

# Effect of Input Control Device on Performance During Training To Operate A Simulated Micro Aerial Vehicle



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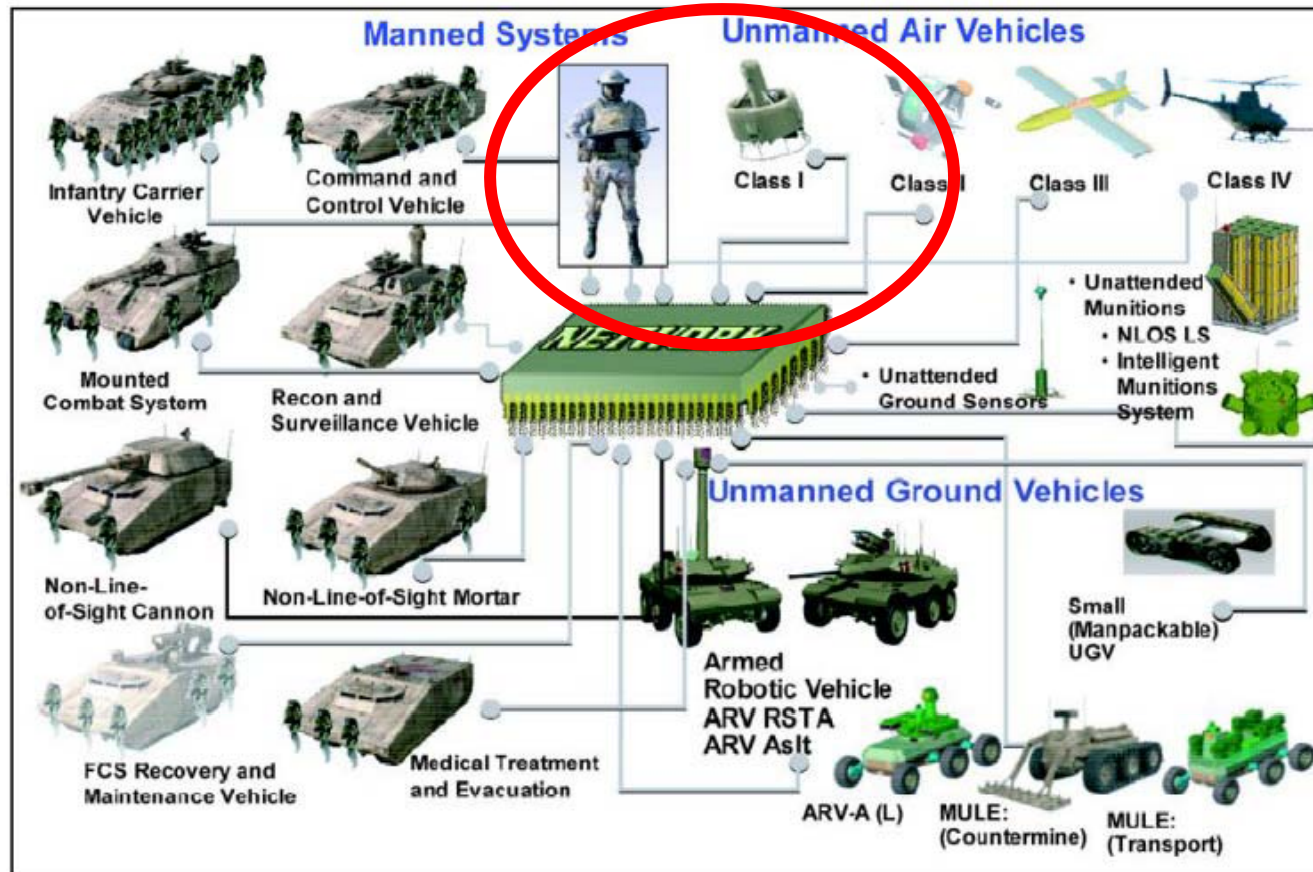
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➤ **Motivation:**

**Will need to quickly and reliably train operators.**

**Human-system interface must be intuitive and easy to master.**

**Structured training scenarios + performance measures required.**



# INPUT DEVICES



**touch screen & stylus**

Point at & Click on symbols on screen

Less Portable

More reliable



**mouse**

The 2 input devices  
used in the  
experiment



**game controller**

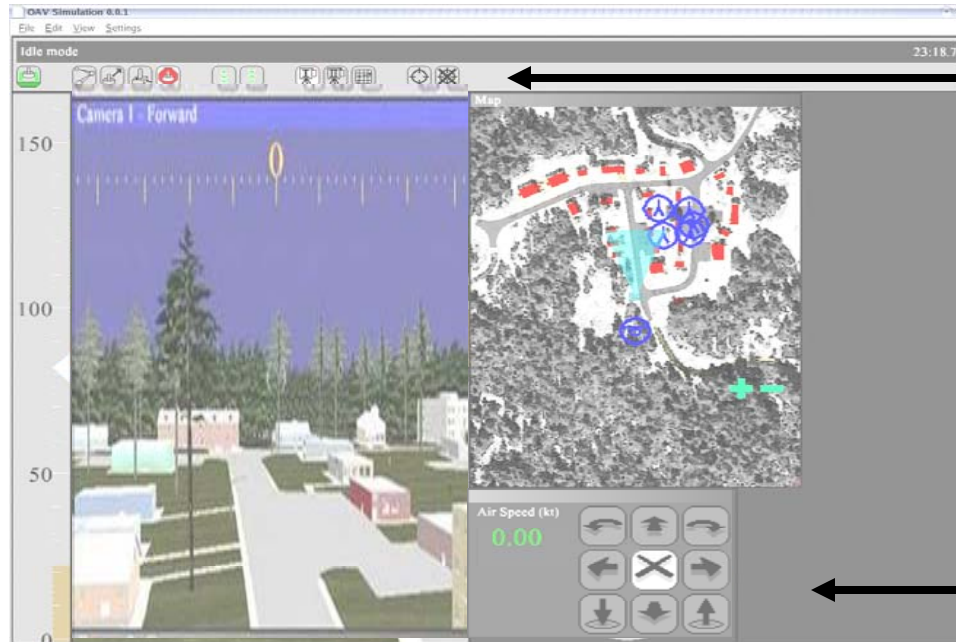
Popular for navigating through  
virtual 3-D space

# Design

- 2 x 2 x 2
  - Input Device (Mouse vs. Game Controller)
  - Input Control Display (Discrete vs. Continuous)
  - Number of Simultaneous Camera Views (1 or 2)
- Covariates
  - Spatial Ability
  - Video Game Experience (VGE)
- Simulated Vehicle
  - Vertical lift / land / hover / rotate in place
  - Simple inertial model
  - Velocity limited to 6 knots



1 Camera view at a time



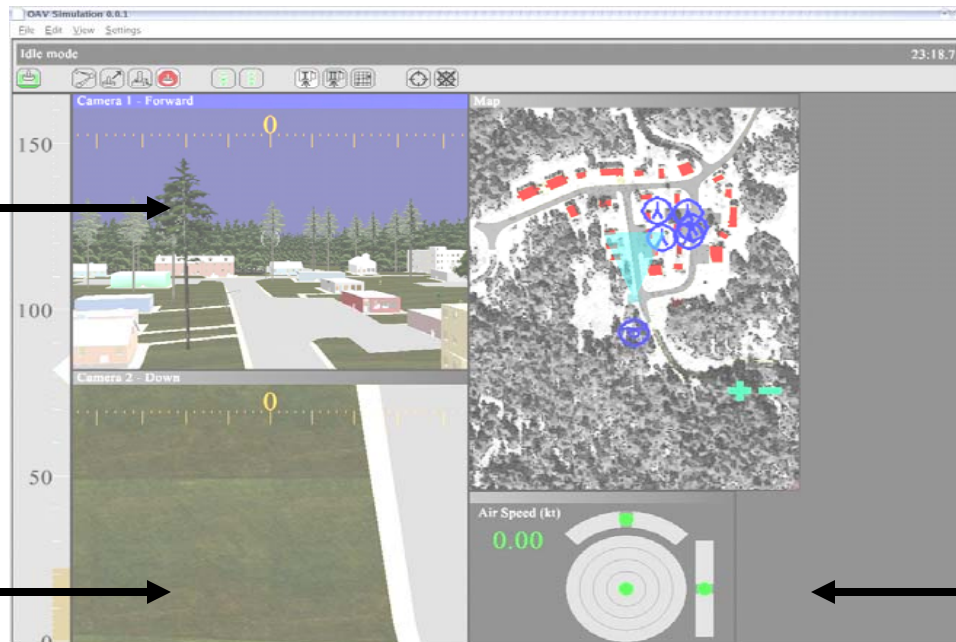
Icons for:

Take off/Land  
Switching/Selecting views  
(Others disabled)

Discrete ICD

2 Camera views at a time

Forward



Continuous ICD



# Initial Training

- To minimal standard
- Complete exercises to
  - Temporal criteria
  - No collisions
- Final 2 exercises
  - “Racetrack” – max 5 tries
  - “Slalom” – max 5 tries

# Missions

(performance measured)

- 1) Racetrack – no waypoints / no restrictions
- 2) Church – find and report personnel inside
- 3) Slalom – no waypoints / no restrictions
- 4) Reconnaissance – find, photo, & recall targets
- 5) Racetrack repetition
- 6) Slalom repetition

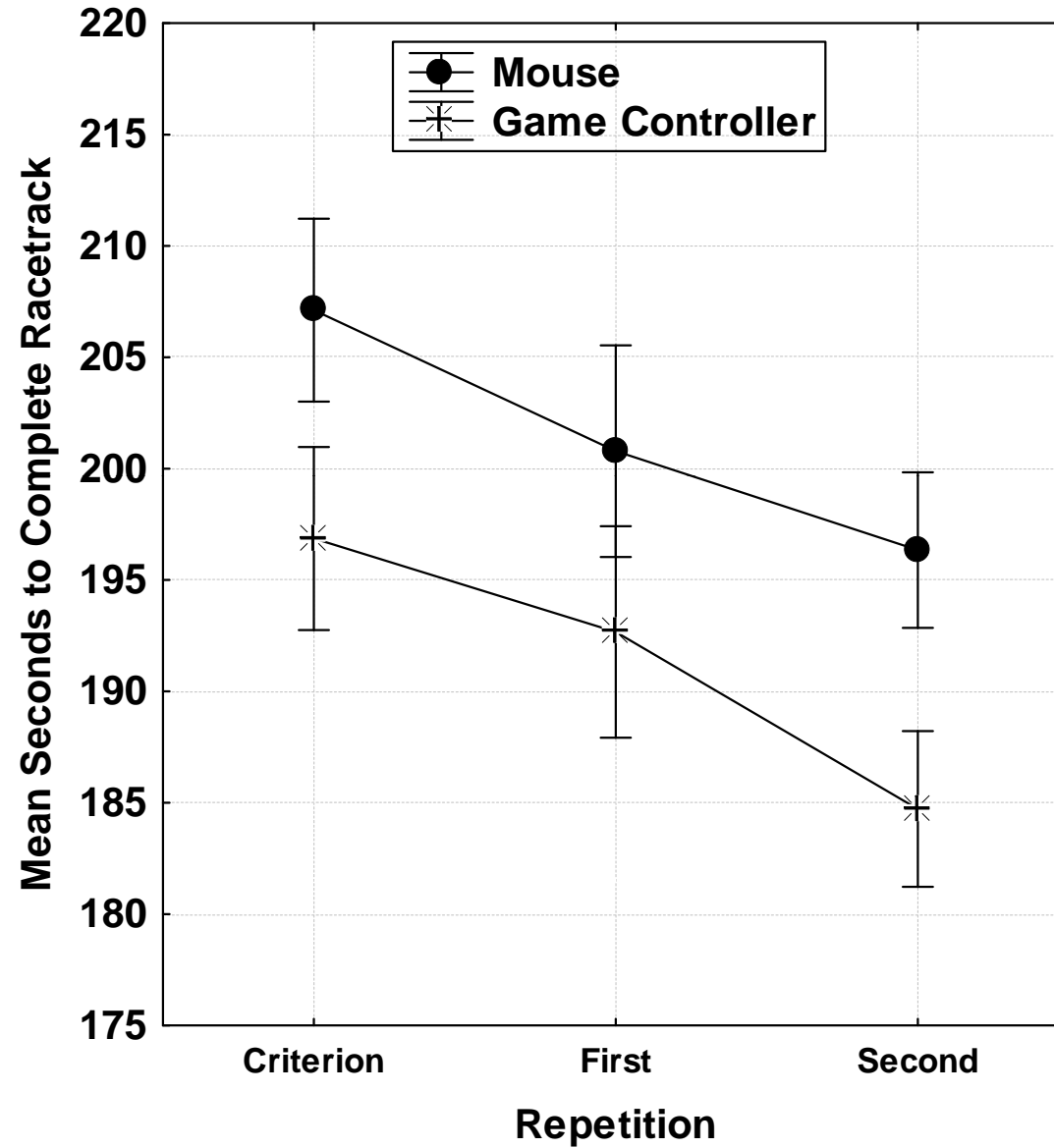
# Measures

- Time to complete
- Collisions
- Workload
- Targets detected / photo'ed / recalled

Racetrack  
Missions

VGE marginal  
covariate of  
time

VGE  
significant  
covariate of  
workload

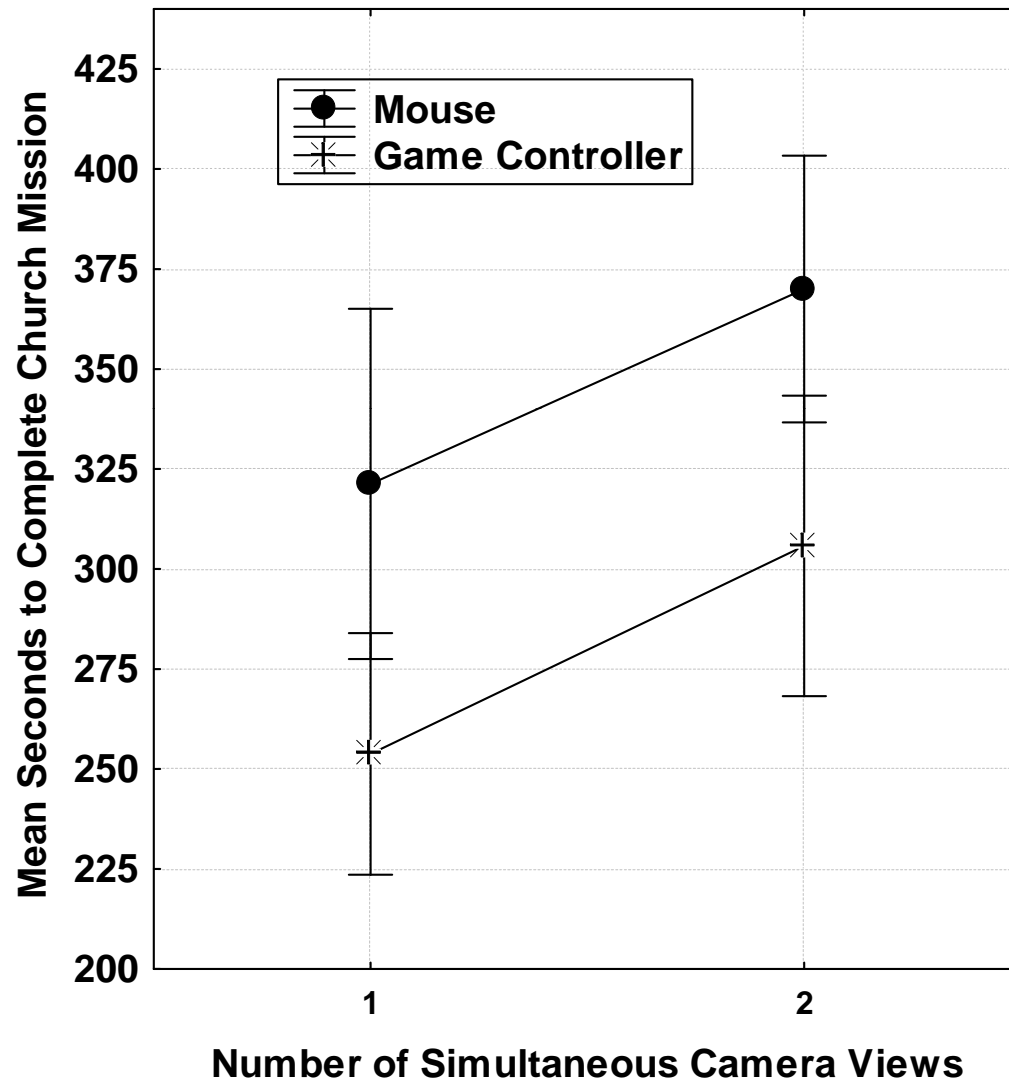


# Church Mission

VGE significant  
covariate of time

VGE significant  
covariate of  
workload

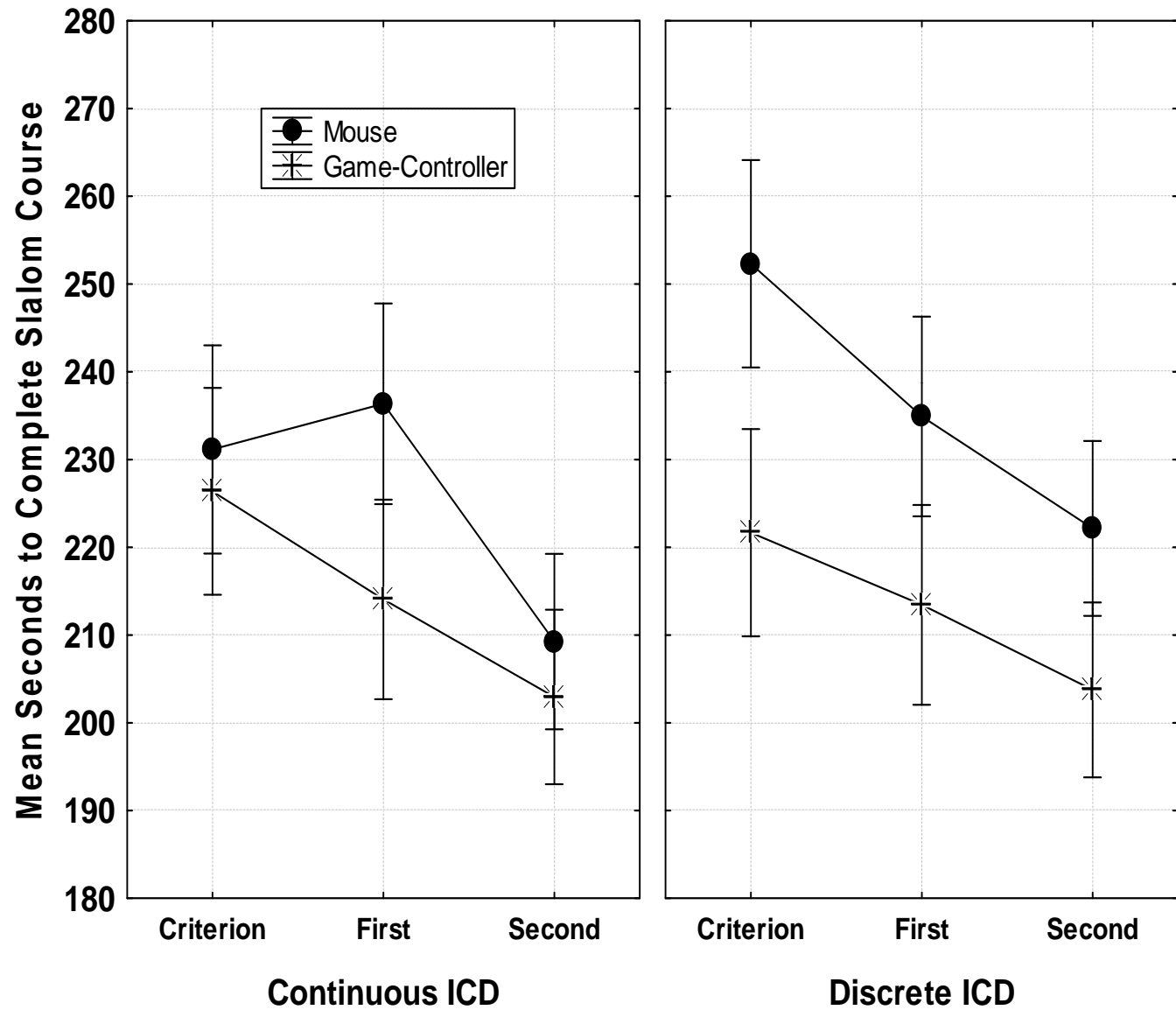
Significantly  
more collisions  
with mouse than  
game controller  
(69% vs. 30%)



# Slalom Missions

VGE significant covariate of time

VGE significant covariate of workload



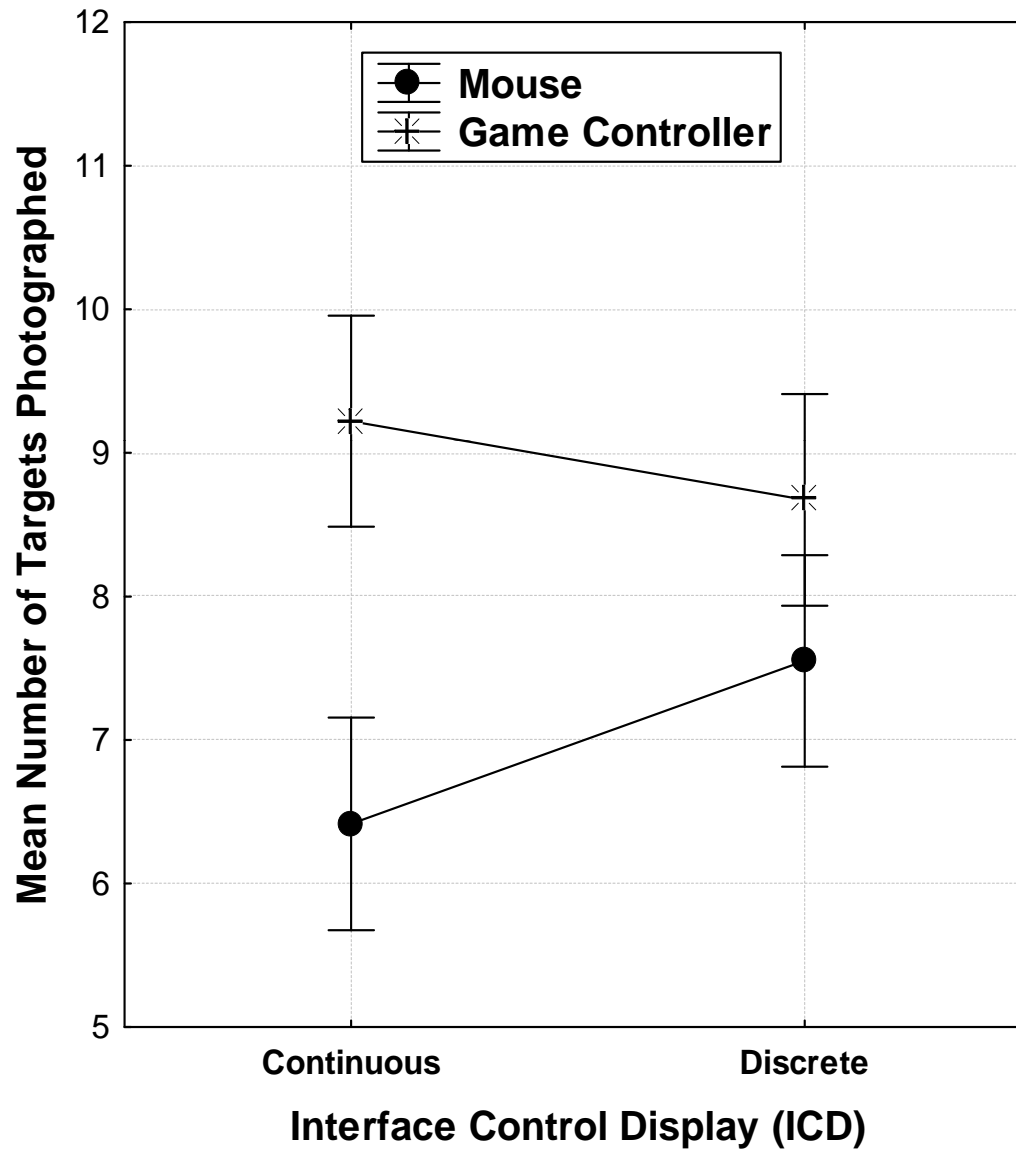
Recon Mission

VGE & Spatial  
Ability

significant  
covariates of  
targets photo'ed  
& recalled

VGE significant  
covariate of  
workload

Spatial Ability  
significant  
correlate of  
number of  
collisions



# Summary and Issues

- Game Controller superior to Mouse
  - Why?
  - Hypothesis: Allowed more focused attention on camera view
  - Hypothesis: not physical device, but cognitive effects
- VGE predictive of performance
  - Why?
  - Hypothesis: Experience / comfort in simulation environments
  - Will it also transfer to the real thing?
- Spatial Ability predictive of performance
  - Why?
  - Substantial navigation and spatial learning required
- Performance improved over repeated missions
  - Control mastery or spatial learning?
    - Requires examination of transfer to novel environments

# Questions?



## More Info?

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- 407-384-3983
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  - Glenn Martin, Duvan Cope, Casey Thurston