

Royal Aeronautical Society

Decision Making in the Real World (An Aviator's Guide)

James Reason

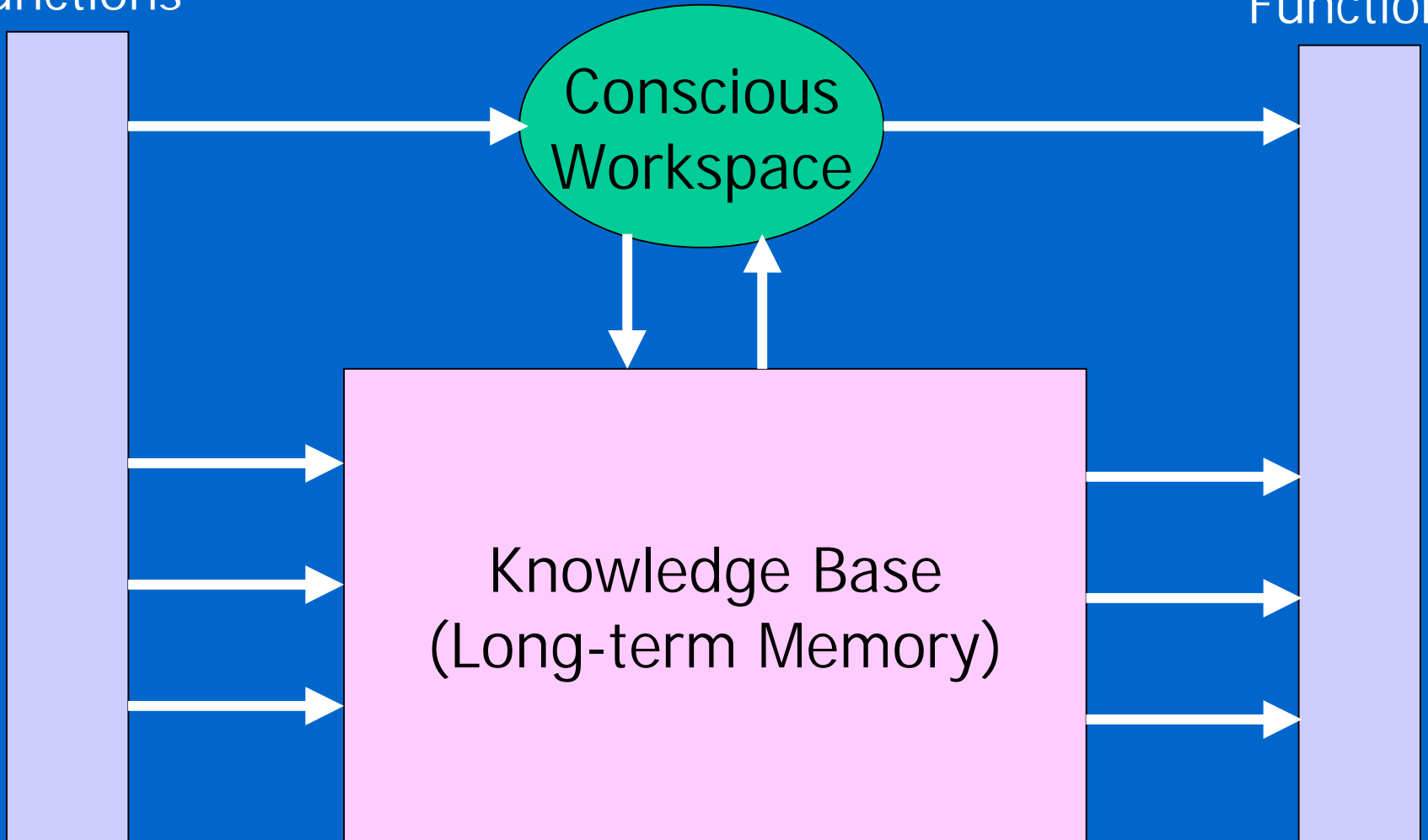
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Pilot's Notes for the mind

Input
Functions

Output
Functions



Conscious Workspace

- Slow
- Effortful
- Sequential
- Limited capacity
- Dominated by vision
- Computationally powerful

Knowledge Base

- Fast
- Effortless
- Parallel processing
- No known limits to capacity
- Handles the recurrent routines
- Processes not directly conscious
- Contains patterns or 'mini-theories'

Three search processes

- Similarity-matching
- Frequency-gambling
- Conscious inference



Two kinds of memory search

Convergent

What barks, wags its tail,
man's best friend, etc.?

DOG



Divergent

Name four-legged
animals . . .

DOG, CAT, HORSE, COW . . .



Under-specification

- Errors arise when mental processes necessary for correct performance are under-specified.
- Under-specification takes many forms: inattention, incomplete knowledge, sparse sensory data, forgetting, etc.
- When processes are under-specified, the mind 'defaults' to a response that is more frequent, familiar and appropriate for the context than that intended/appropriate.

Who said . . . ?

The lamps are going out all over Europe; we shall not see them lit again in our lifetime.

My prediction

Most of you thought . . . But, actually, it was . . .

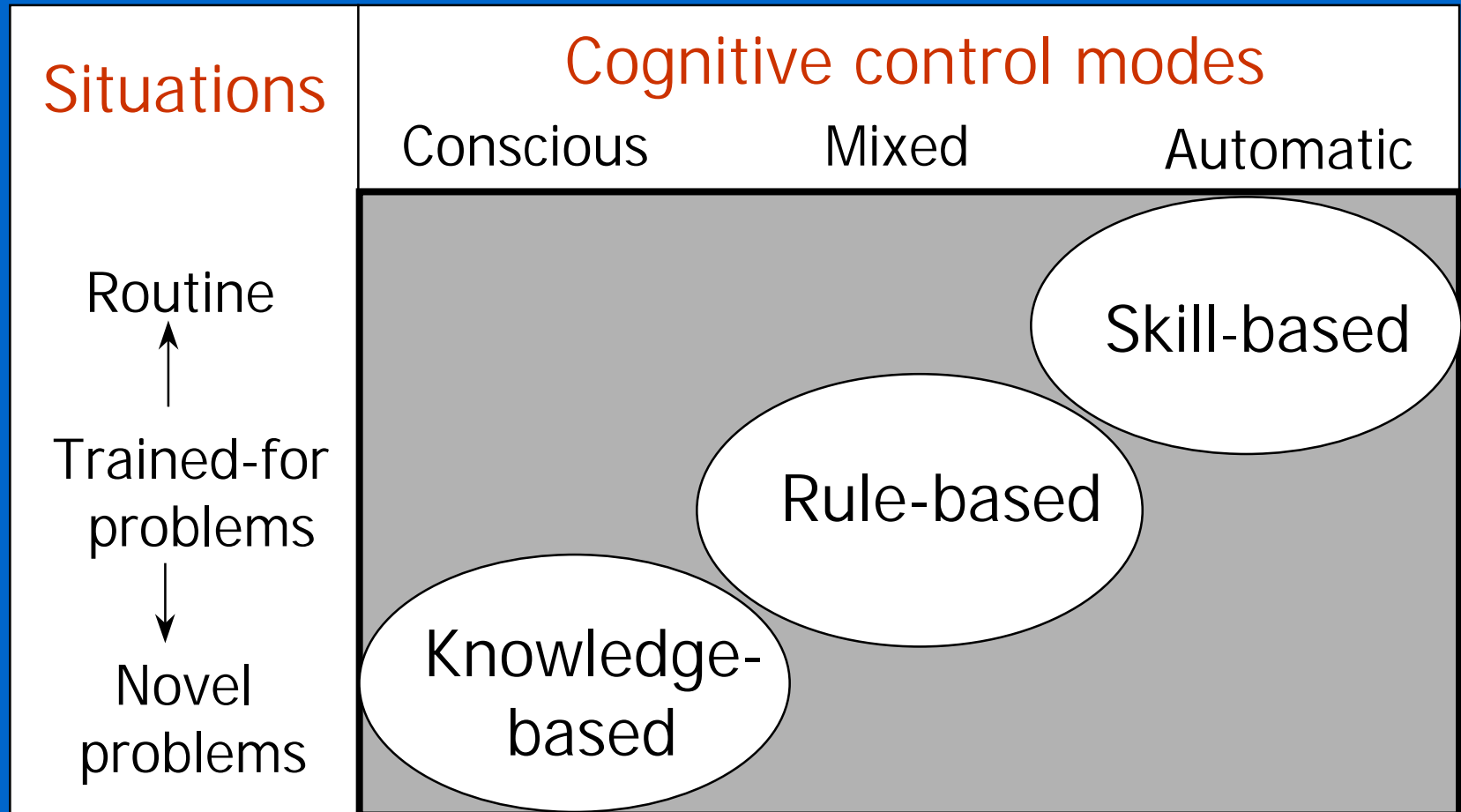


Winston Churchill



Sir Edward Grey

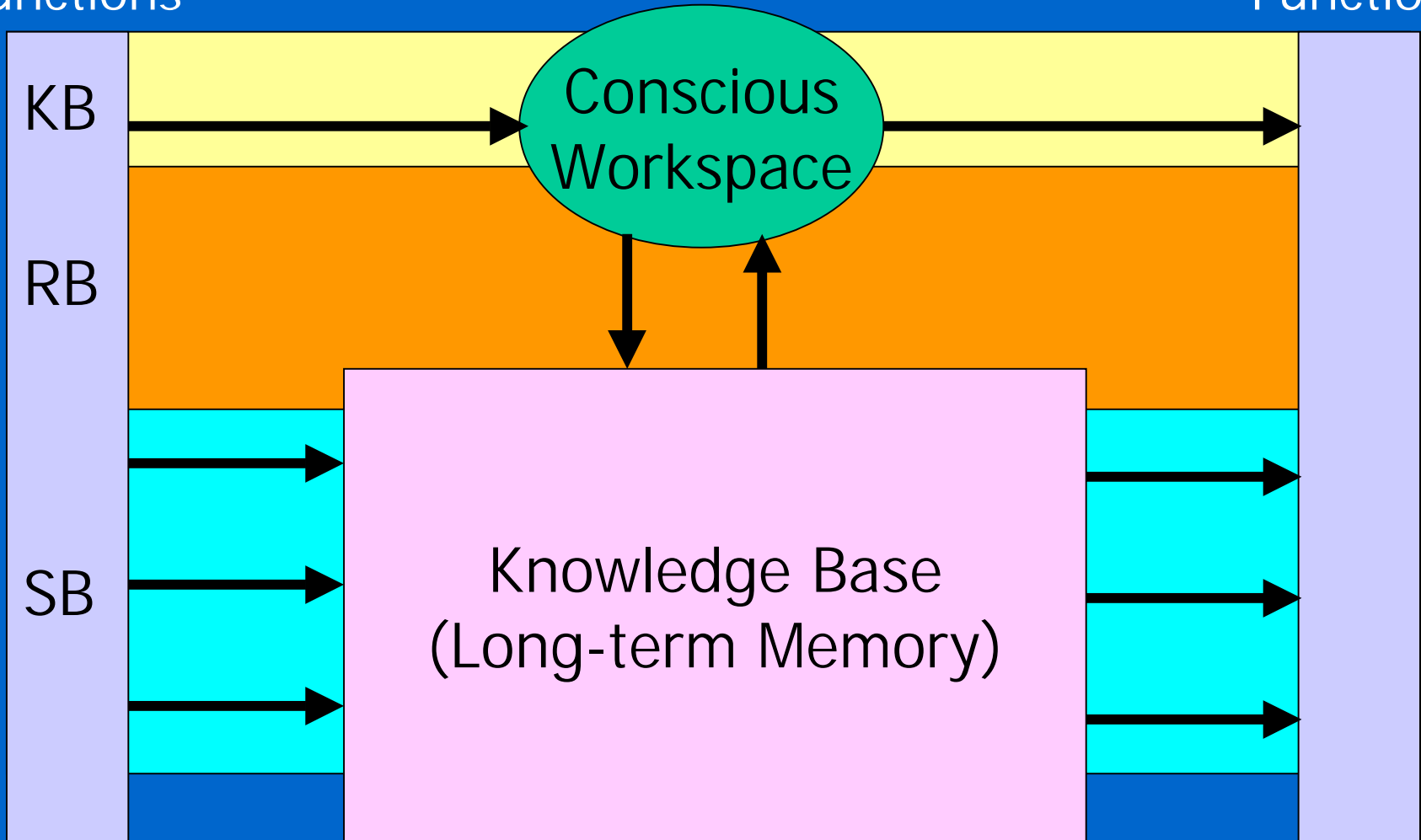
Three performance levels



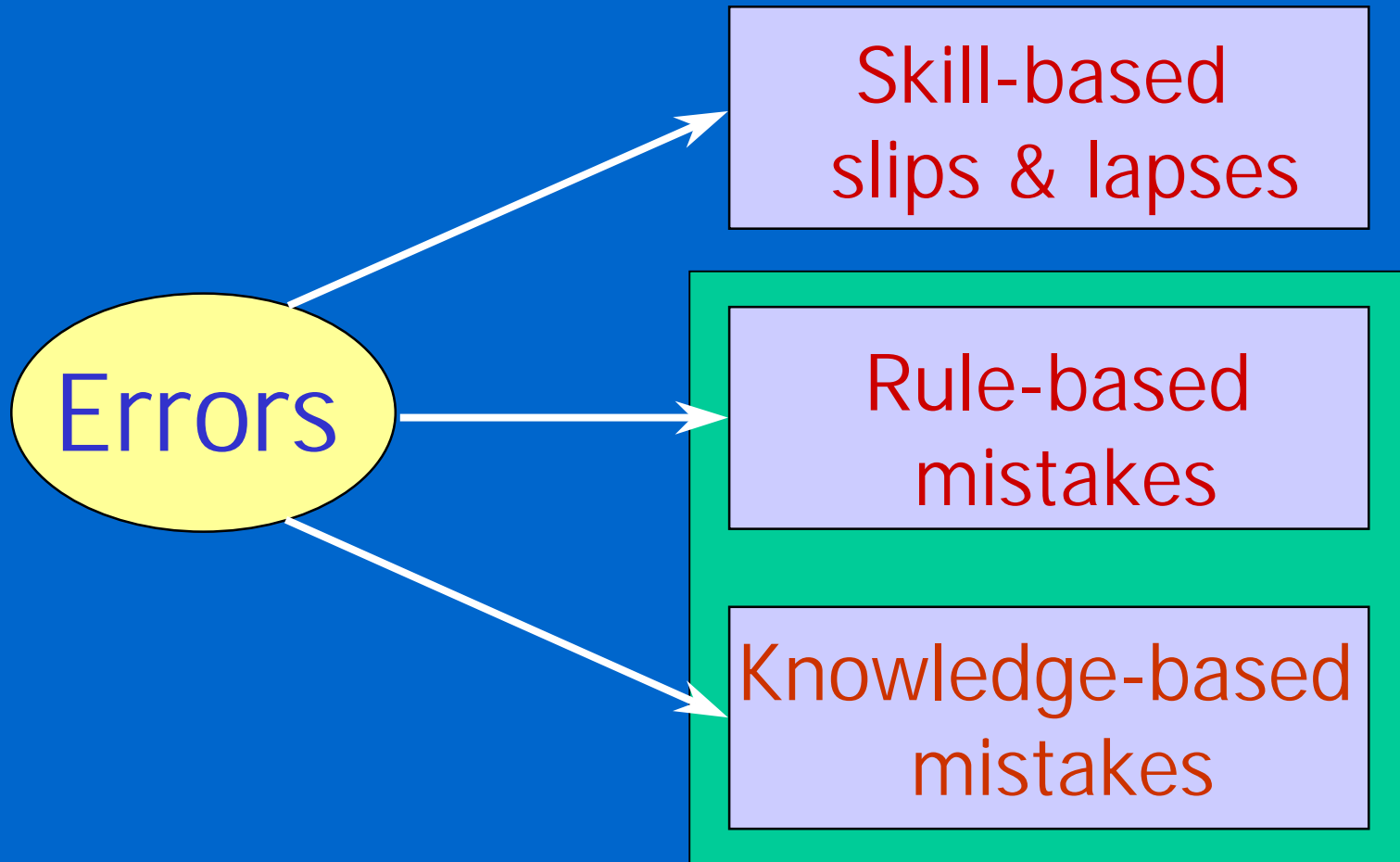
Performance levels

Input
Functions

Output
Functions



Performance-related error types



Rule-based mistakes

- Misapply a good rule
- Apply a bad rule
- Fail to apply a good rule
 - Routine violations
 - Optimising violations
 - Situational violations

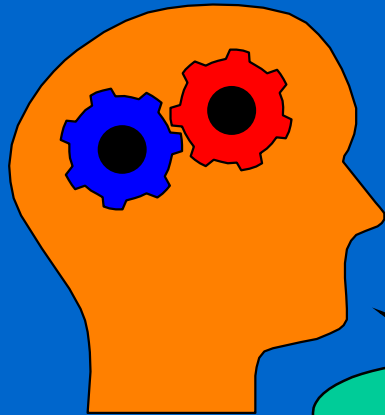
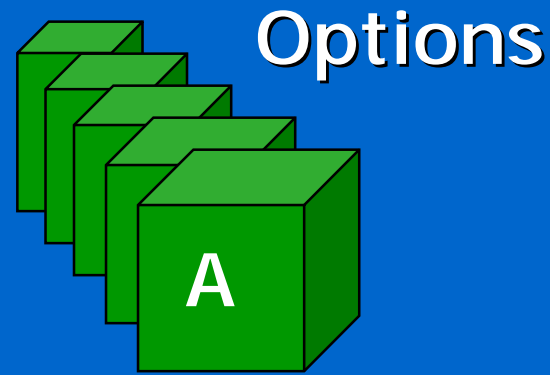
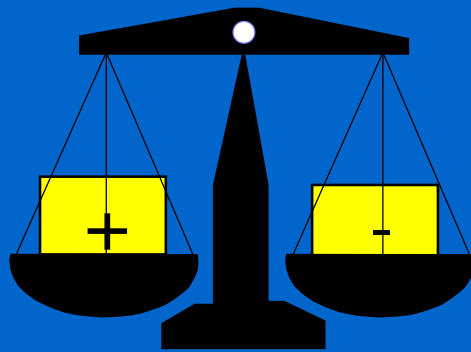
Knowledge-based mistakes

- Keyhole view
- Confirmation bias
- 'Leaky' workspace
 - Vagabonding
 - Encysting
- Overconfidence

Features of real world decision making tasks

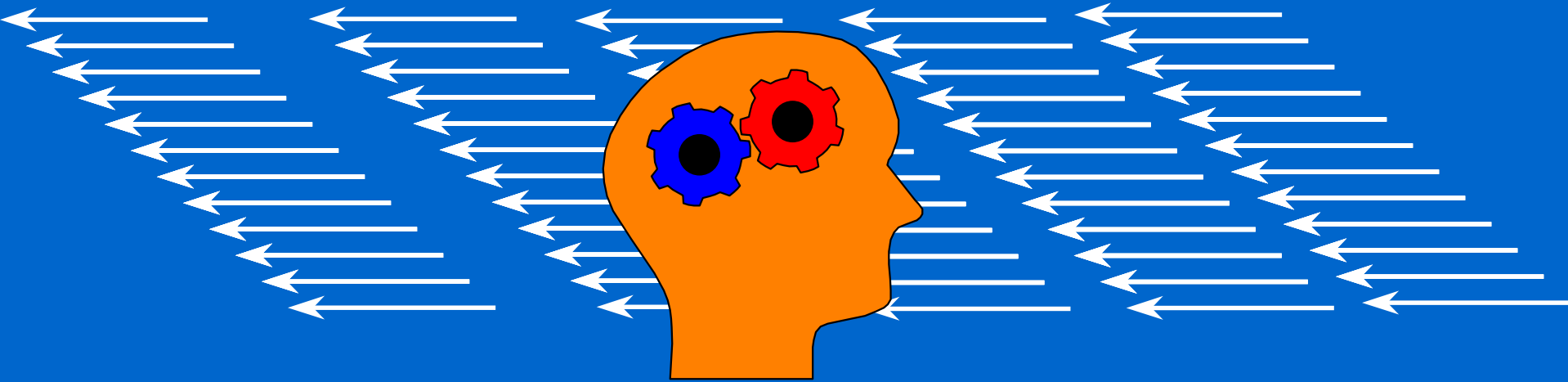
- Ill-structured problems
- Uncertain dynamic environments
- Shifting, ill-defined or competing goals
- Time stress
- High stakes
- Multiple players
- Organizational goals and norms

Classical (laboratory) decision making model



I'll go for Option B

Real world decision making

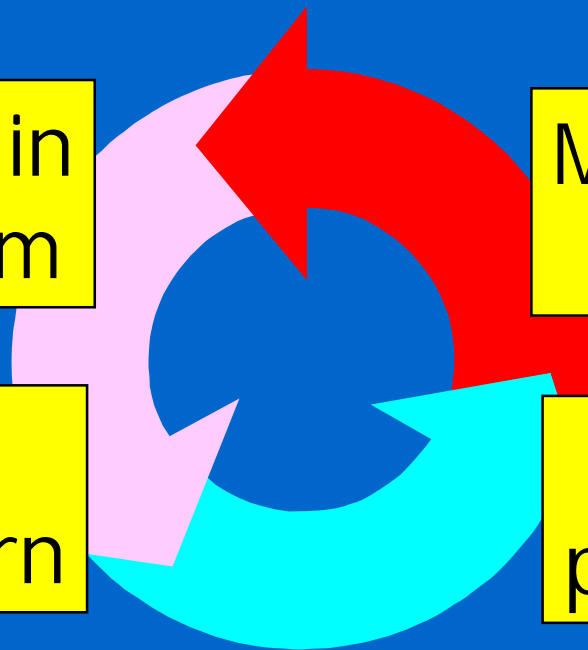


Put your head in
the data stream

Look out for
a familiar pattern

Monitor progress
of action

Generate a
possible solution



Capt. Al Haynes: United 232

'As the aircraft reached about 38 degrees of bank, we slammed the number one throttle closed and fire-walled the number three throttle—and the right wing slowly came back up. I have been asked how we thought to do that; I do not have the foggiest idea. There was nothing left to do, I guess, but it worked.'

Summarising findings from real world DM research

- Decisions are embedded in a larger task, they are not an end in themselves.
- Focus is upon working out the nature of the problem and what a reasonable solution would look like.
- Actions are continuously monitored in relation to goal.
- Situation is frequently changing.

Expert decision making

- Experts tend to generate and evaluate a single option rather than consider multiple options.
- Experts differ from novices not in their reasoning skills but in their situational assessments.
- Decision making is pattern-driven—deciding and acting are interwoven.
- Experts go for workable rather than optimal solutions.