

# Please read this before using presentation

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# Key learnings in human factors from the aviation industry

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# Human Factors lessons from Aviation Research

Never Stand Still

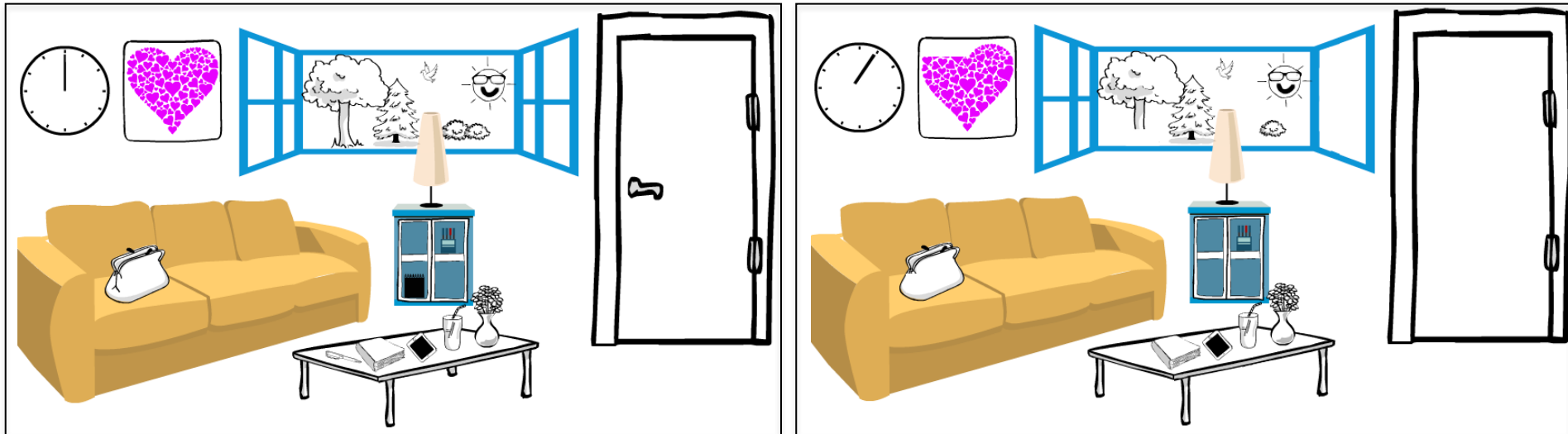
Science

School of Aviation

# Before I Begin – A small task

- Can you spot 10 differences between the two images.
- Time limited – 30 seconds

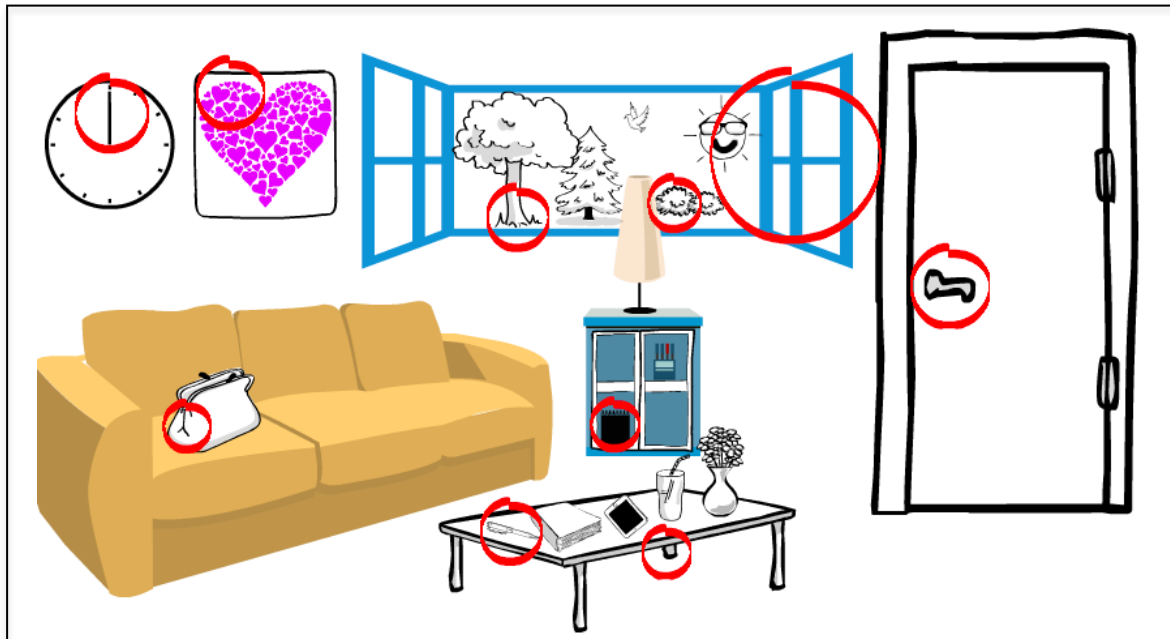
# Spot the Difference – 10 items



# Spot the Differences

**End**

# Spot the Differences – Solution



# Human Factors - cause and effect



Note: Original pictures of Star Wars have been removed due to copyright



# Human Factors - cause and effect

- High tech.
- Sophisticated metal device with a metal flap and buckle.
- Educated users.
- 4 types of seat belts – 3 x flap styles.

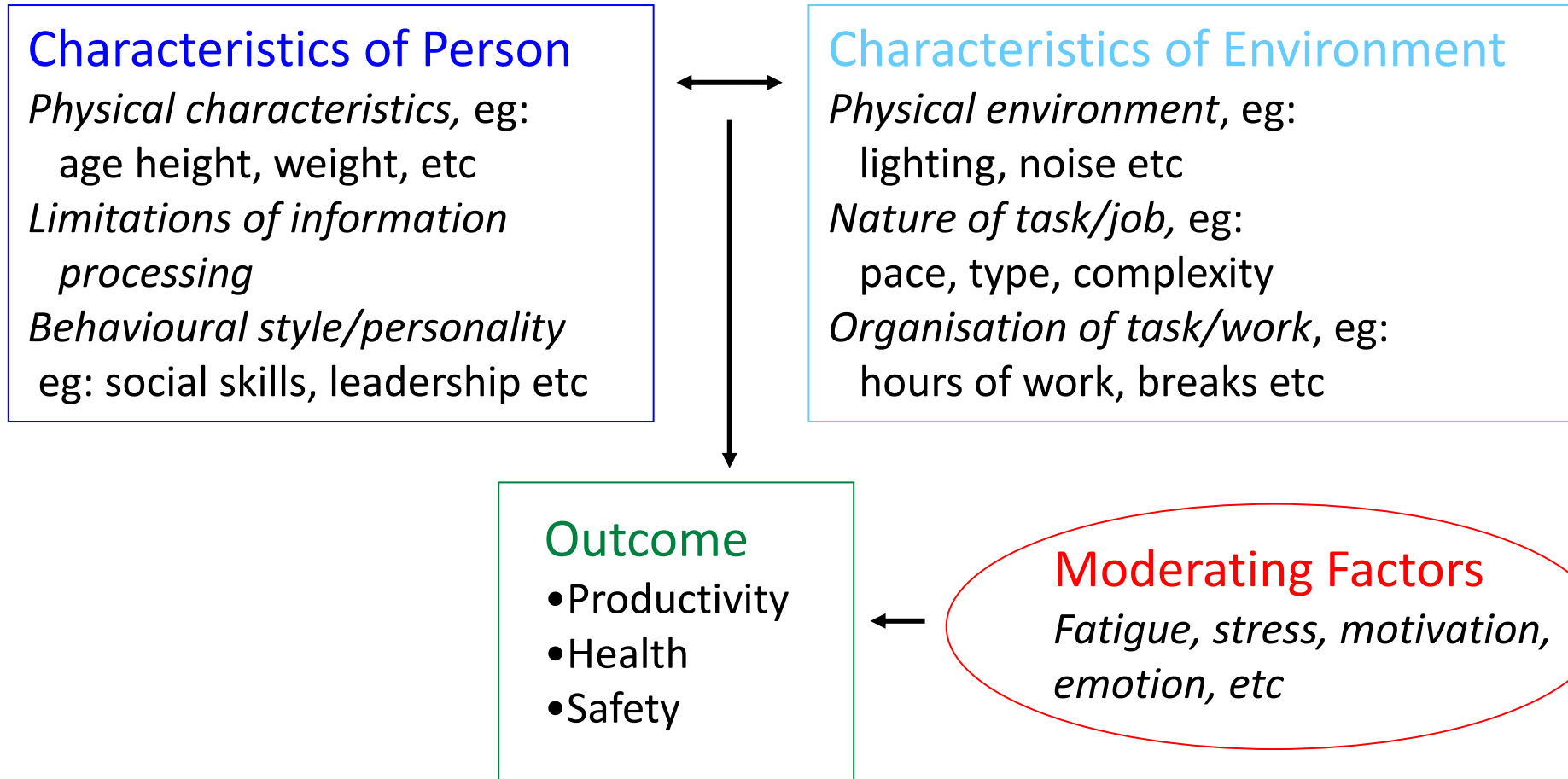


# Human Factors- cause and effect

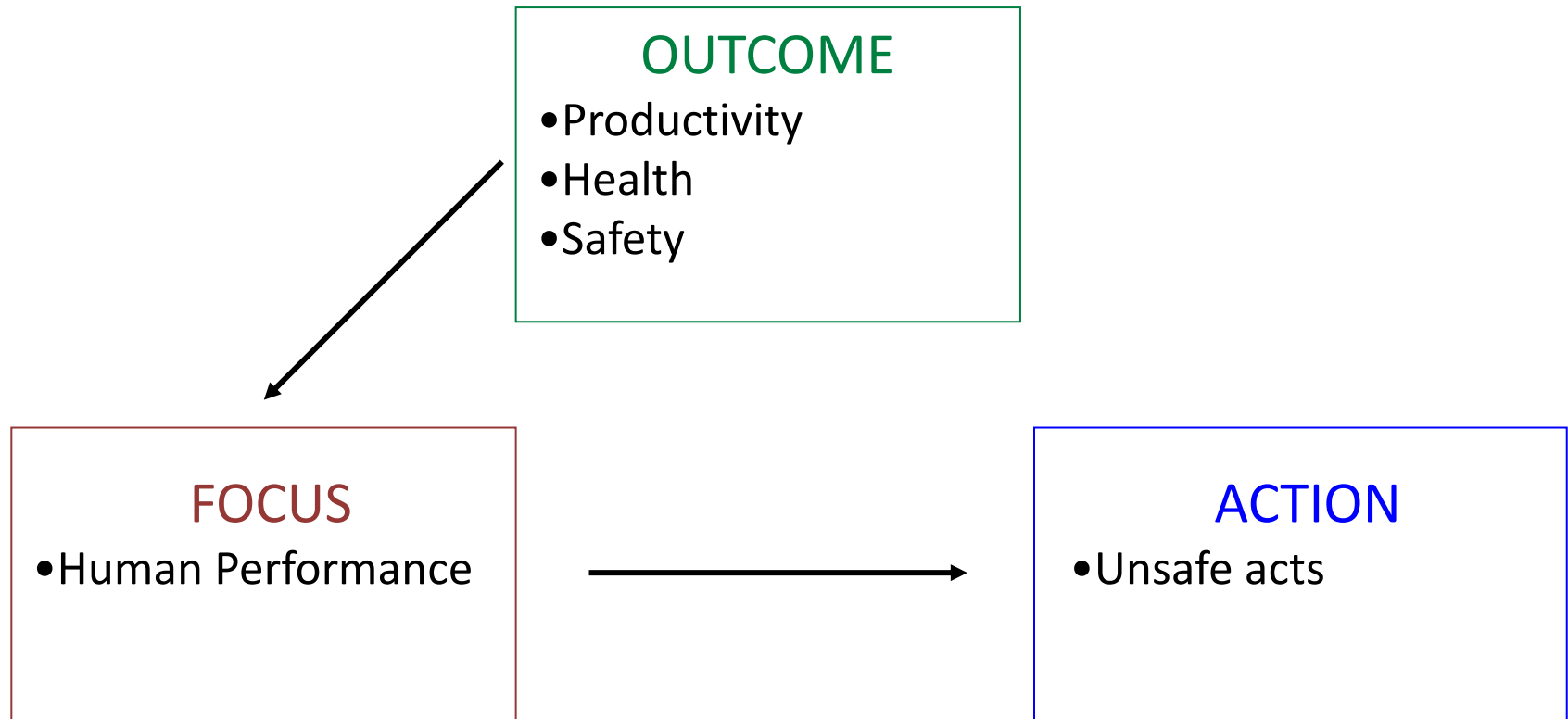
- 3 x flap styles.
- No information about different types.
- No information about angle to open.
- Under stress, attention narrows.
- Panic, performance non-normal.



# Person Environment Fit Model



# Human Factors



# Action (or inaction)

## Unsafe act

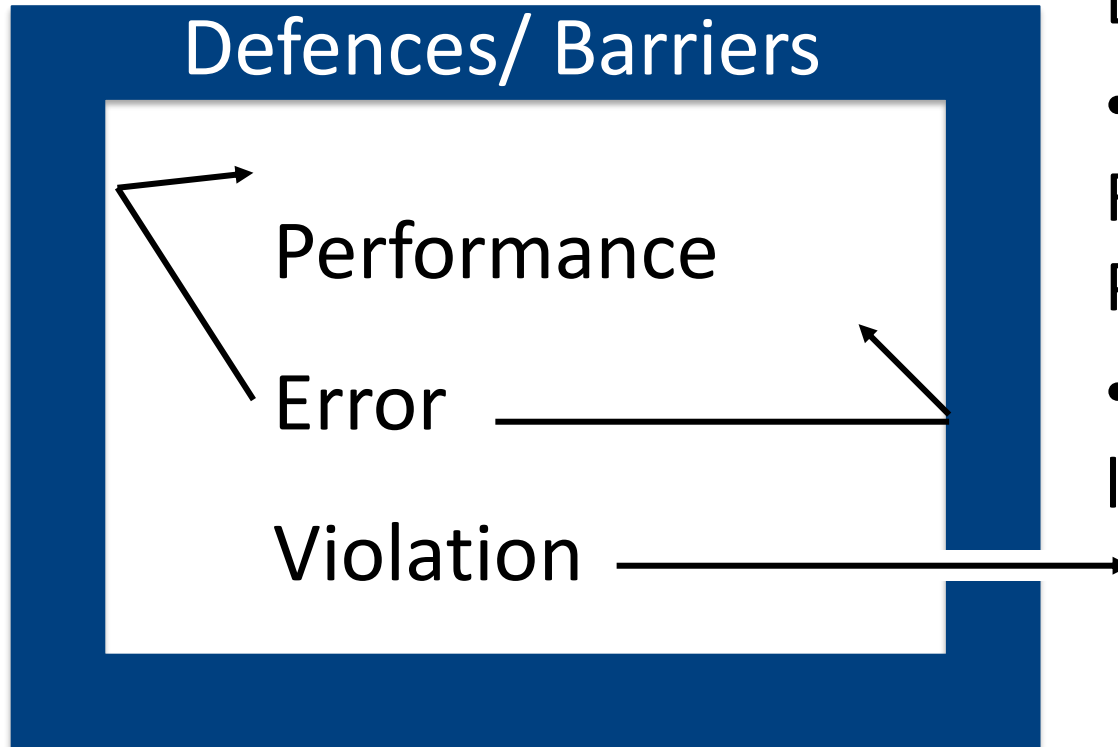
- Unintentional vs. Intentional action
  - Do not confuse action with outcome

# Action (or inaction)

## Unsafe act

- Errors – action or inaction (unintentional)
- Violations – performance optimising (or sabotage)
  
- Errors test defences
- Violations circumvent defences

# Action (or inaction)



## Defences/ Barriers

- Soft – Rules, Regulations, Procedures ...
- Hard – Barriers, locks, equipment...

# Errors & Violations

- Errors test defences
- Violations circumvent defences

Negative outcome:

- Errors strongly related
- Violations weakly related

Combination

- Violation and error



# Bad Reputation - Errors

## Errors

- One of the best learning opportunities
- Divorce consequence from error

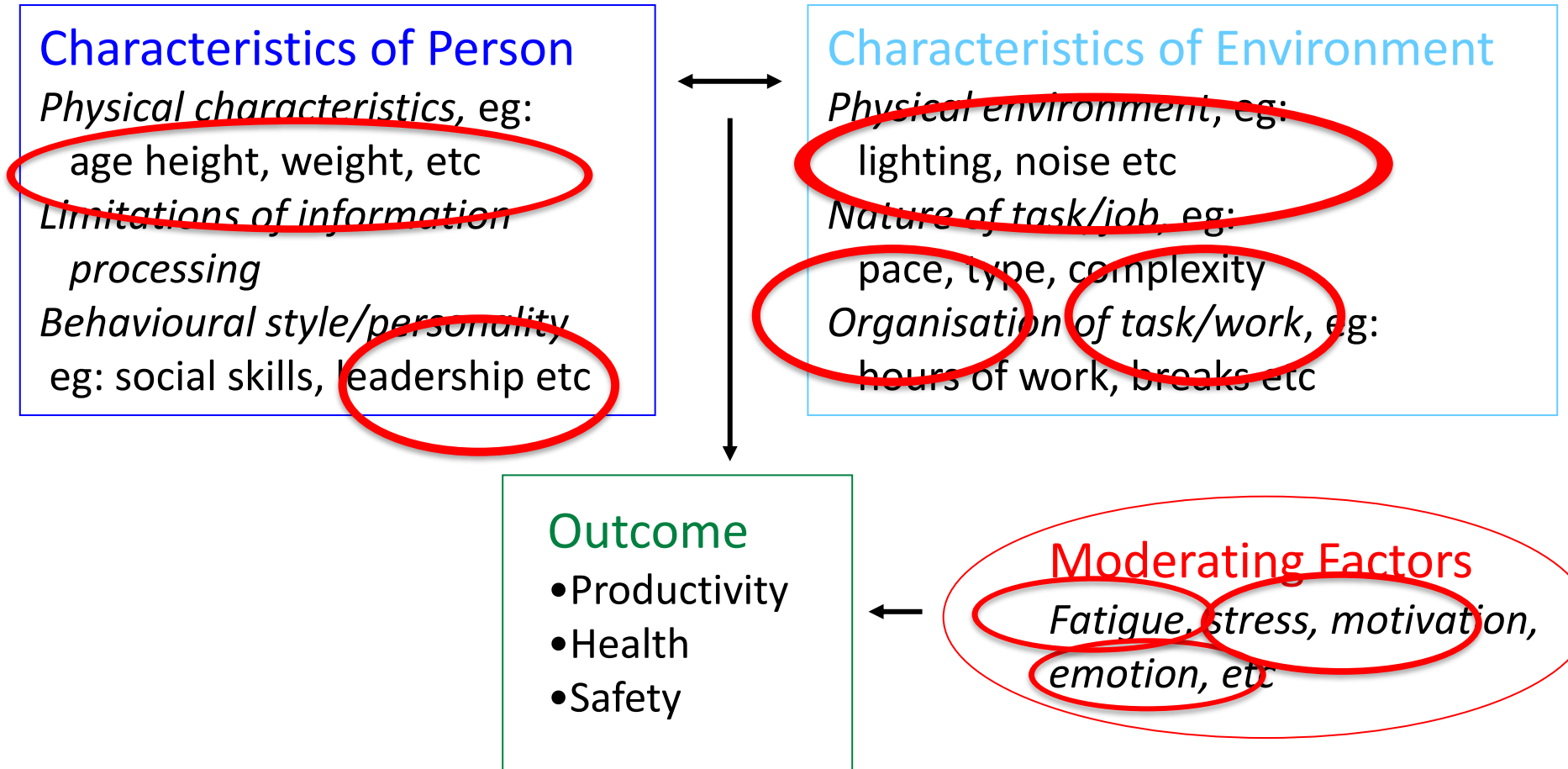
# My Focus

- Understanding human behaviour that leads to errors (or violations)
- Design/redesign (equipment, systems, training, processes, etc) to capture, eliminate, or reduce errors.
- Build defenses in system/s to divorce the consequences from the error.

# Research Areas

- Aircraft cabin safety (communication) - Mood, memory, skills,
- Pilot training,
- Pilot communication - Workload, rate of speech, content, congestion,
- Pilot selection - Explicit vs. implicit scales,
- ATC automation - Use, acceptance threshold,
- Pilot performance – Caffeine.

# Person Environment Fit Model



# Moderating Factors - Mood



# Spot the difference – 10 differences, 30s

Note: Intentionally a blank slide

# Spot the Difference – 10 items

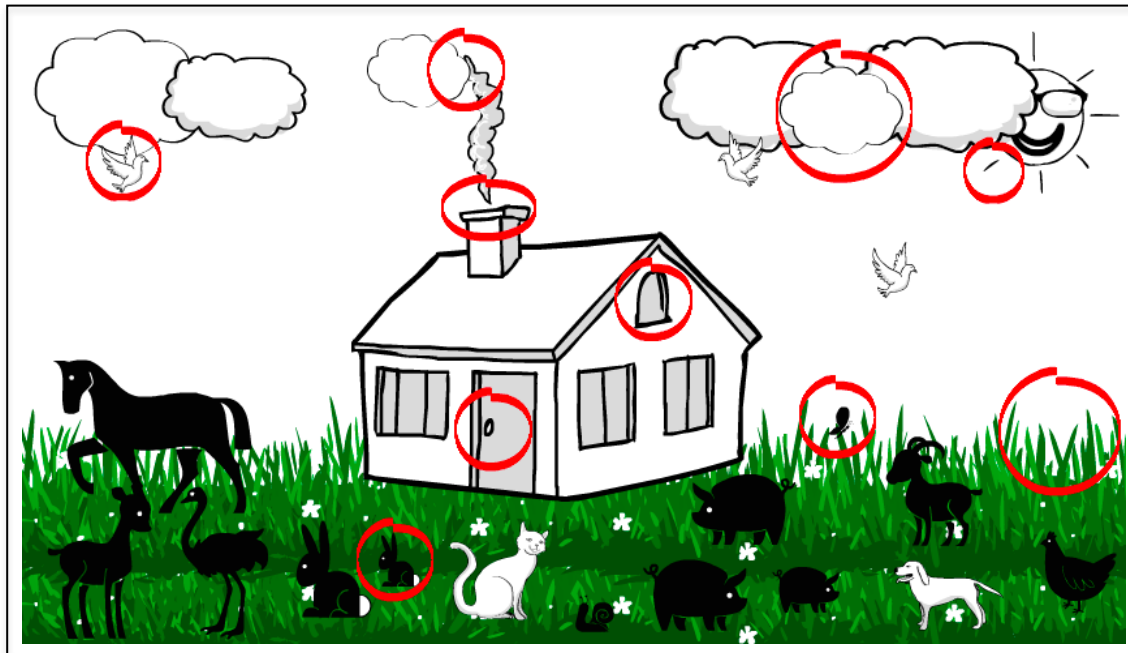


# Spot the Differences

**End**



# Spot the Differences – Solution

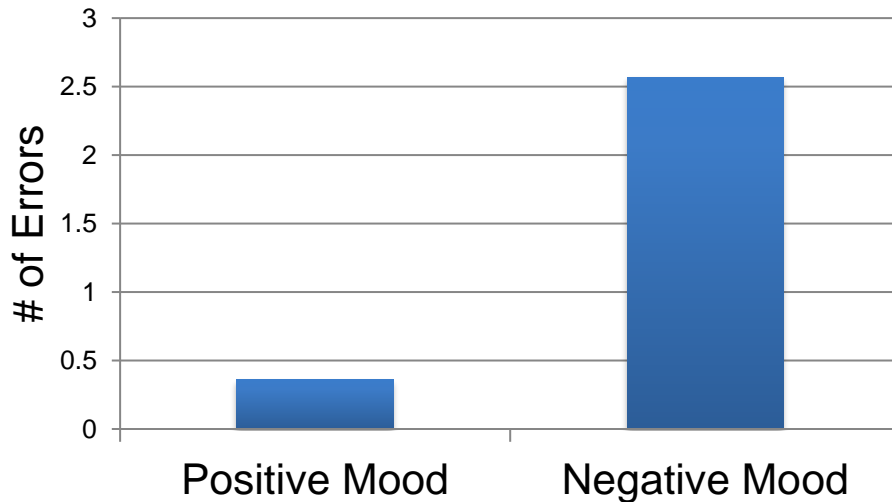


# Mood and Performance – Aviation safety

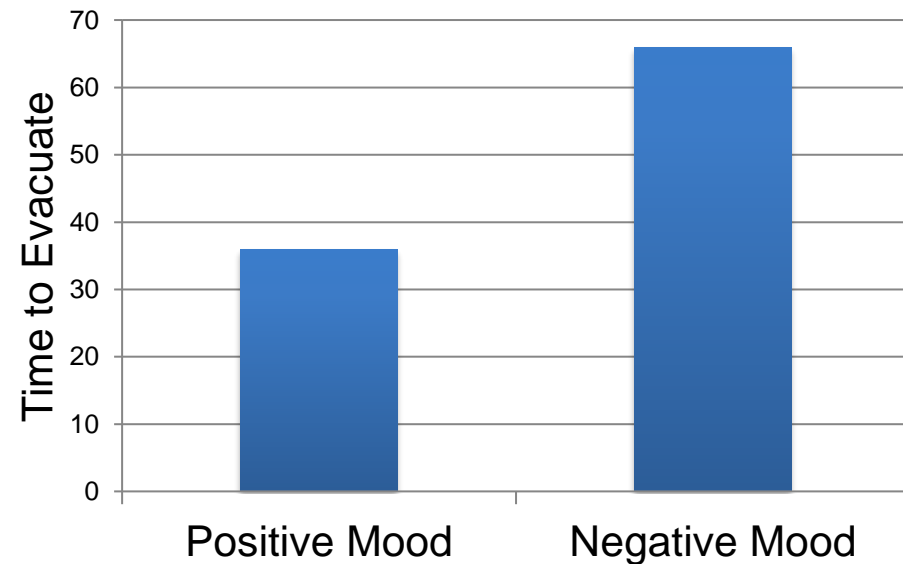
- Known stressor – mood & emotion
- Positive mood = positive performance
- Negative mood = negative performance
- Mood manipulation simple – praise & humour

# Mood and Performance – Aviation safety

No. of Errors distributed across Mood Manipulation



Evacuation Time distributed across Mood Manipulation

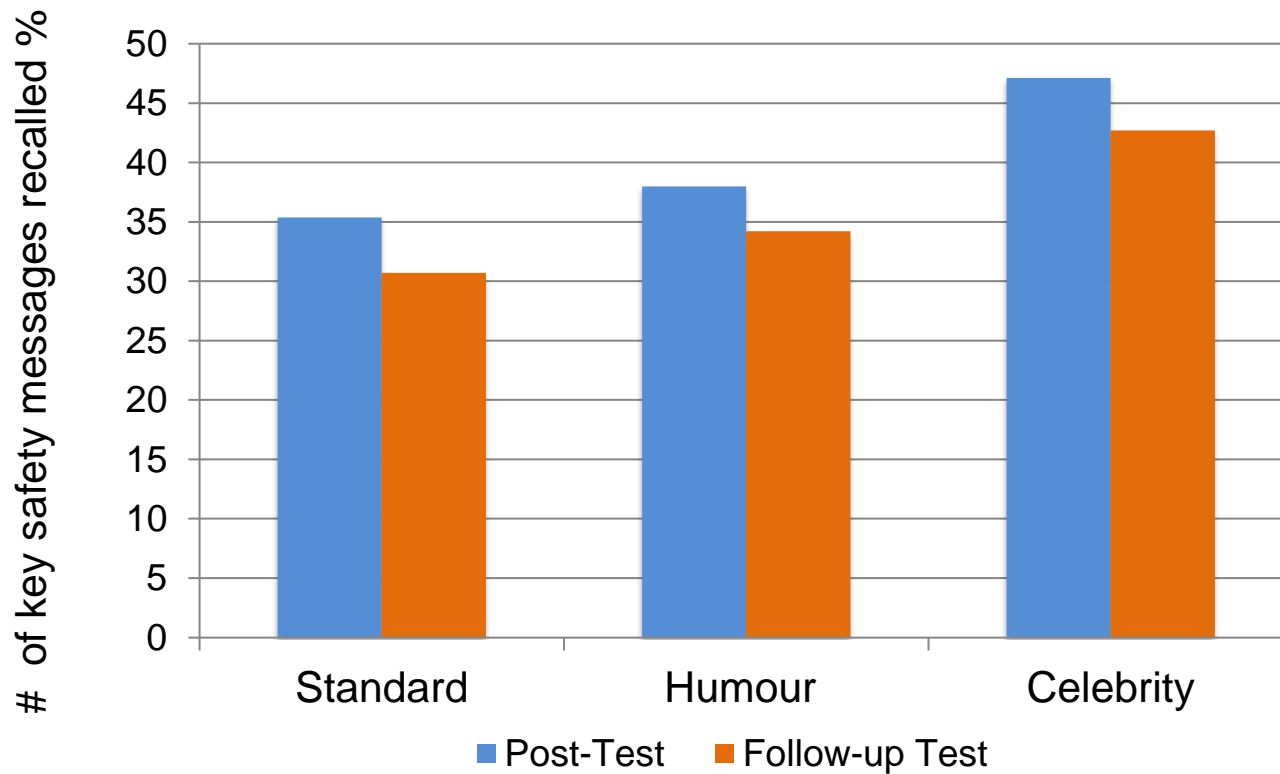


# Moderating Factors – Mode of presentation

- Who or how the information is delivered can affect performance – recall
- In-flight cabin safety briefing:
  - celebrity, humour, movie theme

# Moderating Factors – Mode of presentation

Recall of Key Safety Messages distributed across Briefing Style and Time



# Moderating Factors – Mode of presentation

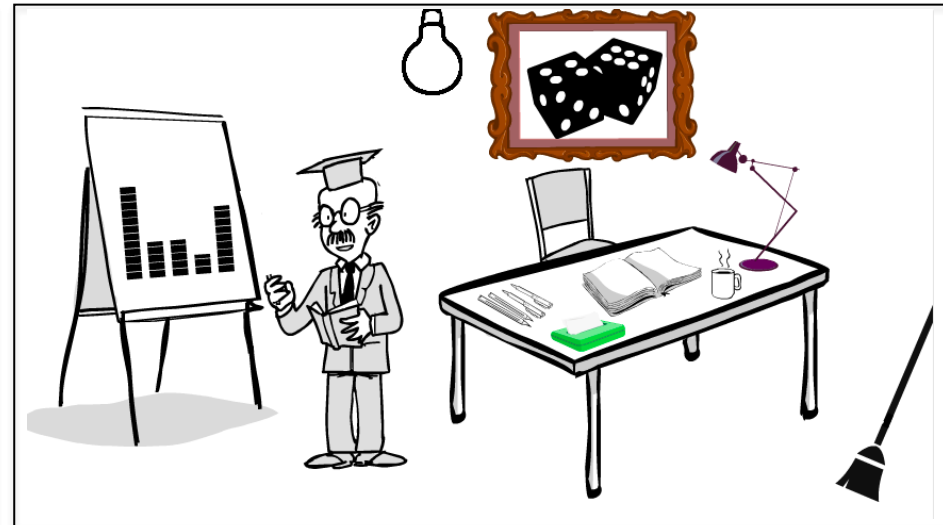
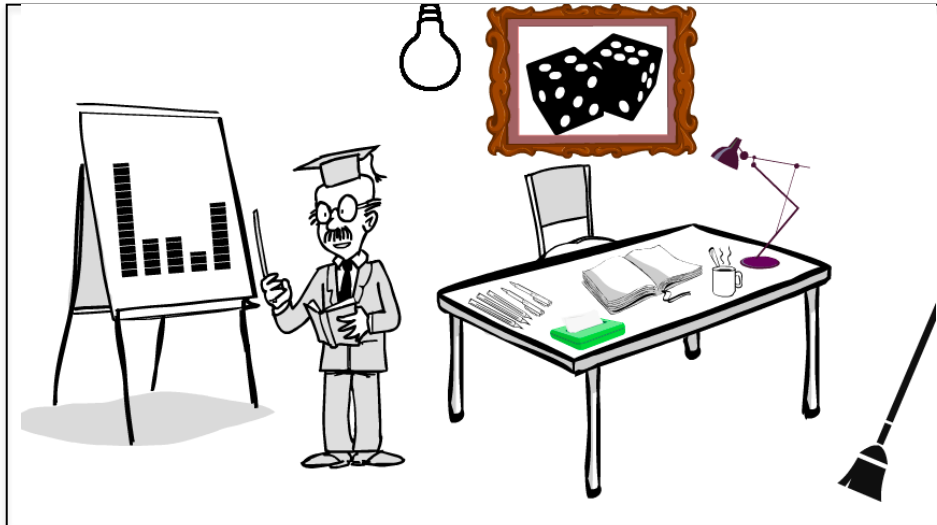
- Celebrity most effective – providing celebrity is recognised.
- Why – respect and admire / want to be liked.
- Humour not as effective.
  - Humour limits information processing - paired with key safety
  - Why magicians / illusionist so effective.

# Spot the difference – 10 differences, 30s

- Noise, 65 dBA of reproduced aircraft noise.



# Spot the Difference – 10 items

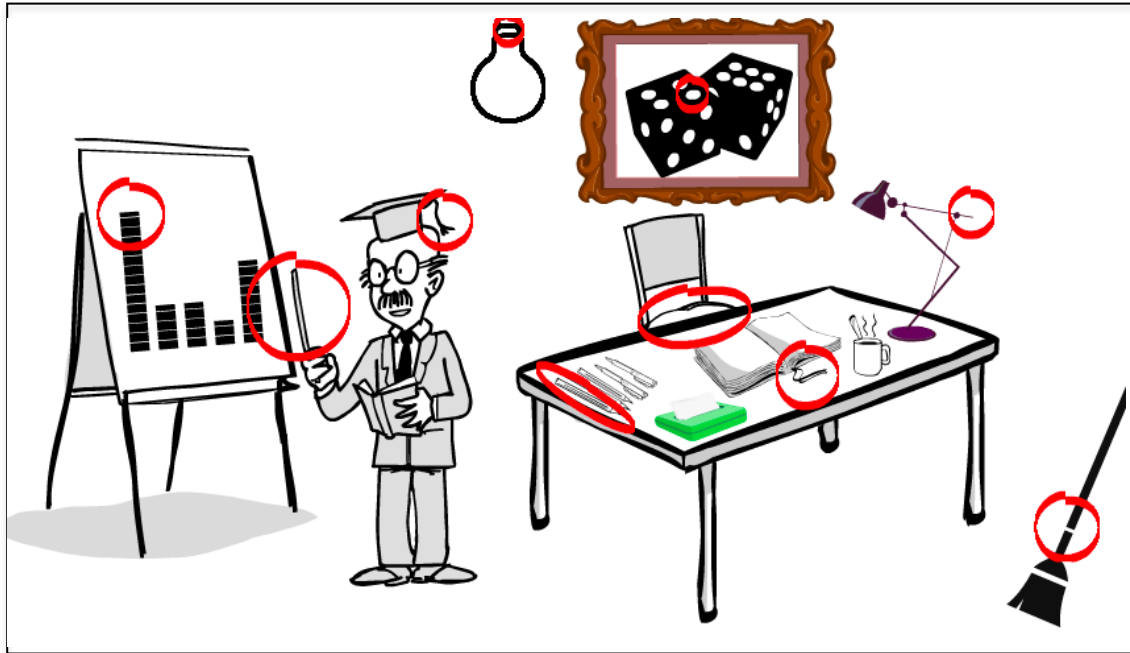




# Spot the Differences

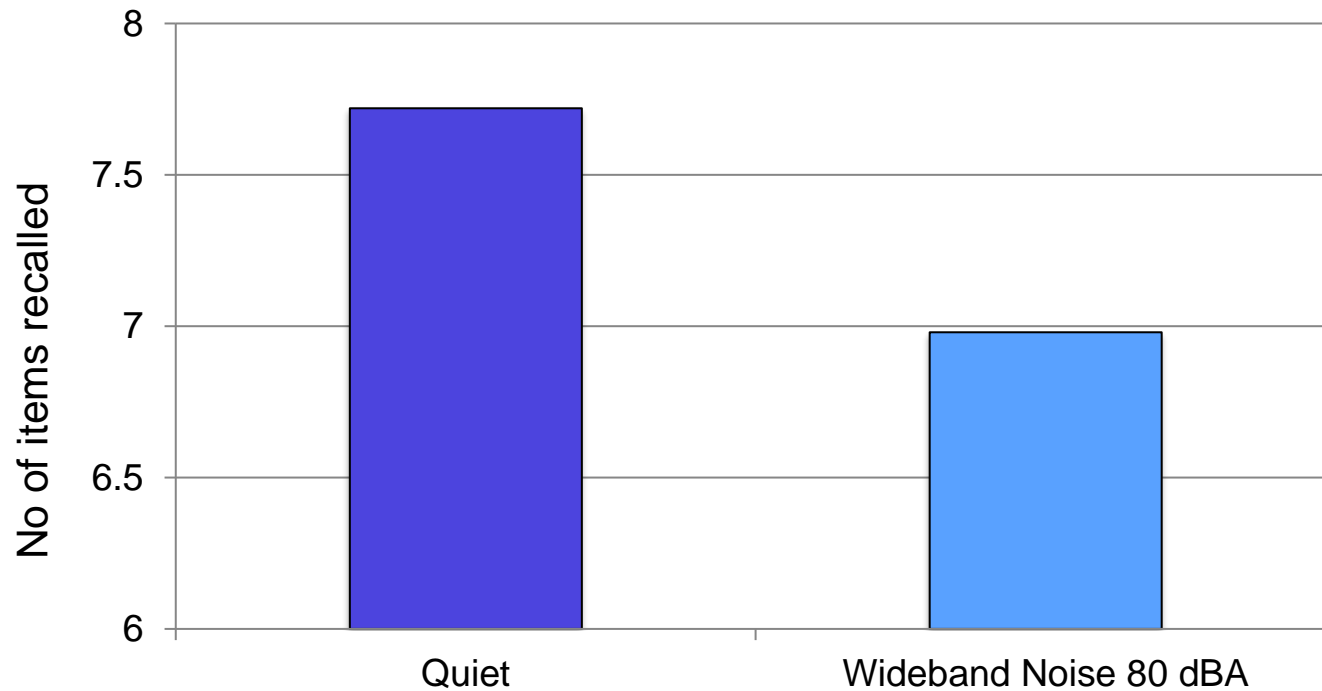
**End**

# Spot the Differences – Solution



# Results – Number Correct

## Recognition Memory – Cued-Recall Task (90 Sec of information)



# Moderating Factors – Noise

- Noise – mask information + consume working memory
- Working memory is limited (process limited information, similar to RAM with computers)
- Noise is processed unconsciously
- Noise adversely affects cognition



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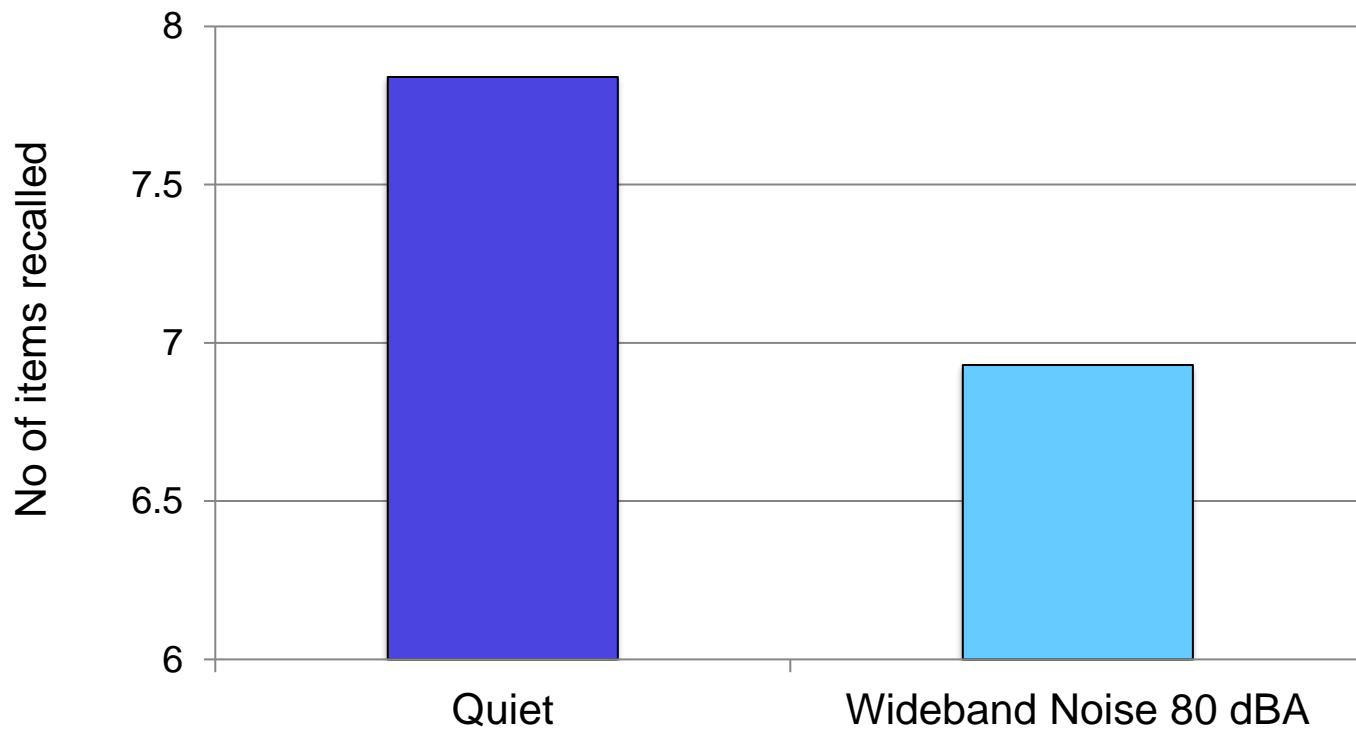
# Moderating Factors – Noise

- Office – 40 dB(A)
- Commercial Aviation – Boeing 747, A321
  - 65 dB(A) taxi
  - 80 dB(A) cruise
- Petroleum, Gas, Chemical Plants
  - ? dB(A)



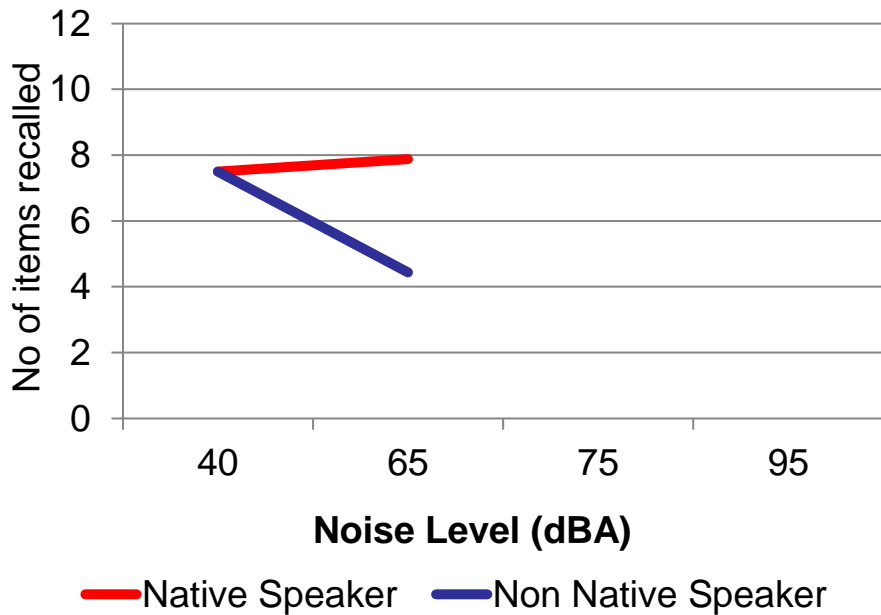
# Moderating Factors – Noise

- Noise effects worse for Non-Native English Speakers.

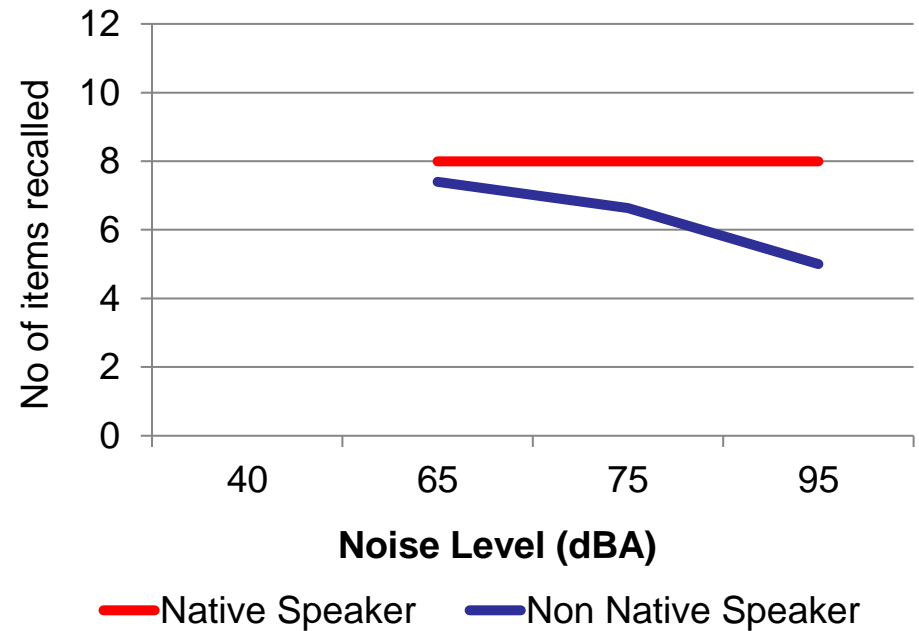


# Results – Noise (NS vs. ESL)

## No Headphones

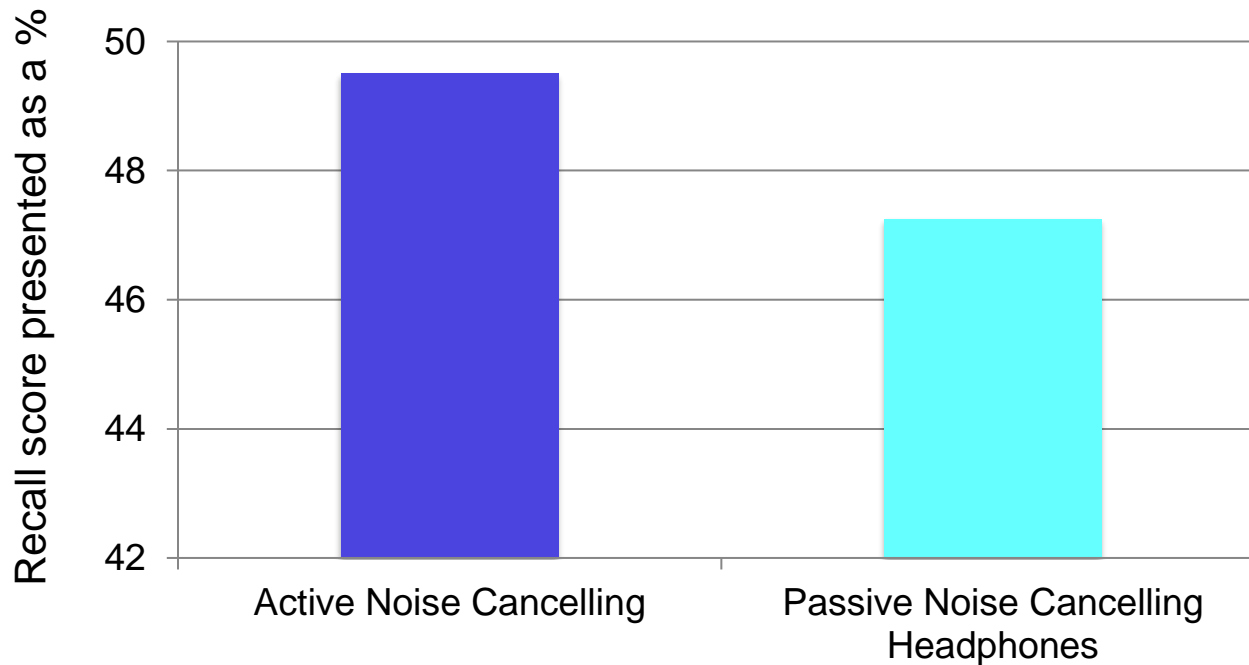


## Noise Cancelling Headphones



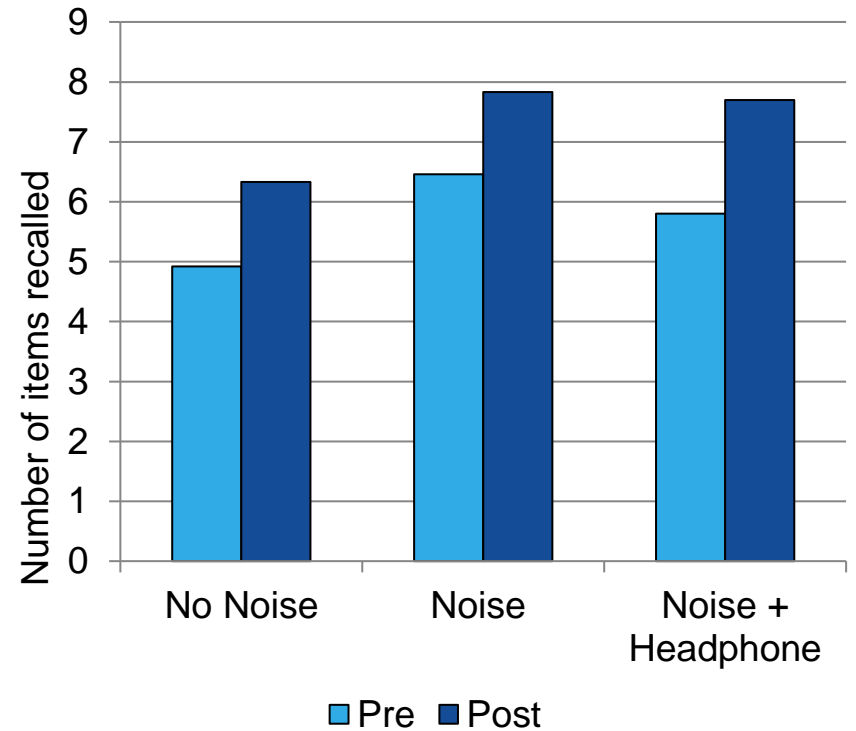
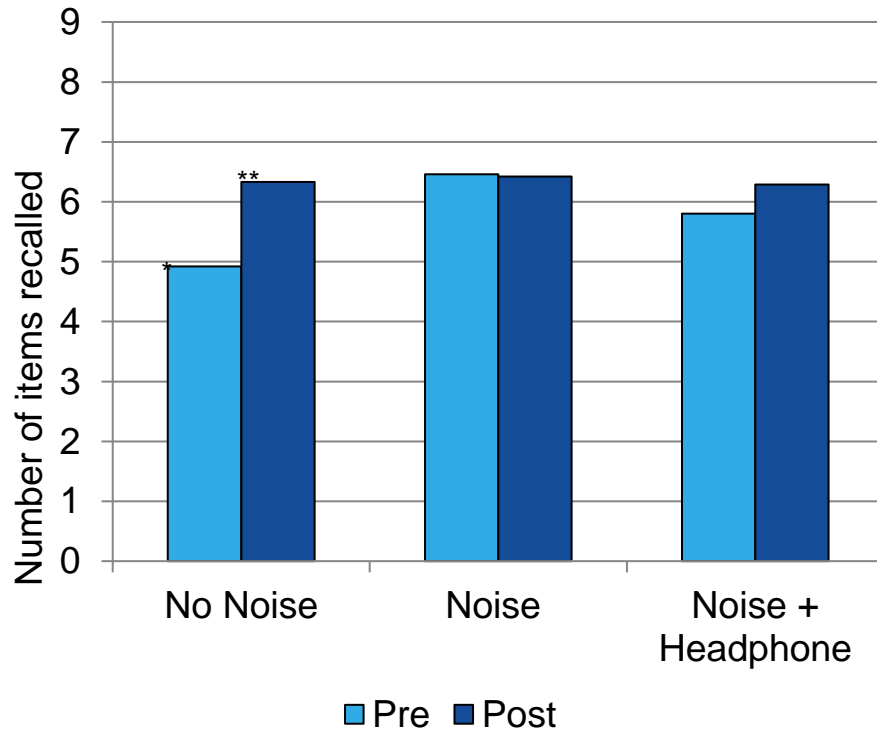
# Results – Pilot 95 dBA

- Active Noise Cancelling vs. Passive Noise Cancelling headphones





# Results – Noise and Fatigue



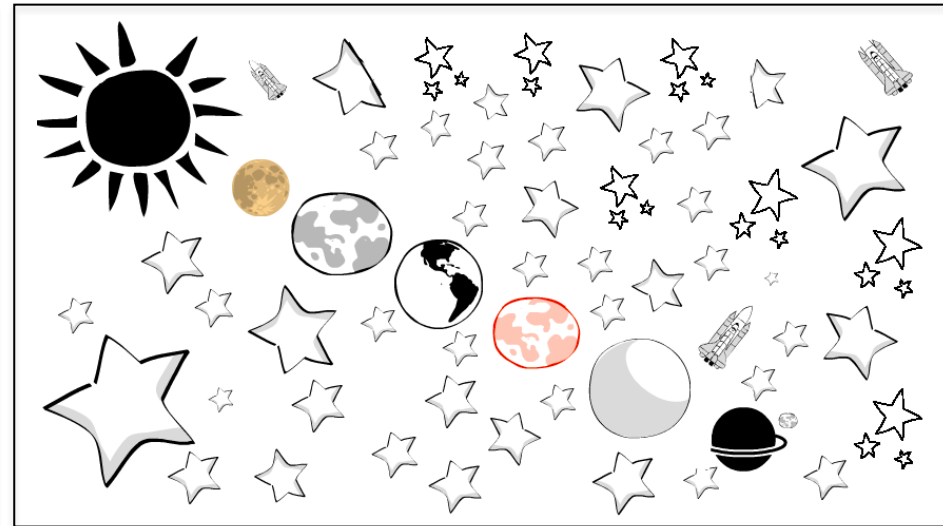
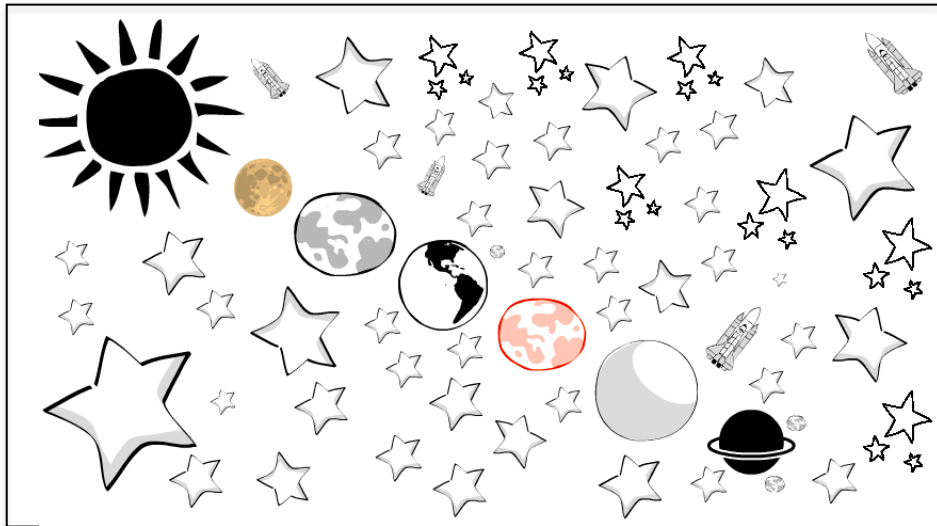
# Noise & Performance

- Multiple studies – 65, 75, 80 dBA
- Working memory (linguistics, maths), ✓
- Recognition memory, ✗
- Reaction time, ✓
- Monotony, and ✓
- Fatigue (2hrs). ✗

# Spot the difference – 10 differences, 30s

- Congestion.

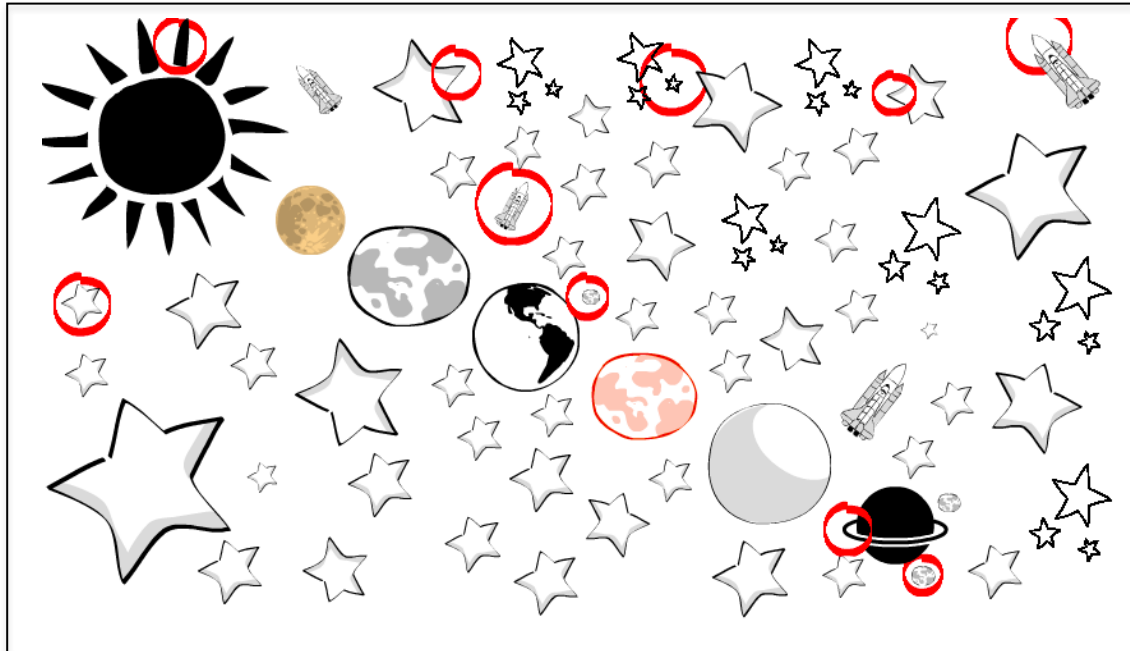
# Spot the Difference – 10 items



# Spot the Differences

**End**

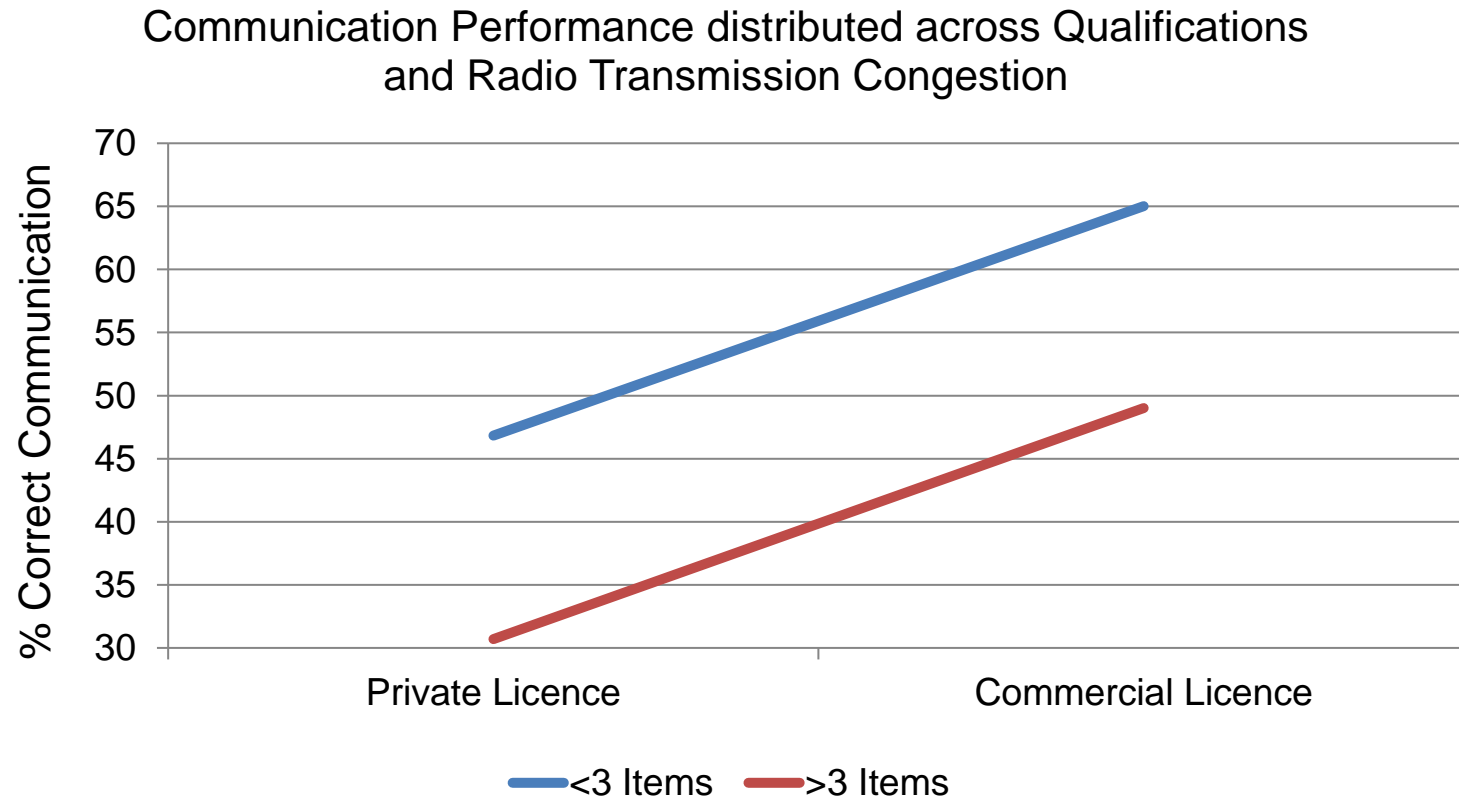
# Spot the Differences – Solution



# Moderating Factors – Congestion

- Modify performance by simply increasing quantity of information.
- Performance adversely affected by additional information.
- Information that is redundant.
- Otherwise known as noise (distracts from the target signal).
- Adding radio chatter with pilots.

# Moderating Factors – Congestion

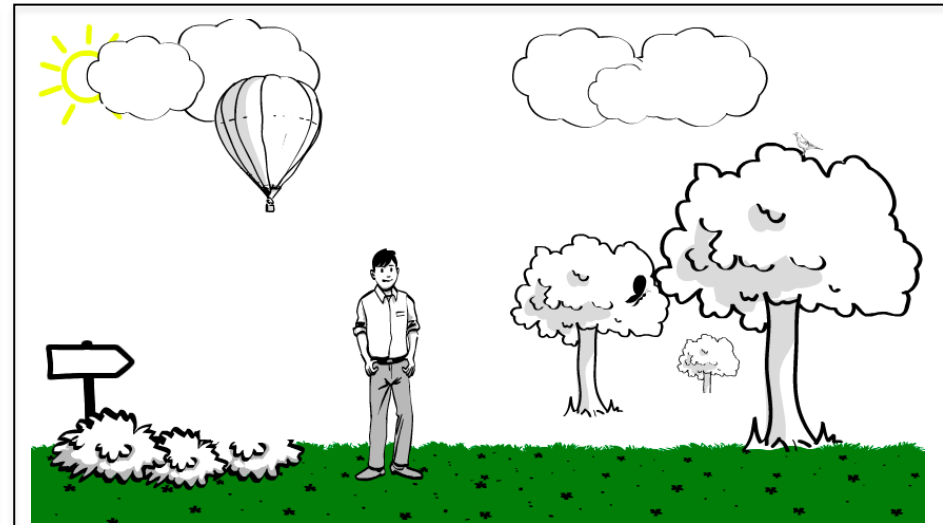
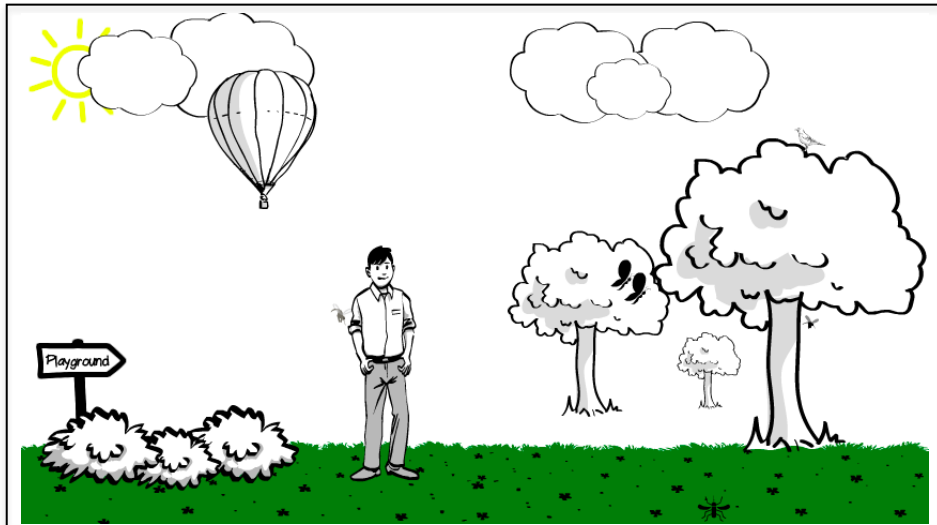




# Spot the difference – 10 differences, 30s

- Workload + maths problems (audio).

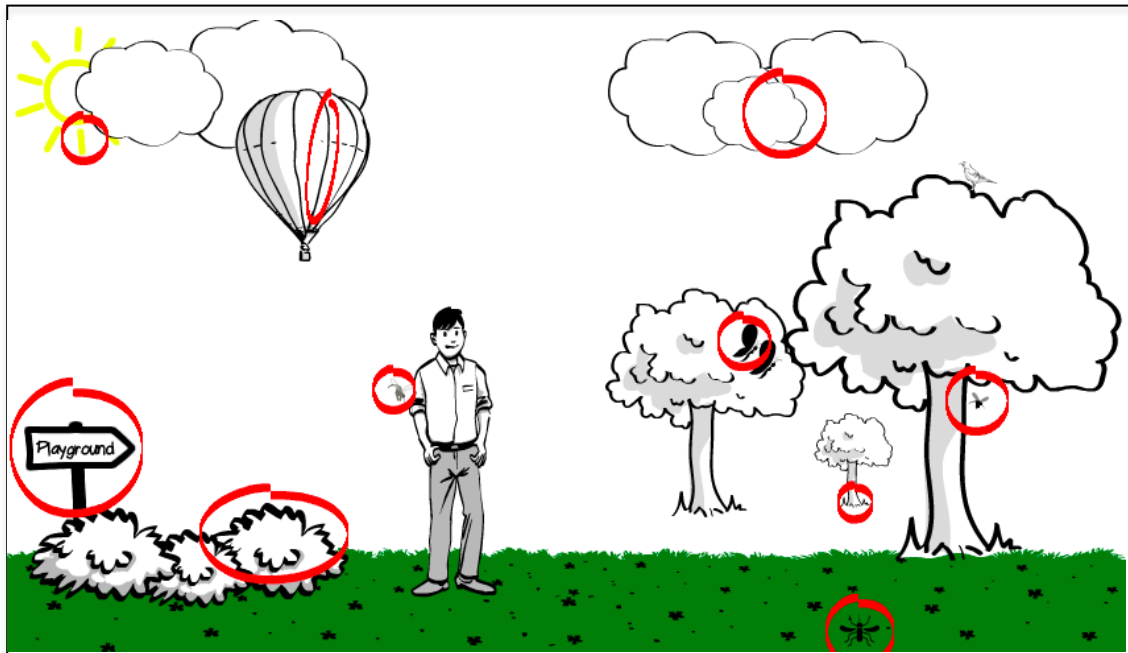
# Spot the Difference – 10 items



# Spot the Differences

**End**

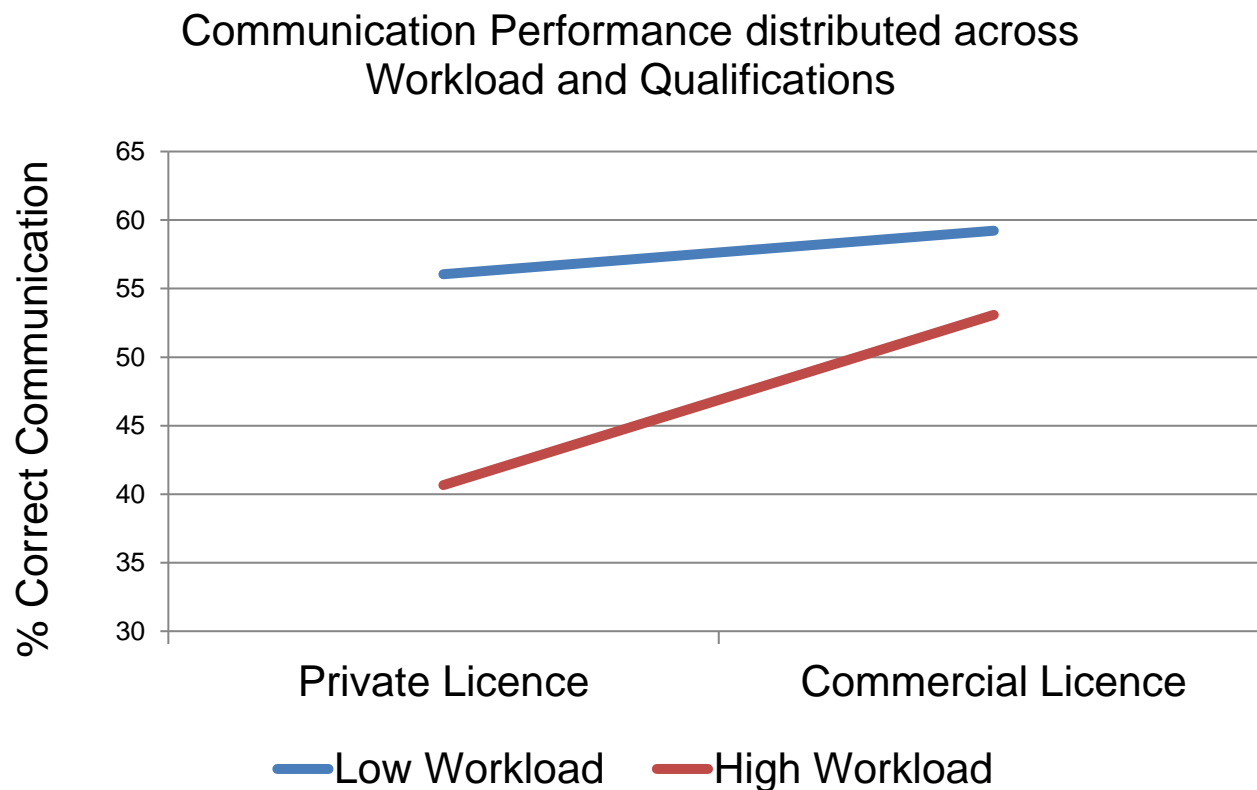
# Spot the Differences – Solution



# Moderating Factors – Workload

- Workload needs to match skill
- How much is too much?
- Pilots performed simple task of a fuel recalculating during flight.

# Moderating Factors – Workload



# Summary

- Human Performance is easily manipulable.
- Errors are unintentional.
- Violations are intentional.
- Errors test defences.
- Violations circumvent defences.
- Understanding the limitations of humans permits design to optimise human performance.
- Spot the differences task help illustrate the impact of certain factors on human performance

# Thank you

## Questions?

[b.molesworth@unsw.edu.au](mailto:b.molesworth@unsw.edu.au)