Using advances in Cognitive Psychology to enhance learning

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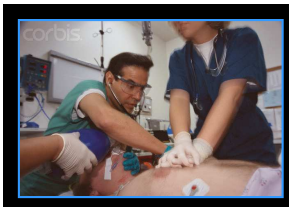
Today's talk

1. Using 'situation awareness' principles to enhance learning in teams
2. Using 'episodic memory' principles to enhance learning from simulation

Team situation awareness during the ICU morning round

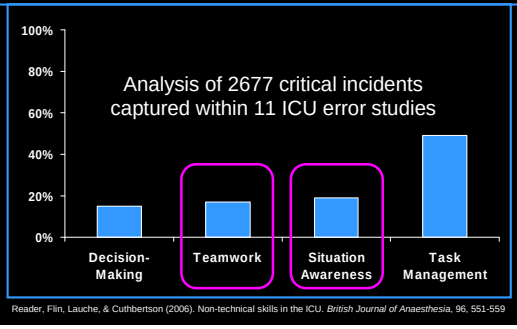


Intensive Care Medicine

- ICU teams provide life saving care to critically ill patients
- The complex, stressful, dynamic and team-centric nature of ICU care heightens likelihood of medical error

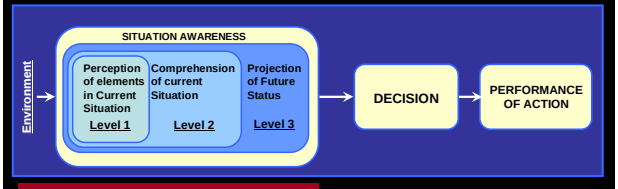
Teamwork and error in the ICU

- 5-10% of ICU admissions experience an adverse event
- Half of incidents caused by "failures in non-technical skills"

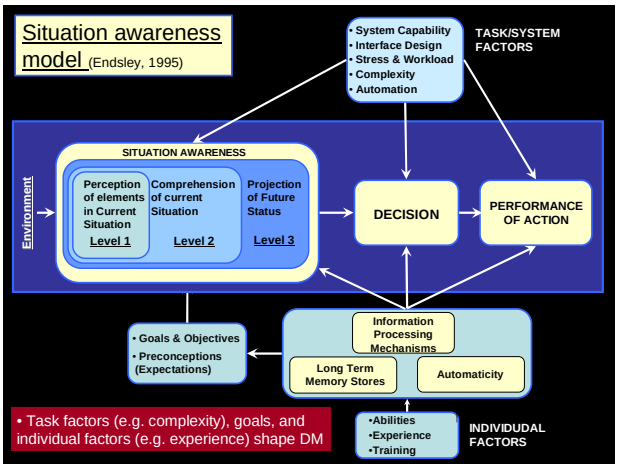


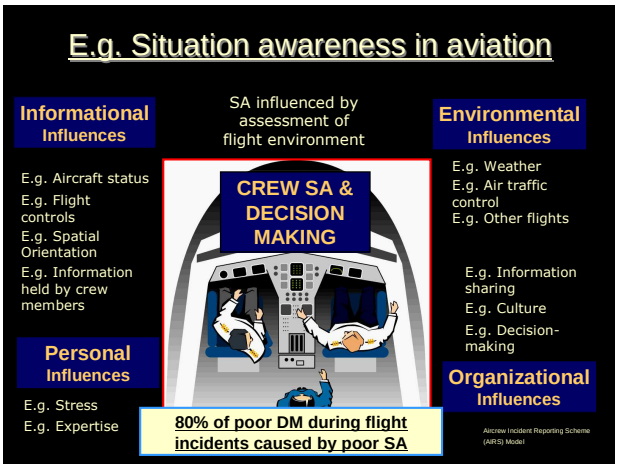
Reader, Flin, Lauche, & Cuthbertson (2006). Non-technical skills in the ICU. *British Journal of Anaesthesia*, 96, 551-559

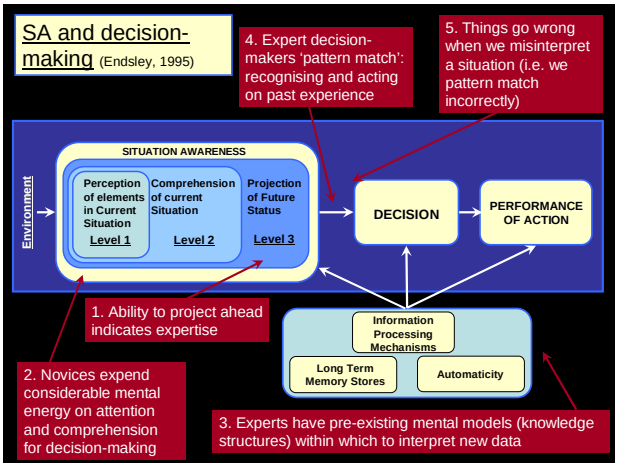
Situation awareness model (Endsley, 1995)

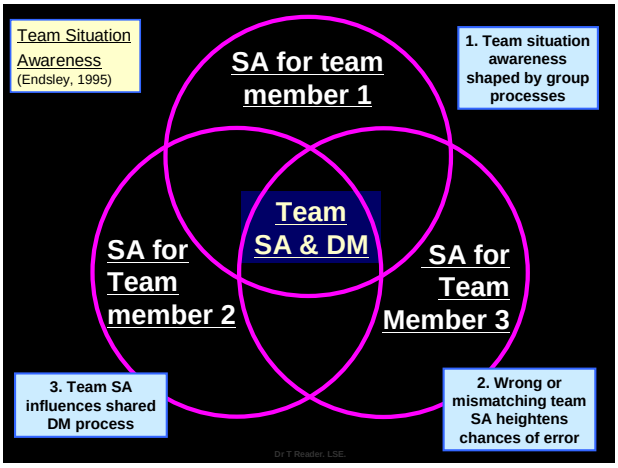


- Perceive information in your immediate environment….
- Comprehend it….
- Think ahead….
- Make a decision….
- Act….









Investigating team situation awareness in the Intensive Care Unit

- Research questions investigated:
  - i. To what do intensive care teams form shared situation awareness during ICU morning rounds?
  - ii. Does participative decision-making influence the formation of team situation awareness

Study method

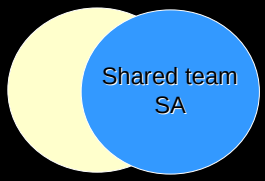
- Real-time data collection of team member situation awareness during the ICU round
- Focussed on team member 'anticipations for patient' outcomes (measured by team members using PDAs)
- Observed interactions during the patient round
- Self-report data on teamwork collected
- Patient outcome data collected

Sample

- 44 ICU team members (forming 37 unique teams)
  - 7 consultants
  - 5 senior registrars
  - 23 junior registrars
  - 9 senior nurses
- Study conducted over a 3 months
- Only patients admitted within 48hrs
- 105 patients

Results: Anticipating patient deterioration:

Team members formed conflicting anticipations (i.e. unshared SA) for 55% of patients



For items on patient discharge, patient survival, and withdrawal of ventilation the team had shared situation awareness for 65% of patients

Reader, Flin, Mearns, & Cuthbertson (2011). Team situation awareness and the anticipation of patient progress during ICU rounds. *BMJ: Quality and Safety, 20, 1035-1042*

Accuracy in predicting patient change

Table 2 Proportion of patients for which the intensive care unit team formed shared anticipations of patient progression, and the accuracy of anticipations for predicting patient outcomes

Situation awareness item	Percentage of patients for which the team formed shared anticipations	Percentage of anticipations accurate for predicting patient outcomes (by team member)			
		Team member			
		Senior doctor	Senior trainee	Junior trainee	Senior nurse
Discharge likelihood	64	65	77*	61*	66
Deterioration likelihood	45	75*	70	59*	60*
Ventilation likelihood	64	70	67	69	69
Survival likelihood	65	67	65	65	63

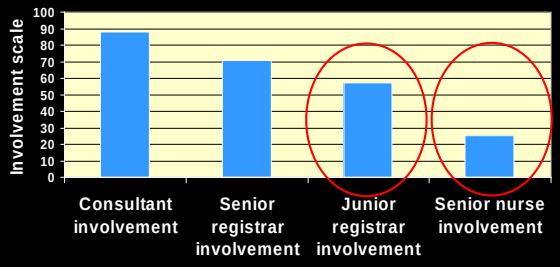
N=105 patients.
*Significantly different at $p<0.05$.

Reader, Flin, Mearns, & Cuthbertson (2011). Team situation awareness and the anticipation of patient progress during ICU rounds. *BMJ: Quality and Safety, 20, 1035-1042*

Conclusion 1.

- Team members frequently form divergent cognitions for patient status
- This occurs for more subtle aspects of a patient's condition
- Qualitatively divergent anticipations of patient change (i.e. deteriorating/improving) indicates team members to have a different understanding of a patient's condition/treatment to the rest of the team
- Junior trainee doctors are most likely to diverge
- Consultants most accurate in predictions
- Implications for safety and learning?

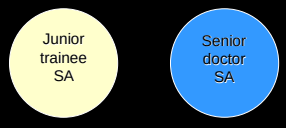
Involvement in the morning round decision making process



Teamwork and shared SA for anticipating patient change during the round

Anticipating patient deteriorations:

Increased involvement of junior trainees in DM influences formation of shared SA with senior doctors



R = .19; P < .001

Anticipating patient deteriorations:

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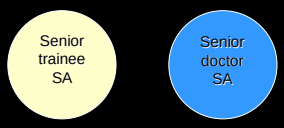

R = .07; P < .05

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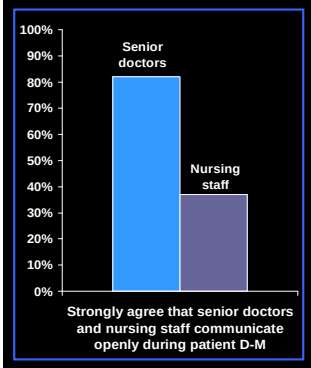
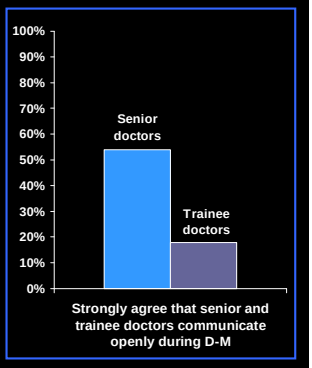
Earlier research shows team members to have different 'norms' on communication behaviour



Strongly agree that senior doctors and nursing staff communicate openly during patient D-M



Strongly agree that senior and trainee doctors communicate openly during D-M

Reader, Flin, Mearns, & Cuthbertson (2007). Multidisciplinary Communication in the ICU. *British Journal of Anaesthesia*, 98, 347-352

Conclusion 2.

- Junior trainee doctors are more likely to form shared SA with consultants when they are involved in decision-making during the round
- This is presumably due to the round being used as a teaching event
  - Trainees can ask questions and investigate patient decision-making
- Considering the crudeness of the measures, this might also be true for other team members
- Self-perceived involvement in the round is closely linked to role hierarchies
- Implications for safety and learning?

Using episodic memory principles to enhance learning in simulation

Endel Tulving

Simulation

- Increasingly being used to aid training
- Experiential form of learning, whereby trainees 'experience' and learn from an event
- Safe learning space
- Different from 'rote learning' or 'case learning'
- Fidelity can be low or high, but belief in the scenario appears important

Effectiveness of simulator training is not consistent.

Often successful, e.g.:

- Boet and colleagues (2011) found anaesthetists to retain cricothyroidotomoy skills up to 1 year after simulation
- ACLS training can result in improved performance over time (Morgan et al., 2009)
- Simulator training can improve real-life performance of cardiopulmonary bypass (Bruppacher et al., 2010)

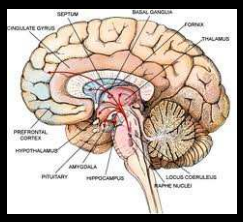
But

- Simulator training can result in no improvement in the performance of oesphageal intubation (Olympio et al., 2003)
- Participants of simulator training often hit a 'ceiling' whereby further training sessions (after the first) do not improve skills for crisis management (Yee et al., 2005)

How can cognitive psychology help us to utilise simulator based-training?

Episodic memory

- The cognitive mechanisms underlying experiential learning are distinct from those used in 'rote' learning
- In effect, we 'tie' aspects of an 'episode' together, including:
  - Visual characteristics
  - Smell and taste
  - Emotional and physical sensations
  - Behaviours undertaken
  - The behaviours of others
  - Triggers of action
  - Knowledge learnt



- Consider:
- What were you doing when you heard Princess Diana had died?)
- The last play you went to

1. We encode and recall 'episodes' holistically (e.g. knowledge, physical skills, and the place they were learned)
2. Episodic memories are triggered automatically (e.g. an environment cue) or through conscious search (recall)
3. An event need only be experienced once to be remembered: but we have little control over forming memories (the event is key)

Simulation and episodic memory

- Simulators try to aid learning through developing and utilising episodic memories (where skills, knowledge, and situational cues are tied together)
- But the deployment of skills learnt in training to real-life will surely depend on:
  - The ability to recognise cues within a real-life episode that are analogous to a simulated episode
  - Recollection of the strategies used to manage that episode

Conclusion 3.

- Simulator training is highly episodic in nature, with the event shaping the memory
- We must use knowledge of episodic memory systems to understand the impact of simulator training upon real life-performance
- It may be useful for explaning why simulation works
- Furthermore, we should use advances in cognitive science to improve the design of simulated training scenarios
  - For example an analysis of simulator studies has shown…

Factors that enhance episodic memory during simulation

Steps	Description
Scenario memorability	Simulator training scenarios that are distinct or noteworthy in some dimension (e.g. novel, enjoyable) may enhance the memorability of the cues connected with that scenario and the relevant behavioural strategies. This appears particularly important for the simulation of rare anaesthetic events
Similarities between simulation and practice	To support anaesthetists recalling the decision-making strategies used to manage an event in simulation, the cues designed to influence decision-making in a simulator scenario should demonstrate high-fidelity in order to prompt recognition and recall in practice
Debriefing participants	Video-supported debriefing after simulator training will provide anaesthetists with the opportunity to (i) note the key situational cues and associated problem-solving strategies associated with a particular anaesthetic scenario, and (ii) unconsciously consolidate and rehearse their memories for key elements of the training episode
Avoiding overly complex training scenarios	For training scenarios that are overly stimulating or complex, learning for routine aspects of scenario management may be sub-optimal due to participant's being overly focused on situational context (e.g. managing stress) and not problem-solving. This is particularly the case for trainee anaesthetists, who may become overwhelmed by the pressure of a training episode
Incrementally introducing new problem-solving tasks	For training intricate problem-solving or technical skills, dividing scenarios into smaller elements may aid learning. Specifically, incremental problem-solving will allow participants to identify and learn solutions for the different problems that may be faced during a complex anaesthetic scenario. This will be especially beneficial for trainees. However, for crisis management training, training events should unfold as they would in reality (i.e. managing a crisis until its conclusion)
Refreshing the content of training scenarios	To continually enhance the technical or non-technical skills of anaesthetists, new and challenging training scenarios will need to be developed. Participants who attend repeated anaesthetic simulated training events may reinforce, but not further develop, the skills learnt during the initial stages of training

Reader, T. (2011). Learning through high-fidelity anaesthetic simulation: the role of episodic memory. *British Journal of Anaesthesia*, 107, 483-487.

Summary

- Cognitive psychology principles may be highly useful for understand and developing training
  - Firstly, research on team situation awareness shows how interactions between team members shapes cognition (and learning) on the ward
  - Secondly, episodic memory theory is insightful for showing how training in the simulator can be transported to the real world

Questions?

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