Cabin Crew Virtual Reality Training Guidelines Based on Cross-Industry Lessons Learned: Guidance and Use Case Results

David Jones
President, Quantified Design Solutions
@DJonesCreates
David Jones

Human Factors

Industrial Engineering

14 Years Training Experience

Focus on Advanced R&D

Military, Medical, Aviation
Why Virtual Reality

And no…the answer is not “because it’s cool”

Well, that’s not the only reason
Computer Based Training

Perfect for basic knowledge acquisition

Affordable
Low barrier to entry

Easily Updated
After all, content does change

Available to Masses
Computers are everywhere now
Mobile Training

Training on the Go
Perfect for Just in Time Training

Trackable
All performance can generally be sent to a Learning Management System
Virtual Training

Engagement, skill acquisition, muscle memory

Physical Practice
Muscle Memory
Smaller Space
Full sized simulators not required
Engaging/Safe
Medium allows for exciting training and safe for high risk tasks

https://www.gartner.com/newsroom/id/3784363
A Little Background on Virtual Reality
How Did We Get Here
1950s-1960s
Morton Heilig’s Sensorama – Full Immersion Experience - Audio, 3D Visual, Scent, Vibration, Fans

1987- Virtual Reality Term
Visual Programming Lab (Jaron Lanier) was the first company to sell VR Goggles and gloves
Mid-90’s- Gaming Companies Want a Piece of VR

Nintendo and SEGA both fail:
Too expensive and clunky

90’s through 2010- LOTS of research

Military, NASA, Education, Aviation, and Medical research in VR.

2010- Present- Commercial Gaming is Back and Better

Hardware platforms are getting better and applying lessons learned from research

2017- Virtual Cabin Crew Training

Virtual training is ready for Cabin Crew and maintenance applications
INDUSTRY GUIDANCE

Standing on the shoulders of giants - Applying lessons learned

To make training good
VR Sickness
#1 barrier to VR integration

**Problem Space**
Motion Sickness- Disagreement between visual perception and vestibular system.

- Simulator Sickness- Subset of motion sickness caused by the use of simulators (interesting to note that experience effects sim sickness)
- VR Sickness- Subset of simulator sickness caused by VR use

Symptoms- Headache, nausea, sweating, drowsiness, disorientation

**Reduce multimodal mismatches**
Improve the match between head movement and visual updates, including improving visual framerates (Badcock, Palmisano, & May, 2014)

**Reduced FOV when moving (reduce vection)**
Leverage approaches to reduce vection, including reducing fast movements in the scene and dynamically reducing the FOV when leveraging controller movement (Fernandes & Feiner, 2016)

**Reduce Unnatural Movements**
Leverage room scale design to allow physical movements to drive visual updates (instead of controller inputs). When controller movement is a must, avoid unnatural movements.

Always allow the user to control the movement.


Additional Guidance

Training Intervals
VR training has the potential to create aftereffects and discomfort after long use. To reduce these effects limit time to 30 minutes of continuous use. To make training as efficient as possible, plan training for short training sessions (1 hour or less) on consecutive days (Kang, et al., 2015)

User Interfaces Need to Change
Leverage natural user interfaces when possible and avoid heads up displays to present information. Instead present them naturally in the environment

Reduce Intrinsic and Extraneous Cognitive Load
Cognitive Load = Intrinsic Cognitive Load + Extraneous + Germaine

Intrinsic Load can be reduced by creating smaller, easier to accomplish steps.

Within VR’s, Extraneous load comes from distracting information and hard to learn controls/interfaces. Simplify controls and reduce distractions.
USE CASE

Cabin Crew Virtual Readiness Trainer
Cabin Crew Virtual Readiness Lab

Opportunity Space

Student Throughput
American Airlines would not have enough physical training platforms to keep up with training demands.

Expanding Class Structure
American Airlines was changing their program to increase training demand and reduce training cycles.

Student Engagement
Students are not engaged during classroom training due to lack of interactivity. This has the potential to lead to poor performance.

Breadth of scenarios
Within a physical training platform, creating and resetting a variety of scenarios takes a lot of time to do.

New Focus to Student Driven Training
American Airlines wanted a way to allow their students to drive their own training on their own schedule with less instructor involvement.
VR Training

Turn-key 12-room VR training lab

Quantified Design and Newton Design developed a VR training application to introduce air crew to new aircraft and complete pretraining prior to FAA approved check-outs on physical trainers.

Designed to practice door operations and knowledge of emergency equipment locations and preflight check requirements.
Cabin Crew Virtual Readiness - Two Training Goals, Two Modes

**Training Mode**
Students are guided through door open and closing procedures as well as the location of emergency equipment

**Evaluation Mode**
Students are evaluated on door open and closing procedures and the location of emergency equipment
Design and Development Process

Iteration in every step

01 Defining Goals
02 Design
03 Research/Rapid Prototyping
04 Final Design
05 Execution
06 Refining
07 Testing
08 Delivery/Support
Results/Training Self-Efficacy

Improved Self-Efficacy
From February Class
High self-efficacy scores increased from 20% of students to 68%

Scope/ Process
50 Students completed self-efficacy Measures given before and after training

Limitations of Research
Small Scale (50 Learners)

Perceived Ability Opening A321 Door
(Pre/Post)

- Pre:
  - Low: 36%
  - Moderate: 44%
  - High: 20%

- Post:
  - Low: 4%
  - Moderate: 32%
  - High: 68%
Results/Transfer of Training

Improved Performance
From Jan – March
Unsatisfactory rate dropped from 25% to 2%
Error Free Increased from 34% to 82%

Scope/ Process
750 Students completed training
VR training changes added in February to focus on monitor and challenge skill

Limitations of Research
Currently completing comprehensive review associating time in VR and performance in VR to initial procedural evaluations
LESSONS LEARNED/ GUIDANCE AND NEXT STEPS

Cabin Crew Virtual Readiness Trainer
Controls Can’t Be Simplified Enough

**Lesson**
When you think you’ve simplified enough, simplify again

Initial Design- 4 buttons on control
Simplified Controller- 2 buttons on control
Final Design- Hand tracking

REJECTED
Provide all Long Distance Movement Through Teleportation

**Lesson**
When required to move a larger distance than the room space will allow, leverage teleportation to reduce potential for sim sickness

Tested Designs-
- Walking with controls
- Free teleportation
- Restricted teleportation
Integrate Learning Management and Progression System

**Lesson**
Leverage a data driven progression system to unlock training as students complete

Initial Training - Fully unlocked to allow for exploration. This led to reduced training efficiency as students did not train to proficiency prior to moving on

Final Design - Supports train to proficiency progression guiding them through an optimal training path

Complete A321 Training to Unlock
Future Research

Detailed analysis to evaluate effects of time in VR to trials saved and initial transfer performance in live evaluation
Visit our Booth for a Demo and compete to win an iPad Mini – Compete all week to add chances for the drawing