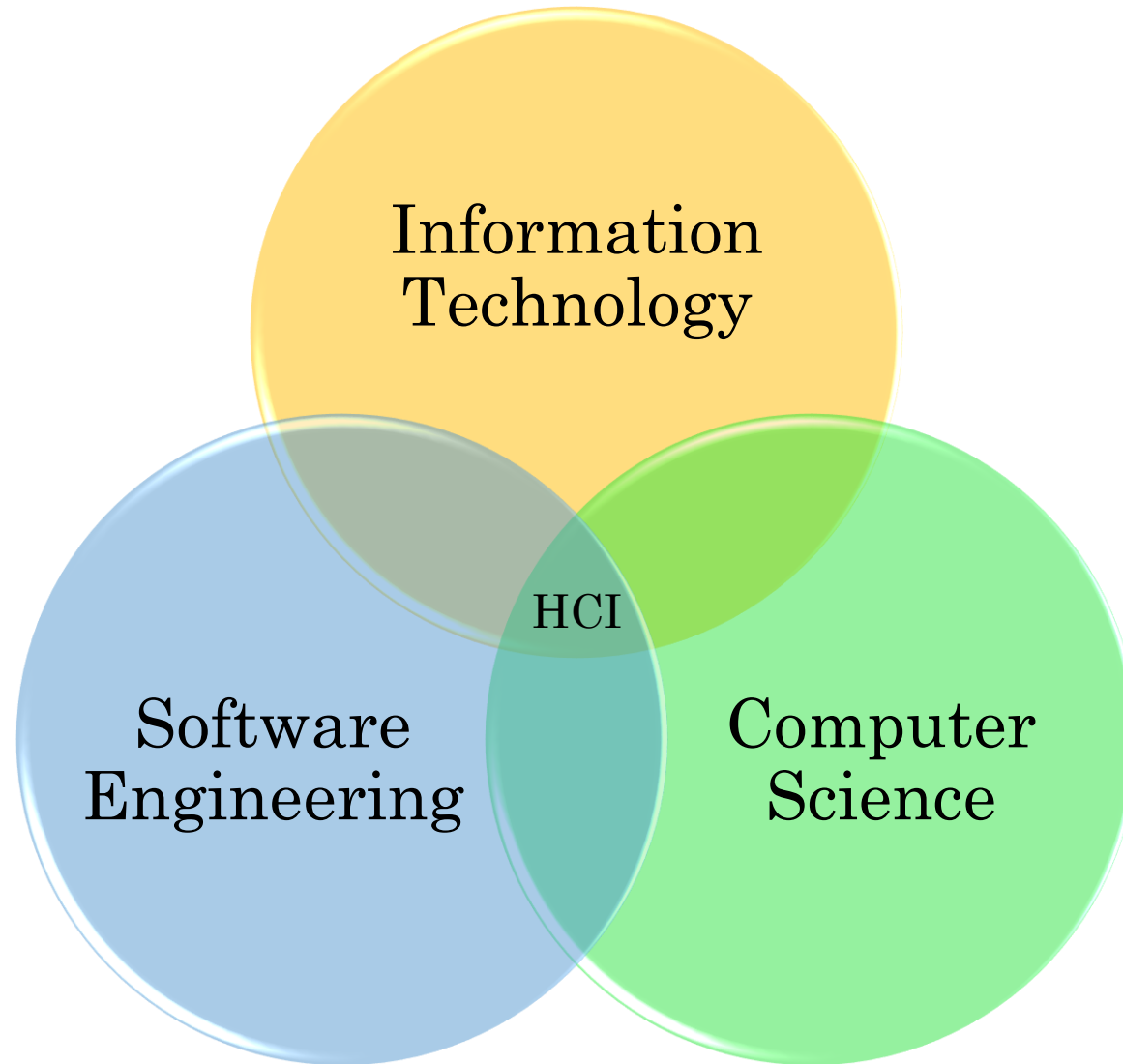
02

Interaction Fundamentals

In this session...

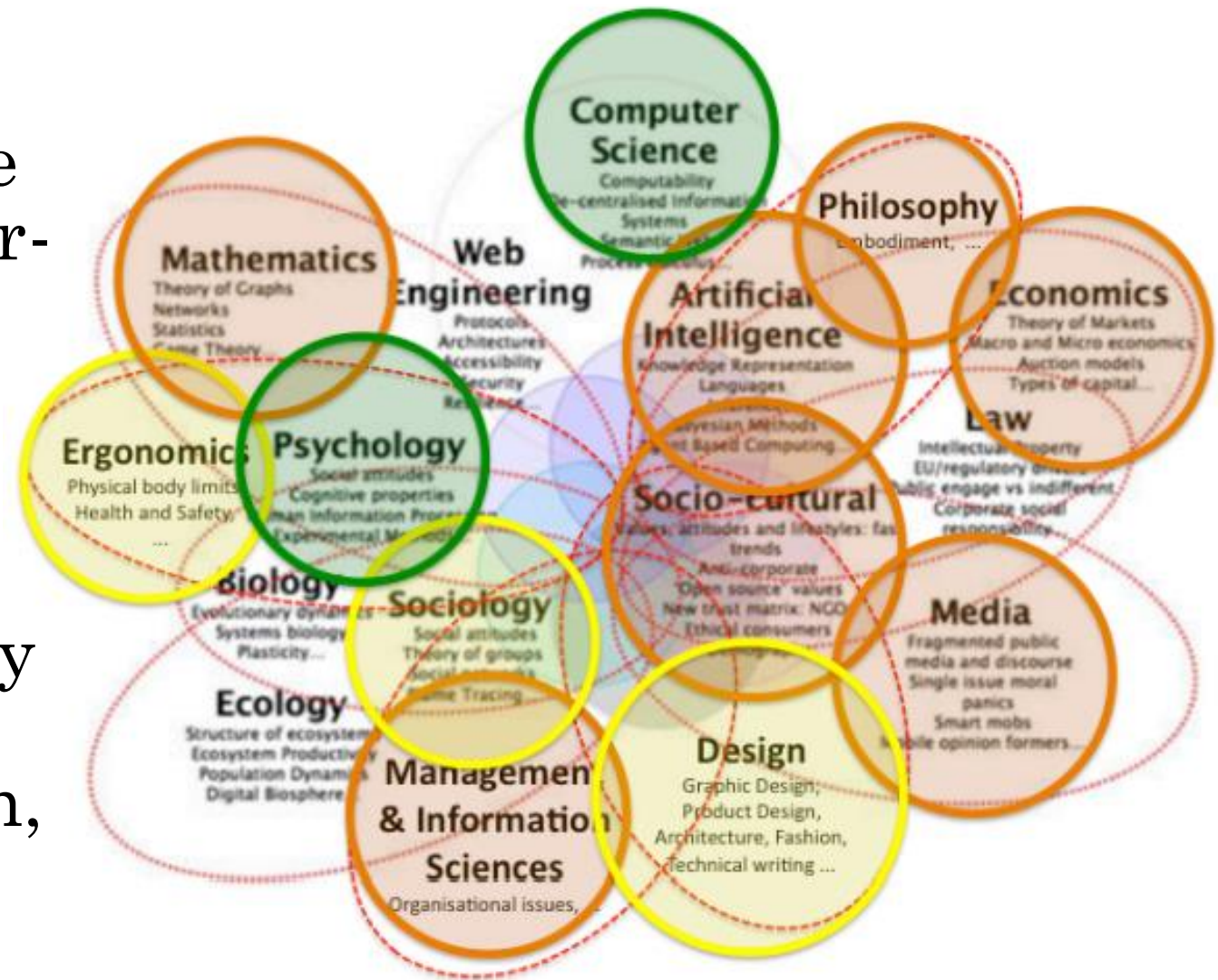
- Introduction to User Experience Design (UX)
- Ethics and HCI
- Contextual Inquiry
- Interaction Fundamentals
- Gulfs of Execution and Evaluation

HCI and You



HCI and Other Disciplines

- Various disciplines work together to create interfaces that are user-friendly and efficient
- Plays a crucial role in ensuring that the interaction between humans and technology is seamless, efficient, and enjoyable (Norman, 1988; Shackel, 1990)



User Experience

- UX is more important than ever before
- Through technology, customers are more informed than ever before, and so have higher expectations
- UX will overtake product and price as the key brand differentiator by the end of the decade



Why Do IT Developers and Software Engineers Need HCI?

- People have died because software engineers did not understand the people and contexts their systems were intended to support
- Systems can fail for many reasons other than being poorly engineered
- Most systems fail for social, not technical reasons
- All systems will (somehow) be used by people so understanding users is part of the job of a developer

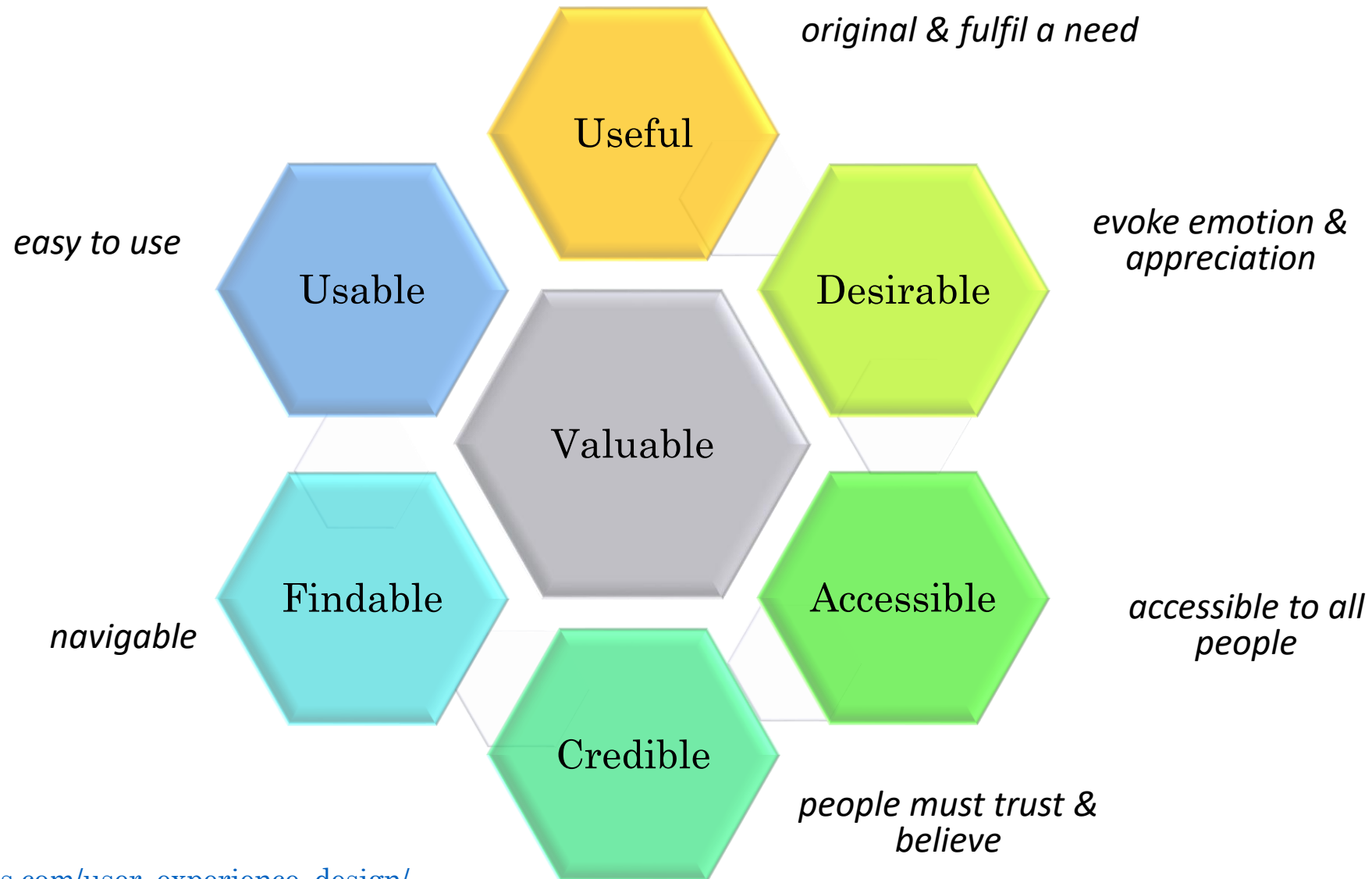


Why Do IT Developers and Software Engineers Need HCI?

- Because it's legislated
- International Organisation for Standardisation (ISO) standards are internationally agreed by experts
 - ISO12207:2017 (Software life cycle processes)
 - ISO9241-210:2019 (Human-centred design processes for interactive systems)



Peter Morville's UX Honeycomb



Ethics

- As computing professionals you must act responsibly and consider the wider impact of your work
- You must place the interests of the public above those of personal, business or sectional interests
- You must strive to enhance the quality of life of those affected by your work



ACM Code of Ethics

- The [Association for Computing Machinery \(ACM\) Code of Ethics](#) is concerned with how fundamental ethical principles apply to a computing professional's conduct. Composed of four broad sections:
- General Ethical Principles
- Professional Responsibilities
- Professional Leadership Principles
- Compliance with the Code



Ethics in DECO2500/7250

- People will be involved in your design activities
- Treat people with respect
- Be transparent about the purpose of the research
- Value their time
- Protect their identity, data and reputation
- Give them control over their data



How do we start understanding people and their needs?

- Contextual inquiry
 - Research methodology that involves in-depth observation and interviews of a small sample of users to gain a robust understanding of work practices and behaviours
- Context: Research takes place in the users' natural environment as they conduct their activities the way they normally would
- Inquiry: The researcher watches the user as they perform tasks and asks for information to understand how and why users do what they do

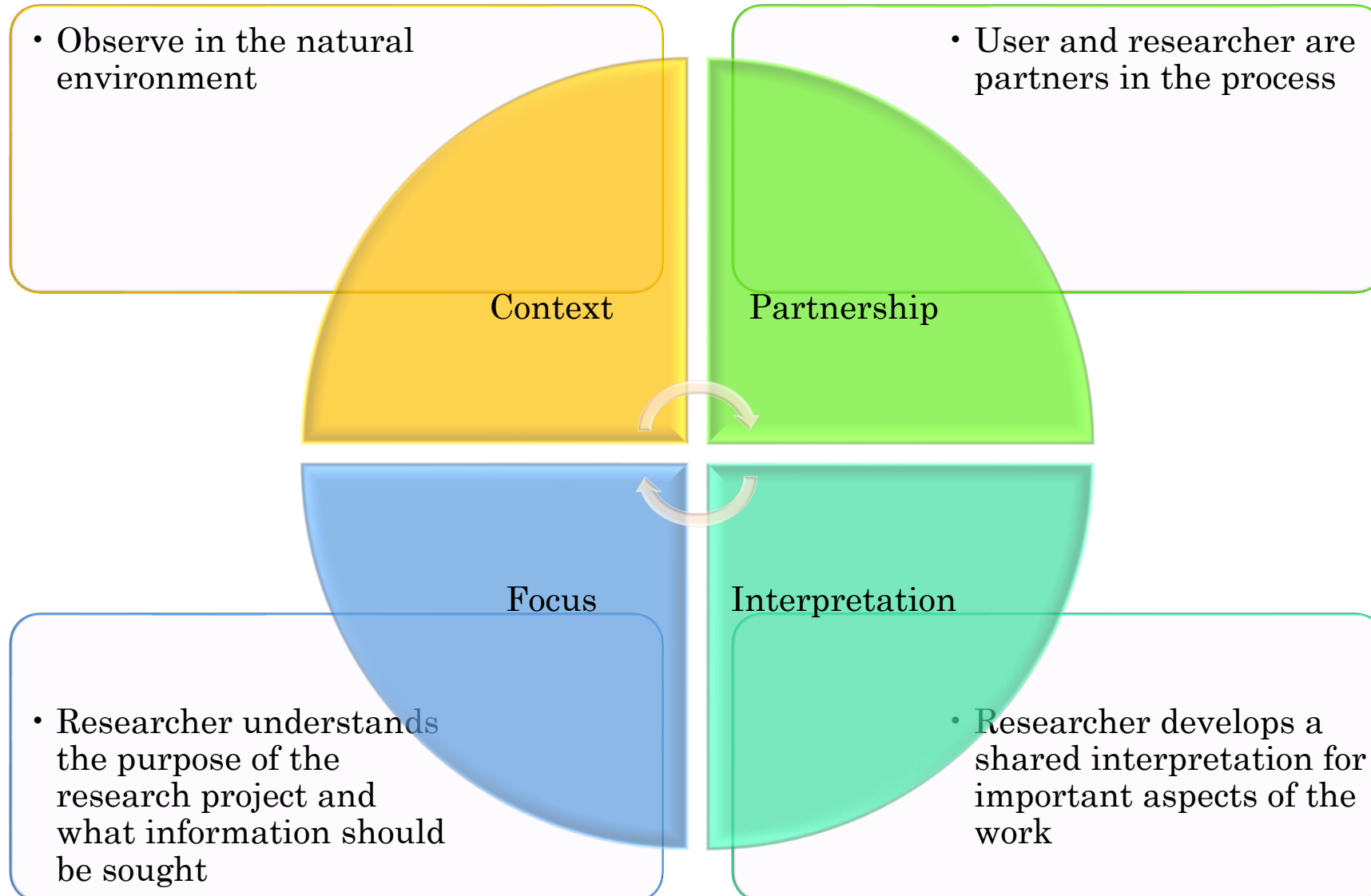


Contextual Inquiry

- Can provide richer and more relevant information about how users complete processes
- Allows the researcher to see things you wouldn't anticipate and uncover low-level details that have become habitual and invisible



Contextual Inquiry



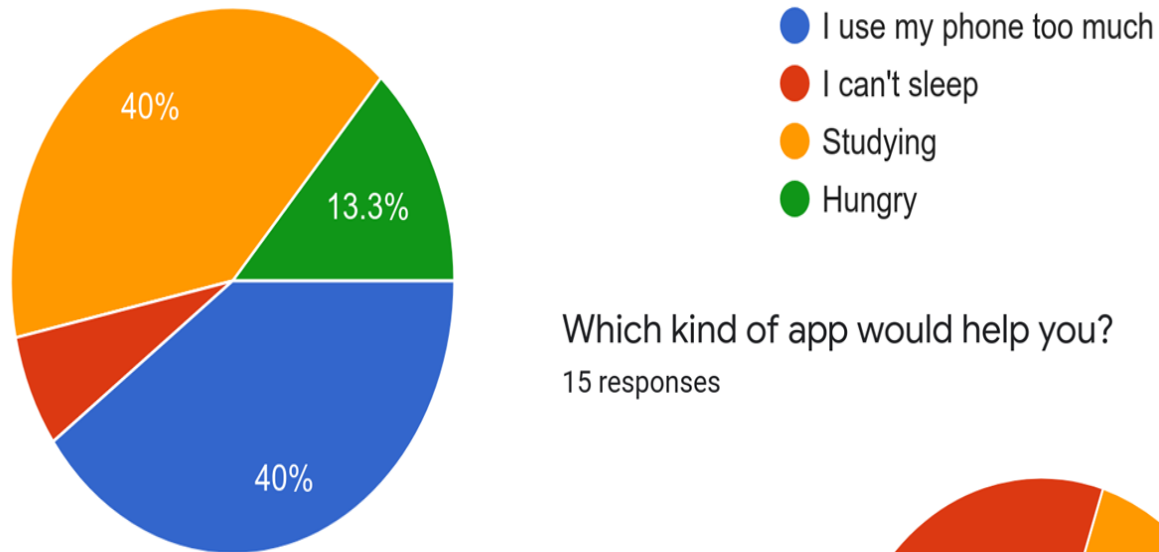
Conducting Contextual Inquiry

- Interview people
- Observations
- Research existing applications and systems in the domain/topic
- Conduct an online survey

Limitations of Surveys

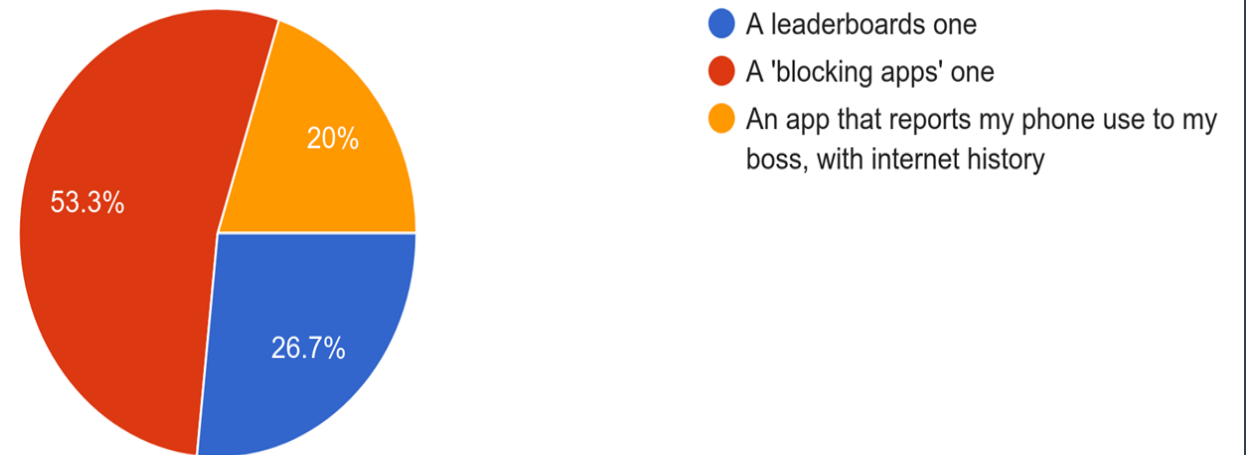
Why is it hard to sleep at night?

15 responses



Which kind of app would help you?

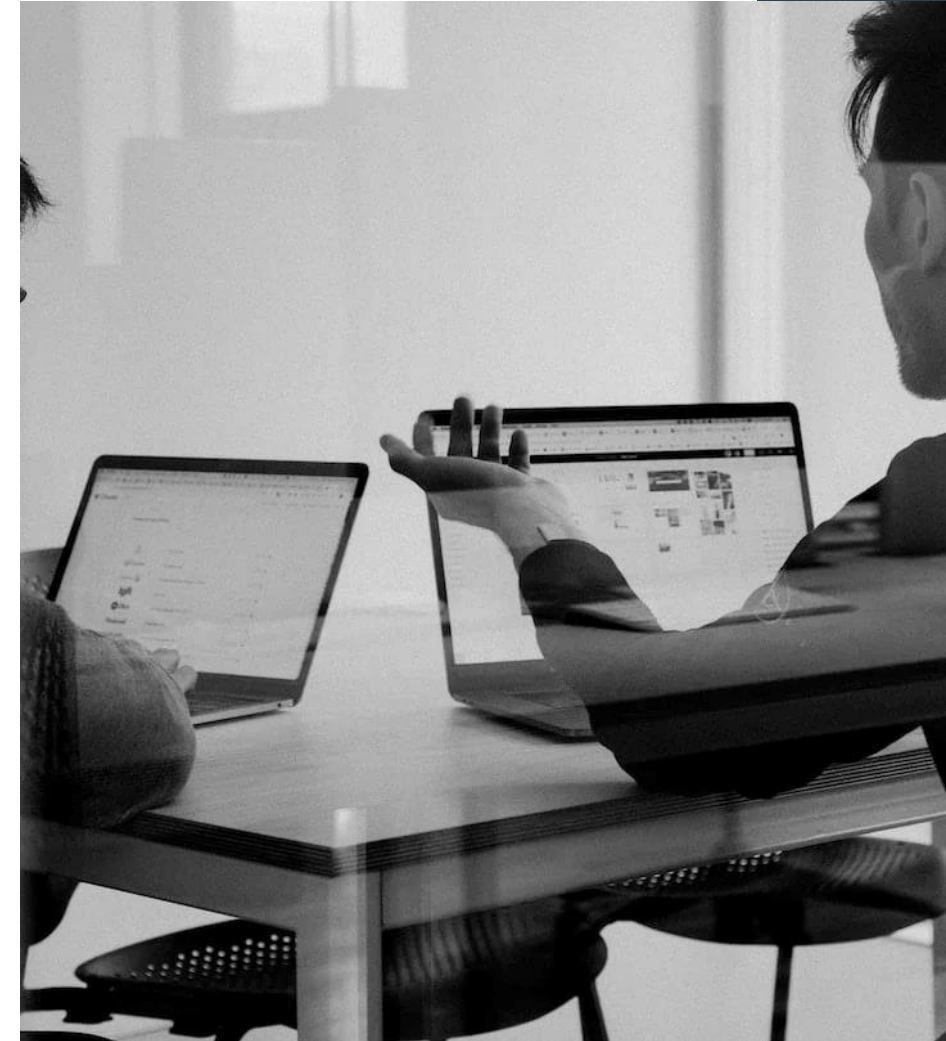
15 responses



"From this contextual inquiry I chose to make a behavioural change app that blocks apps to help people who use their phone too much."

Interviews

- Generally, there are two types of questions that can be asked during the contextual inquiry: questions about *current behaviour*, and questions about *potential changes*
 - “Why did you click on this button?” are behavioural, and they are asked in response to something a participant did.
 - “What would you suggest to add to the product to make it better?” or, “What did you like/dislike about this product?” help participants articulate responses about their needs or formulate requests for changes.
- It’s important to prepare a list of both types of questions for the session



What will we do with our data?

To understand people's problems, needs and goals we need to understand our data and figure out what will really help them:

Existing systems
research (desk
research)

User Interviews

Observations

Online Surveys



Identify Insights



Meaning & Needs

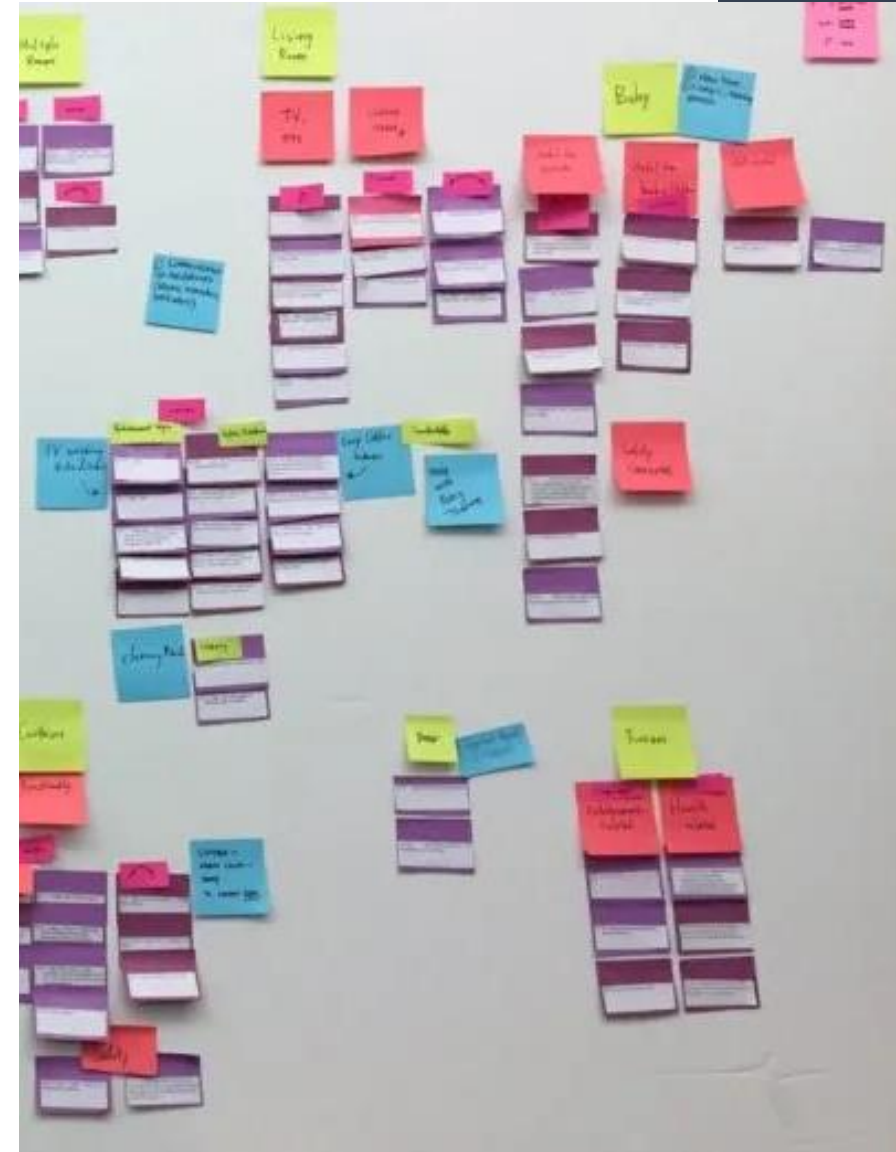


- Frame analysis
- Deeper meaning
- Root causes
- Is it the *real* problem?
- What hasn't been said
- etc.

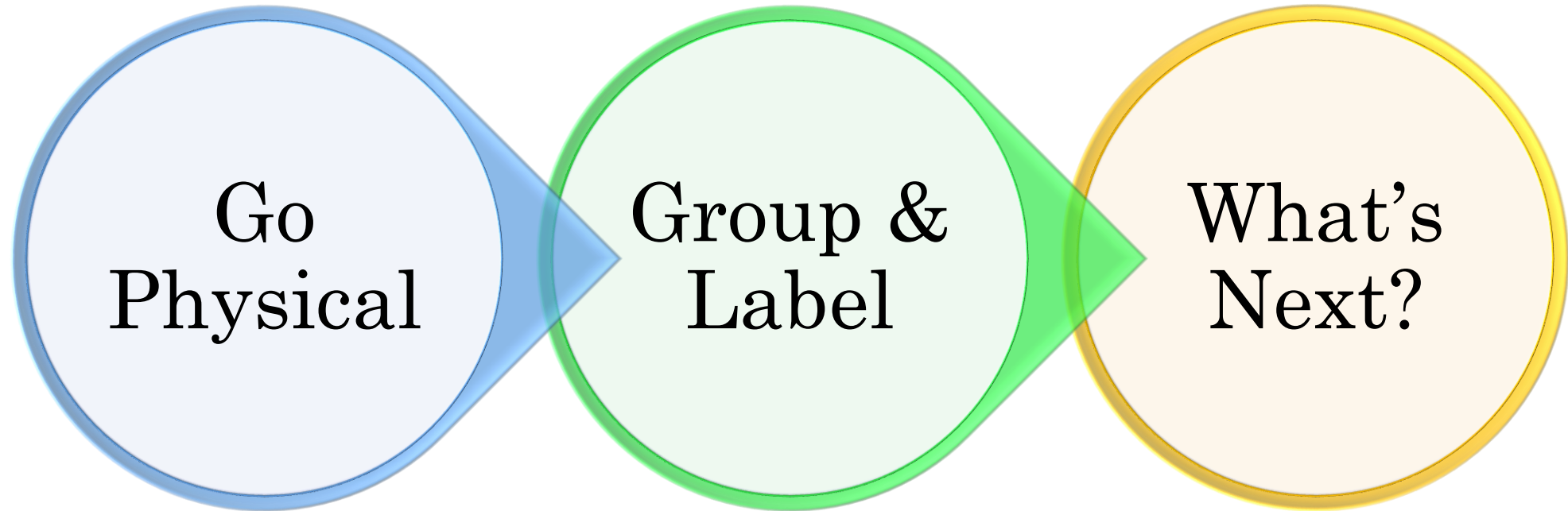
- Necessary outcomes
- Features for those outcomes
- Interactional requirements for those features
- Interface requirements for those interactions

Data Analysis

- Bridging the gap between user research raw data and creating personas is one of the biggest challenges for UX designers.
- Insights, problems, observations, ideas, concerns and pain points need to be transformed into a concrete format to be able to understand their users in a holistic way
- Affinity Diagram is a tool that gathers large amounts of language data and organizes them into groupings based on their natural relationships



Affinity Diagrams



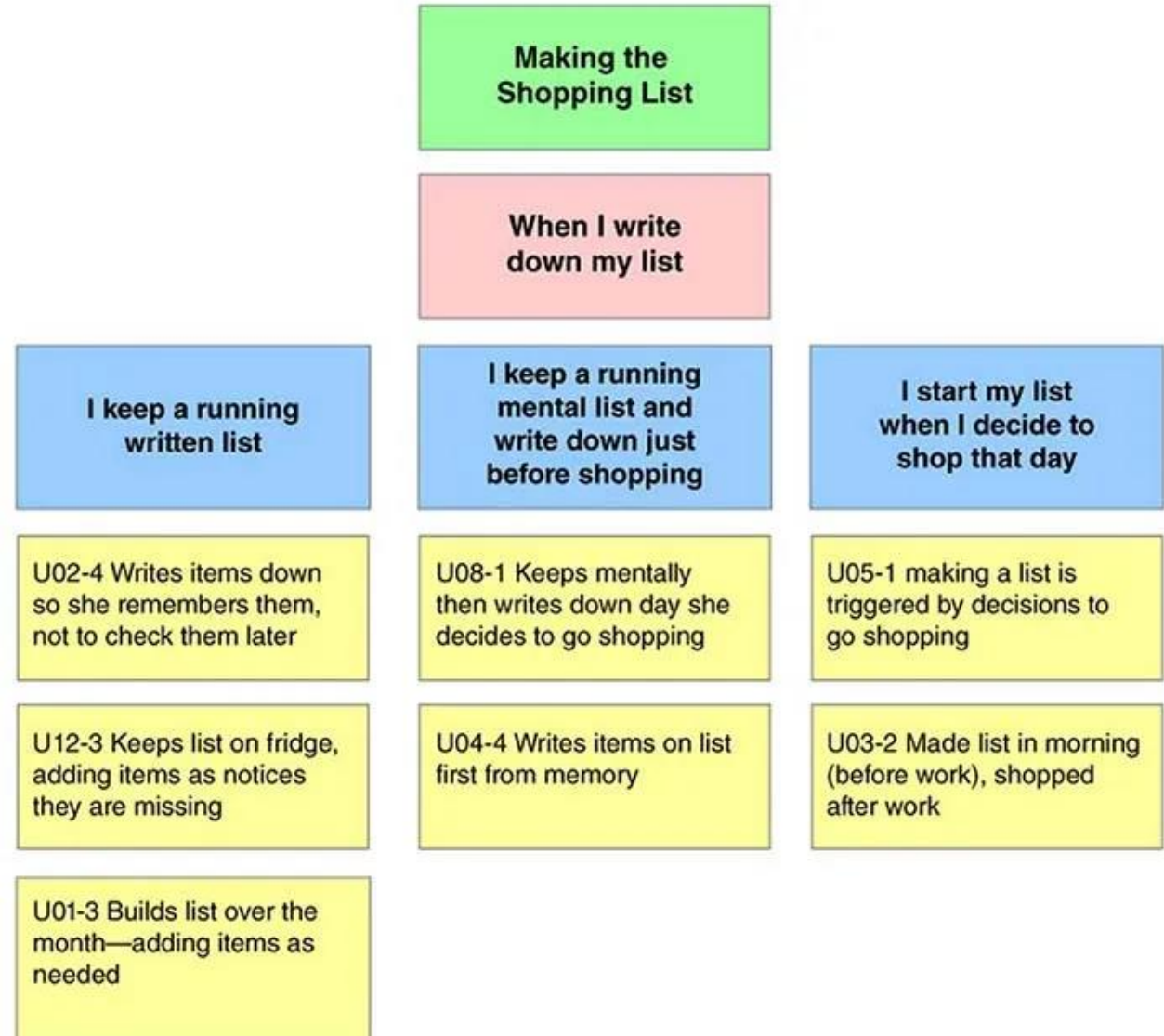
Affinity Diagrams – Go Physical

- Take all data collected and write them down on yellow sticky notes
- Each sticky note must have only one information, insight, problem or pain point
- Make sure to keep a note that reference to the original transcript or source of information to return back when need to (Use U1, U2 & U3 to refer to your users)



Affinity Diagrams – Group & Label

- Yellow: The building blocks of the affinity diagram, each yellow note represents a single observation, idea, pain point or insight.
- Blue: A group of yellow sticky notes (Two to four notes is the best) grouped together.
- Pink: A higher level groups containing blue sticky notes.
- Green: The top level grouping which contains a group of pink sticky notes.



Affinity Diagrams – What's Next?

- Finished affinity diagram will give you a holistic view of all the user research you have done and you will be able to see the full picture
- The next step could be building the personas, requirements and user journeys...

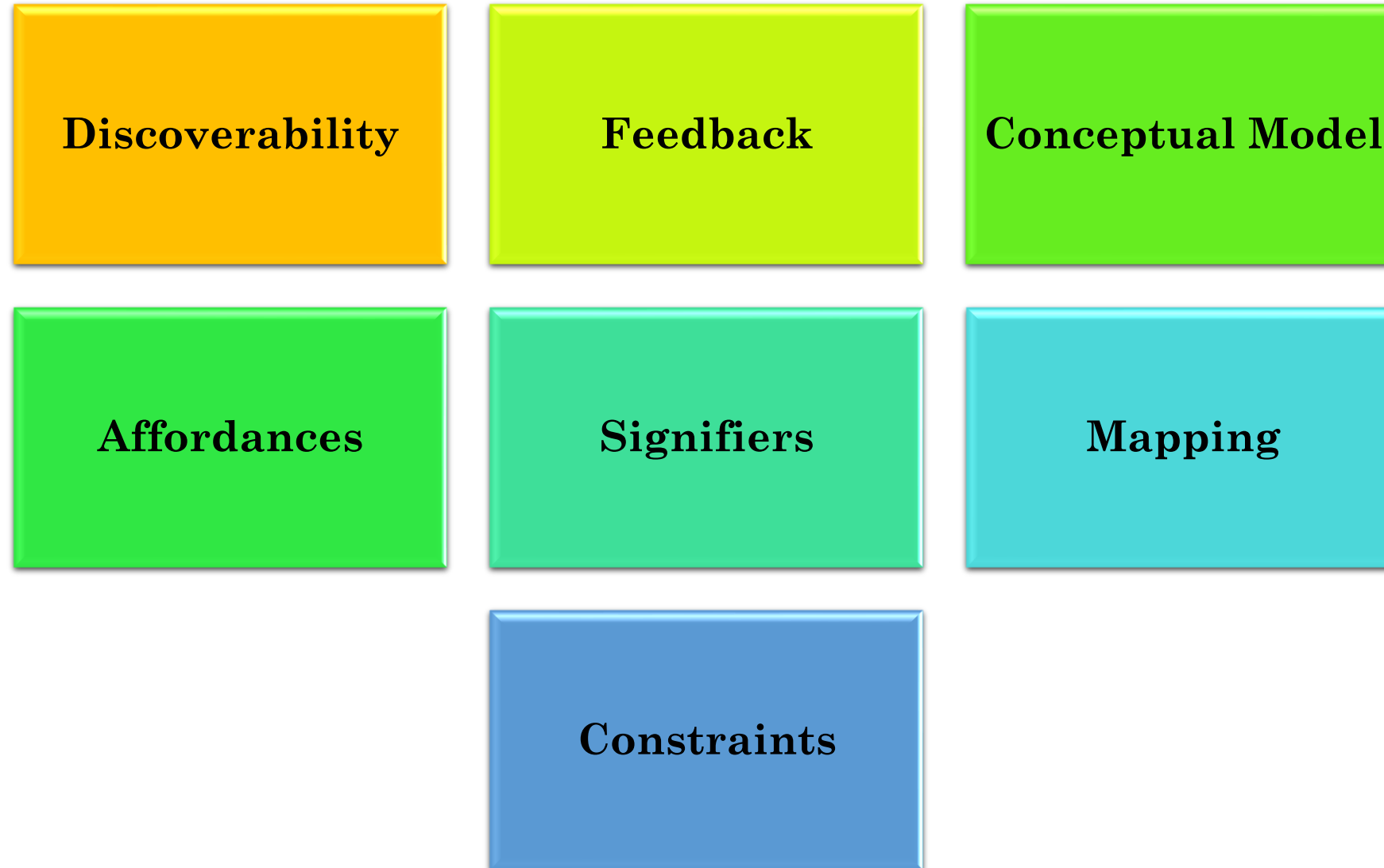
How do we design more usable systems?

Our first bit of theory is from design: 7 principles



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7 Fundamental Principles of Design



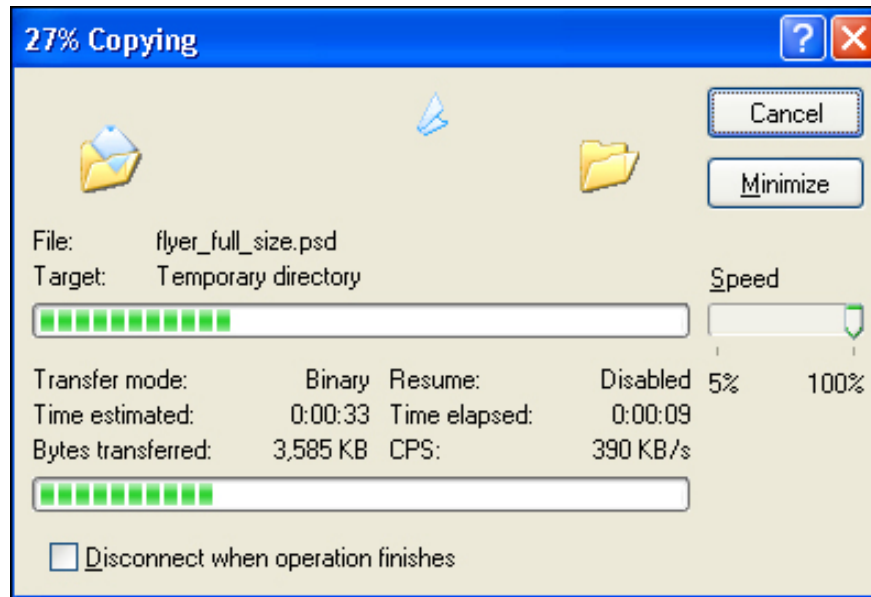
7 Fundamental Principles of Design

- Discoverability
 - Users can determine what actions are possible and the current state of the system.



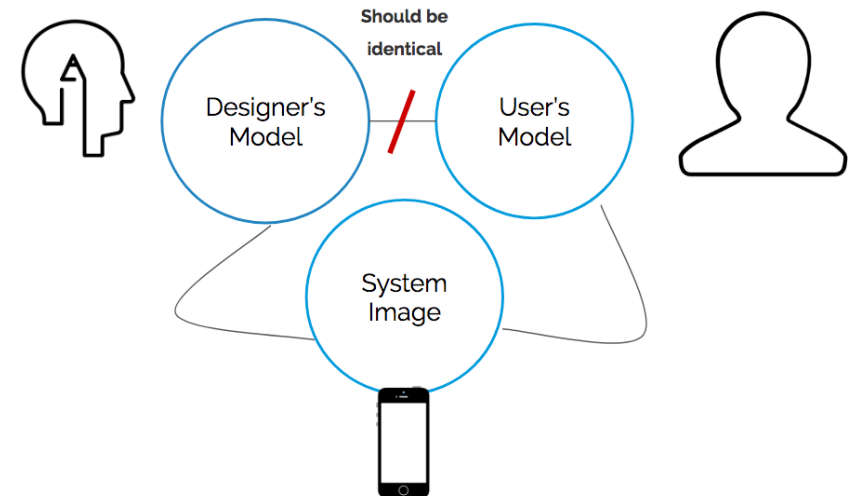
7 Fundamental Principles of Design

- Feedback
 - The system immediately communicates the results of a user's action, and displays continuous information about its own state.



7 Fundamental Principles of Design

- Conceptual Model
 - Describes a holistic understanding of a system: how it works, how it behaves, what it does
 - The designer's conceptual model of the system is a “high-level description of how a system is organized and operates”¹.
 - Conceptual models are revealed through the patterns of interactive behaviour designed into a system—how the system collectively behaves over time.



¹Johnson, J., & Henderson, A. (2002). Conceptual models: Begin by designing what to design. *Interactions*, 9(1), 25–32. <https://doi.org/10.1145/503355.503366>

Don Norman, "The Design of Everyday Things" (Chapter 2)

7 Fundamental Principles of Design

- Affordances
 - Affordances are the physical possibilities for action an object provides a user.
 - Things like: throw-able, push-able, squeeze-able, turn-able, twist-able, etc.
 - Do not depend on interpretation, meaning, recognition or understanding. They are just “there”—possibilities for physical action.

Interaction Fundamentals – Affordances

- Refers to the properties of an object AND the person
- It's the relationship between the object and the person and what the person can do with that object
- In HCI, affordance is defined as *perceivable* action possibilities
 - Depend on the users' physical capabilities and their goals and past experiences



7 Fundamental Principles of Design

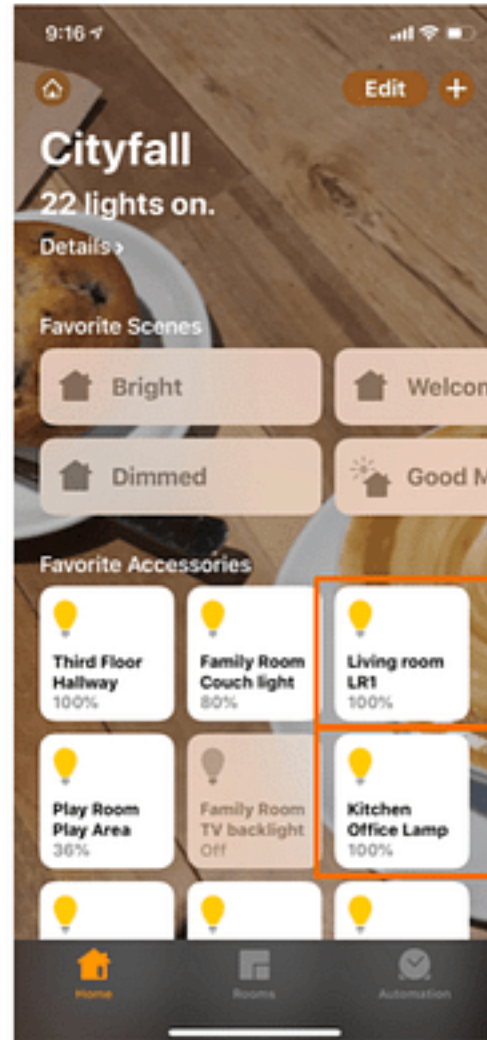
- Signifiers
 - Signifiers are meaning-carriers
 - Signs, indicators, signals, icons, animations etc. that can be interpreted meaningfully
 - Act as signs to indicate affordances

Interaction Fundamentals – Signifiers

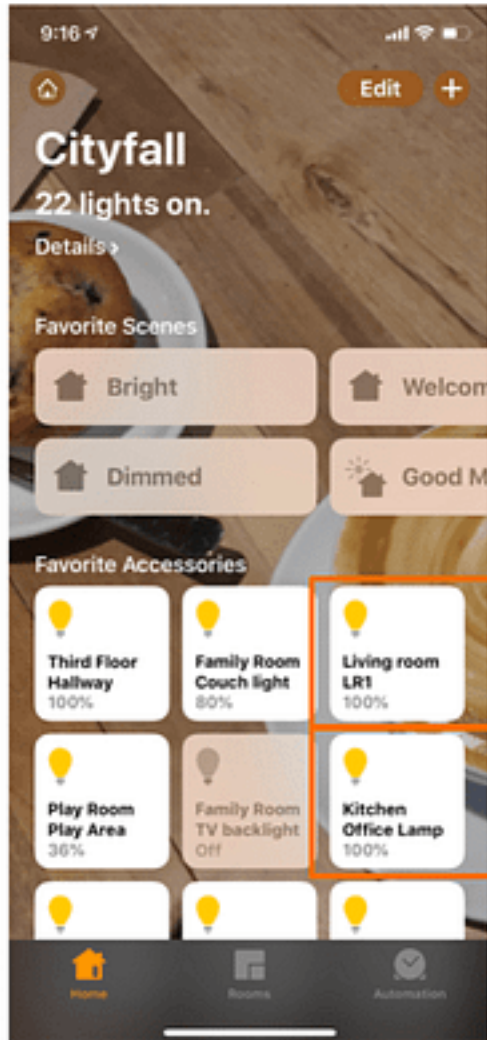
- Communication “devices” or indicators that tell people what to do and where to do it.
- Some sort of indicator, some signal in the physical or social world that can be interpreted meaningfully and help people understand.



Affordances vs Signifiers



Affordances vs Signifiers



Affordance

- The button itself (invisible tap target that takes up set space on touch system (the primary affordance), not the visual representation of a button)

Signifiers

- The visual representation of a button
- The lightbulb icon to tell you it's a lightbulb you are controlling
- The label to tell you which room the light is in
- The percentage to tell you how bright the bulb is

Affordances vs Signifiers



Affordances vs Signifiers



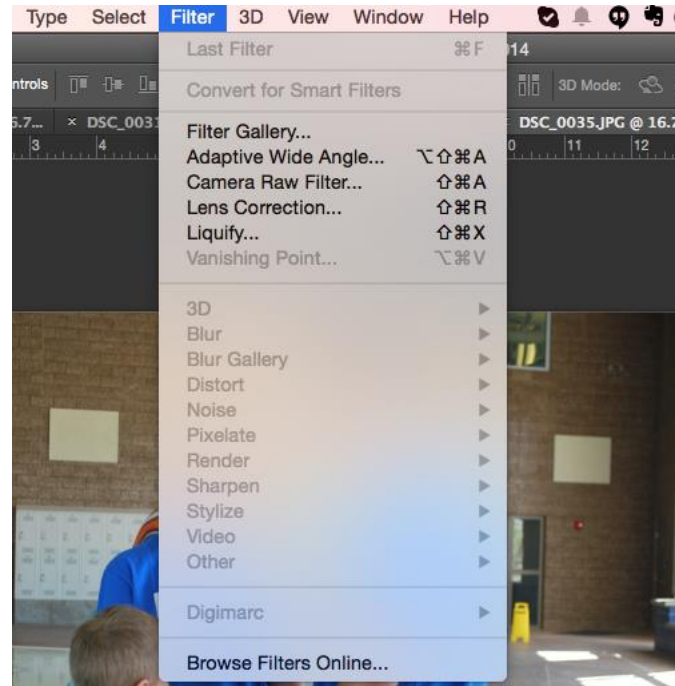
7 Fundamental Principles of Design

- Mapping
 - The relationship between controls and their actions follows the principles of good mapping, enhanced as much as possible through spatial layout and temporal contiguity.



7 Fundamental Principles of Design

- Constraints
 - Providing physical, logical, semantic, and cultural constraints guides actions and eases interpretation.



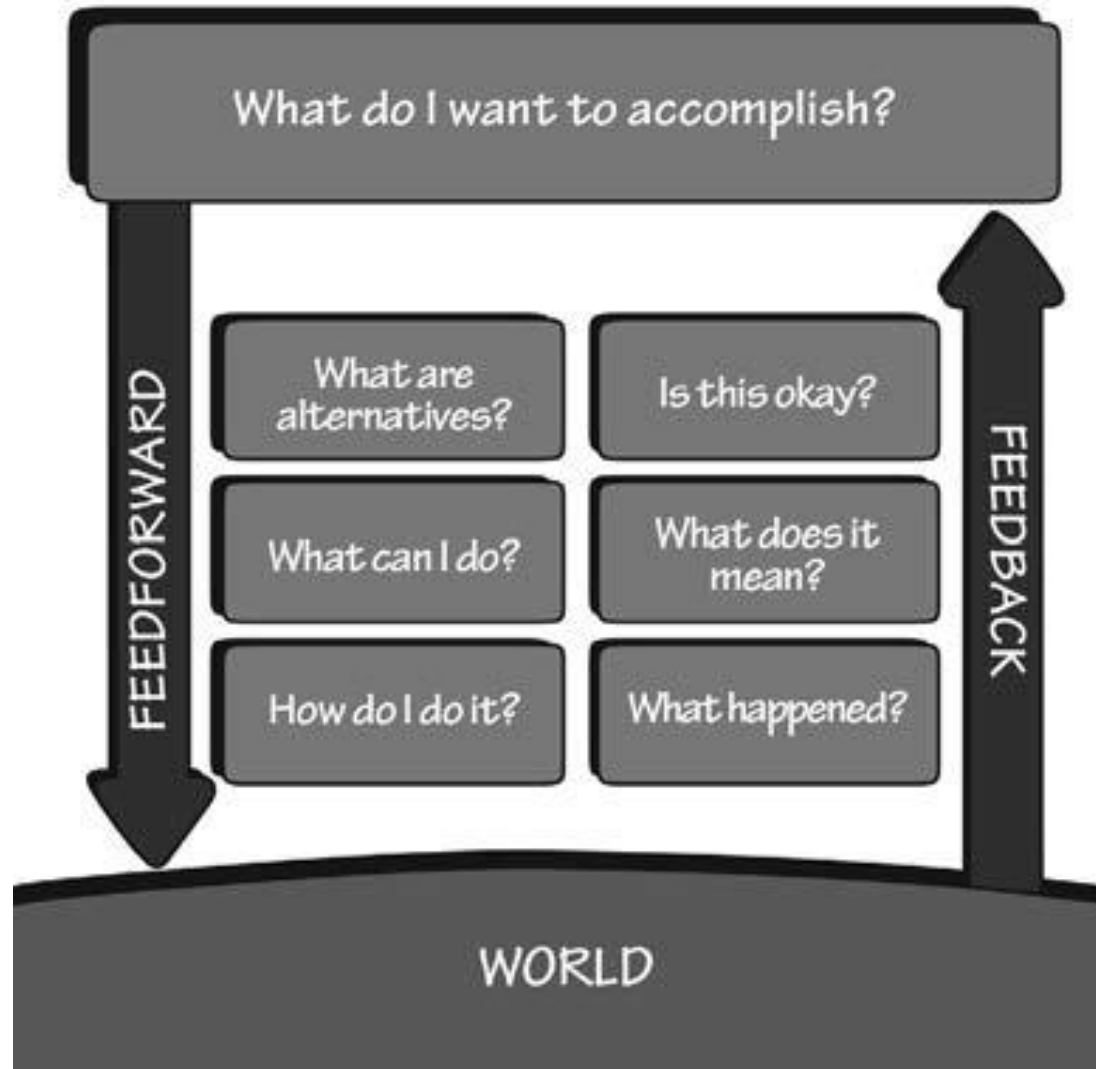
Interaction under a microscope

- Our second bit of theory...

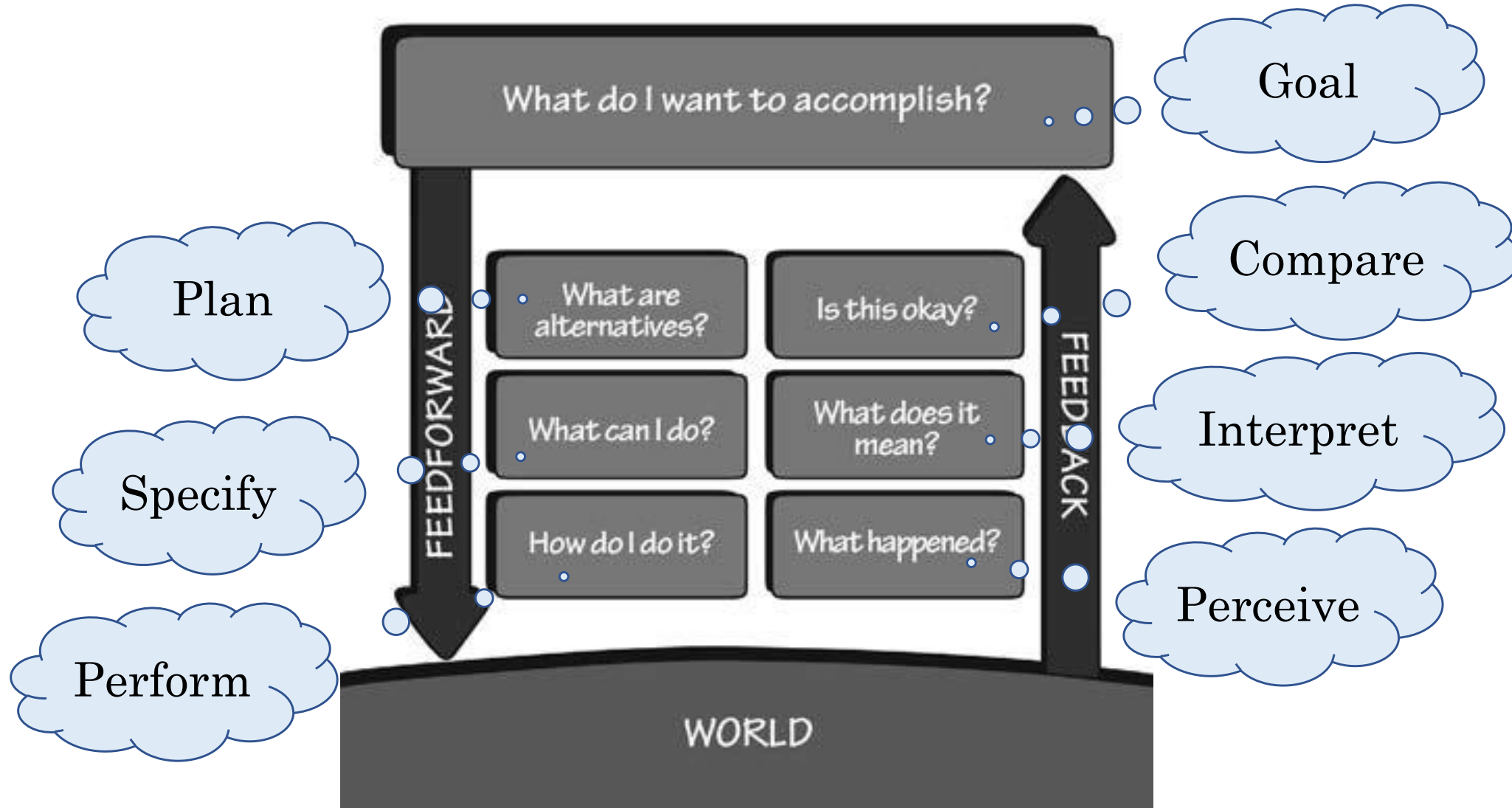


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The Seven Stages of Action

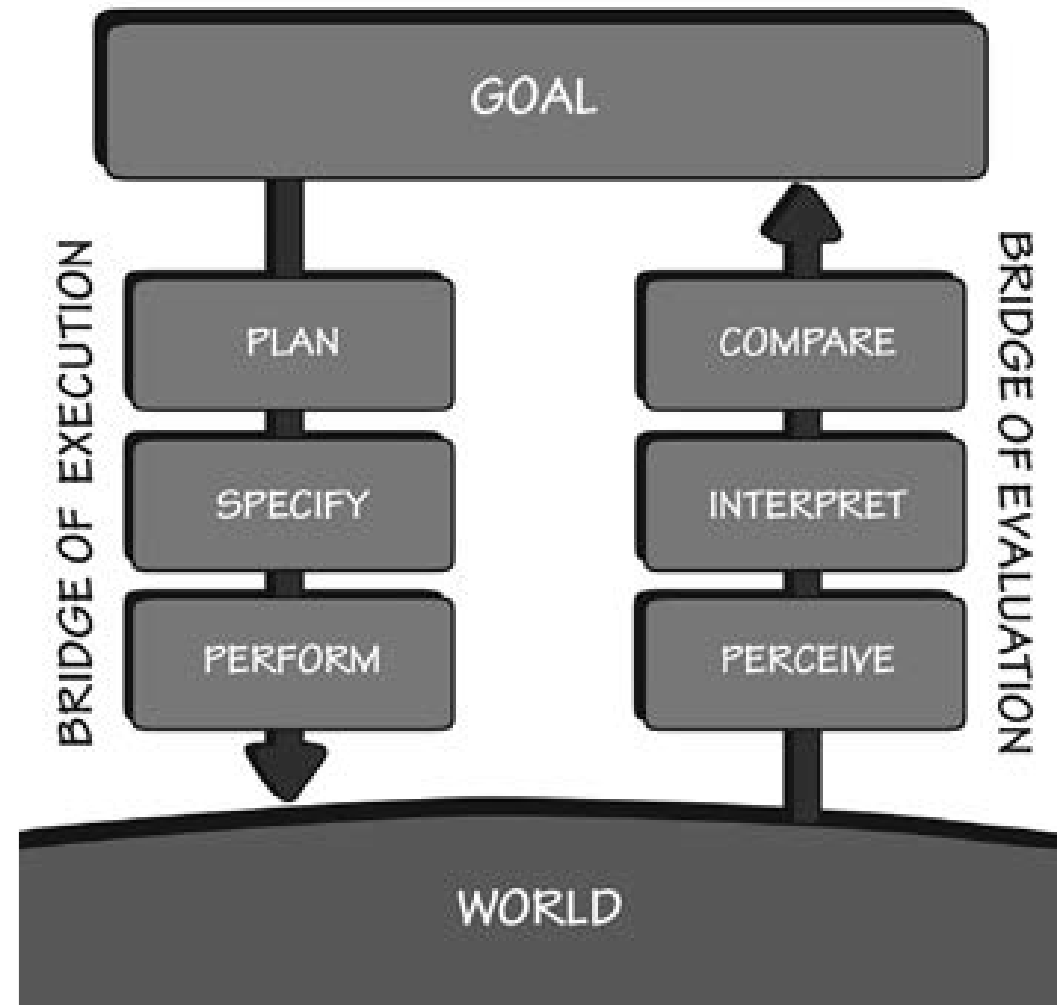


The Seven Stages of Action



Gulfs of Execution and Evaluation

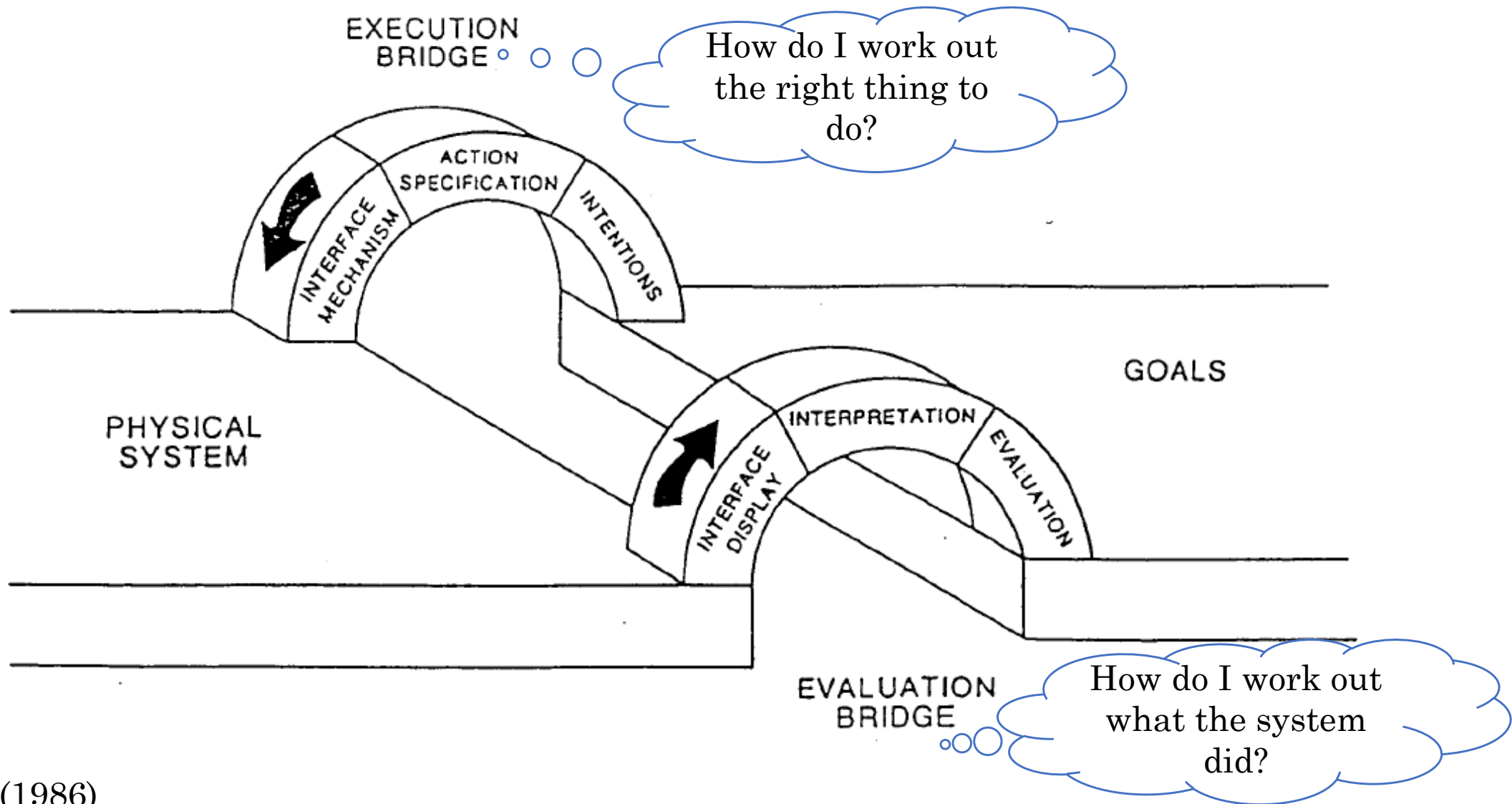
- Norman's (1986) "Seven Stages of the Action Cycle" composes interactions into steps
- Each step may be well or poorly supported.



Gulfs of Execution and Evaluation

- The gulfs are two sources of difficulty when interacting with a machine or system. They occur due to issues with discoverability and feedback.
- Gulf of Execution
 - Difference between the user's formulation of actions to reach a goal and actions allowed by system
 - If the actions allowed by a system match the user's intention, then interaction will be effective
- Gulf of Evaluation
 - Distance between physical presentation of system state and expectations of the user
 - If a user can readily evaluate presentation in terms of goals, the gulf of evaluation is small

Gulfs of Execution and Evaluation



Gulfs of Execution and Evaluation

- The interaction starts with the person having a goal that they want to accomplish



Physical System

Goal
What do I want
to accomplish?

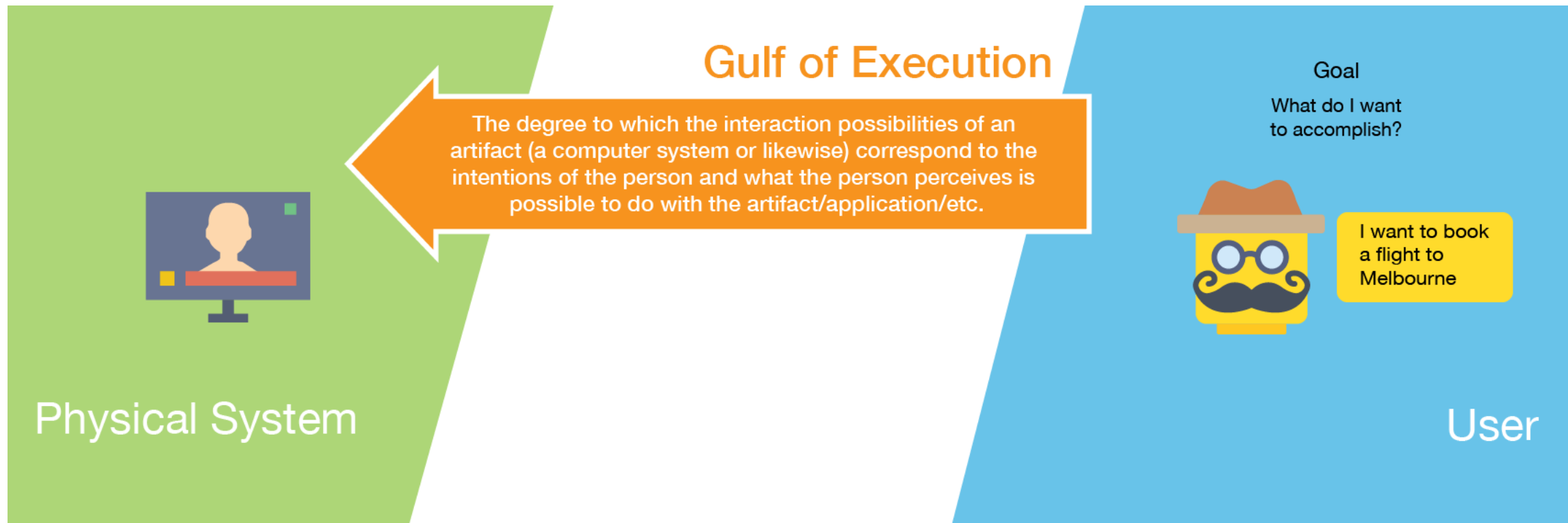


I want to book
a flight to
Melbourne

User

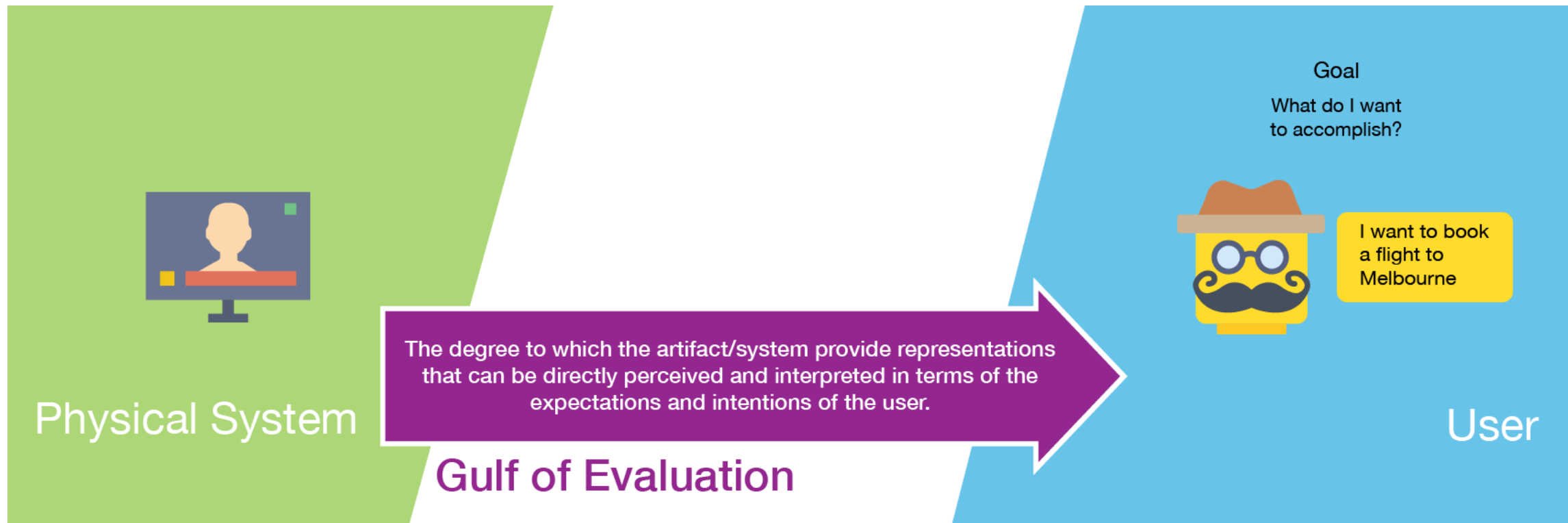
Gulfs of Execution and Evaluation

- The **Gulf of Execution** is the gulf between a person's goal and the means of achieving that goal



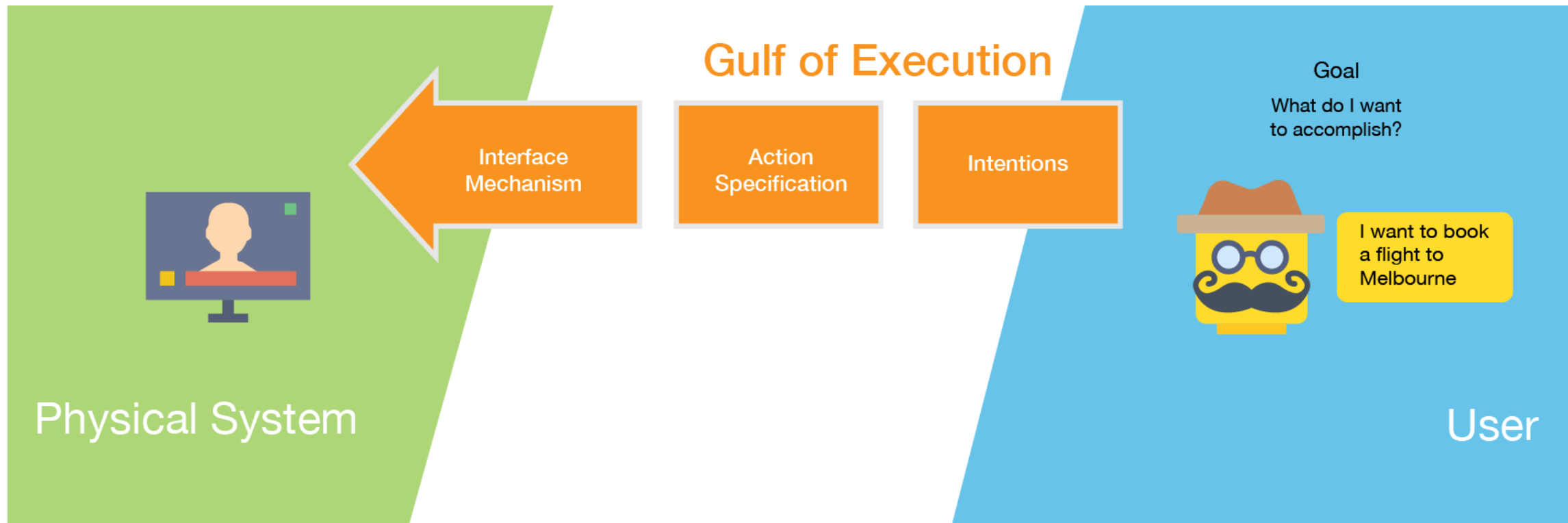
Gulfs of Execution and Evaluation

- The **Gulf of Evaluation** is the gulf between assessing the state of the world (the system) and determining if that state matches the person's goal.



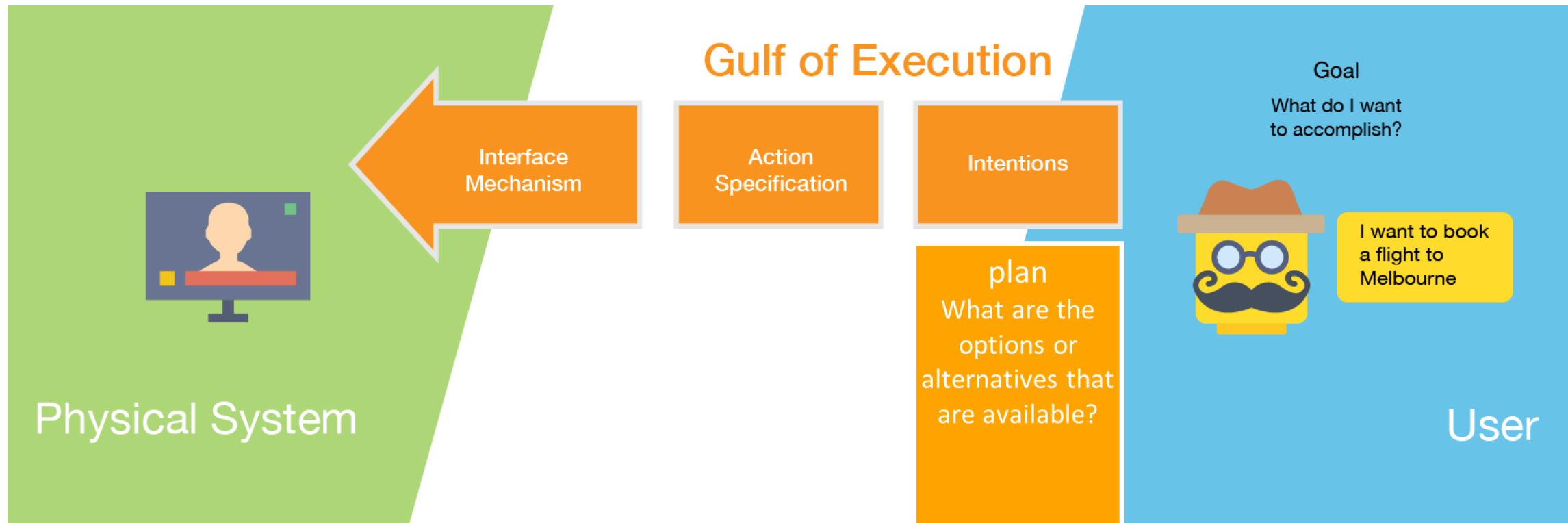
Gulfs of Execution and Evaluation

- Within the **Gulf of Execution** there are three stages or questions that people work through...



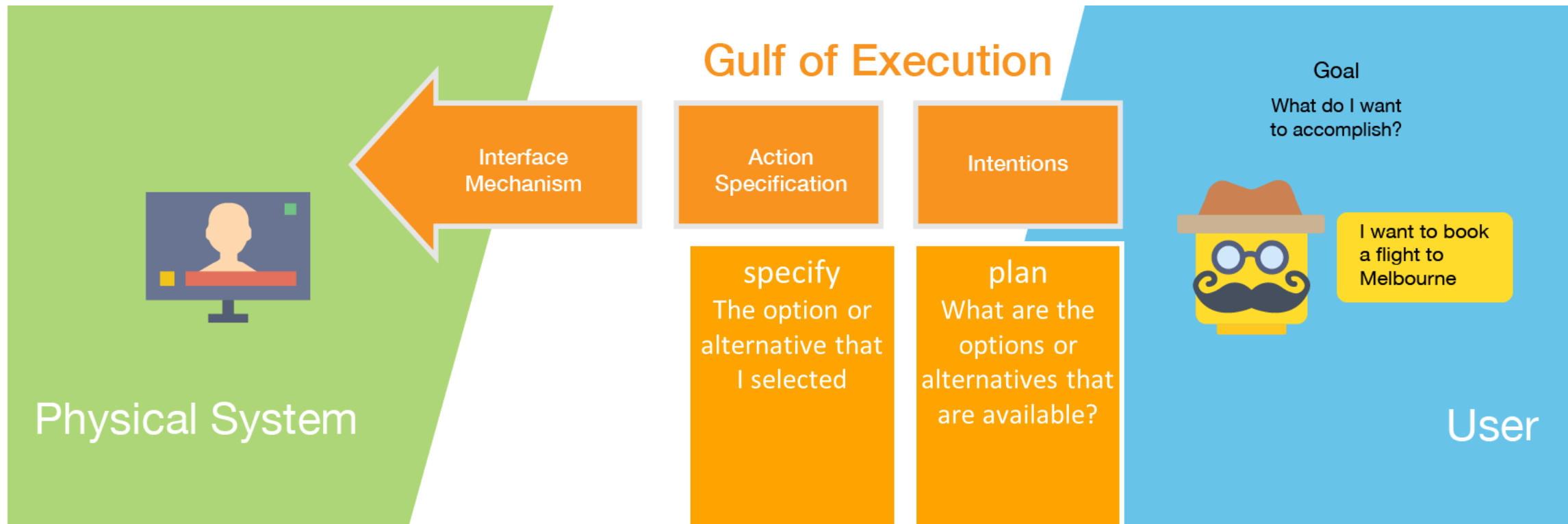
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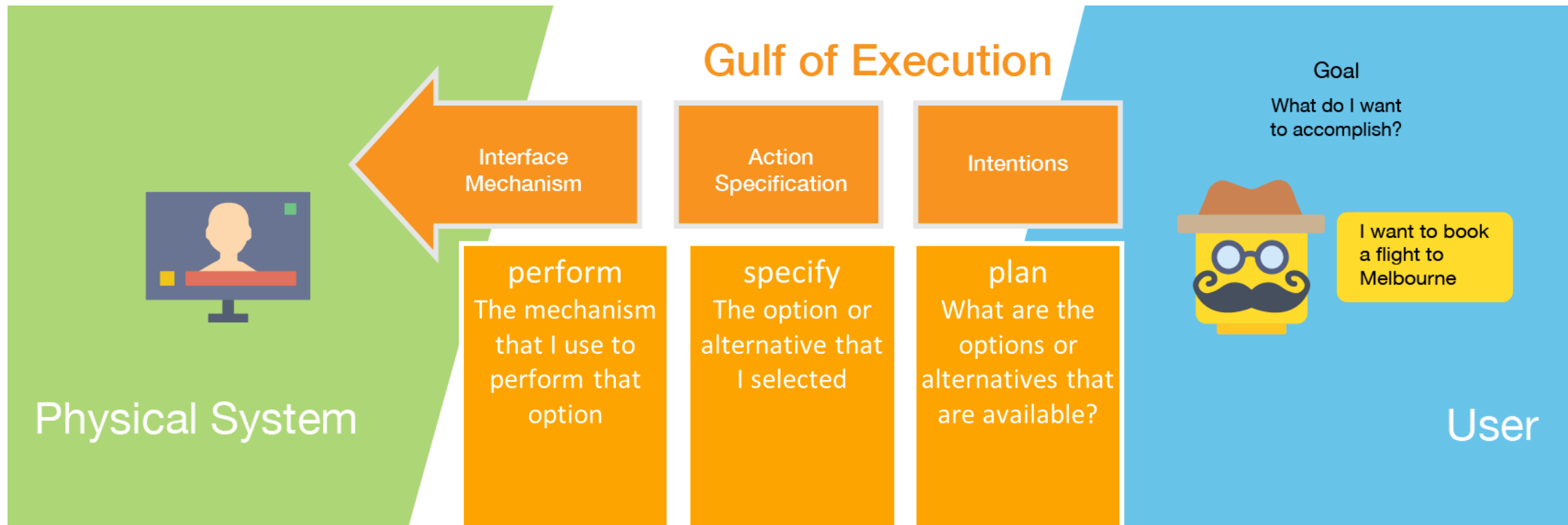
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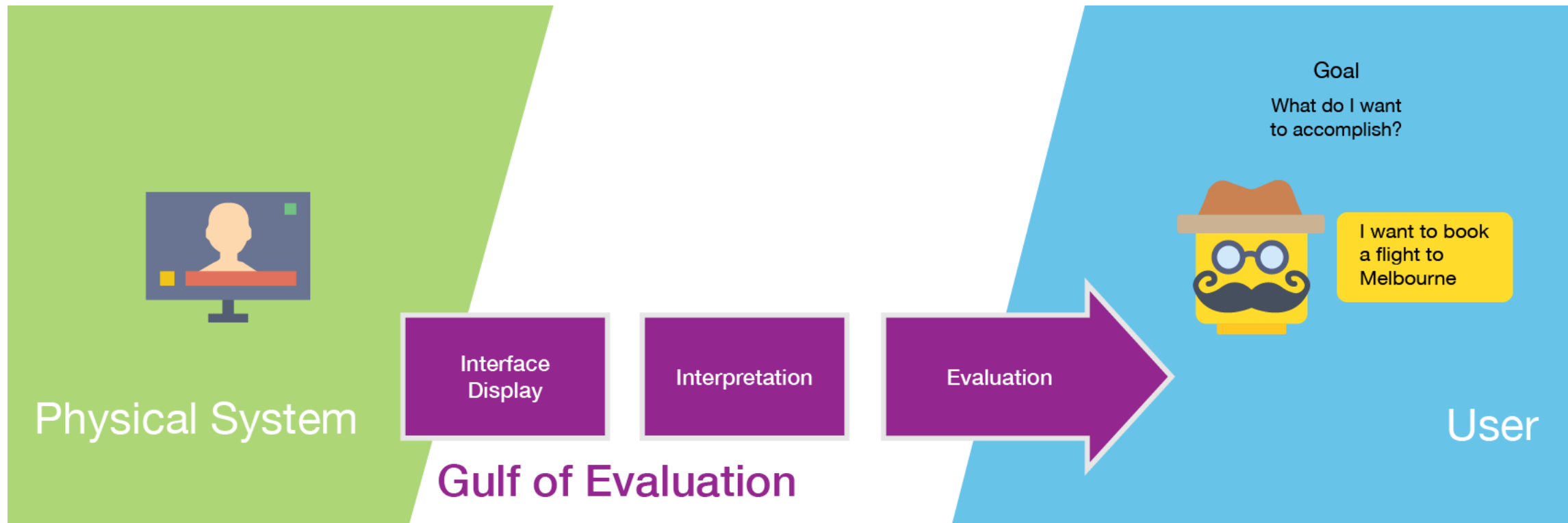
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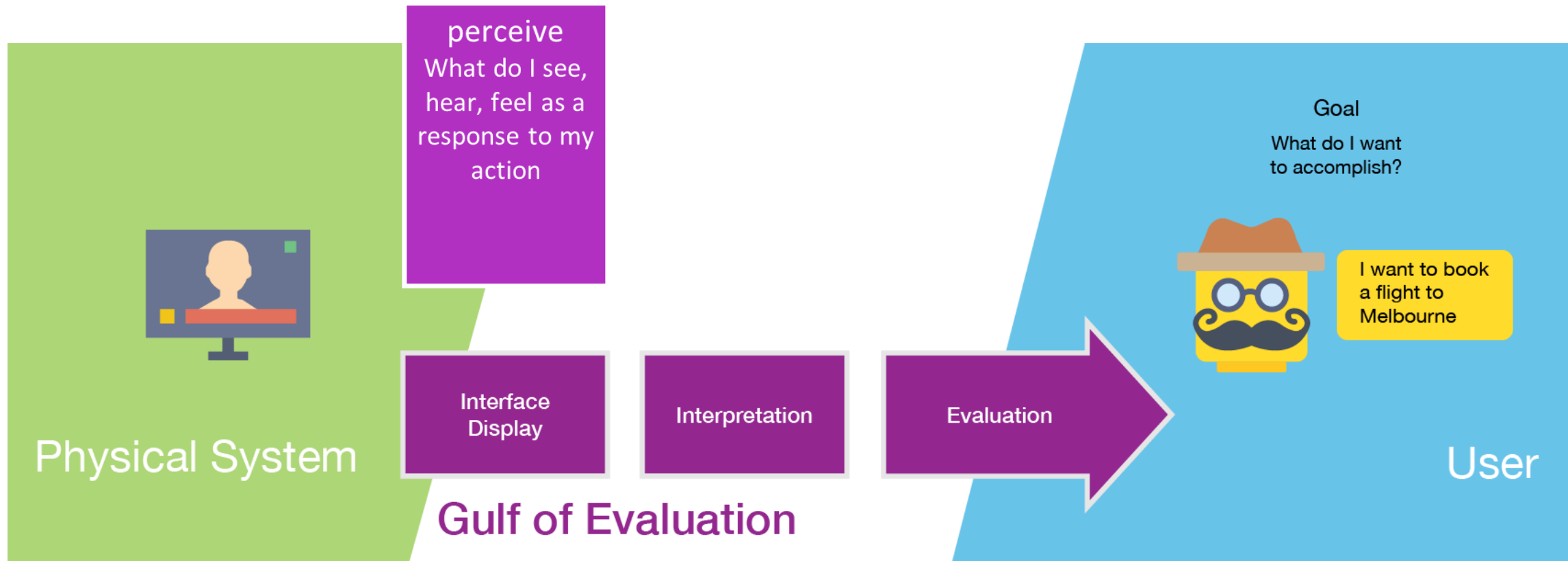
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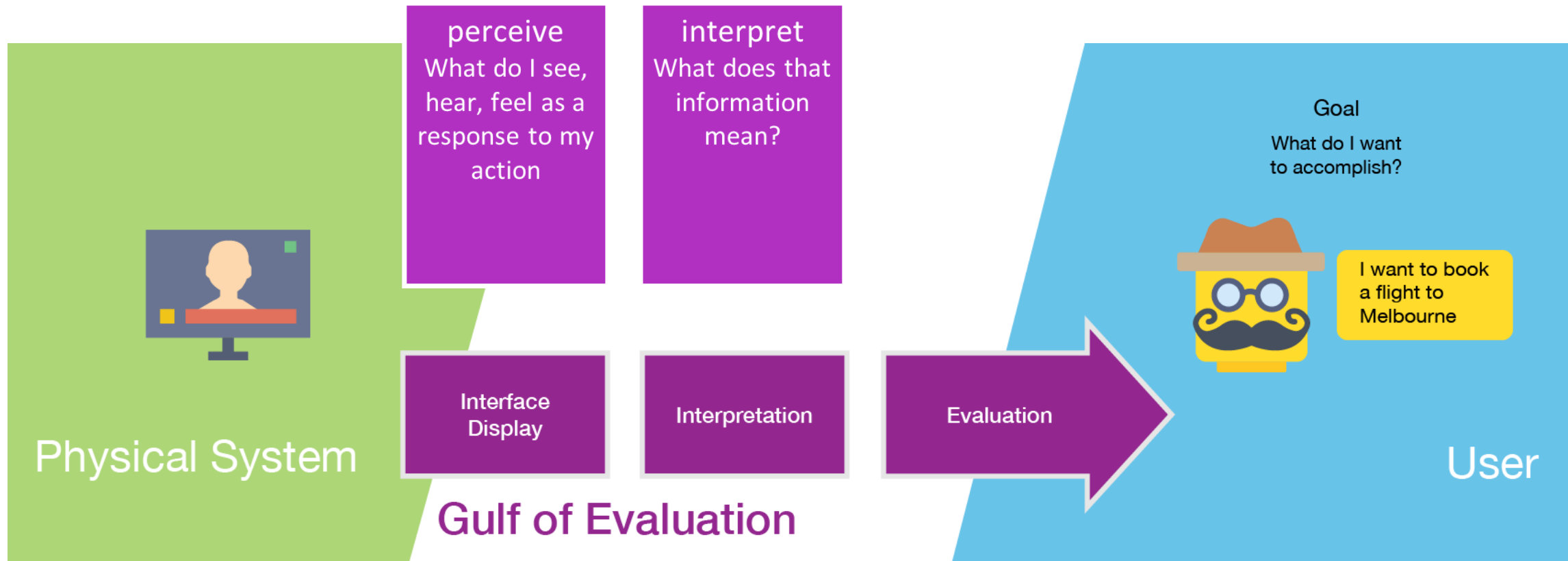
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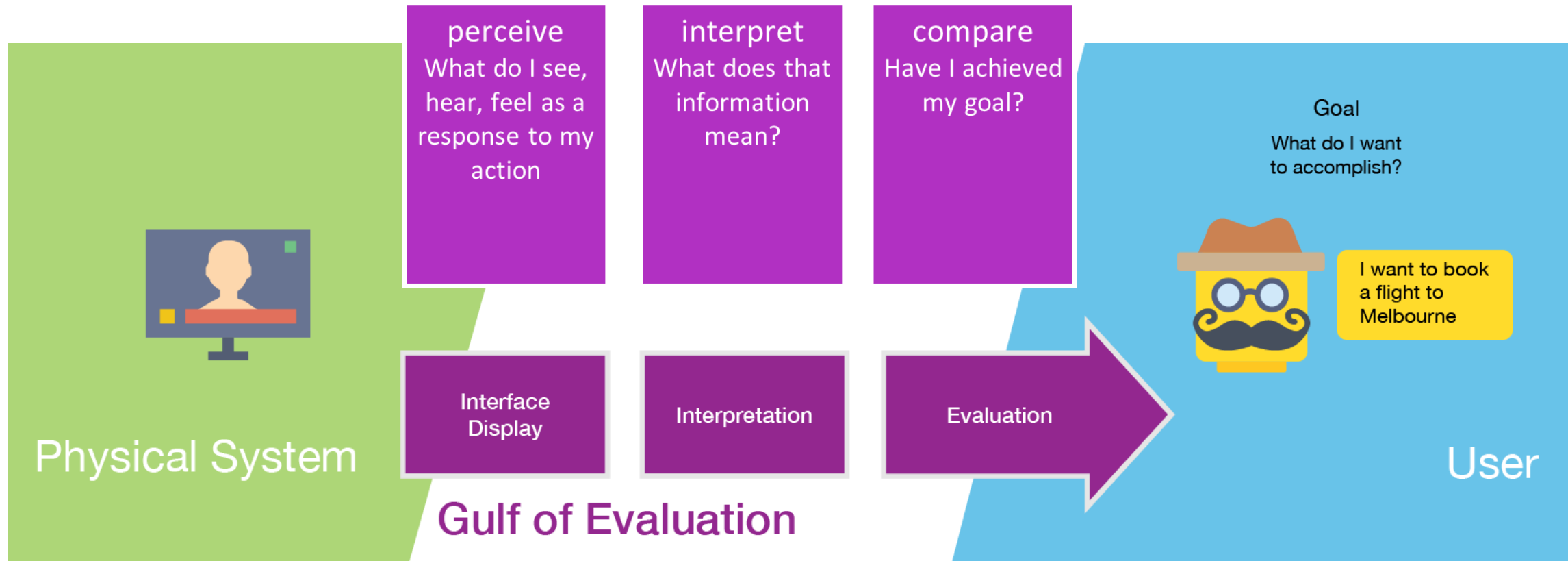
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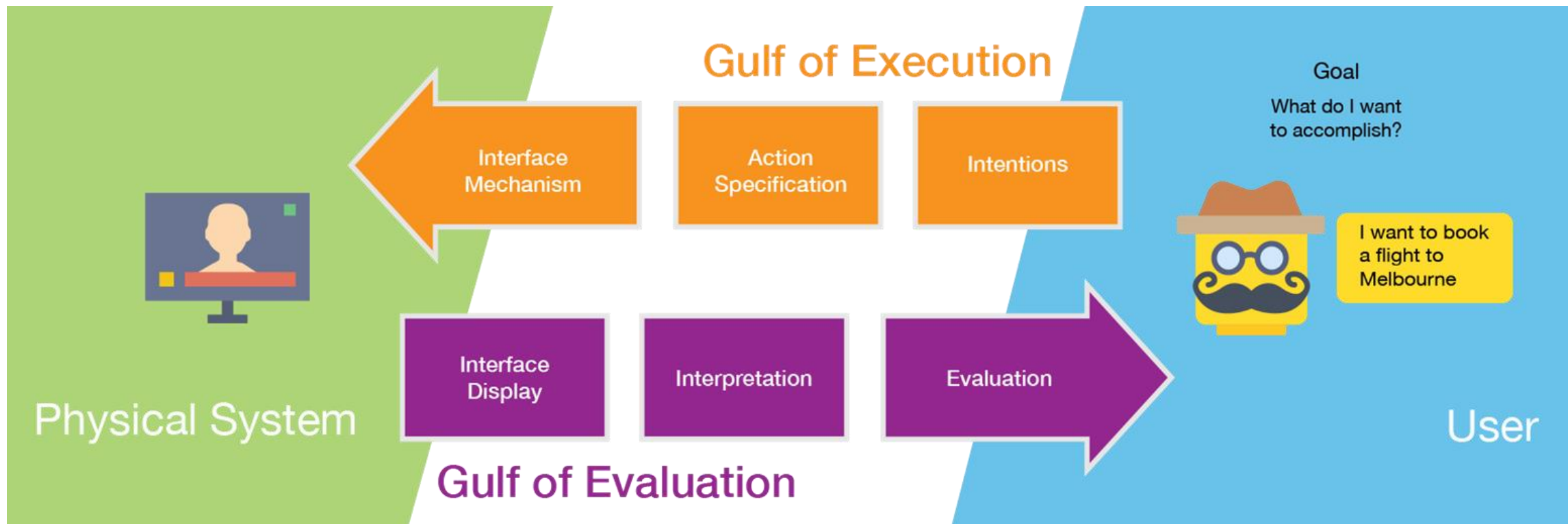
Gulfs of Execution and Evaluation

- We don't always follow this sequentially - but tend to jump backwards and forwards
- Some steps are not conscious (even goal setting)
- Problems can arise at any step in the sequence - even with the user's goal (not having a clear understanding of what they are wanting to do)



Gulfs of Execution and Evaluation

- It is a useful tool to evaluate interactions and systems



Gulfs of Execution and Evaluation

- AND there are many other factors that impact on an interaction, which we will cover in the future

FUNCTIONALITY

UI

IX PARADIGM



COGNITION

ATTENTION

PERCEPTION

EMOTION

SOCIAL

The only correct answer to any UX design question is...It depends

Assessment and Feedback

- This course will give you an opportunity to use/apply HCI theories & methods in the context of a specific design context (the project in the studios)
- There are very few questions with absolute right/wrong answers, but there are always better/worse ones.
 - Wicked problems
 - Requires interpretation, judgement (and in the design context) rationale for decisions

Summary

- User experience is an important aspect of the design process that should not be overlooked
- As computing professionals, you have a responsibility to act maturely and consider the wider impact of your work
- The seven-stage model of the action cycle is a valuable design tool that provides a basic checklist of questions to ask when designing software
- Designers can support their users by being aware of the gulfs and bridging them

Next Time...

- In our next session, we will look at **Mental Models and Conceptual Design**