

# “Are we there yet?” Perceiving, comprehending and projecting lessons learnt from SA research



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## Background & Relevance

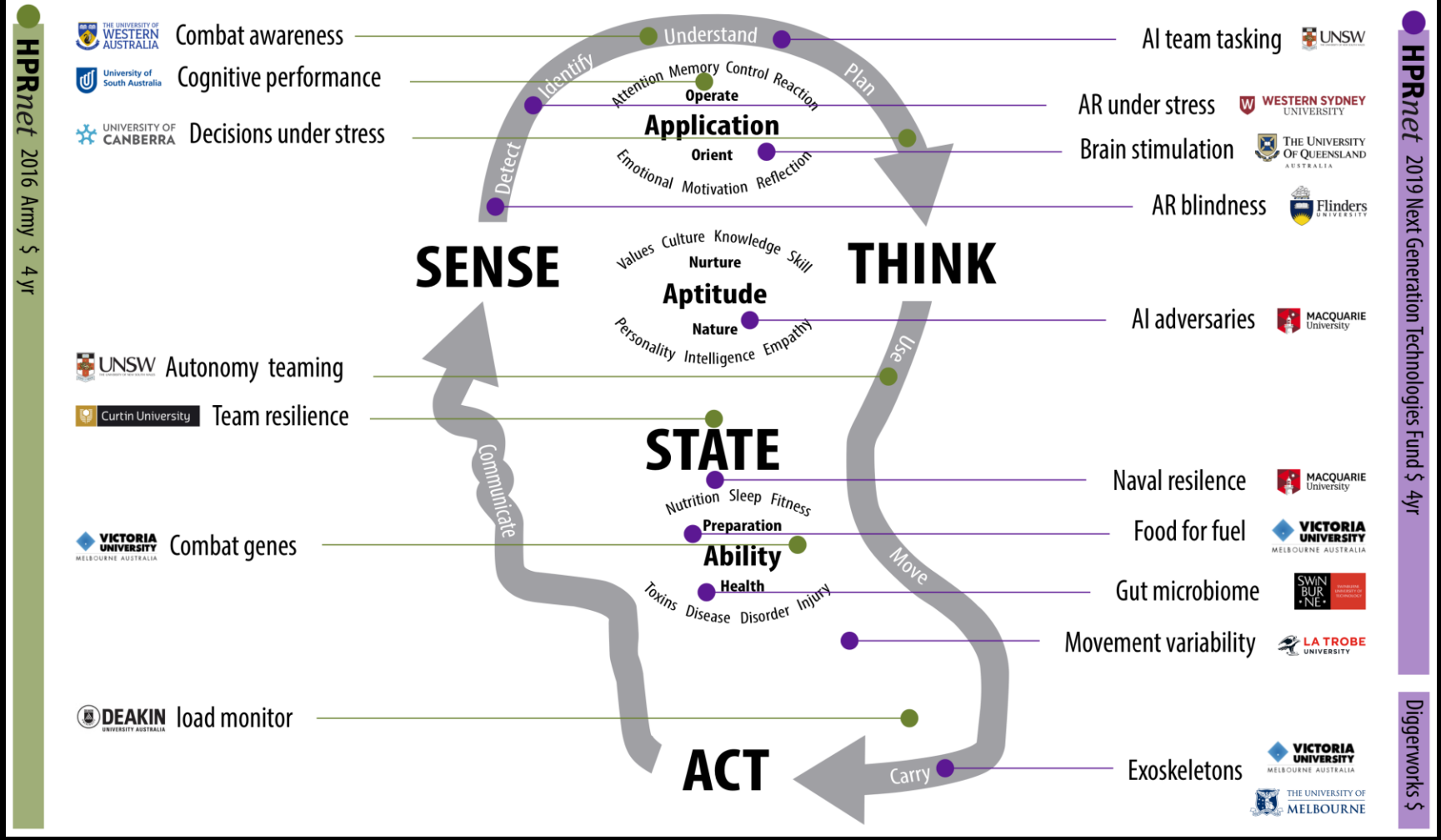


Army operations are defined by increasing complexity due to technological change, and greater capabilities of adversaries

Success requires superior situation awareness (SA) – knowledge/comprehension of operational environment

To achieve this, Army has committed to research to augment cognitive capabilities and preparation in warfighters

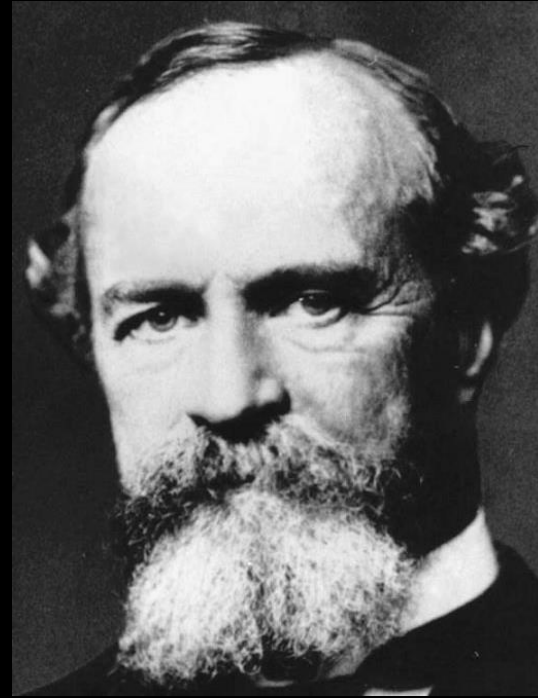
# HPRnet @ UWA



**UNIVERSITY OF WESTERN AUSTRALIA**  
 Selection, training and intervention strategies to improve warfighter situation awareness.

Research focused on developing tools to assess and augment cognitive skills underlying SA and complex task performance

What is SA?



"Everybody knows what attention is."

*William James*

What is SA?



SITUATIONAL AWARENESS  
IT'S WORTH

**How to Develop the Situational Awareness of Jason Bourne**



SITUATIONAL AWARENESS  
SOME LESSONS CAN ONLY BE LEARNED ONCE!

# What is SA?

Mental model of current events, their inter-relationships and future predictions

This model may be "complex" (Endsley) and in the head or "sparse" (situated approach) with information offloaded, or even distributed across a techno-social system  
(Stanton)

Lots of evidence it requires good cognitive skills such as long term memory, short-term memory, and attentional control

Is SA just cognition?



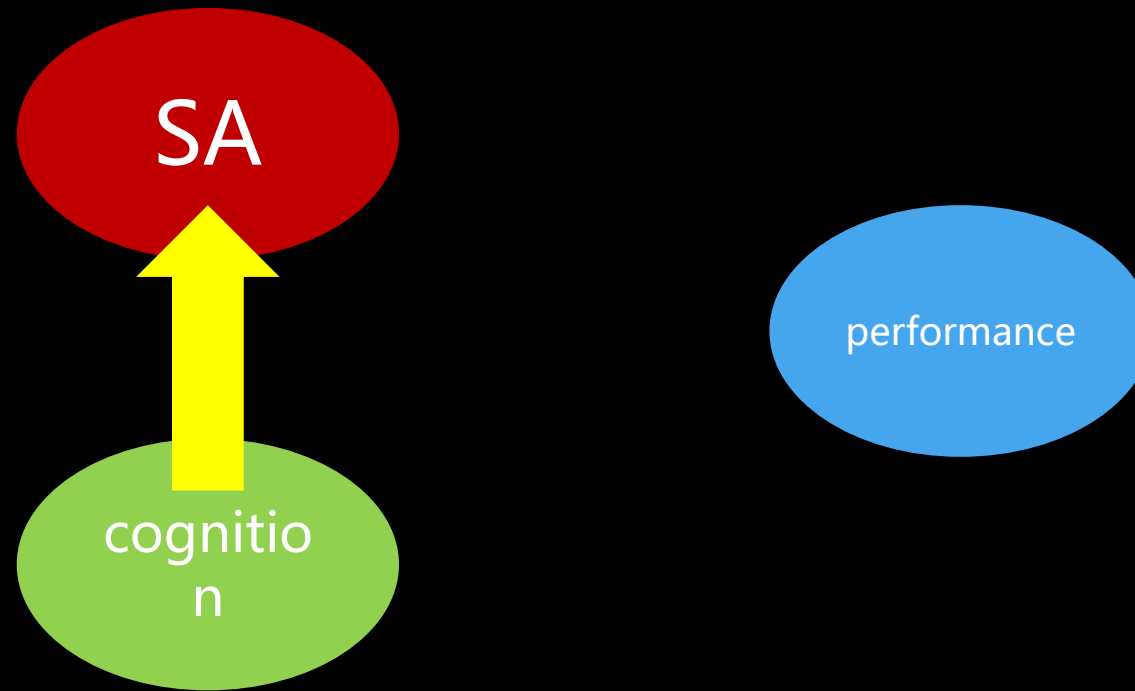
SA

cognition  
n

performance

Is SA just cognition?

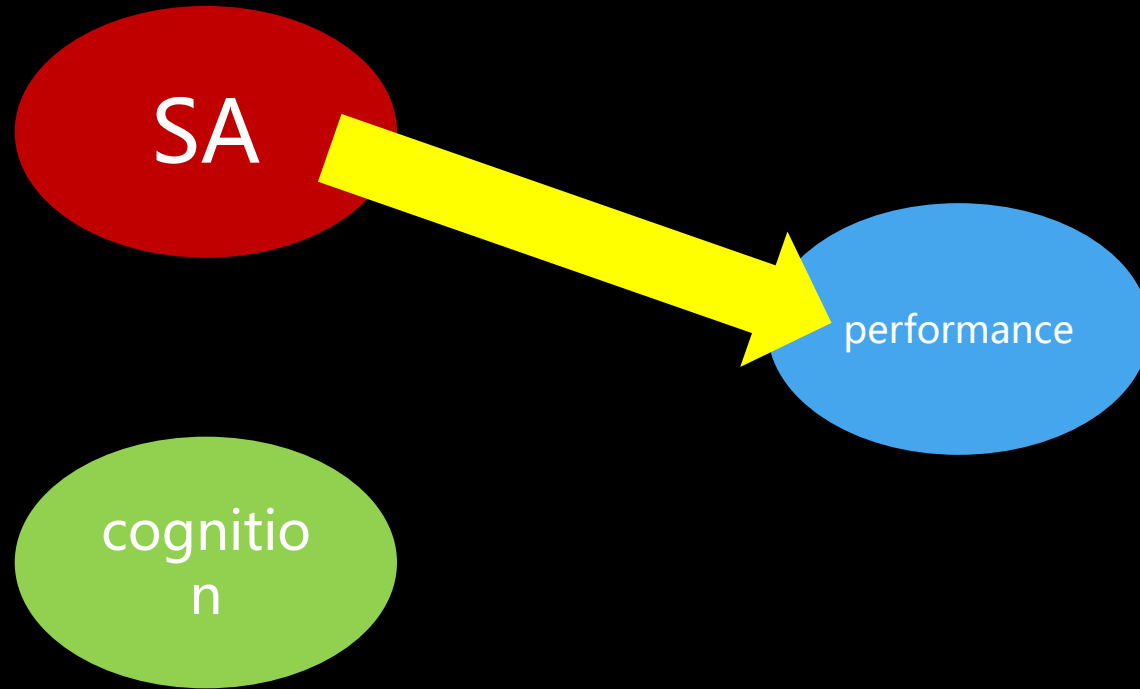
Past studies have looked at relationship of cognition to SA





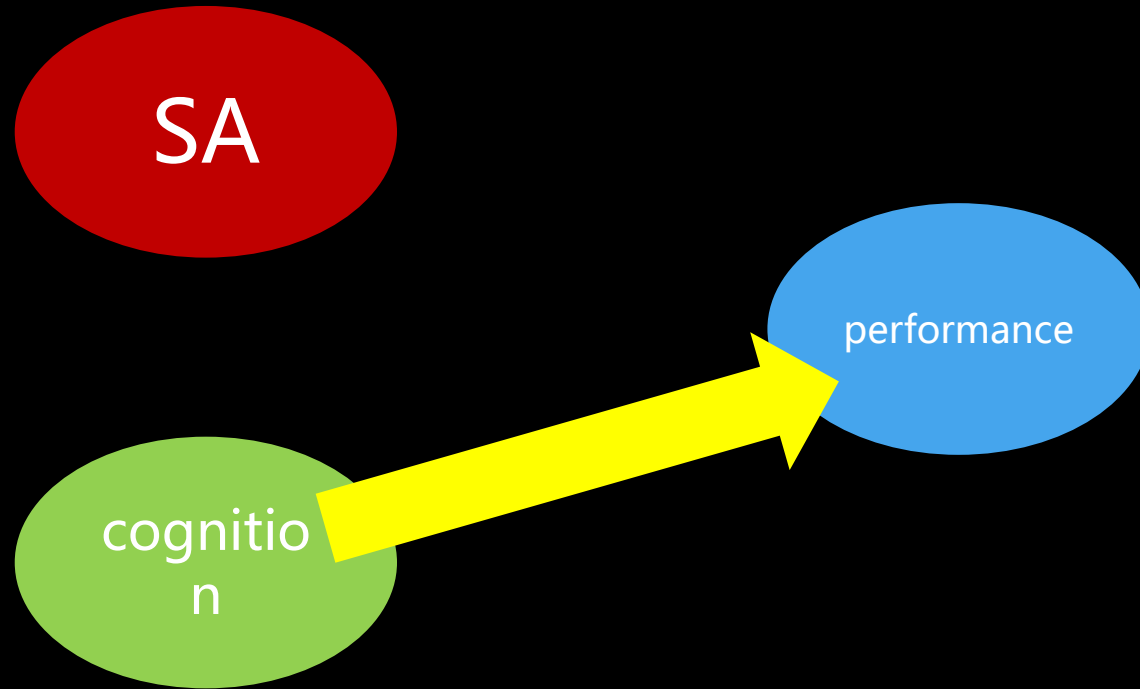
Is SA just cognition?

Past studies have looked at relationship of cognition to SA, or SA to performance



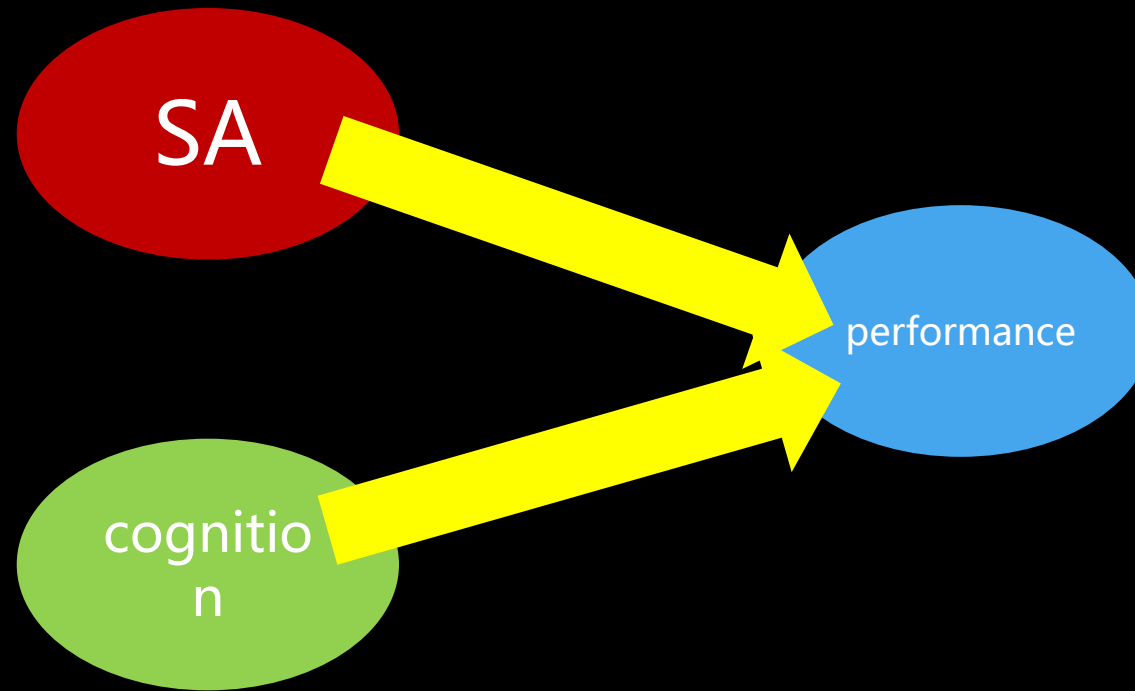
# Is SA just cognition?

Past studies have looked at relationship of cognition to SA, or SA to performance, or cognition to performance



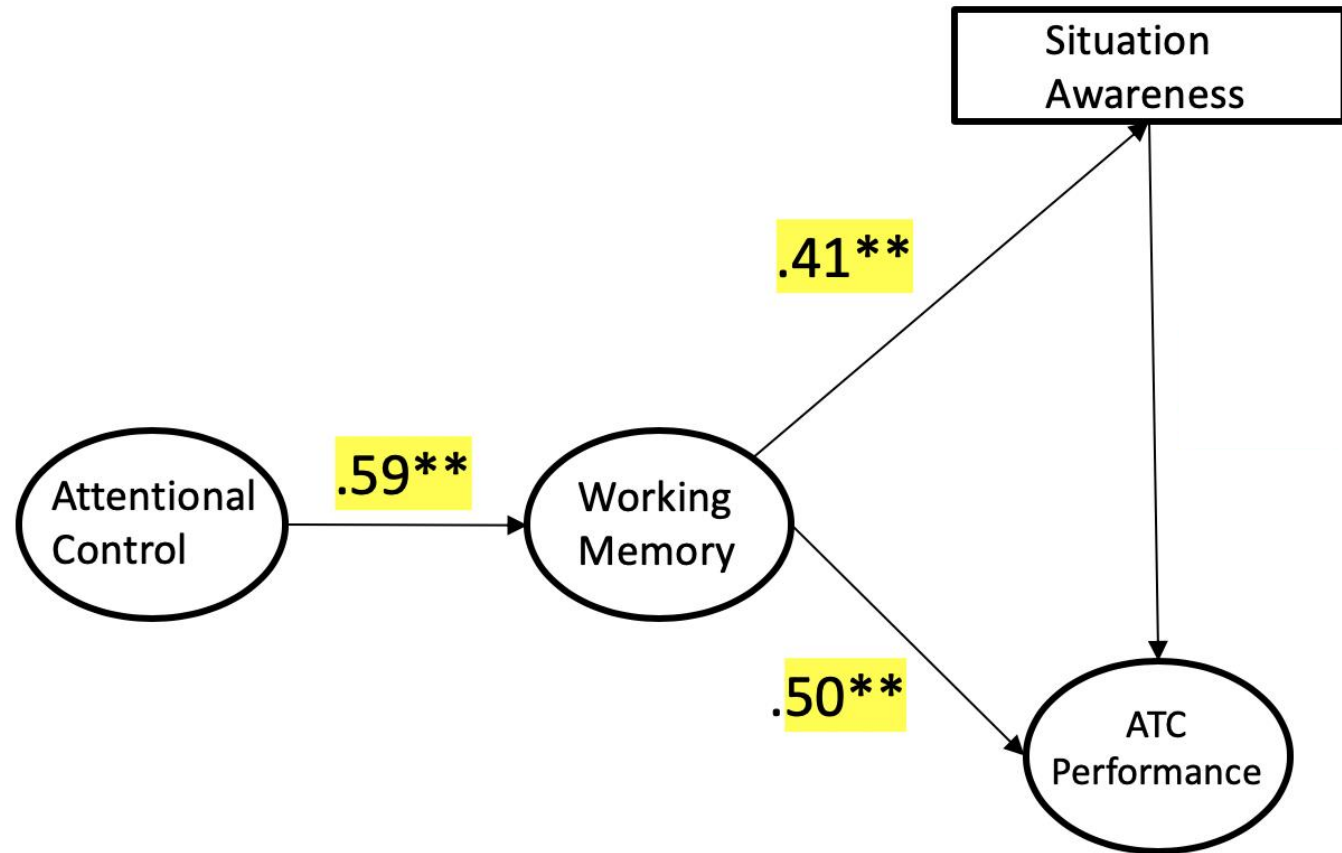
# Is SA just cognition?

To our knowledge, however, no one has looked at all three relationships at the same time...



If SA is not "just cognition" it should still independently predict performance even when cognition is accounted for

# Is SA just cognition?



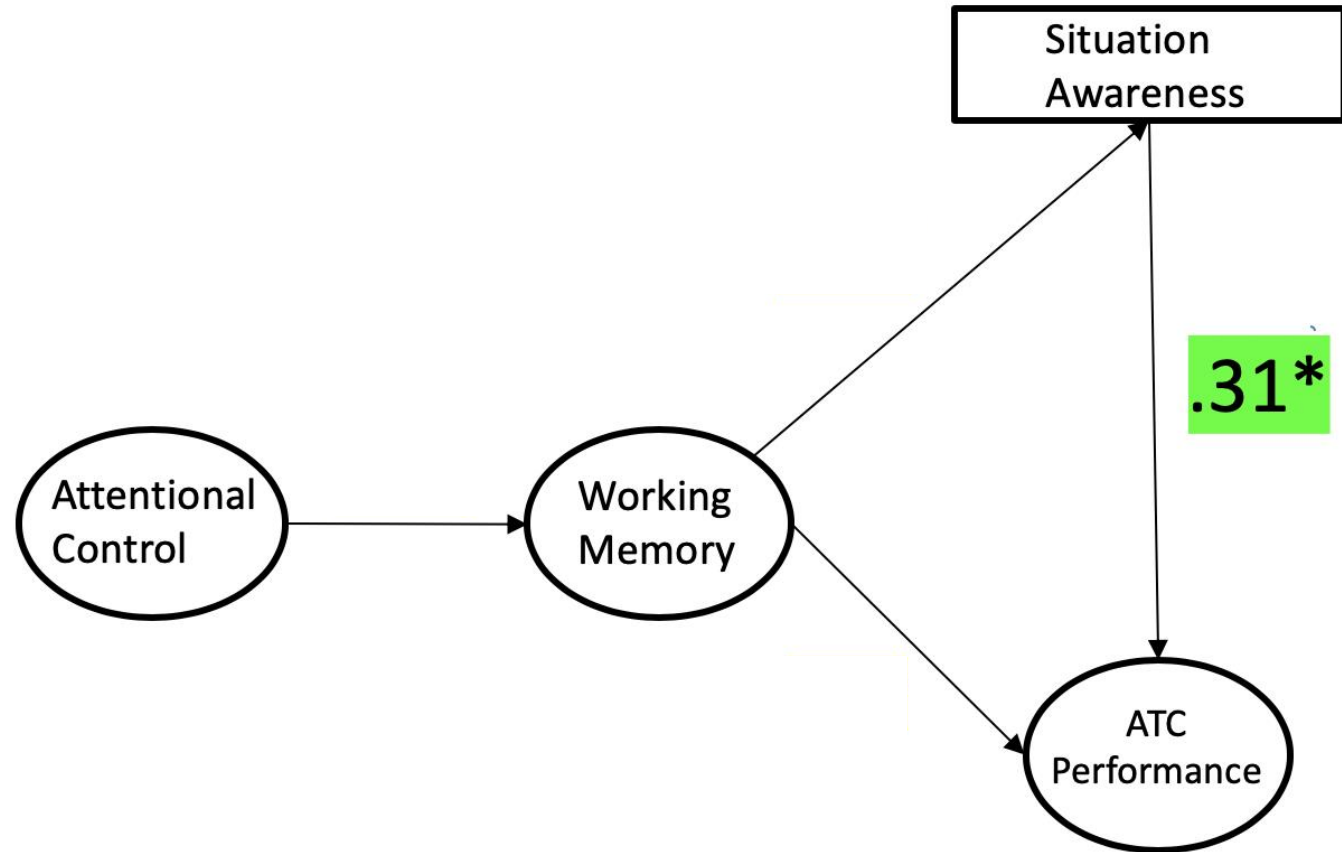
Fit statistics =  $\chi^2(32) = 34.79, p = .67, RMSEA = .02, CFI = .98$

Is SA just performance?

Theoretically, no. SA is a mental model of a situation, but this model will not necessarily ensure good performance

# Is SA just performance?

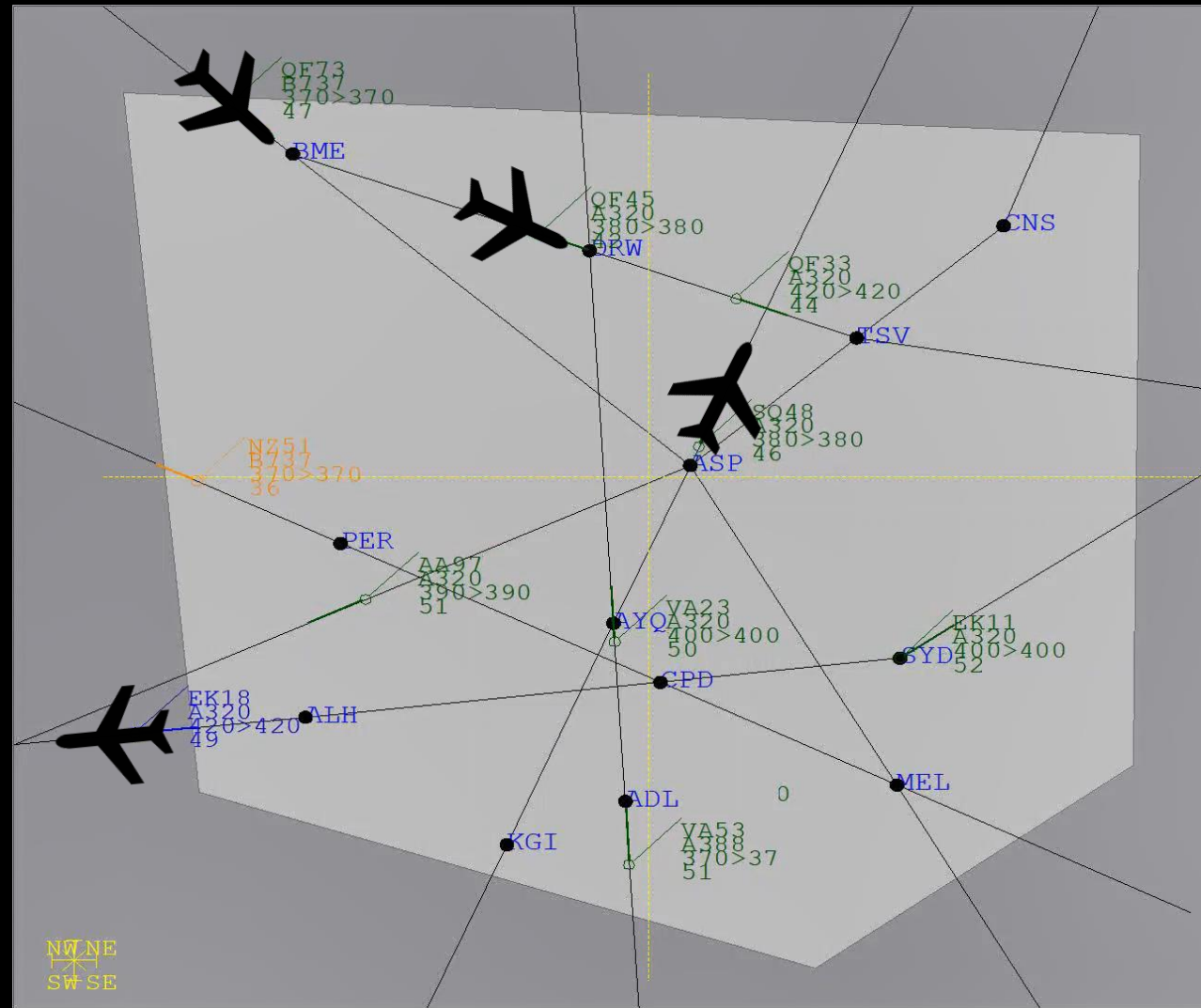
Statistically, no. If SA were just performance then they should be correlated very highly.



Fit statistics =  $\chi^2(32) = 34.79, p = .67, RMSEA = .02, CFI = .98$

Is cognition sufficient for good SA?

A persistent findings was that SA in our unstructured environment was poor even when cognitive ability was high



Is cognition  
sufficient for  
good SA?



This highlights the importance of environmental factors in formation of SA

Understanding and predicting future states in the environment require detecting statistical regularities:

- events that occur at regular times and/or places
- events that require attention and decision-making

These regularities allow correlations to be formed between events that support effective mental models that underpin SA



Is cognition  
sufficient for  
good SA?

One way to enhance this process is by reducing  
uncertainty in the environment (e.g., better sensor data)  
... but this can lead to cognitive overload

Training can impart intelligence and historical information  
that helps to provide structure to chaotic environments  
(top-down)

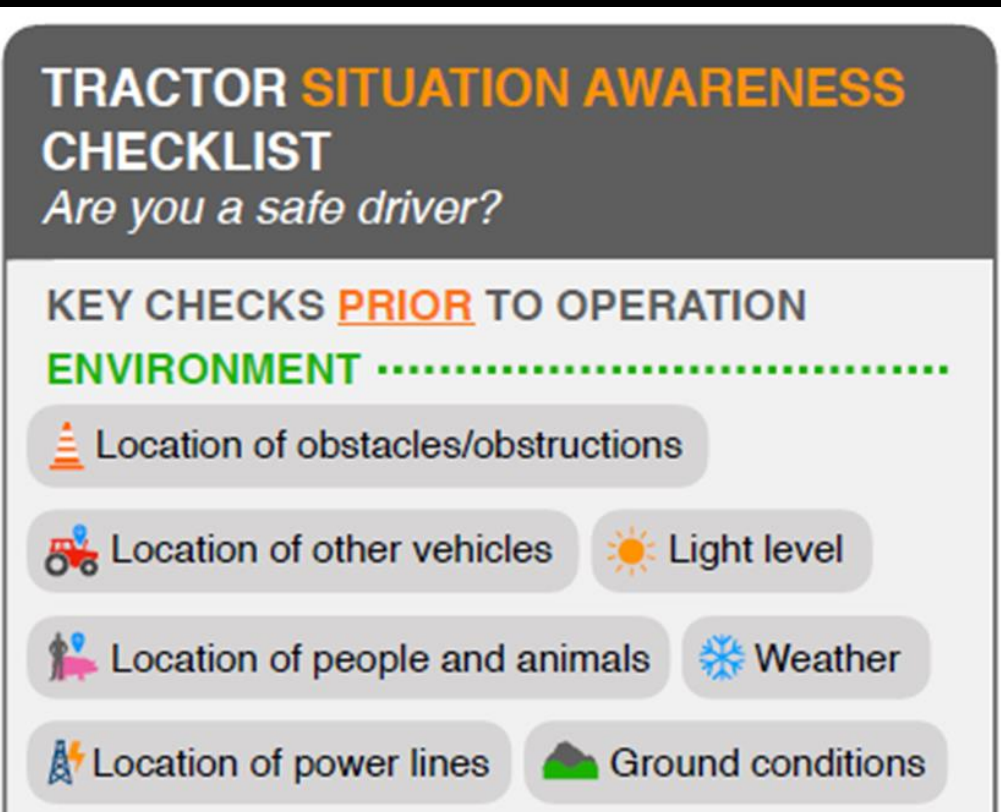
Doctrine also imparts perceptual and cognitive routines  
(i.e., procedures) that facilitate detection of regularities  
and creation of meaningful correlations (bottom-up)



# What does "Good SA" look like?

Shift thinking from SA as:

- Generic
- External
- Synonymous with data/information
- Technology-centric



**TRACTOR SITUATION AWARENESS CHECKLIST**  
*Are you a safe driver?*

**KEY CHECKS PRIOR TO OPERATION**

**ENVIRONMENT** .....

- 🚧 Location of obstacles/obstructions
- 🚗 Location of other vehicles
- ☀️ Light level
- 👤 Location of people and animals
- ❄️ Weather
- ⚡ Location of power lines
- 🌱 Ground conditions

Specific roles and tasks have specific SA requirements

Requirements can be sourced from doctrine, SOPs, TTPs, etc.

See example from agriculture.

## Supporting SA experimentation and benchmarking



Develop realistic and representative scenarios.

This requires optimising and balancing:

- Scenario complexity
- Opportunities for responses and consequences
- Experimental control and repeatability
- Opportunities for measurement

# Selection and Training



Understand role and task specific SA requirements

Selected personnel based on current or potential SA capacity

Implement training programs

- Examine barriers and enablers

Look for synergies with related projects, e.g. Cognitive Employment Standards, Human performance initiatives

# Conclusions



SA is more than the sum of its cognitive parts

Good SA is necessary for good task performance ... but it is not sufficient

Good cognition is necessary for good SA, but so is a "good" environment that supports formation of mental models

SA experimentation requires close collaboration between researchers and Subject Matter Experts

Good quality SA research can assist Army in training, selection, and interventions

# Credits



**Australian Government**

**Department of Defence**  
Science and Technology



THE UNIVERSITY OF  
**WESTERN**  
**AUSTRALIA**



Curtin University



Attention and Human  
Behaviour Laboratory

perceiving | thinking | doing

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