

Human Factors and Human-Machine Interaction

Constraints and the 7 Stages of Action

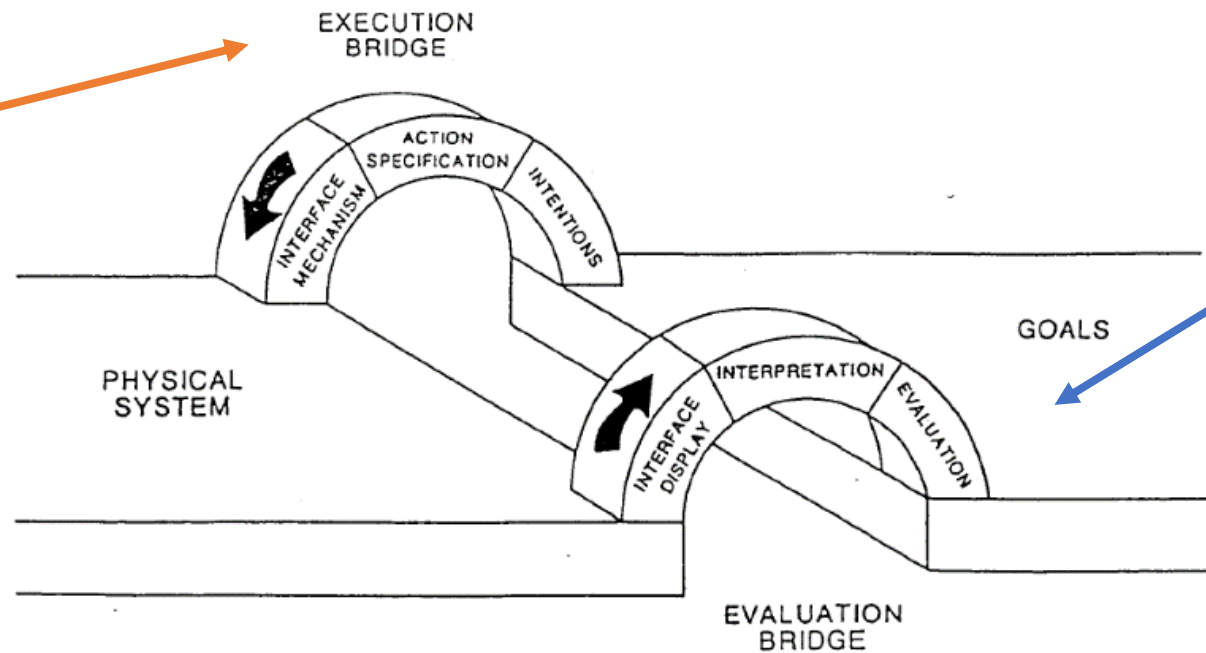
FACULTY
OF COMPUTER SCIENCE



THE GULFS OF EXECUTION/EVALUATION

Gulf of Execution

People try to figure out **how something works/operates**



Gulf of Evaluation

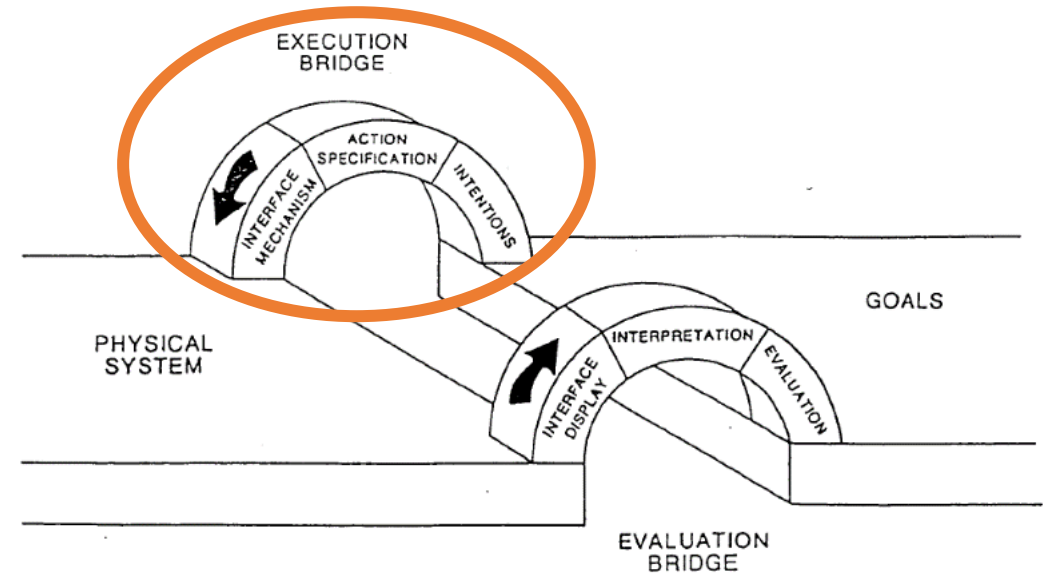
People try to figure out **what happened**



GULF OF EXECUTION

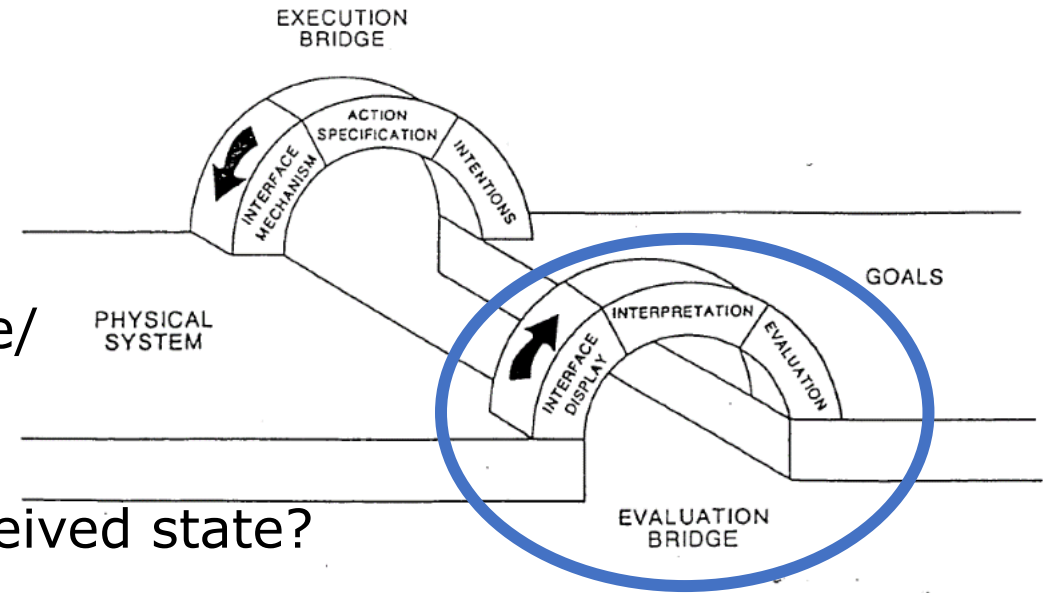
- Starting point of an action: Goal/Task
- How can we achieve this goal?
- Which steps do I need to take? What can I do?
- Are there problems during execution?

→ Bridge with: **signifiers, constraints, mappings, conceptual model**



GULF OF EVALUATION

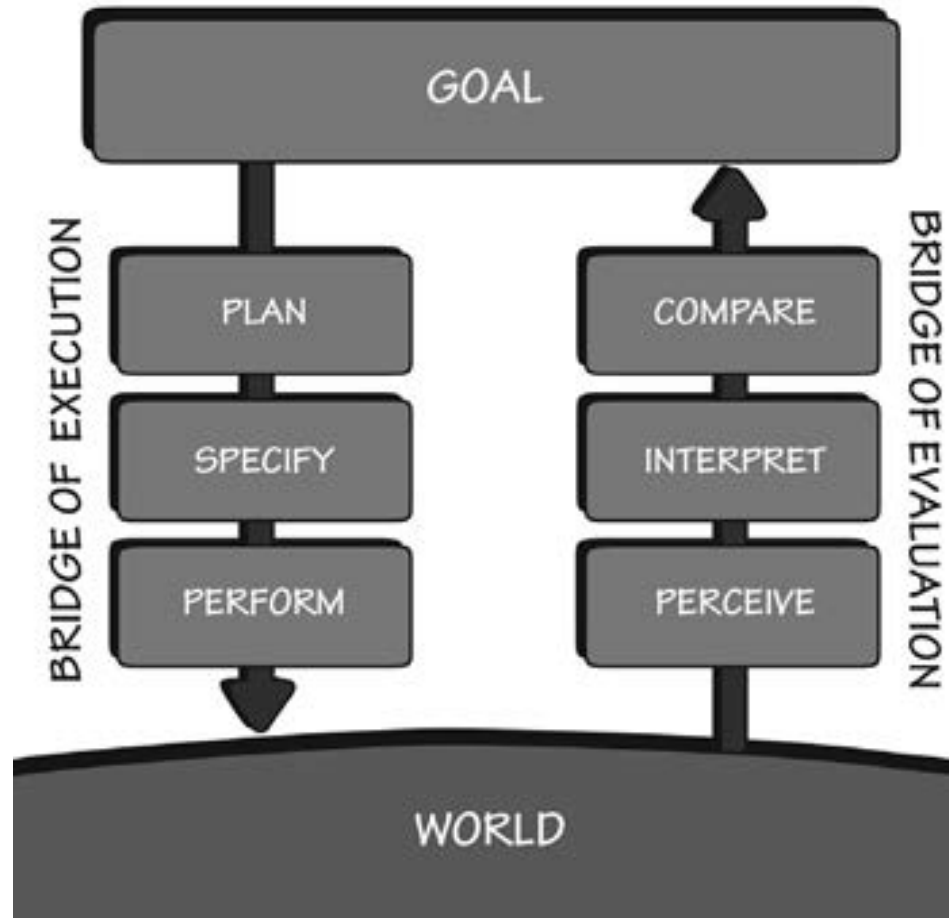
- **Perception:** How does the „world“/interface/product look like after interaction?
- **Interpretation:** Can I understand the perceived state?
- **Evaluation:** Does the state meet the original goal?
- *„The Gulf of Evaluation reflects the amount of effort that the person must make to interpret the physical state of a device and to determine how well the expectations and intentions have been met.“*



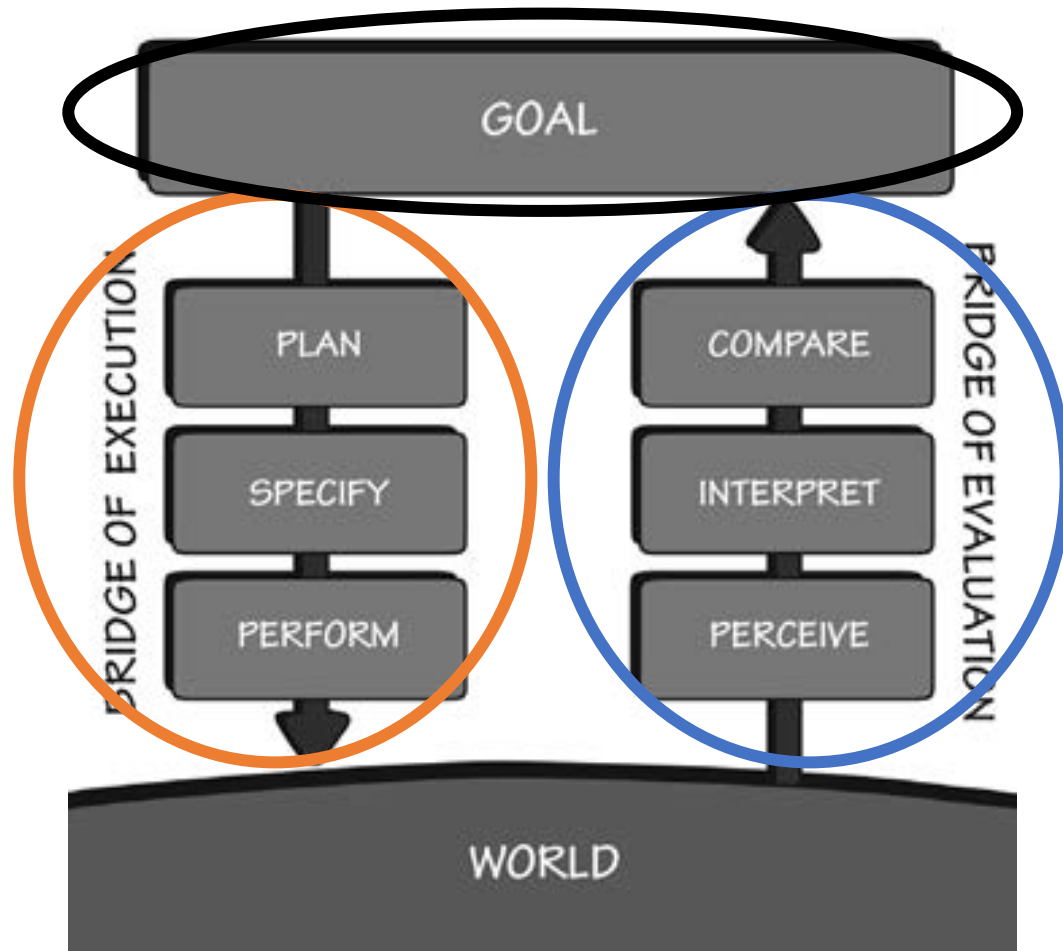
→ Bridge with: **feedback** and **conceptual model**



7 STAGES OF ACTION



7 STAGES OF ACTION



1. **Goal**: Form the Goal
2. **Plan** the action
3. **Specify** an action sequence
4. **Perform** the action sequence
5. **Perceive** the state of the world
6. **Interpret** the perception
7. **Compare** the outcome with the goal

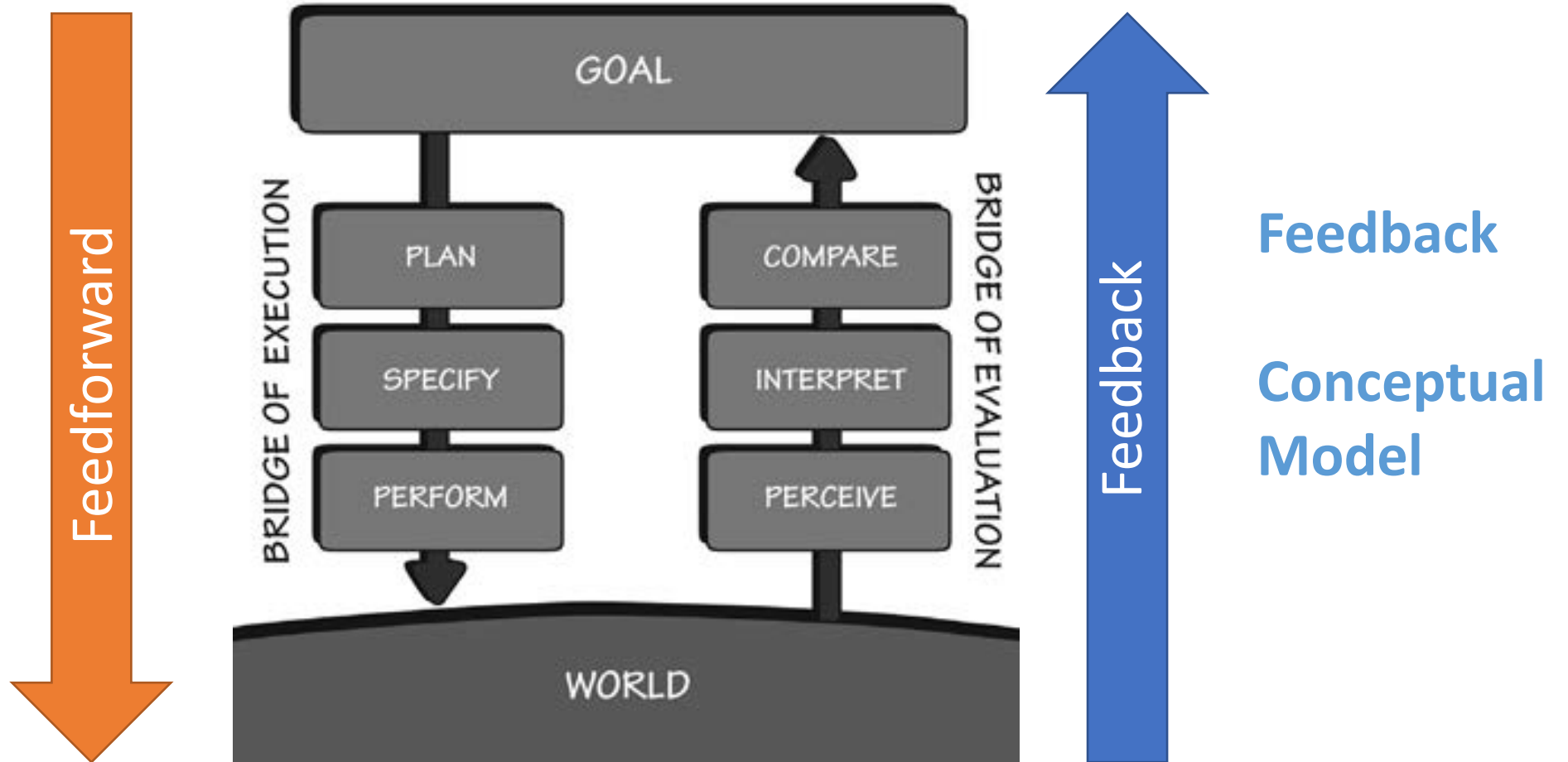
7 STAGES OF ACTION

Signifiers

Constraints

Mapping

Conceptual Model



(PHYSICAL) CONSTRAINTS

- Constrain possible interactions/operations
- Reduce errors
- Guide attention
- Simplify creation of conceptual models

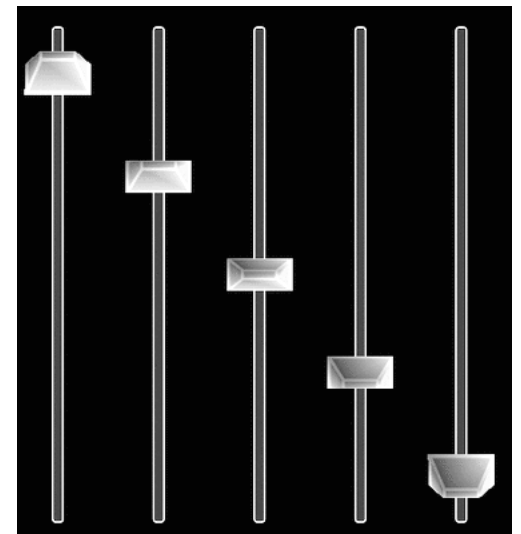


CONSTRAINTS



CULTURAL CONSTRAINTS

- How to increase something:
 - Clockwise rotation (very clear)
 - Left-right movement (not universally valid)
 - Down-Up movement (problematic)
- Behaviour in social situations (frames, scripts, ...)
- Cultural Constraints change over time



CULTURAL CONSTRAINTS

- Use of signal colours
- Use of signal shapes



SEMANTIC CONSTRAINTS

- Based on our knowledge in a situation/in the world
- Lego motor bike
 - Position of the rider
 - Position of the tires
 - Position of the windshield
- Semantic constraints can change over time



CONSTRAINTS

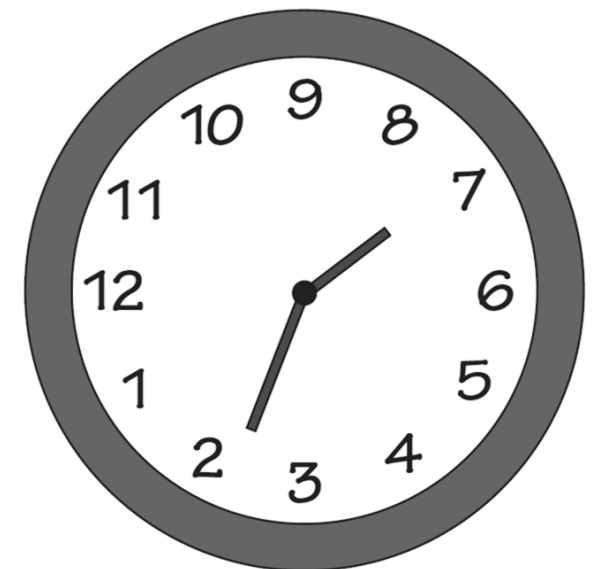


STANDARDS

- Precursor: Conventions
- **Advantage:** Facilitation by limiting the scope of action (variant of mostly cultural constraints).
- Standards often **formalized** and **legally binding**
- **Examples:**
 - Time: What time is it?
 - Right/left division in road traffic
 - positioning of steering wheel, indicator lever, gear shift, ...
 - charging socket for smartphones



https://live.staticflickr.com/2007/2243896940_eca8c620ab_b.jpg



STANDARDS



STANDARDS



Source: Wikipedia



KNOWLEDGE IN THE WORLD

- Knowledge in the world is externalised knowledge
- Environment provides support...
 - ...to remember things
 - ...to perform actions
- Right timing is important
- Effort required by learning to interpret the information
- When time & place are right: effective and efficient
- Realized by signifiers, constraints, mappings
- Aesthetics



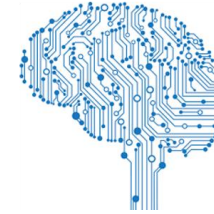
KNOWLEDGE IN THE HEAD

- Memory is knowledge in the head
- **(Classic) Structure of memory:**
 - **Sensory:** ultra short-term memory
 - **Short-term or working memory (STM):** Capacity limited („Miller's magical number 7"), easily disturbed ,easily retrieved, different sensory modalities.
 - **Long-term memory (LTM) :** no known capacity limit, recall may be strenuous, declarative procedural, episodic
- **Prospective memory :** memory for the future, "I must not forget that tomorrow I will ...", signal vs. message

Sensory



Short-Term



Long-Term



KNOWLEDGE IN THE HEAD

- Requires effort (for storage and/or retrieval)
- Reduces demands on designer
- Immediately available in working memory; may require time-consuming search in LTM
- With automatisms: very efficient



KNOWLEDGE IN THE WORLD AND IN THE HEAD



Source: Wikipedia



EXERCISE: IMPROVE THE DESIGN!

1. Read up on Constraints (Chapter 4) and the 7 Stages of Action/the Gulfs (p. 38 - 44)
2. Find items with **a bad design**
3. **Analyse:** Why is the design bad? Explain with the *7 Stages of Action* model where the interaction fails. How does this relate to the fundamental principles we have heard about?
4. **Improve** the design
5. Present your analysis

