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Mixed Initiative Systems for Human-Swarm Interaction: Opportunities and Challenges

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Outline

- Robot Swarms
- Mixed Initiatives
- Challenges
- Modelling Mixed Initiatives



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Scope of the Work

Opportunities and challenges in the design of
mixed-initiative systems



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Robot Swarms





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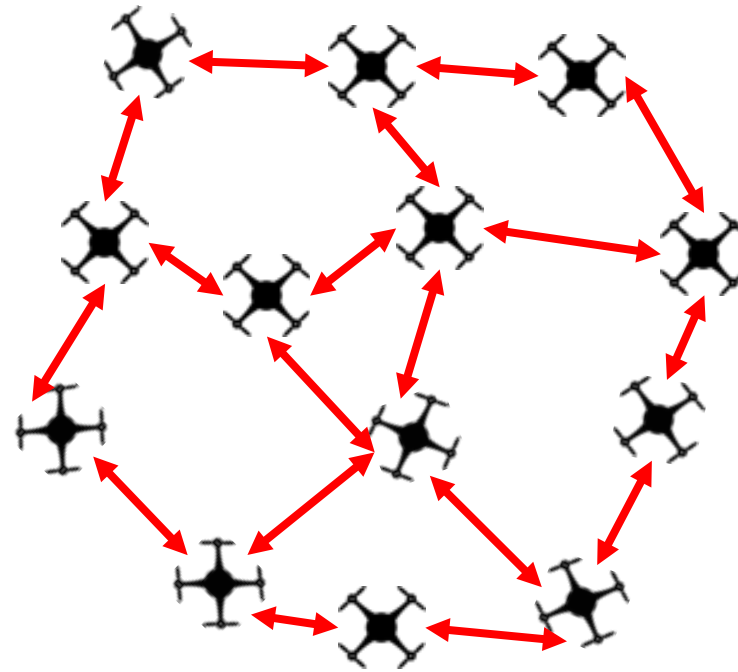
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Robot Swarms





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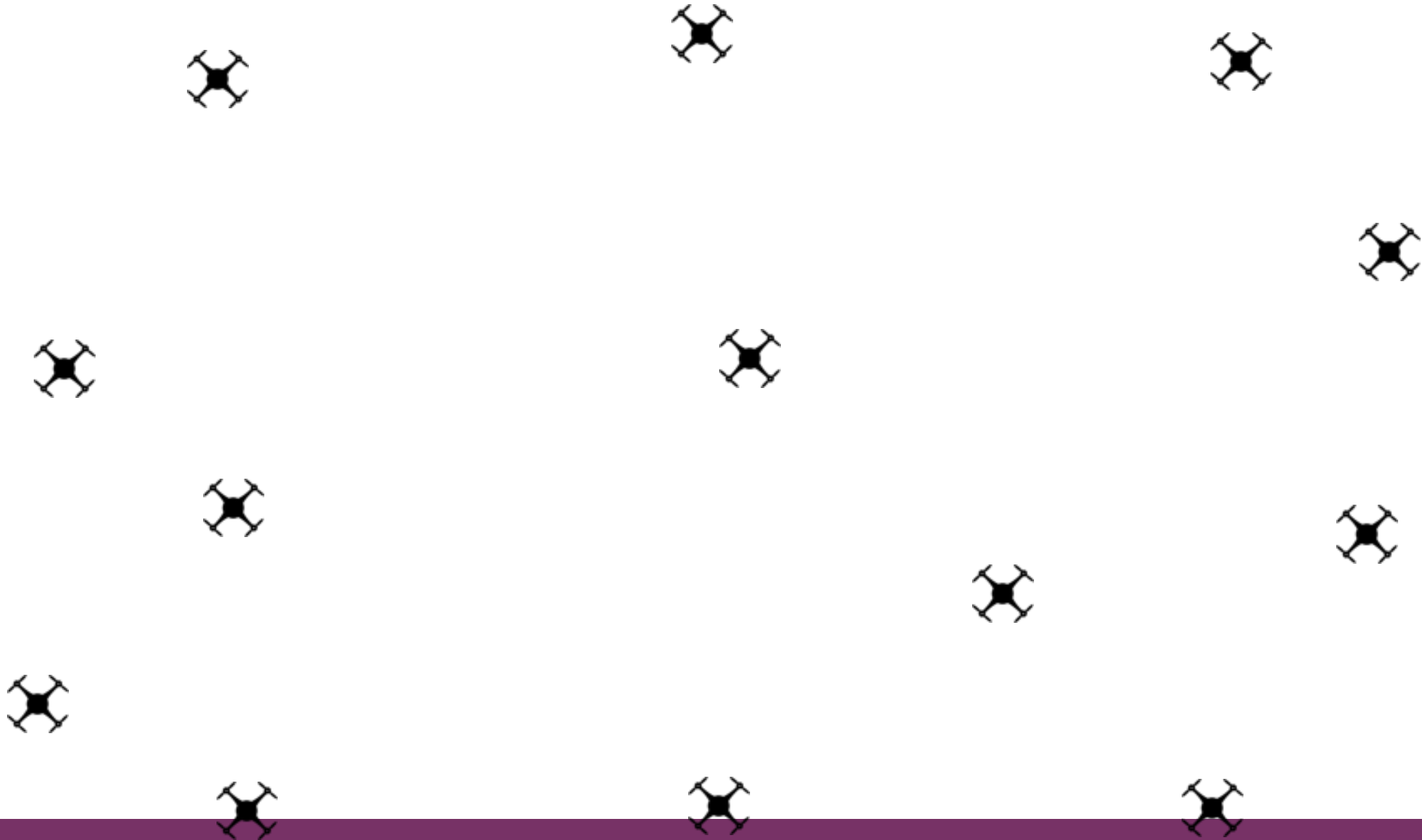
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Robot Swarms





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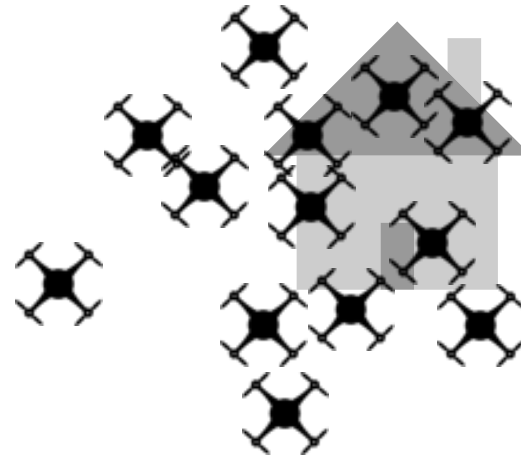
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Robot Swarms





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Robot Swarms



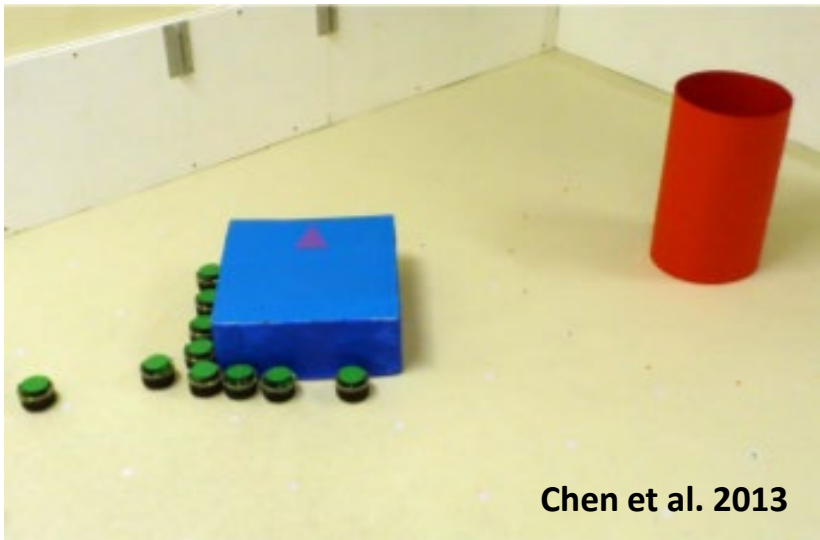
Alonso-Mora et al. 2014



Robot Swarms



Alonso-Mora et al. 2014



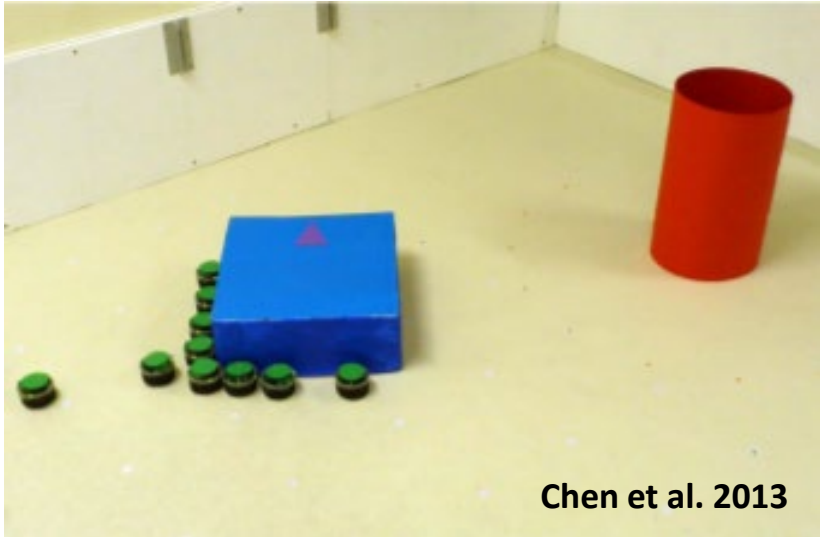
Chen et al. 2013



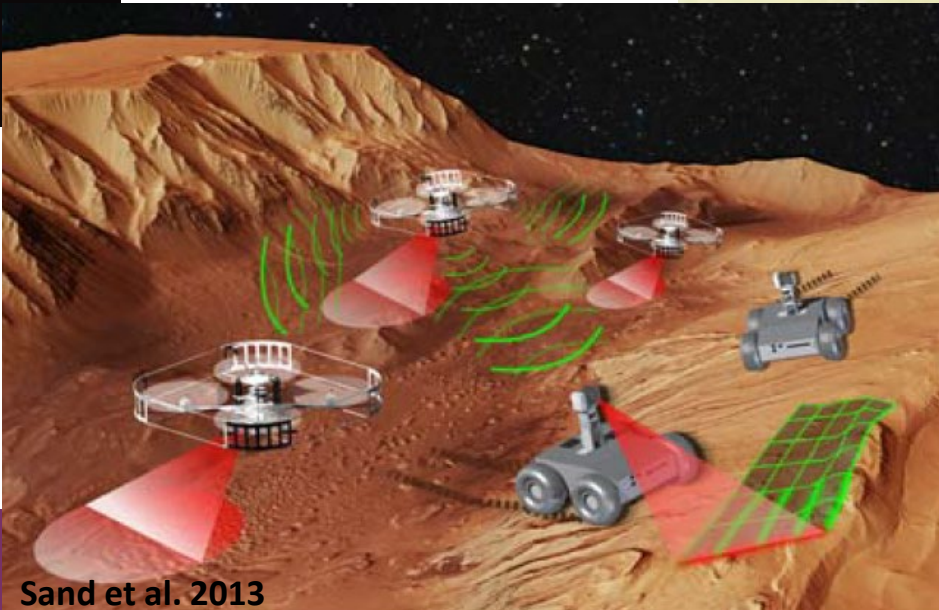
Robot Swarms



Alonso-Mora et al. 2014



Chen et al. 2013

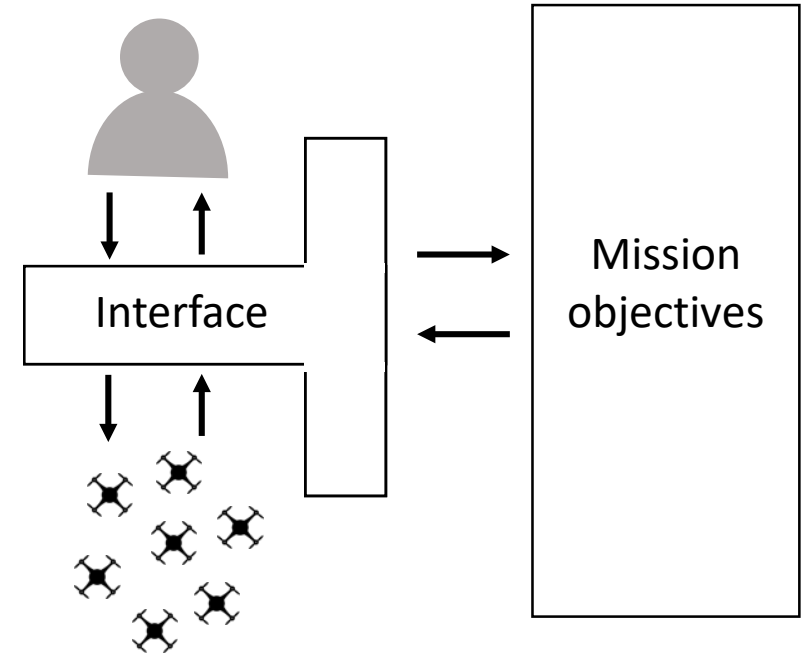


Sand et al. 2013



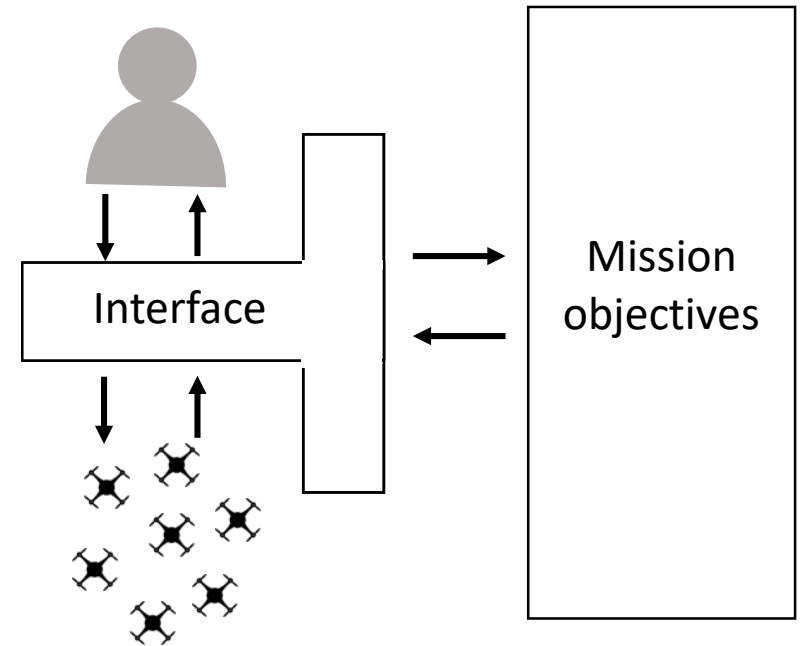
Human Swarm Interaction (HSI)

- Real environments can be unstructured and dynamic





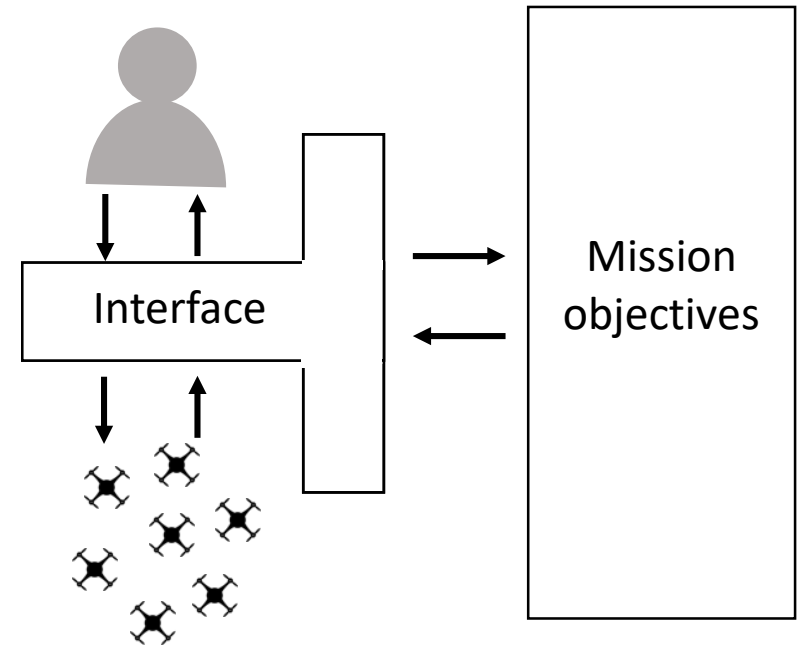
Human Swarm Interaction (HSI) Task Allocation





Human Swarm Interaction (HSI) Task Allocation

- The human can be:
 - Operator

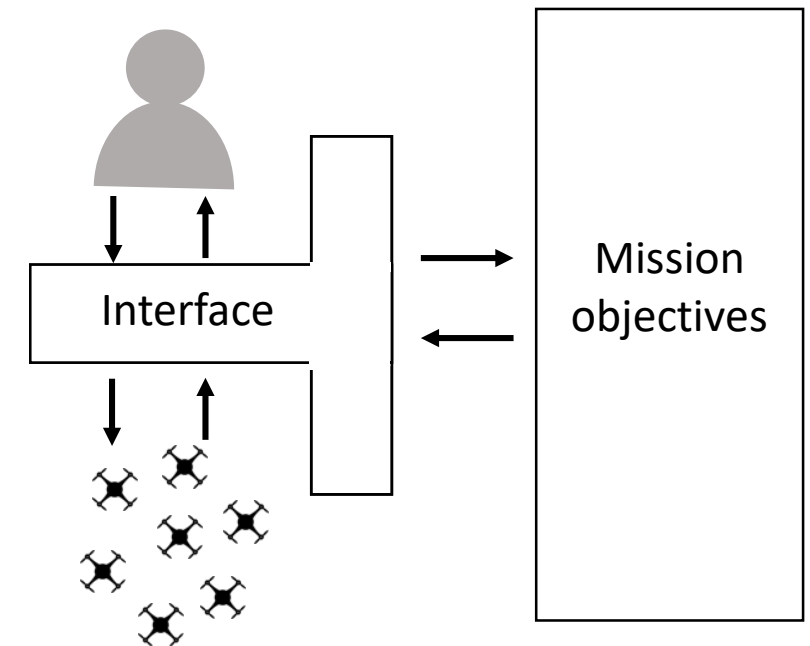




Human Swarm Interaction (HSI) Task Allocation

- The human can be:
 - Operator

Workload

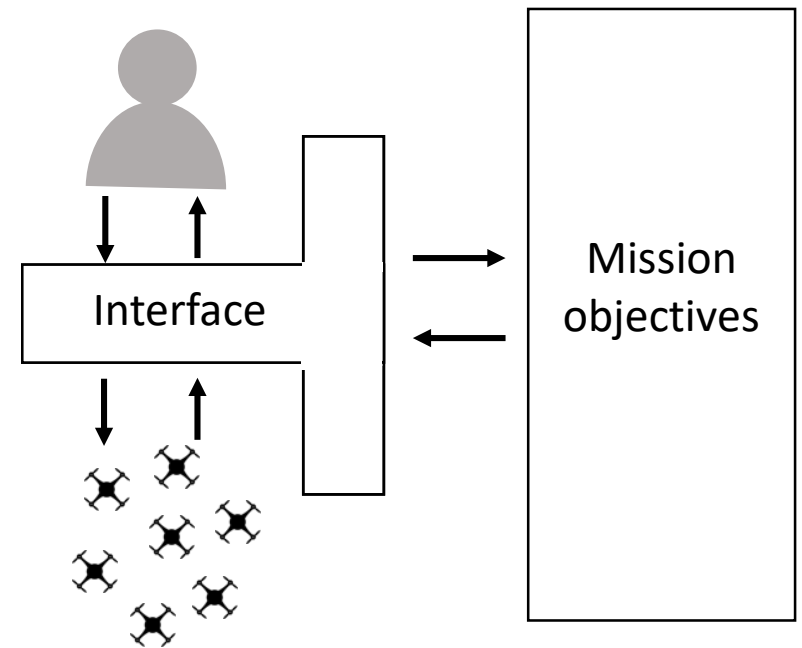




Human Swarm Interaction (HSI) Task Allocation

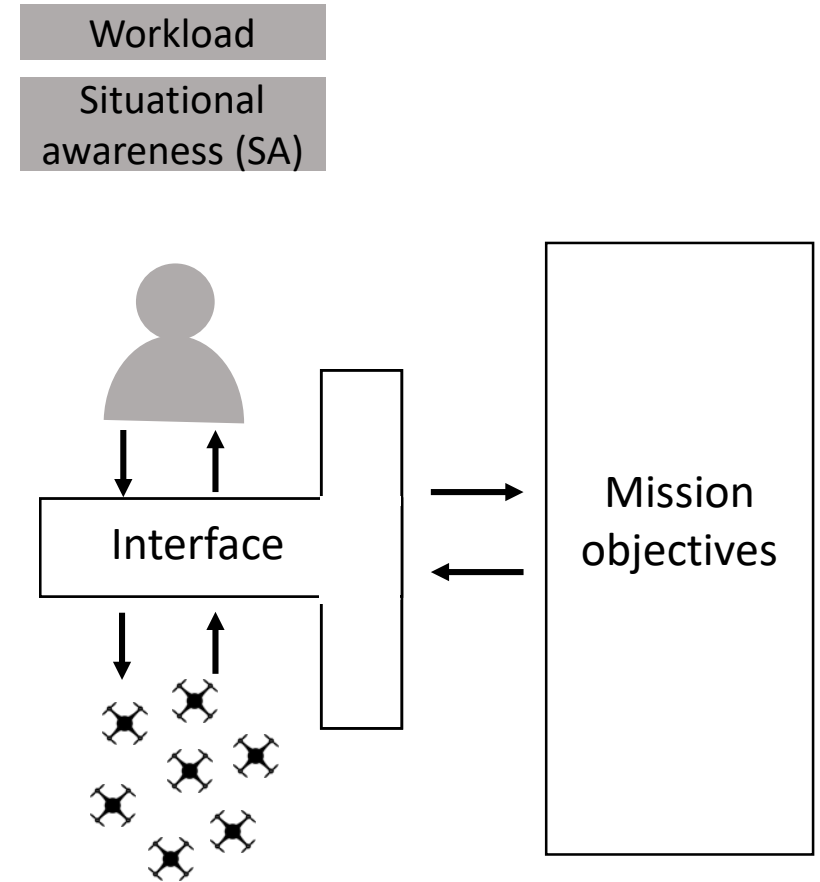
- The human can be:
 - Operator
 - Supervisor

Workload



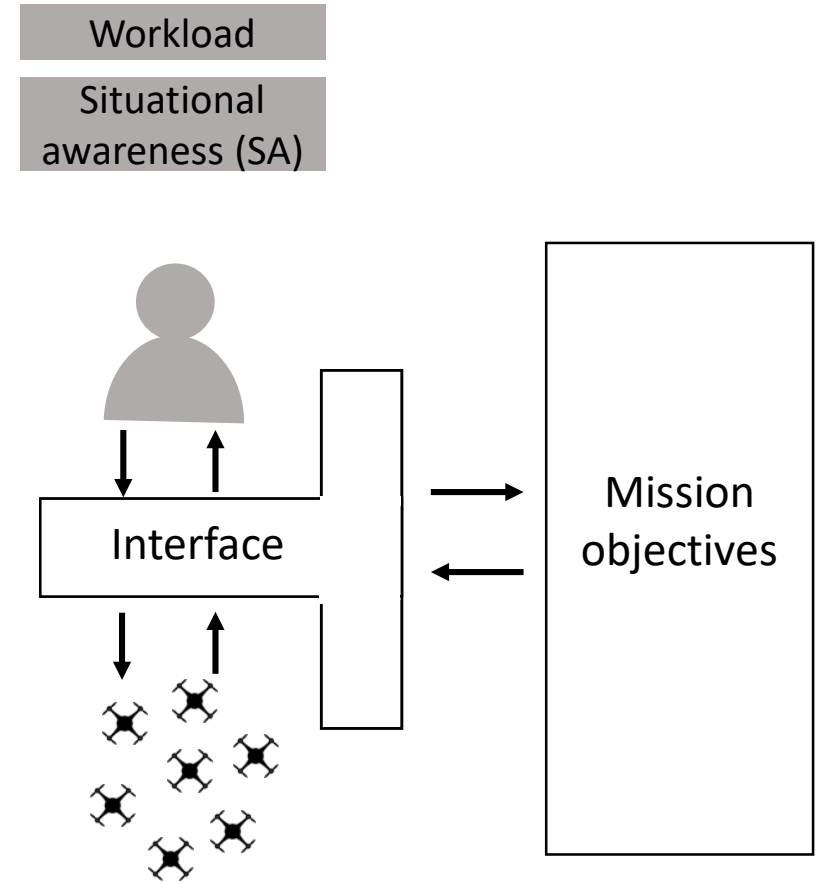
Human Swarm Interaction (HSI) Task Allocation

- The human can be:
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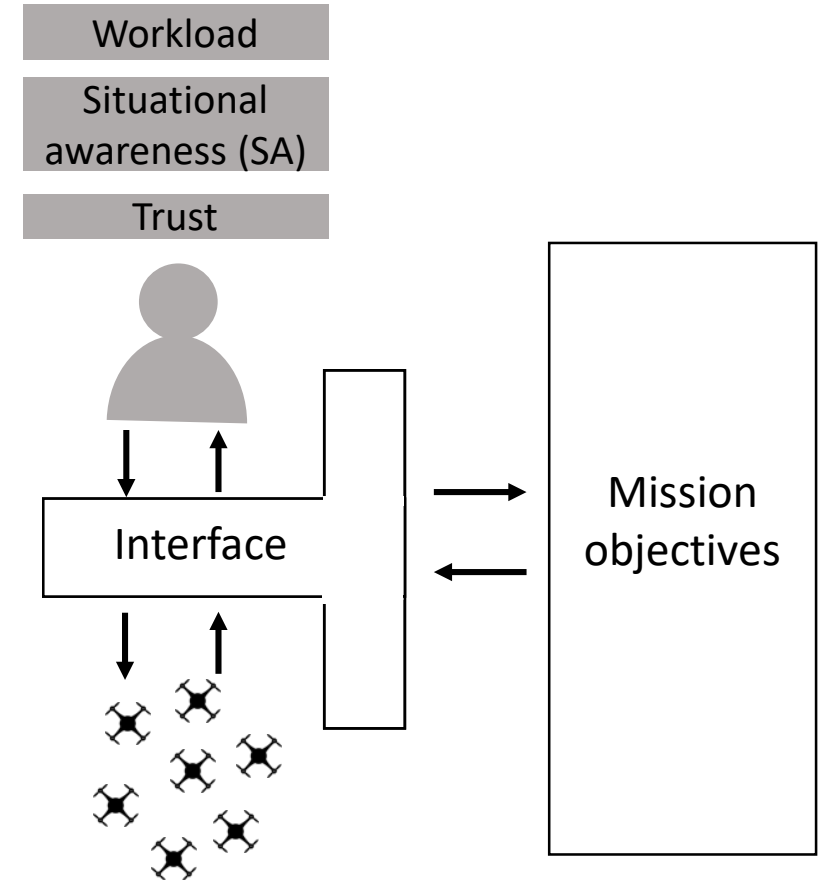
Human Swarm Interaction (HSI) Task Allocation

- The human can be:
 - Operator
 - Supervisor
 - Teammate



Human Swarm Interaction (HSI) Task Allocation

- The human can be:
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 - Supervisor
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Human Swarm Interaction (HSI)



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Objectives

Success

Workload

Situational awareness (SA)



Human Swarm Interaction (HSI)

Objectives

Success

Workload

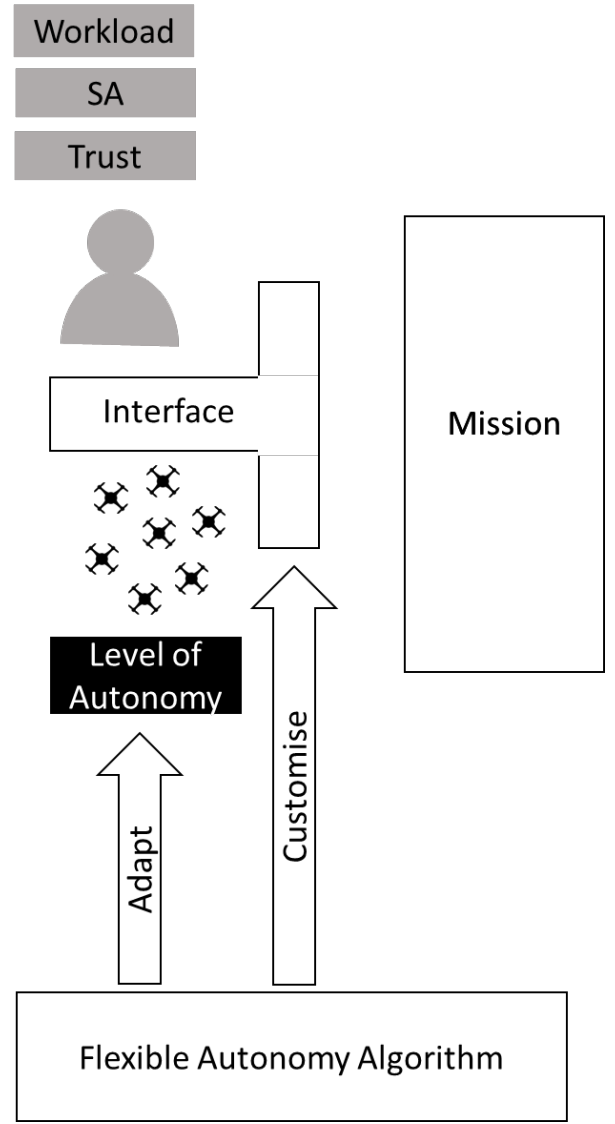
Situational
awareness (SA)

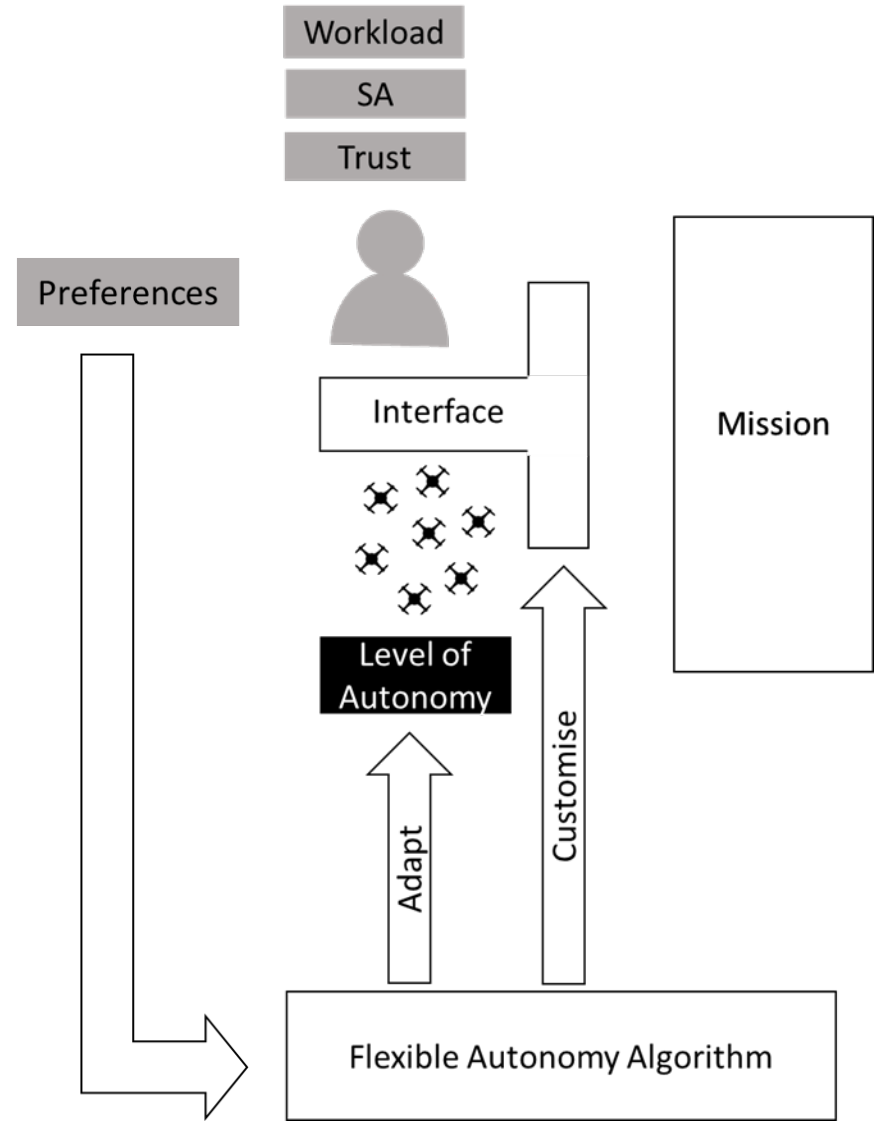
Constraints

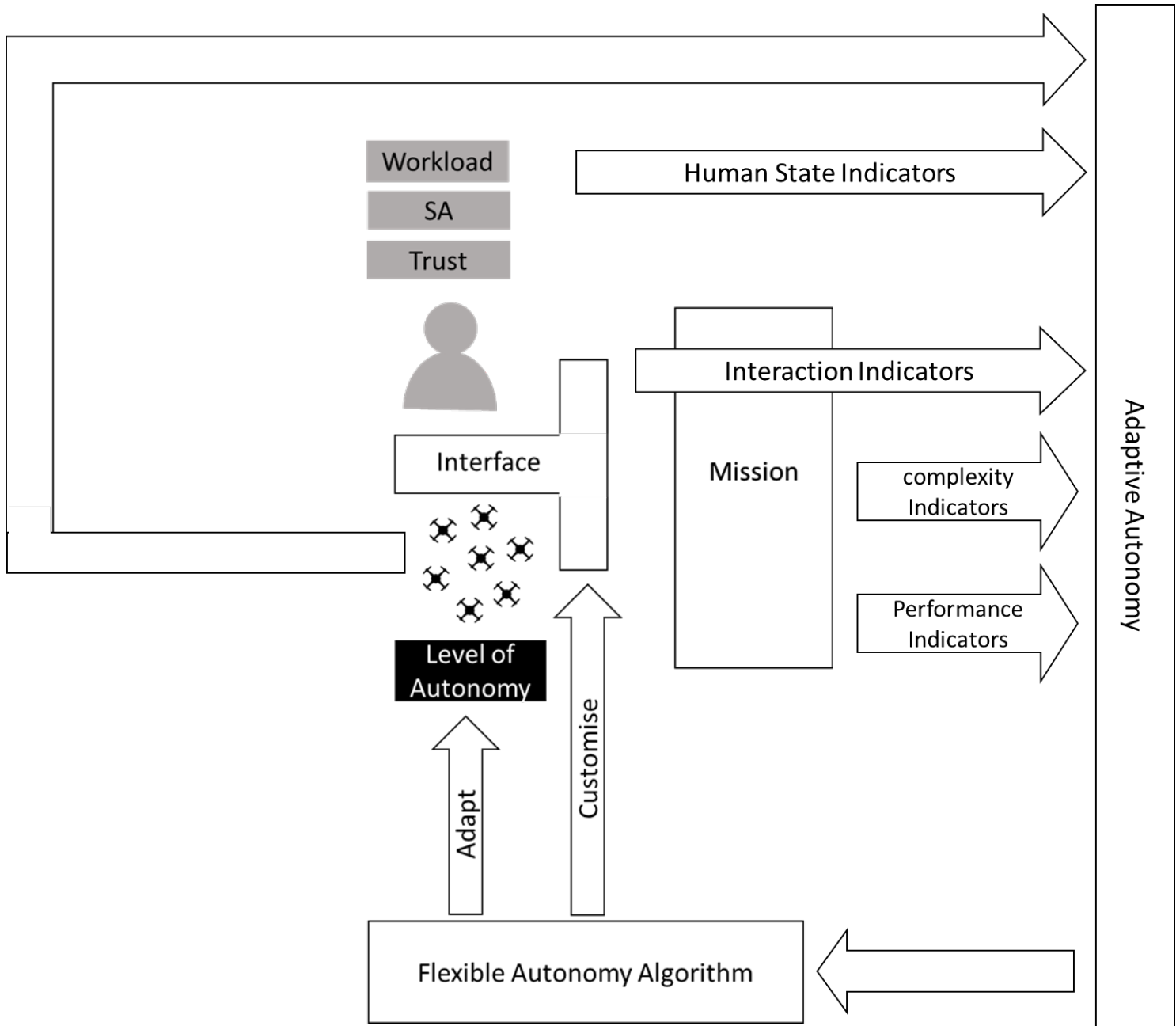
Task
requirements

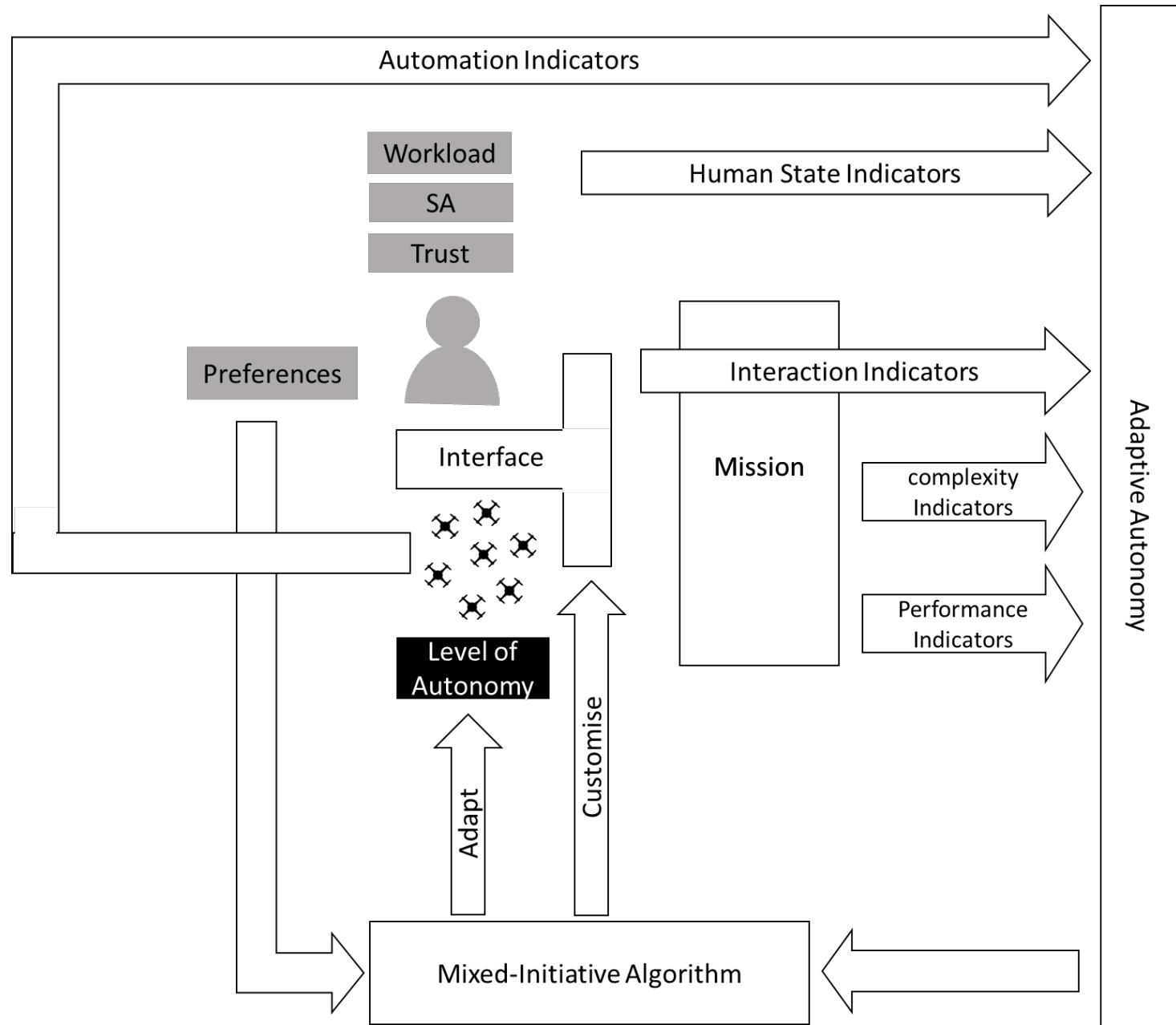
Swarm
automation

Human trust











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Mixed Initiatives for HSI

- Realtime adaptation
- Human is part of the adaptation
- Adaptation is not overhead on the human



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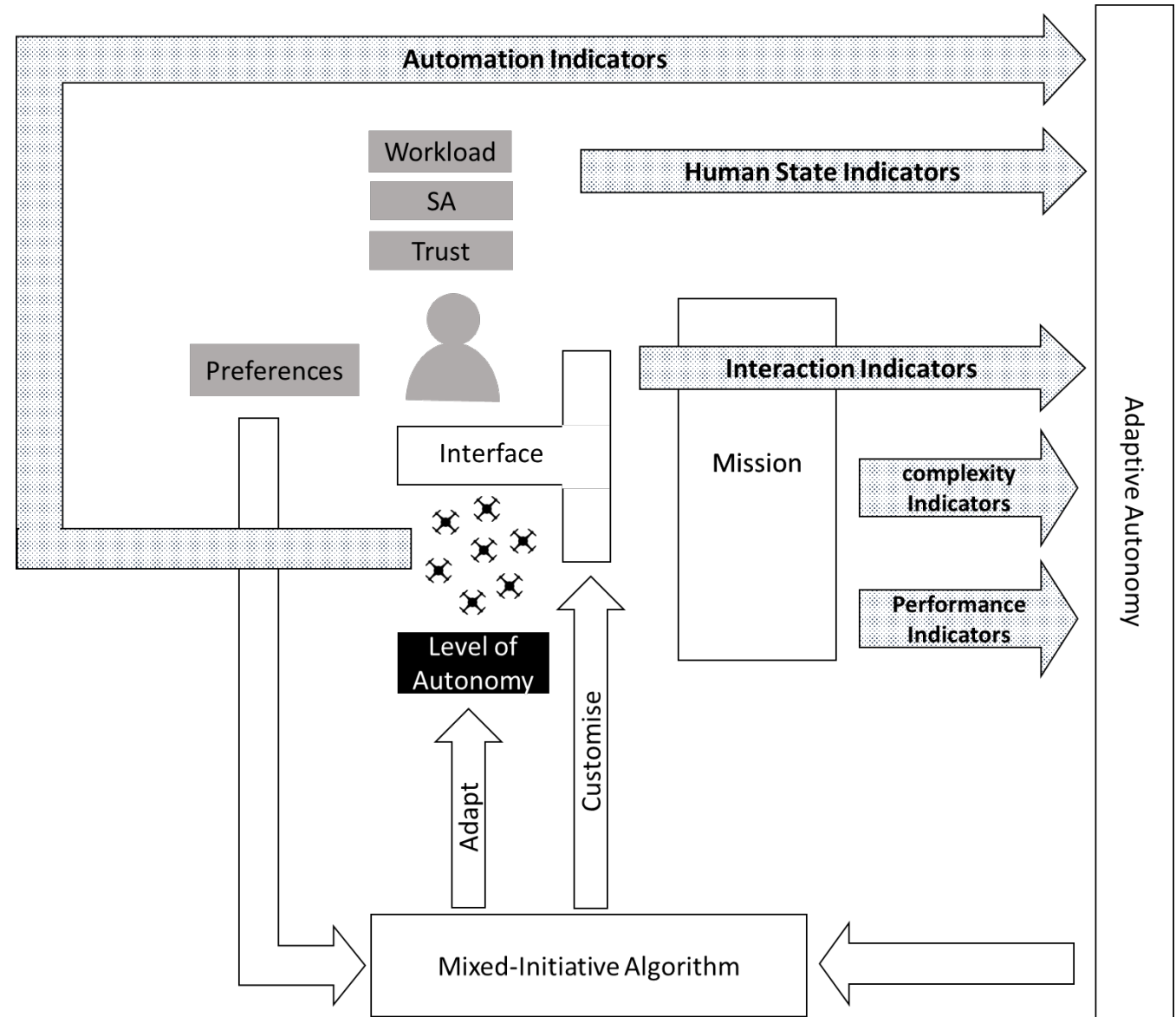
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Challenges

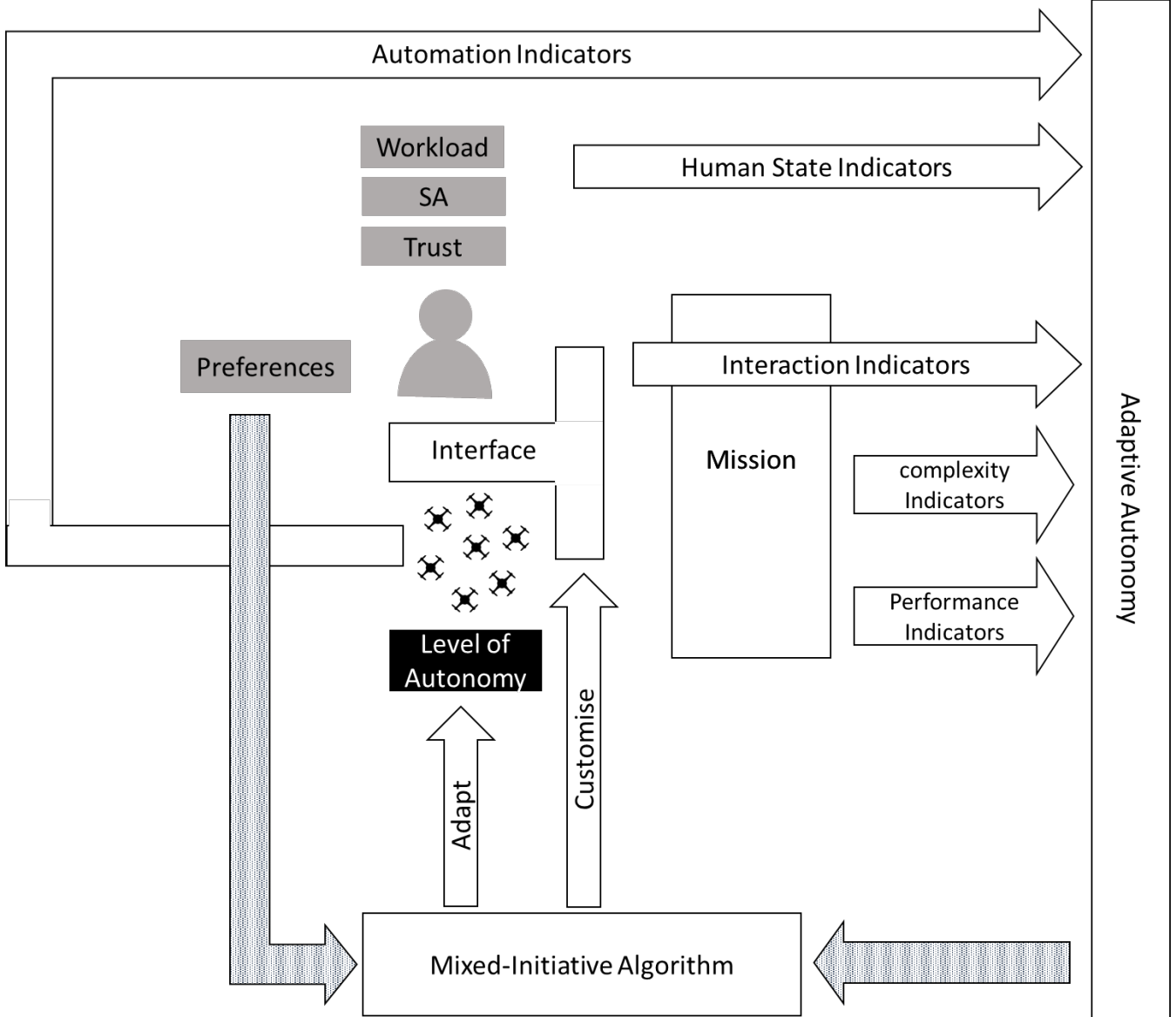


- Combine values from different indicators



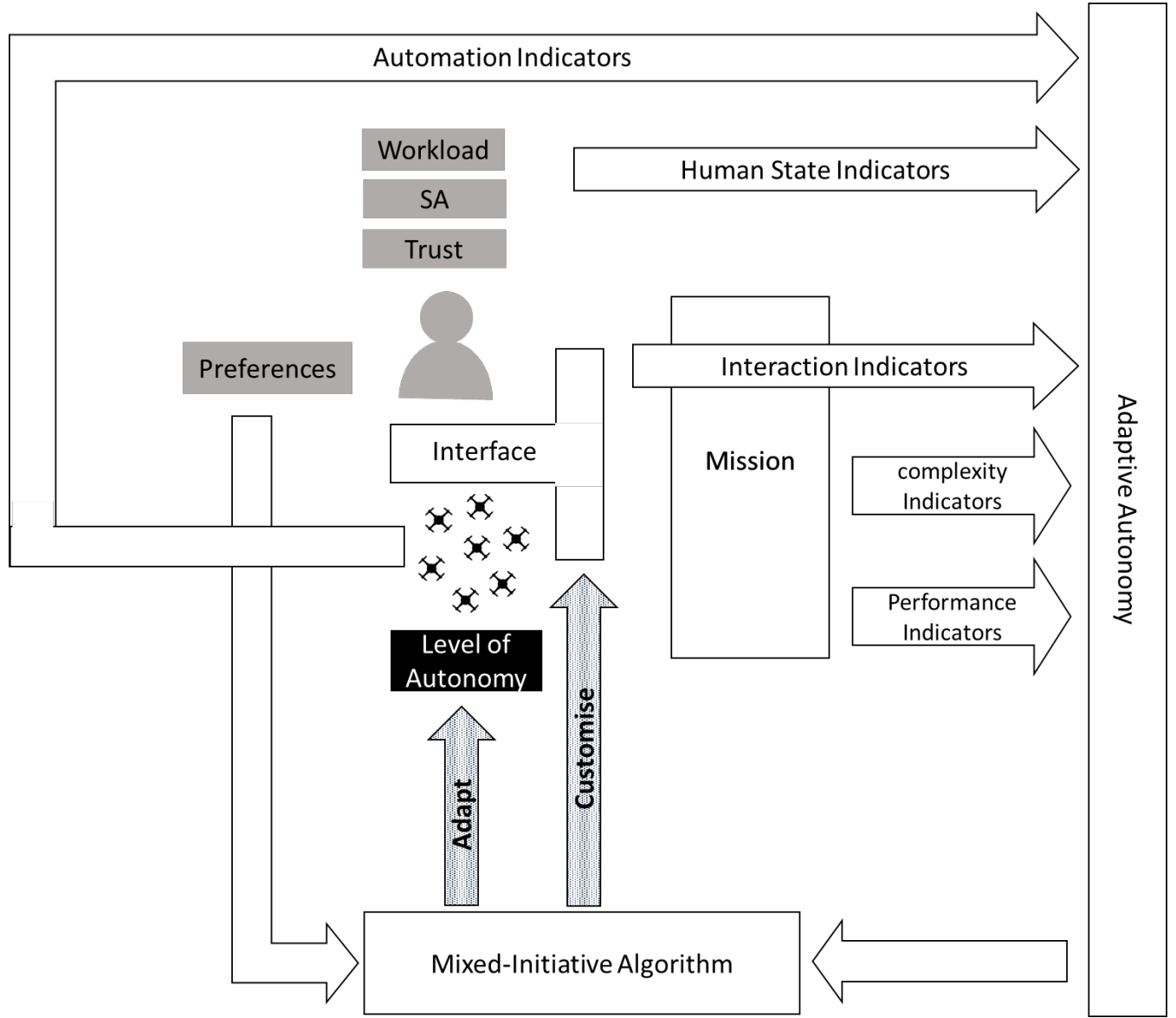


- Combine human preferences and automation recommendations





- Avoid sudden changes





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Design of mixed-initiative systems

- Sufficient data



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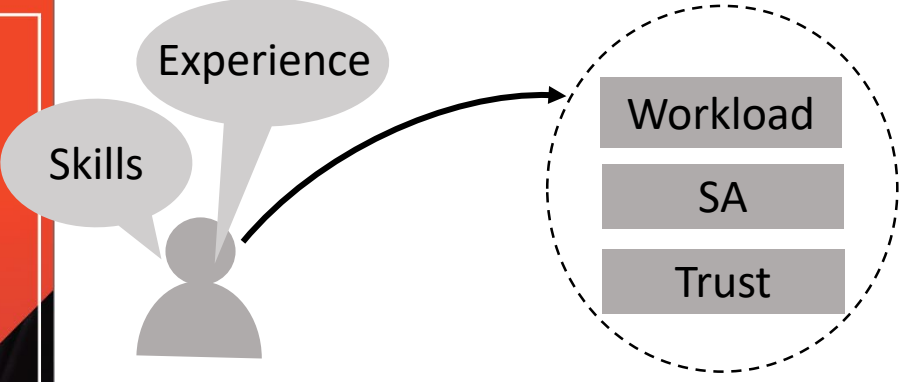
Design of mixed-initiative systems

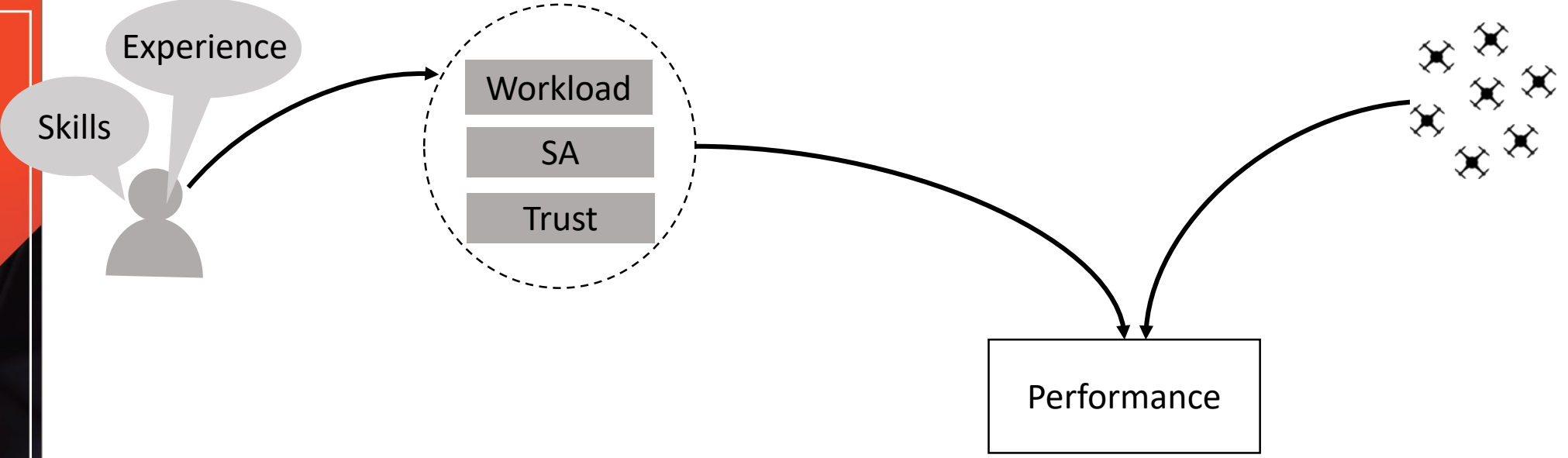
- Sufficient data
- Modelling and Simulation Techniques

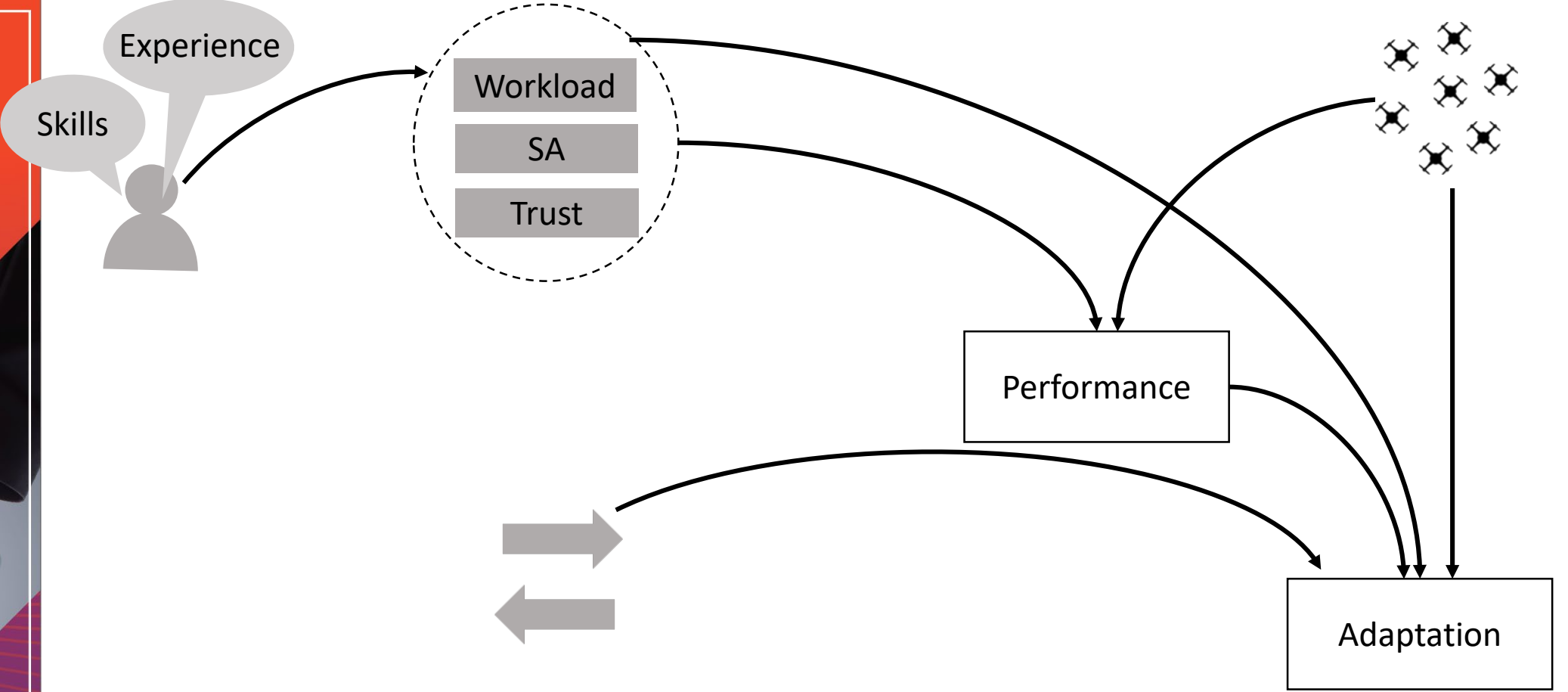


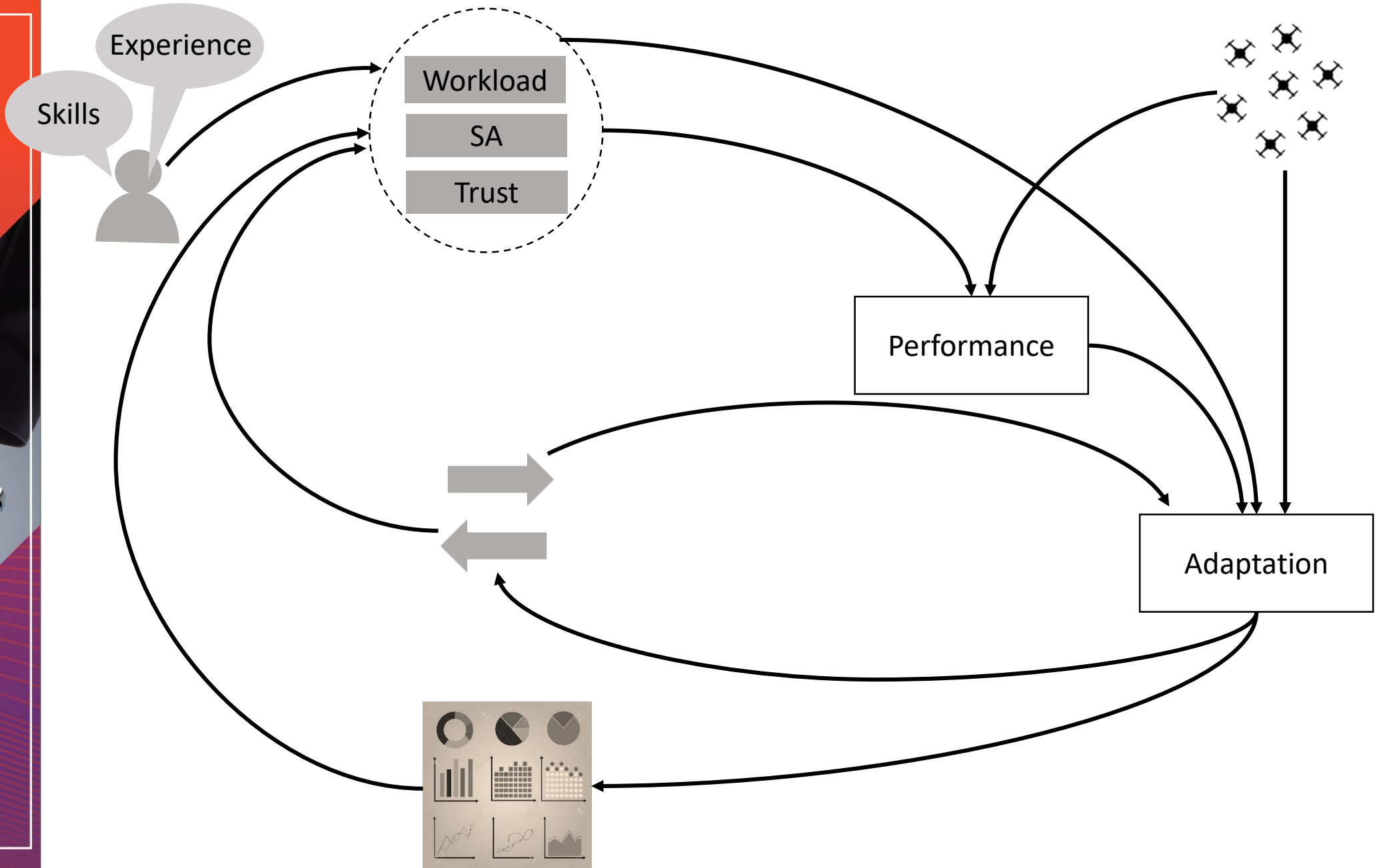
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Summary

- The need for mixed initiatives for effective HSI
- Challenges in designing mixed-initiative HSI
- System modelling



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Thank you!