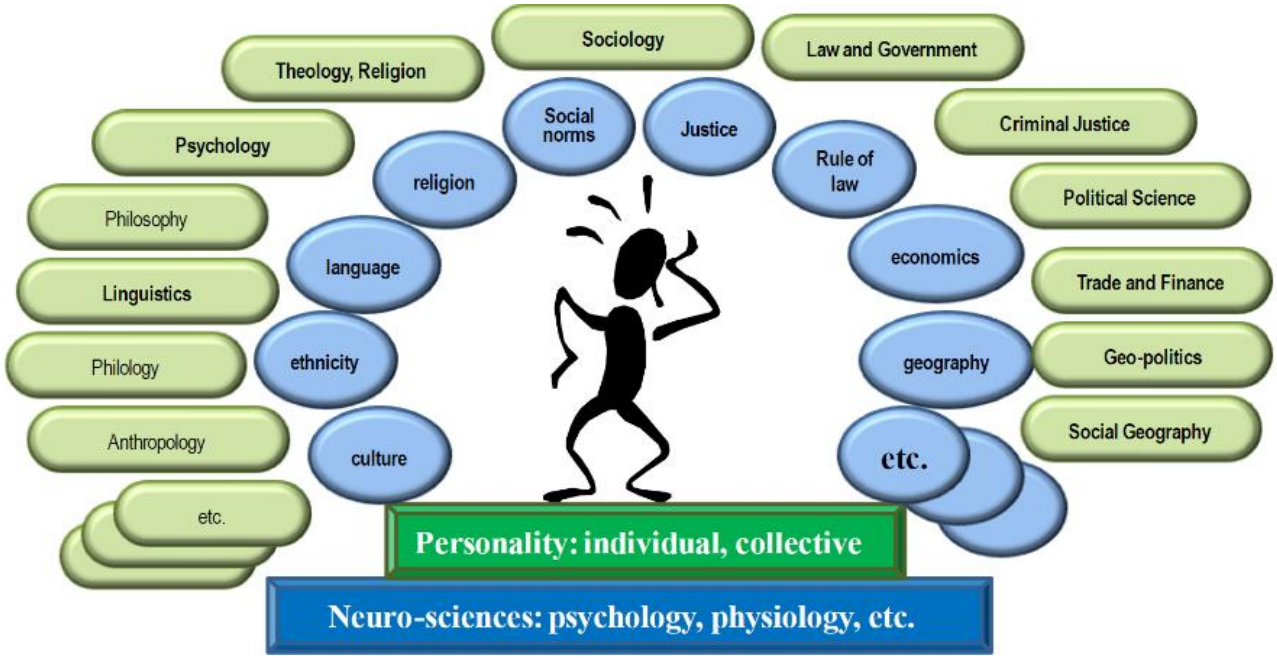
A Reference Architecture for Human Behaviour Representations

Mark Lewis
GBR

Thomas Alexander
DEU

Wim Huiskamp
NLD

Curt Blais
USA



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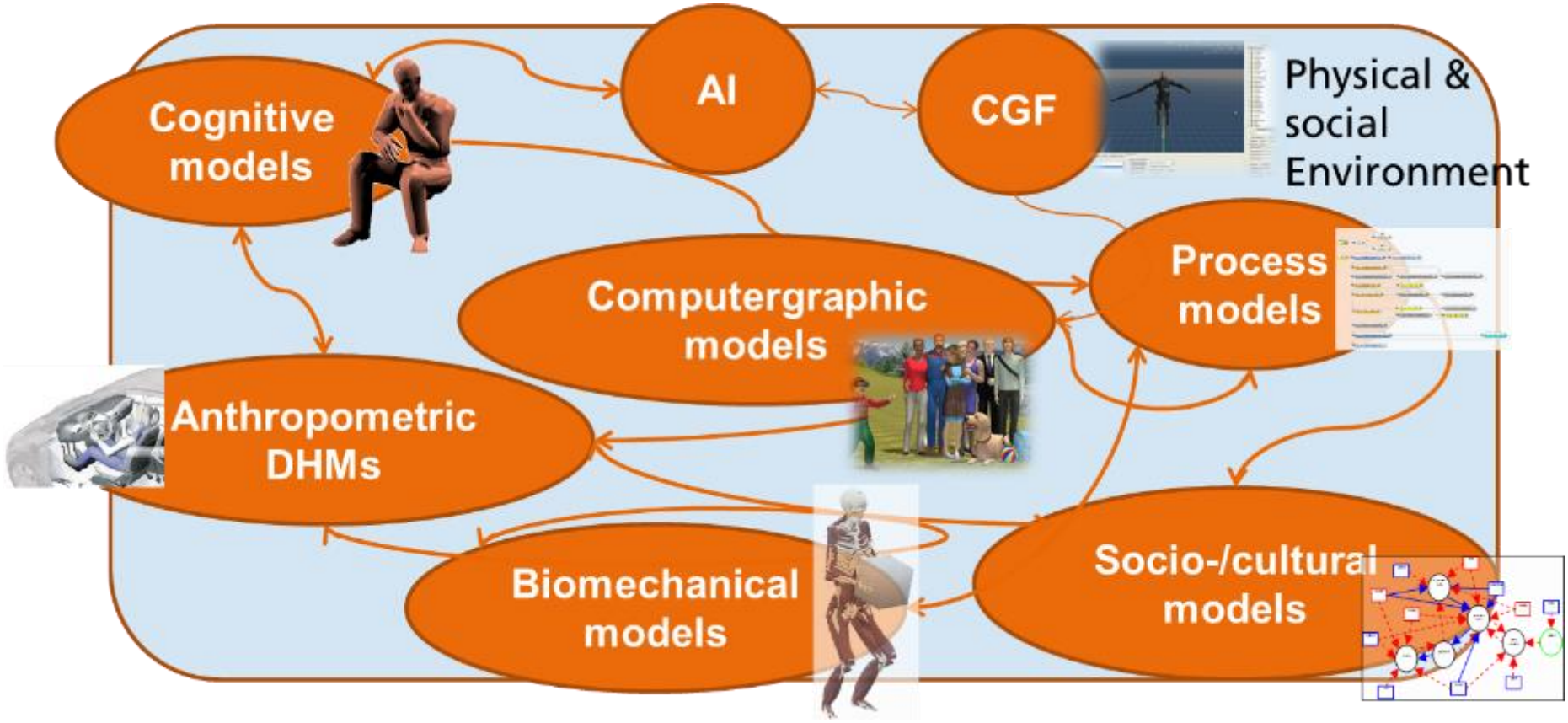
Background and Approach

- Human behaviour models are critical elements in training simulations
- Current practice involves application-specific models and propriety modelling frameworks and (rigid) software
- A Reference Architecture (RA) for human behaviour models supports the development of interoperability standards
  - Reduce model development costs
  - Increase model reuse
  - Facilitate integration and interoperability with simulation environments
  - Increase the flexibility of using alternative modelling formalisms

Human Behaviour Model

- An abstract structure of human psychology, physiology and other aspects that interact to achieve embodied goals and predict performance, expressing observed variability in behaviour attributable to differences in the person's characteristics, to differences in the situation or to the interplay of both, mapping characteristics of empirical phenomena into values of parameters and models in an artificial world.
  From: RTO-TR-047 AC/323(SAS-017)TP/25.

Behaviour Modelling:
Digital Human Models for various domains



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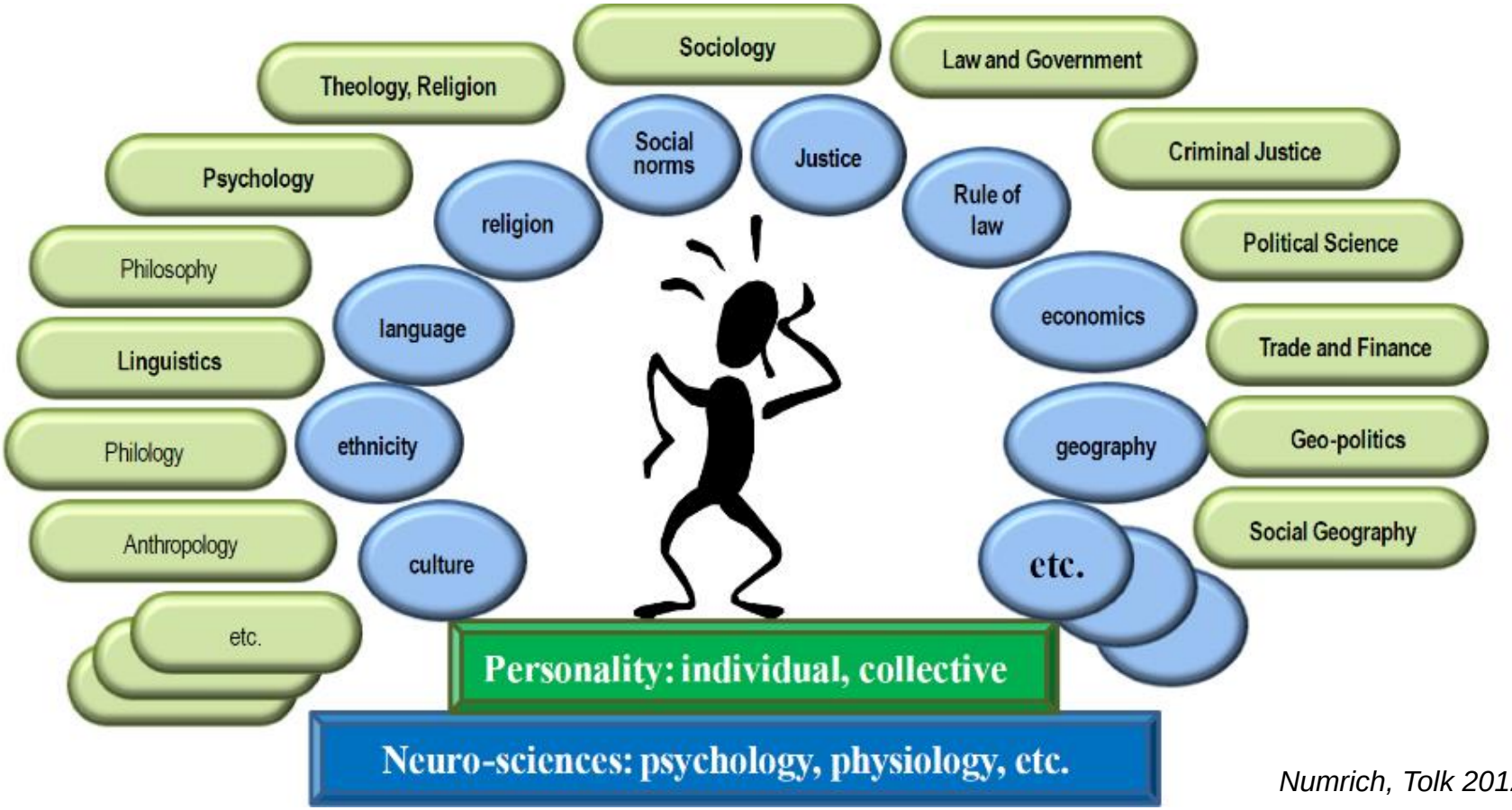
Behaviour Modelling:
Factors involved in Human Decision Making



Numrich, Tolk 2012

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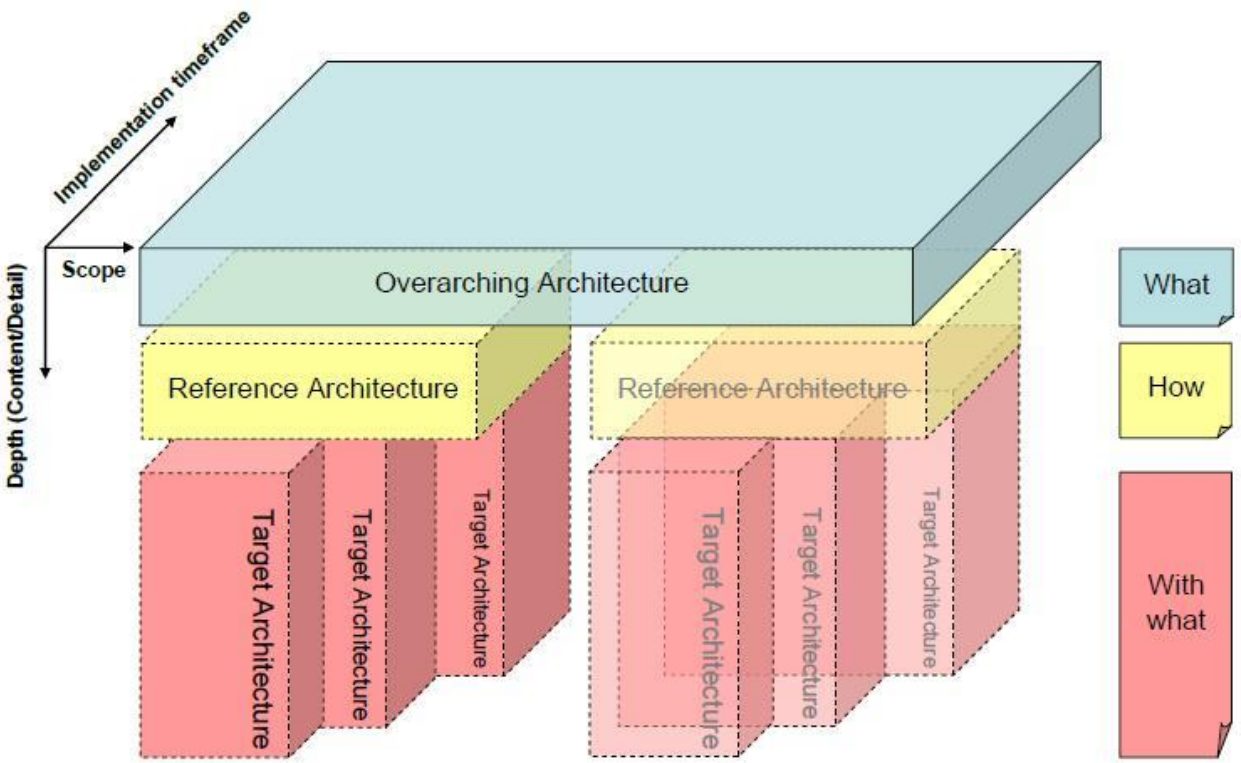
Reference Architecture
Definition of NATO/ISO



Reference Architecture (RA): an abstract form of architecture.
A reference architecture generally provides a template solution for a concrete *solution architecture*

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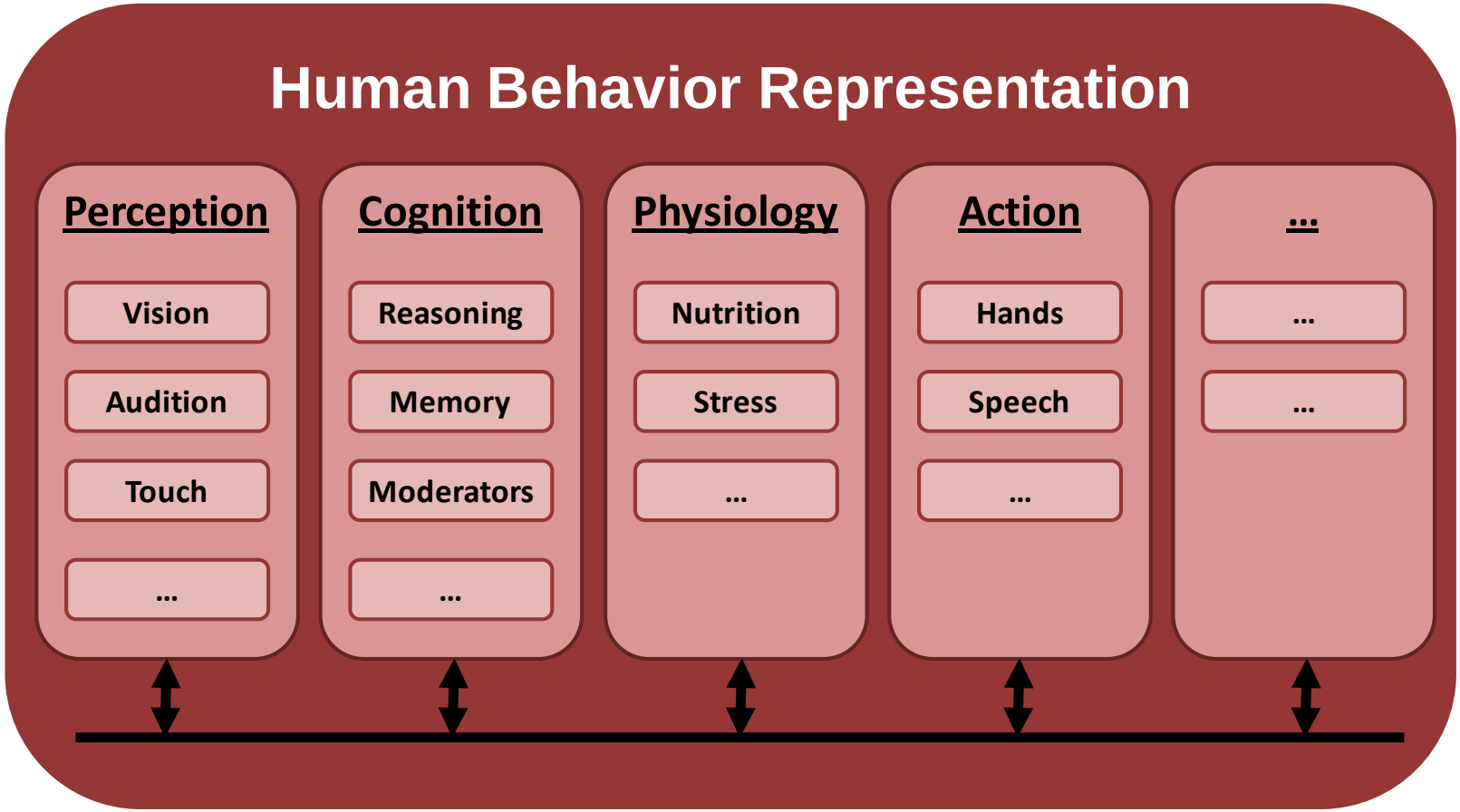
Developing the Reference Architecture: Original draft for an overarching architecture



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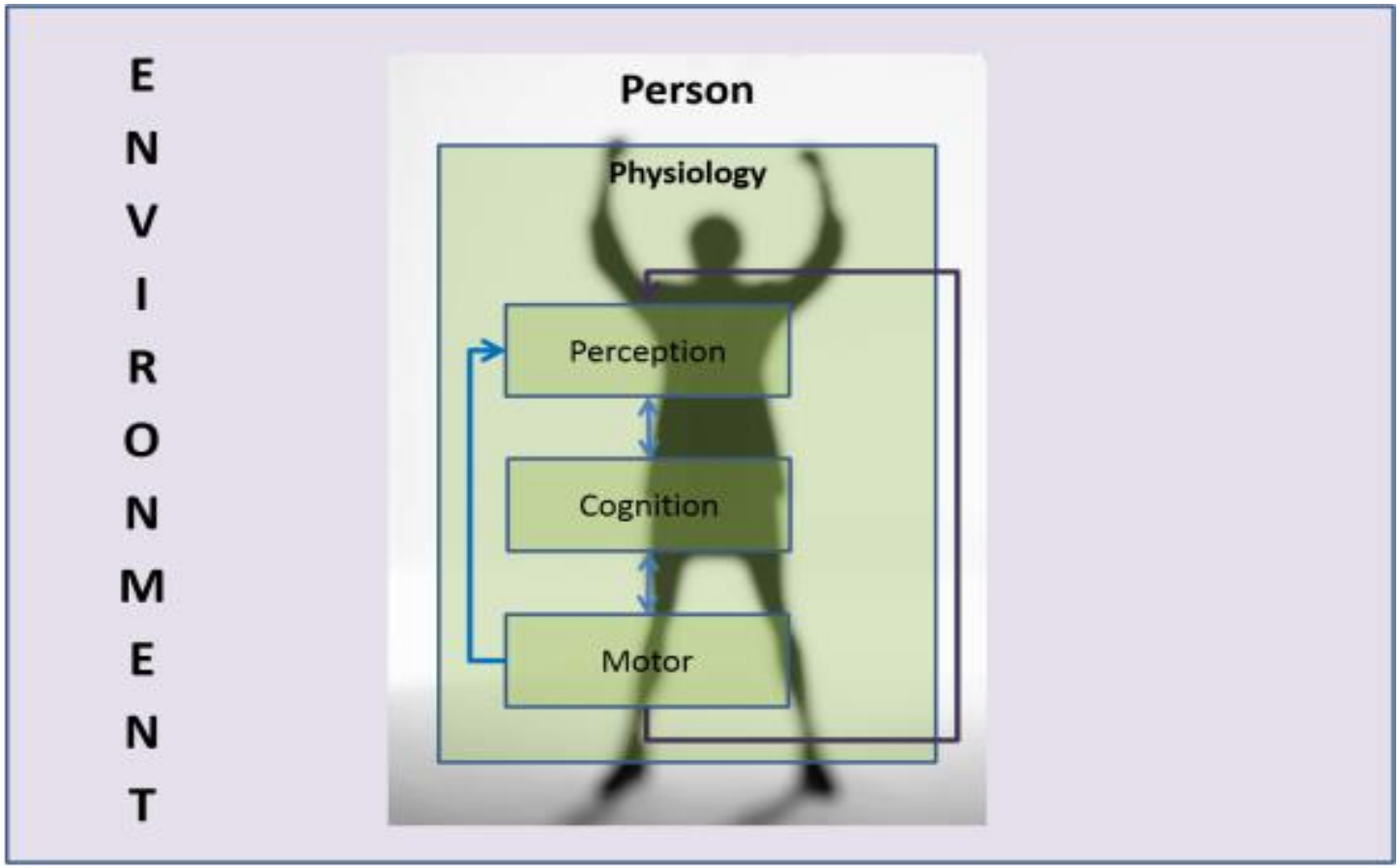
Developing the Reference Architecture: Overarching architecture – current approach



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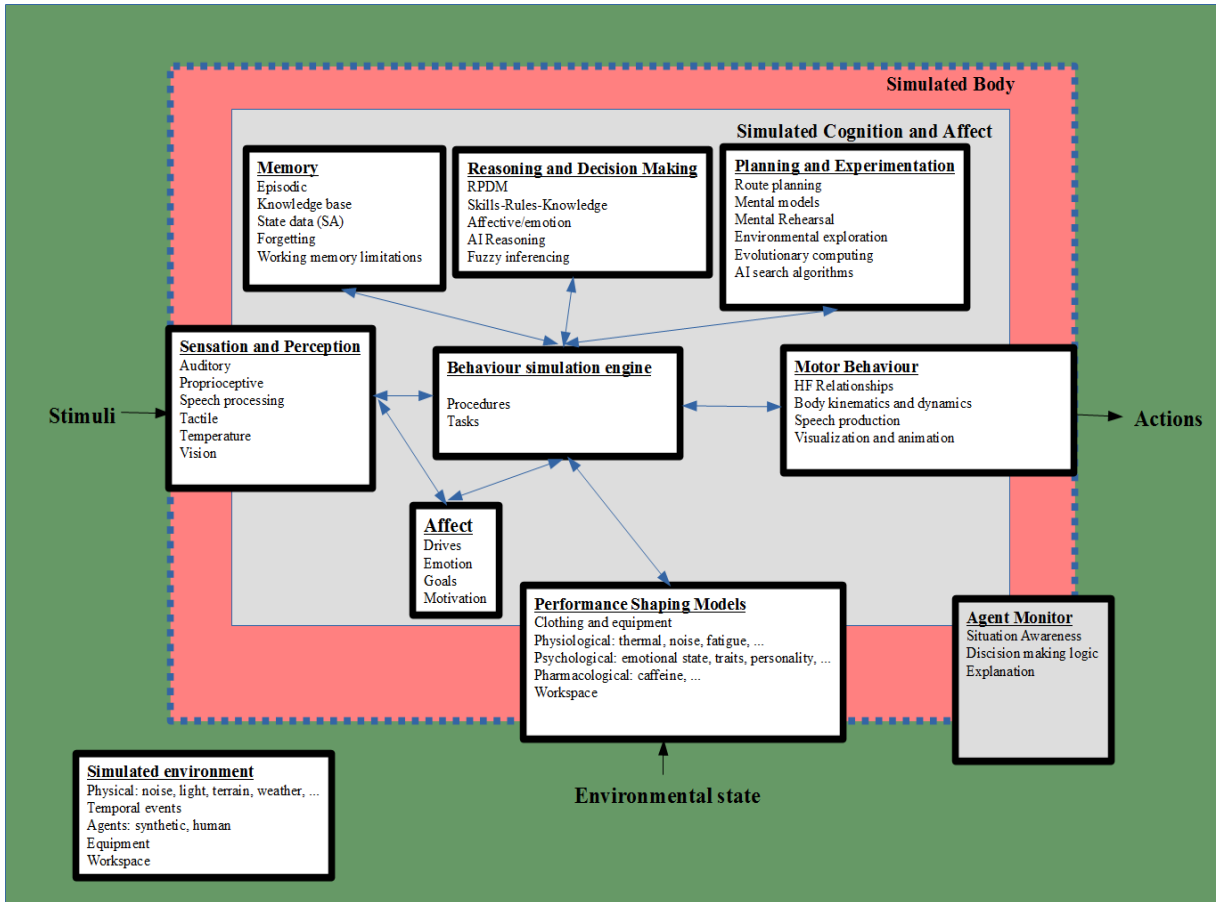
Developing the Reference Architecture: Overarching architecture – structure

Interactions between different models and HBM modules



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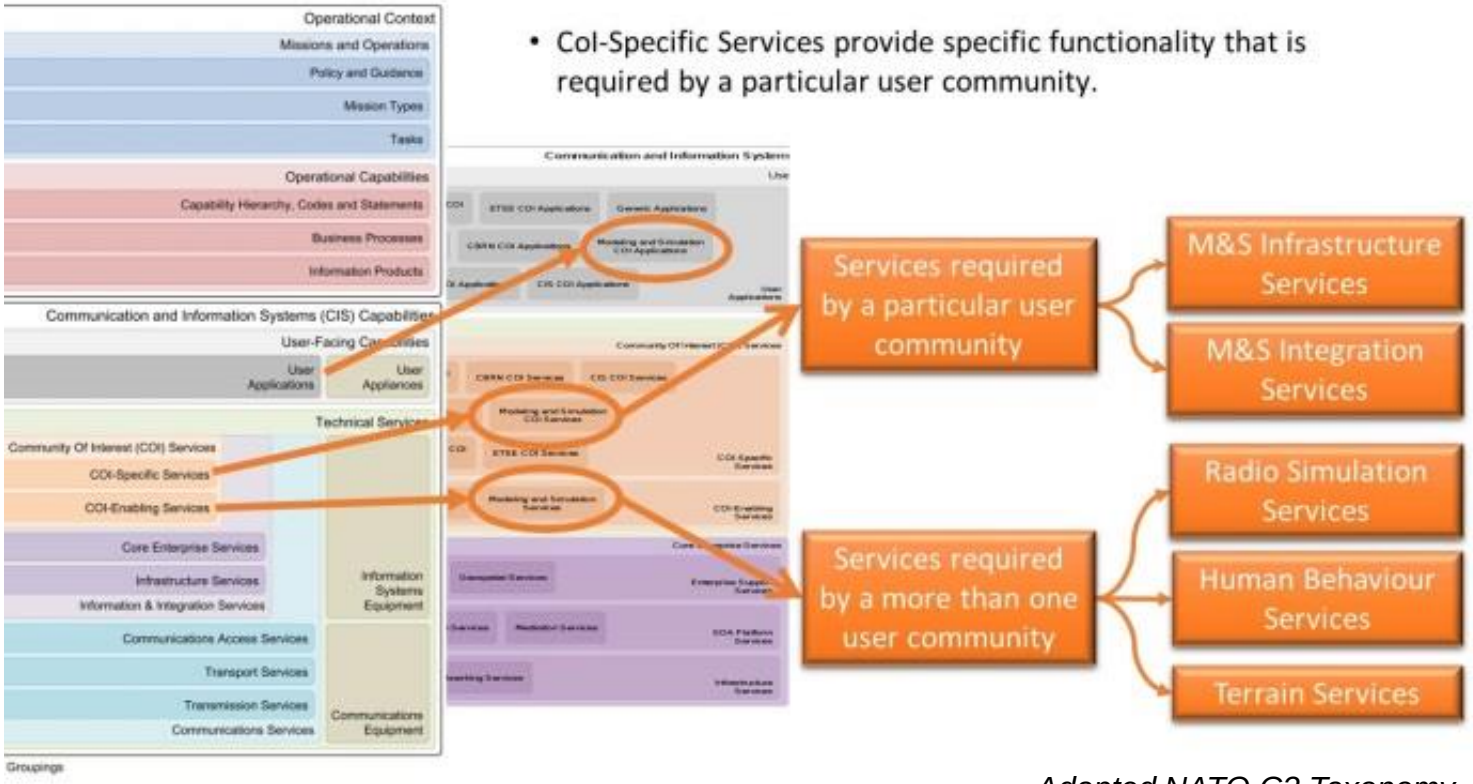
Developing the Reference Architecture: NATO-adapted HBM reference architecture

- CoI-Enabling Services provide functionality that is required by more than one community of interest,
- CoI-Specific Services provide specific functionality that is required by a particular user community.



Adapted NATO C3 Taxonomy, MSG-136 MSaaS

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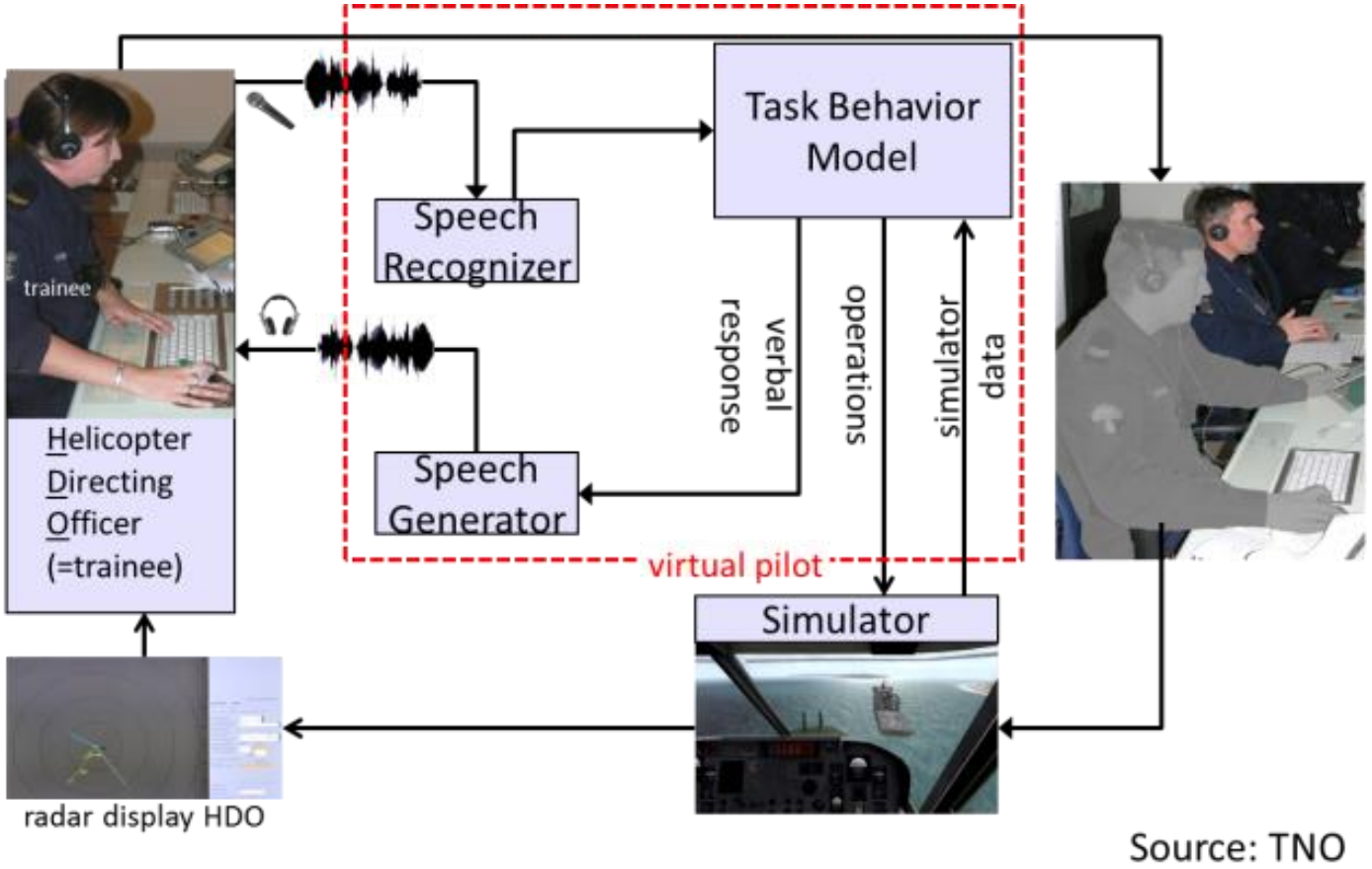
Developing the Reference Architecture: Example for a military training application



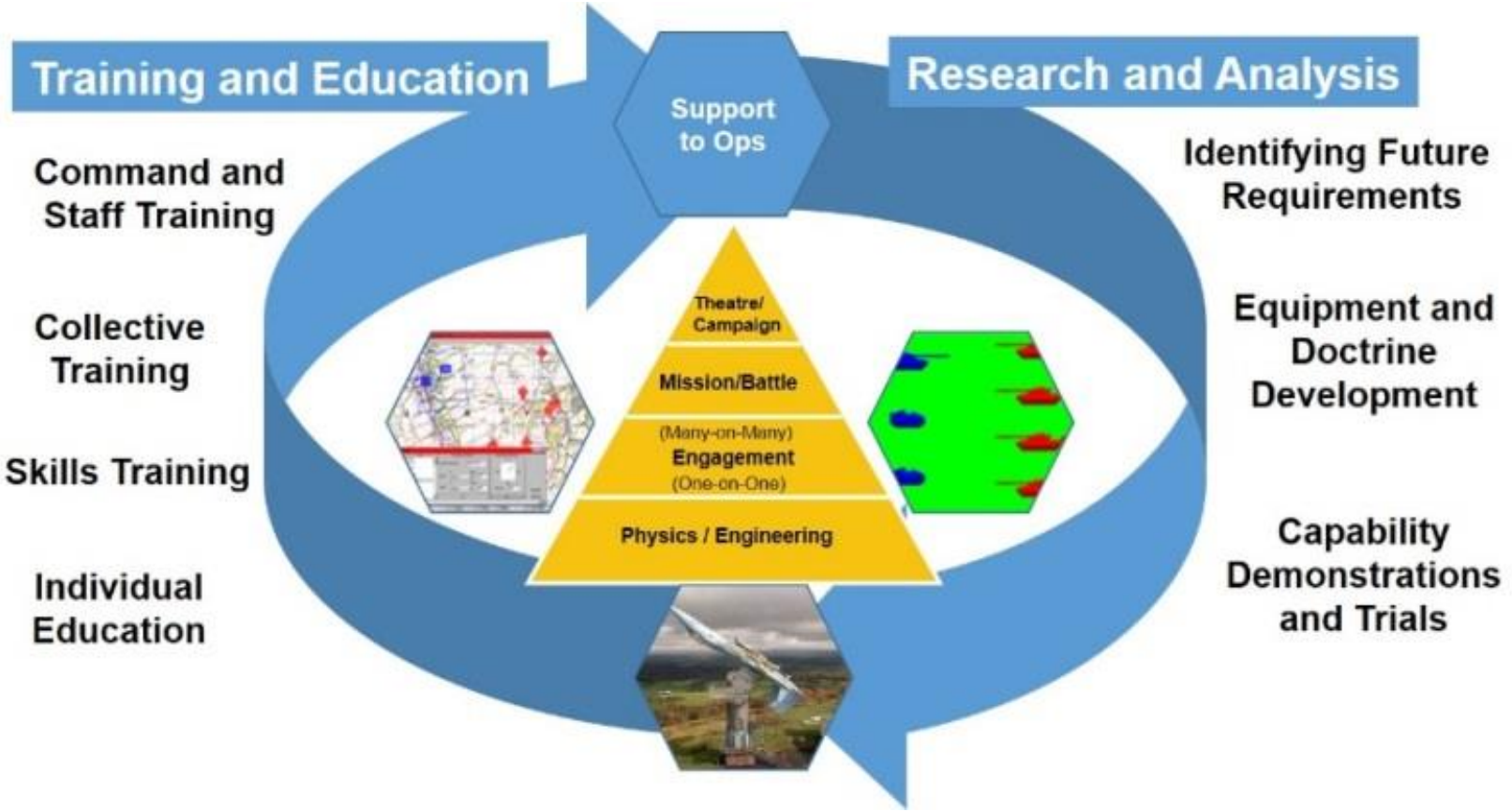
Source: TNO

Challenges for Developing the RA: Areas of HBM deficiencies

Deficiency	Comments
Cognition	Thought processes comprised Judgement, rational analysis and intuition
Decision Science (Making)	Methods and tools to gain understanding
Human Physiology	Biology that deals with the mechanical, physical, bioelectrical, and biochemical functions of humans
Human Psychology	The scientific study of mental functions and behaviours
Leadership	The ability to influence the actions of others
Morale	The capacity of people to maintain belief in an institution or a goal, or even in oneself and others
[Human]/Soldier as a Family Member	Examining military family issues associated with readiness
[Human]/Soldier Resilience	The ability to adaptively respond to challenges and adverse events
Stress	The complex and constantly changing result of processes inside a Soldier while performing a combat-related mission
[Military / Civilian] Unit, ***[organisations & cultures]*** as complex system	The self-organizing properties of a unit emerging from the complex interactions within the unit and with external influences
[Military / Civilian] Unit ***[organisations & cultures]*** Cohesion	Described as interpersonal bonds among members (social cohesion) or a shared commitment to the mission (task cohesion).

Adapted from Fefferman,2015

Challenges for Developing the RA: HBM RA for other applications



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Challenges for Developing the RA: Future requirements and simulation capabilities

Requirement	Simulation capability
Humans operating in isolation	Independent characters
Humans operating in groups	Crowd Flow Group behaviour
Humans operating platforms	Land domain simulation e.g. traffic Air domain simulation Maritime domain simulation
Human background clutter	Background Pattern of Life
Complex and simple behaviours	Artificial Intelligence based behaviour models Hierarchical behaviour execution

Conclusions

- Development of a RA for HBM of individual players is expected to improve quality and efficiency, and enable more reuse

- Recommended Approach
  - Analysis of relevant training application cases
  - Development of RA Building Blocks
  - Implementation of Solution building blocks
  - Assessment

Questions?

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