Controlling variance and sources of error

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Validation workshop, Atlantic City, NJ, 19-21 March

Context: Real Time Simulations

- Validation: ***want to know how controllers will use new tools, interfaces, and airspace in real life, and if it will work for the full range of controllers***
- Therefore ***we want variance***
- We *don't want error*, variance that would not be there in the real situation

Sources of Error

- Simulation stability
- Subject unfamiliarity
- Pseudo-pilots/ghost pilots
- Experimenter bias
- Traffic samples
- Team and organisational aspects
- Controllers *playing the game*

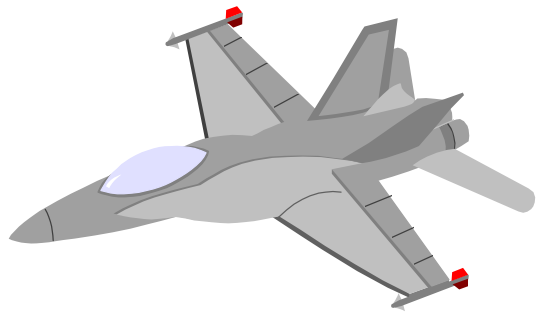
Subject Unfamiliarity

- Insufficient training & experience
  - HMI
  - Airspace
  - Tool
  - Traffic behaviour
  - Teamwork
- Criterion testing & experimental sector ‘validation’ for controllers

Learning process stages

- Basic learning
- Coping
- Competence
- Exploring
- Consolidating

Traffic

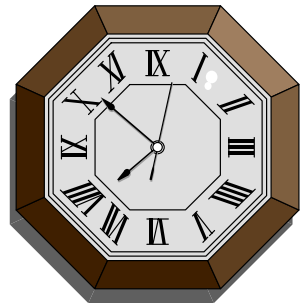


- Realistic - habitual but not repetitive
- Adapted to future environment
- Pseudo-pilots: more character definition, more variance!
- Non-nominal events (LOOK project)
- Designed to test the tool/airspace, based on analysis of the system and likely interactions. Not (always) just live traffic

Dimensions of Fidelity

- Physical - look and feel
- Cognitive - thinking patterns and responses
- Temporal - simulation responses; pilot responses; peaks and troughs; ‘shift patterns’
- Organisational fidelity
- Affective/emotional fidelity
- Cultural fidelity

Temporal & Organisational Aspects



- Length of simulations
- Start-up and slow-down - why? Lose 50% of the simulation usage
- Position handover (SA)
- Peaks and troughs

Cultural & Motivational

- Culture of professionalism
- Activity, a ‘buzz’
- Motivating
- Delivering good service
- Shifting aircraft
- Does it feel like and Ops room?
- Operational errors (LOSS) - debrief?

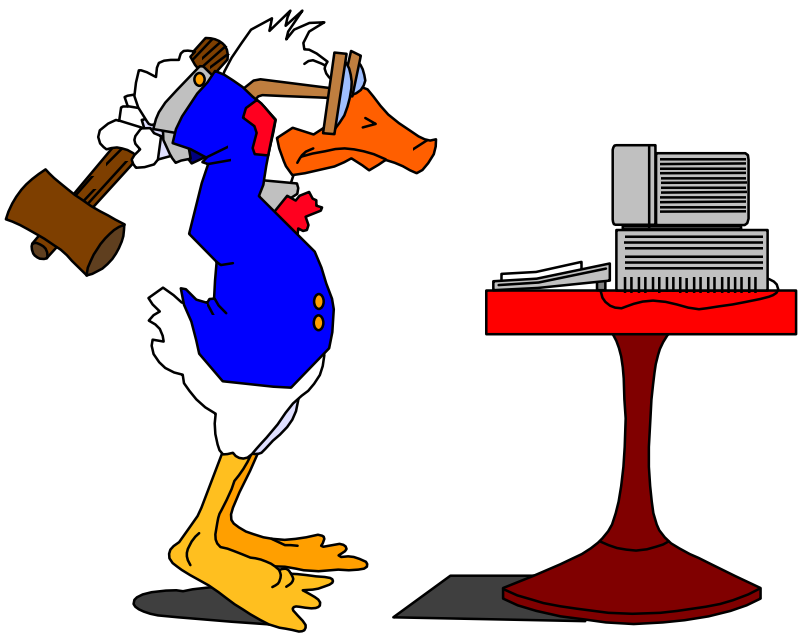
Data Precision

- Dependent Variables
  - Mental Workload
  - Situation Awareness
  - Human Error
  - LOSSs/OEs
  - Hazard log
- Intervening variables - '*Triangulate*' - convergent measures, noting 'dissociations'

Experimenter Bias

- *We'll know what we are looking for when we find it. Ask lots of questions, it will turn up…*
- Hypothesis testing with IVs and DVs
- Polarising questions - would you use this tomorrow?

More data, more interpretation of dynamic events



- ATM is dynamic - ‘capturing the river’
- Many measures are terminal
- Need more concurrent measures, and interpretation in terms of events in their scenarios, auto-confrontation, etc.

So what?

- Sector validations for controllers
- Position handover
- Non-nominals & traffic realism
- Get to the consolidation phase of controller learning
- OE reporting and debriefing
- Less experimental culture, more Ops room..
- Ask the controllers
- Validations should also occasionally produce negative results - we learn from negative feedback

Conclusion

- Real-time simulations are a strength in ATM
- Currently they tell us often what we would like to believe
- Need a richer context, more of an Ops room climate
- Need a harder approach - validations must state how they would fail a concept.

Thanks & Questions