Structural Mapping Between Human Behaviour Models and Autonomous System Architectures

ABRF → ABRFA

Behaviour → Architecture

Using ABRFA

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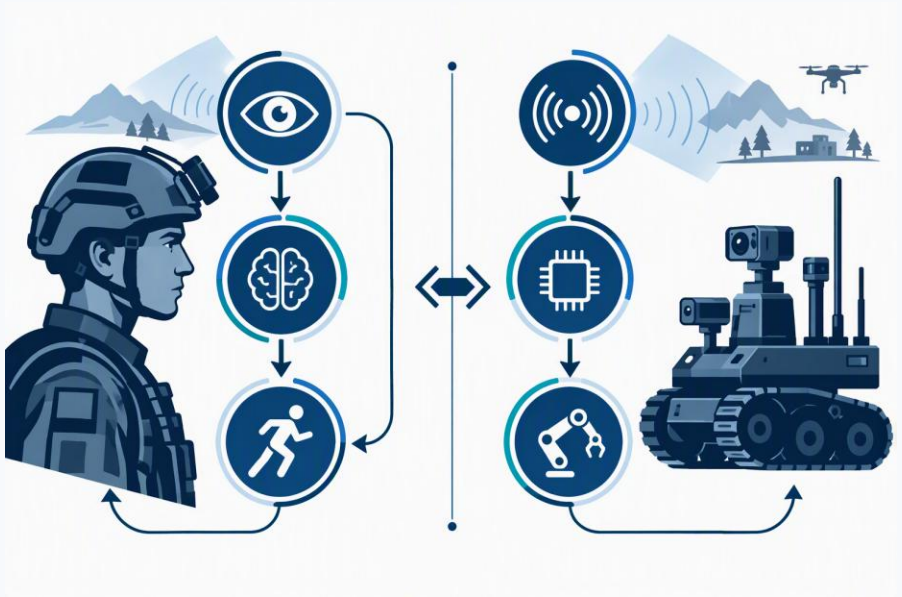
Two Domains, Similar Functions

Human Behaviour Modelling

- Perception
- Cognition & decision
- Action

Autonomous Systems

- Sensing
- Decision & control
- Execution



Similar functions — different architectures

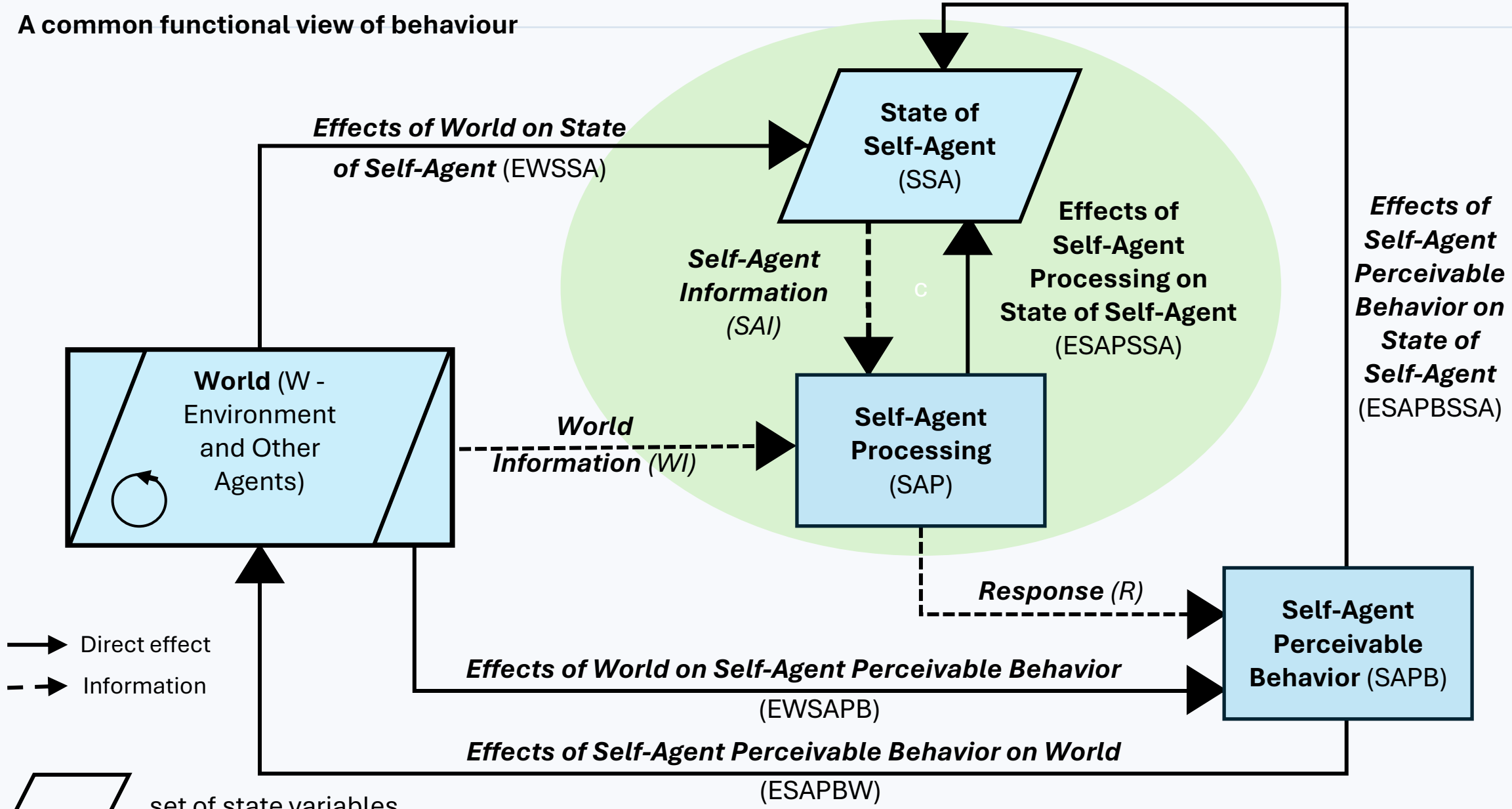
Agent Behavior Reference Framework (ABRF)

- a tool to aid in simulation **conceptual model** documentation
- support of communication, collaboration
- design of new models
- behaviour theory and implementation independent
  - developed by NATO STO MSG-222 „Representing Human Behavior and Decision-Making in Modelling and Simulation“

What the agent does — not how it does it

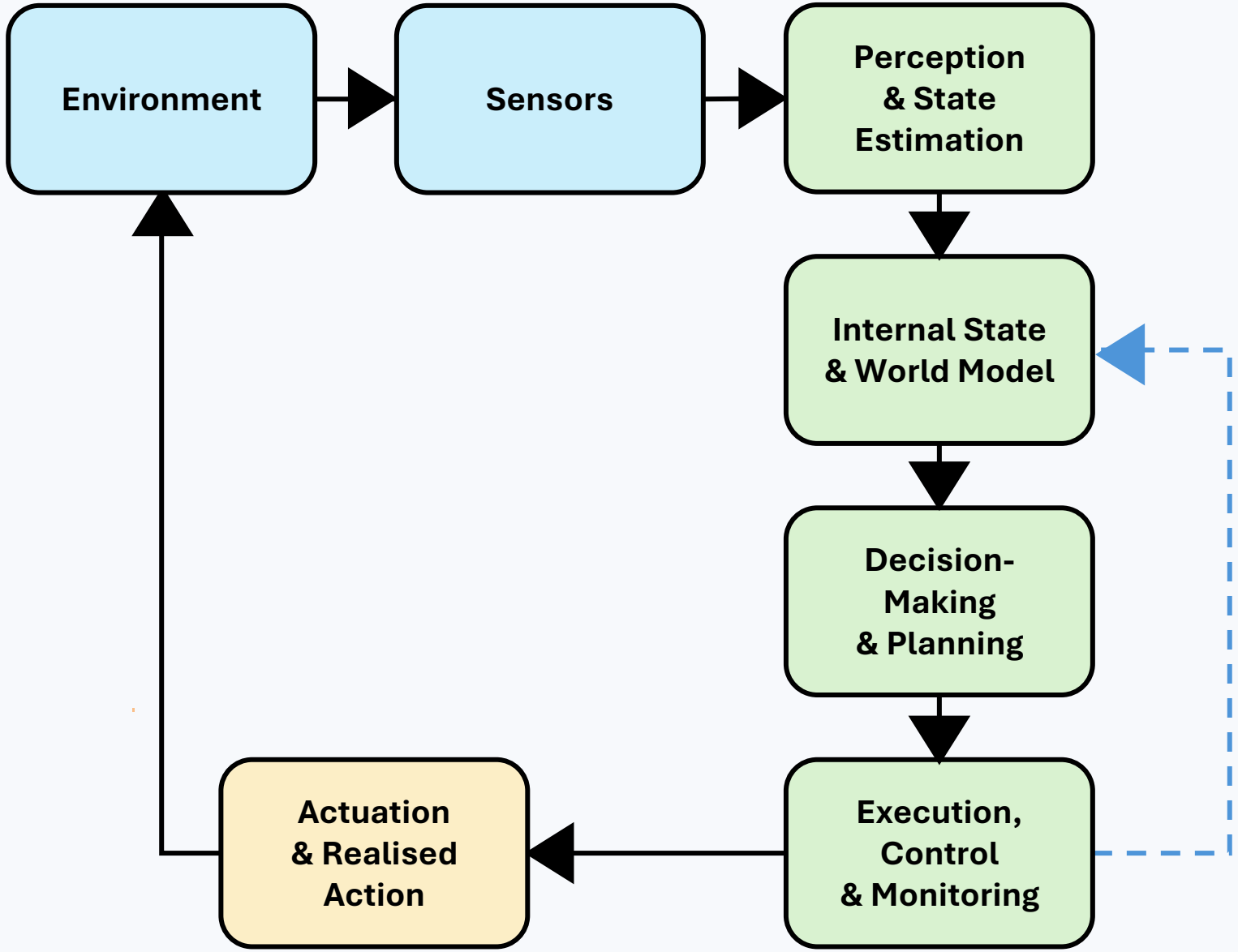
ABRF Functional Structure

A common functional view of behaviour

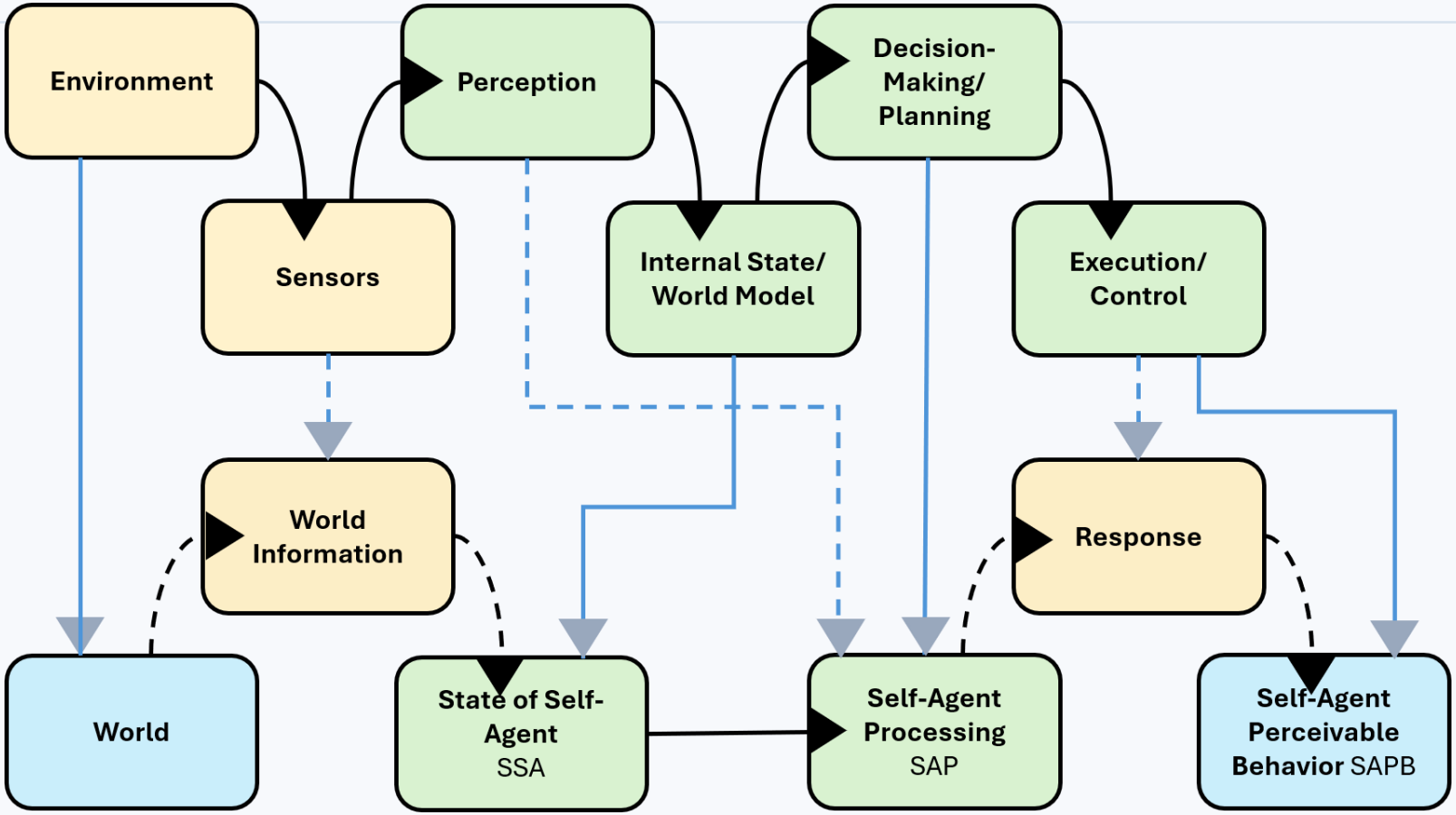


Autonomous-System Functional Architecture

A comparable functional cycle



Structural Mapping: ABRF ↔ Autonomous Architecture



Mapped
Perception ↔ Sensing
Decision ↔ Decision & Control
Action ↔ Execution

Unmapped
Platform / System Interaction
Command & Decision Coordination
Execution Management

ABRF aggregates self-state, world model, goals, plans, execution status, and learned knowledge within one state component

What Does the Mapping Reveal?

CORRESPONDENCE

- Perception
- Decision
- Action

GAPS

- Platform
- Coordination
- Execution

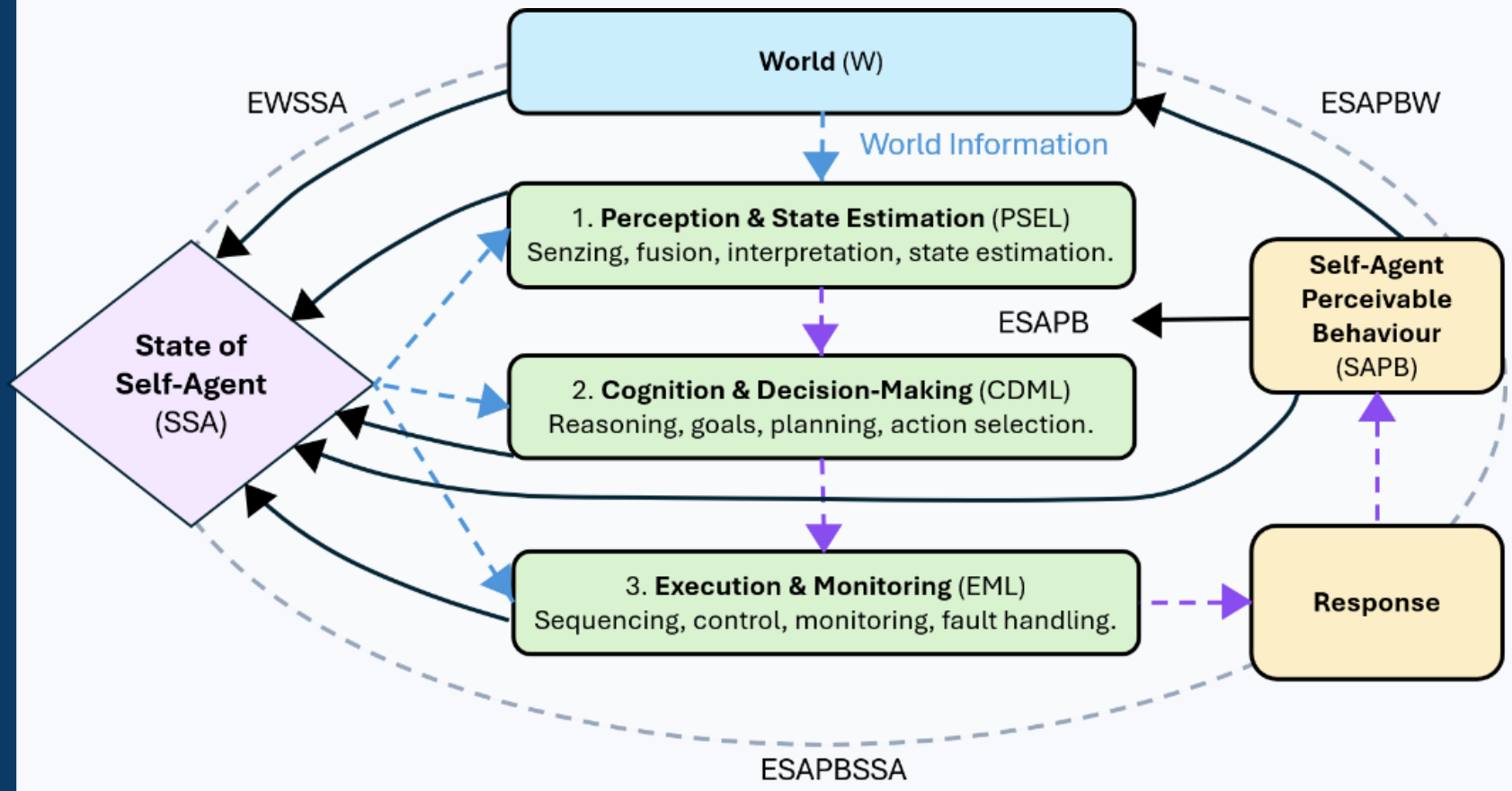
REQUIREMENTS

Greater clarity is required for:

- Perception and State Estimation
- Cognition and Decision-Making
- Execution and Monitoring.

The mapping also reveals architectural gaps

From ABRF to ABRFA



Design follows five principles:

1. compatibility with ABRF,
2. theory neutrality,
3. functional explicitness,
4. scalability across autonomy paradigms and aggregation levels,
5. support for interoperability
   - clear inputs, outputs, state dependencies, and boundaries

SAP = PSEL ∪ CDML ∪ EM

From behavioural framework to reference architecture

Common functional architecture for

- Human agents
- Autonomous agents
- Hybrid human–autonomy systems



Supporting points

- Common functional vocabulary
- Explicit allocation of responsibilities
- Human–machine functional relationships

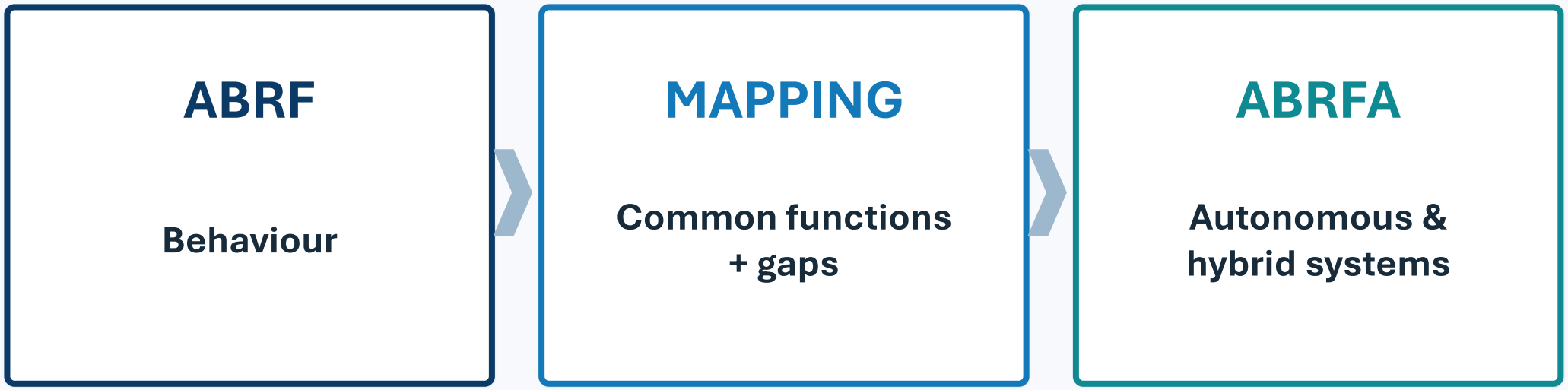
One functional view — different agents

ABRFA can support

- Functional decomposition
- Allocation of responsibilities
- Architecture comparison
- Integration & composability reasoning

Reason about architecture before implementation

Conclusions



From modelling agents to architecting human–autonomy systems

Thank you — Questions?

Conclusions

ABRF provides the behavioural foundation

ABRFA extends it towards autonomous-system architecture

Structural mapping creates the bridge

From modelling agents to architecting human–autonomy systems

Thank you — Questions?