Designing an Interruption Management Experiment: Evaluating the Working Awareness Interruption Tool (WAIT) for Air Traffic Controllers

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Motivation

• Interruptions frequent in Air Traffic Control environment
  – Other controllers, pilots, radio calls, phone calls, routine duties

• Opportunities to help reduce impact of interruptions on radar controllers
  – Support interruption awareness through modifications to controller tools and interfaces
Focusing on Non Co-located Controller – Controller Communications
VSCS Screen

(Left) [Image Link](http://www.instruction.greenriver.edu/aviation/images/site/img_atcpicture.jpg)

(Right) recreated from an image adapted from Transportation Safety Board of Canada (2003)
Example Problem: “Calling for Release”

Those interrupting (Interrupters):
- Limited awareness of availability of person they are calling (“interruptee”)
- Limited ways to convey the urgency level of the interruption

Those being interrupted (Interruptees):
- Don’t have ways of communicating their availability
- Don’t have information on urgency
Research Question

• How could controllers communicate:
  – their availability?
  – the urgency level of an interruption?
Approach

- Understand how interruptions occur in real air-traffic control environments
- Develop tools that would help support interruption awareness
- Evaluate tools using user-based experimental methodology (before and after using this tool)
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Develop tools that would help support interruption awareness

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• Overview of the Experimental Environment
  – Research objective
  – Experiment placement
  – Participant’s screens
  – Experimenters’ screens
  – Participant’s tasks
  – Experimenters’ tasks
Experimental Conditions

- No availability mode: Baseline display
- Manual availability mode
- Automated availability mode
Communication channels

No-Availability Mode Interface: Baseline display

PRESS SPACE BAR TO COMMUNICATE WITH CONTROLLERS OR PILOTS
Automated and Manual Mode Interface

Controller’s availability indicator

Participant’s availability indicator

Communication channels

PRESS SPACE BAR TO COMMUNICATE WITH CONTROLLERS OR PILOTS.
Challenges and Lessons Learned

• Experiment Design
  – Task design
  – Scenario design
  – Training design

• Participants Background

• Data Analysis
Experiment Design: **Task Design**
(Developing a task environment)

- **Challenge**
  - Representative of real world operations
  - AND be able to introduce interruptions in a controlled manner.
  - Intuitive easily learned interface for users

- **Solution**
  - Simplified Air Traffic Control world, all planes at altitude
  - experimenter team to emulate and play role of pilots and controllers – allowed controlled, planned interruption events
  - Participant uses only voice – no interaction with computer
Experiment Design: Scenario Design

• Challenge
  – Multiple conditions being tested – how to ensure scenario equivalency
  – Initial traffic levels generated too much workload

• Solution
  – Rotating traffic patterns
  – Reduced traffic
  – Highlights importance of early pilot testing
Rotated Traffic Patterns
Experiment Design: Scenario Design

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Experiment Design: Training Design

• Challenge
  – Substantial differences in use of WAIT tool in different conditions
  – Difficult / unfamiliar task
  – Naïve users
  – Limited time with each participant
  – How to construct effective, time efficient training?

• Solution
  – General and specific training sessions
Participants Background

• **Challenge**
  – Lack of ATC Experience
  – Lack of wait screen monitoring observed in pilot tests

• **Solution**
  – WAIT score system development
  – Introduce sound cues to WAIT to draw participant attention
Tools to Support Data Analysis

• Challenge
  – Anticipating analysis needs
  – Exploratory study so not clear what observations will provide most insight

• solution
  – Pre-planning of data to be logged
    • Performance measurement
    • Log files data
  – Audio and video recording
  – Interviews and questionnaires
Future work

• **Near term:**
  – Apply and evaluate the user-based experiment

• **Long term:**
  – Applying the tool in real world environments
    • Refining prototype designs
    • Integrating into actual VSCS screen real-estate constraints
Questions & Comments?

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