Characterizing Exploration Behavior in a Large-Scale Desktop Virtual Environment

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Introduction

Background:

1. How people explore a novel large-scale space may impact their navigation ability and spatial memory, yet previous research has largely constrained the encoding process.

2. Sex differences are commonly found in navigation ability, and are thought to result from long distance travels conferring fitness benefits to males (e.g., finding mates), and fitness costs to females (e.g., risk to offspring).

3. Exploration is a precursor for establishing a spatial memory, but sex differences in exploration have yet to be tested experimentally.

Hypotheses:

1. We expect to find sex differences in exploration consistent with the fitness costs/benefits.

2. We expect that these exploration patterns will account for spatial memory and navigation performance.

Study 1: Method

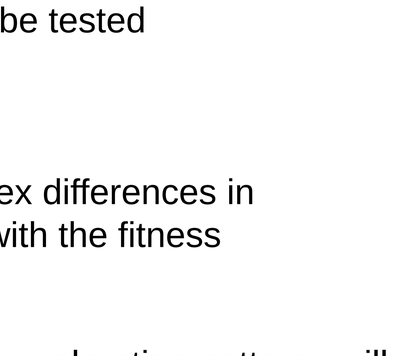
Sample: 78 (36 F, 42 M) Undergraduates (Mean Age: 22.6 yrs.)

Encode: Explore a 1 km^2 virtual environment in search of 5 objects, and remember where the objects are located. Return to the start. Point in the direction of each object, and navigate back to each object.

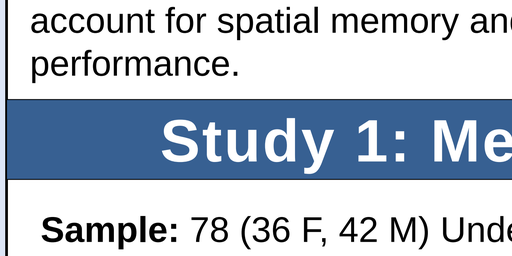
IVs: Amount of Revisiting and Proportion of Time Paused.

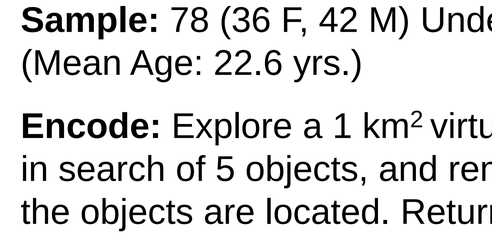
DVs: Pointing Errors and Navigation Efficiency.

Top Down View of World



Samples of Participant View



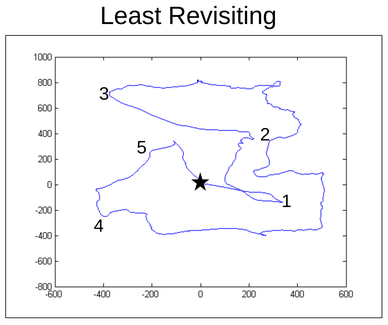


Materials: Participants sat at a 30” monitor and used a gaming controller to explore world.

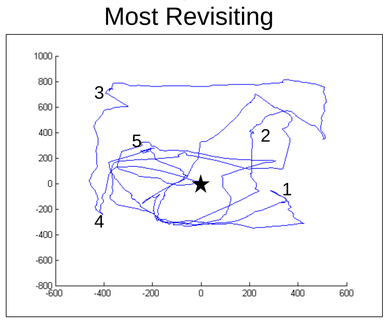
**Rendered Field of View = 60 degrees*

Study 1: Results

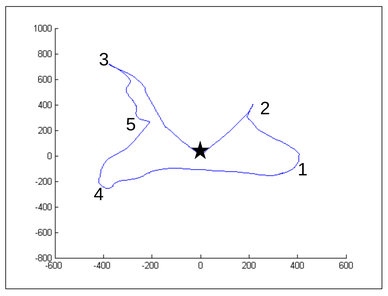
Participant 10
Least Revisiting



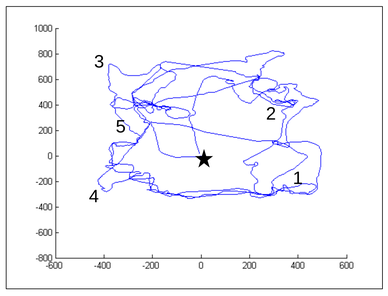
Participant 69
Most Revisiting



Participant 15
Most Efficient Navigator
Fréchet Distance: 8,215.01



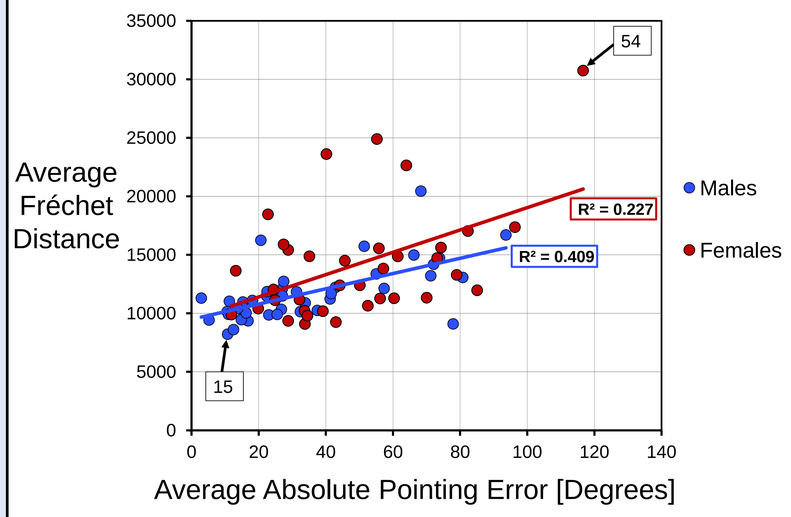
Participant 54
Least Efficient Navigator
Fréchet Distance: 30,745.68



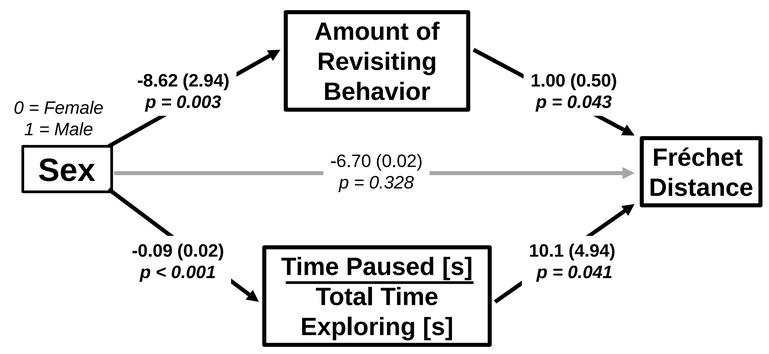
Navigation Efficiency Metric Correlates with Pointing Errors

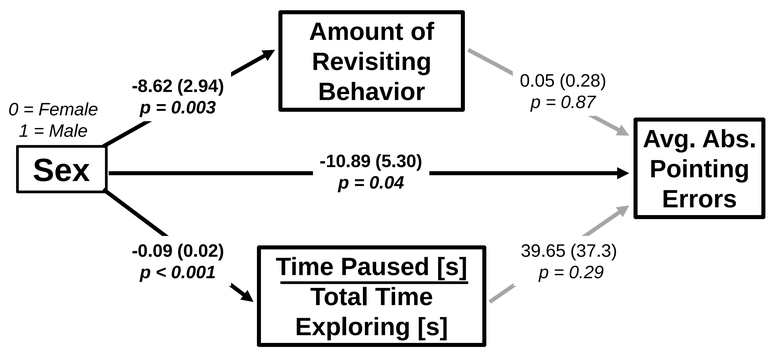
Males: r*(42)* = 0.64, *p < 0.001*

Females: r*(36)* = 0.48, *p < 0.01*



Are there Sex Differences in Exploration Patterns and do they Predict Navigation Efficiency and Spatial Memory?





**Bootstrapped mediation analyses. Numbers reported are unstandardized Betas with Standard Errors in parentheses. Revisiting and Pausing variables were correlated in the model, but not presented in the path diagram.*

Study 2: Method

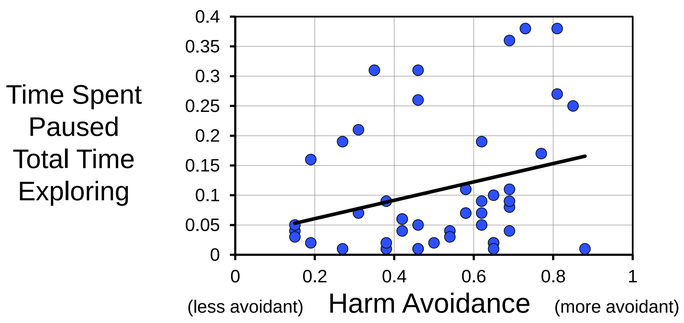
Sample: 46 (20 F, 26 M) participants from Study 1 completed the following Questionnaires after the exploration task (Study 1 Method).

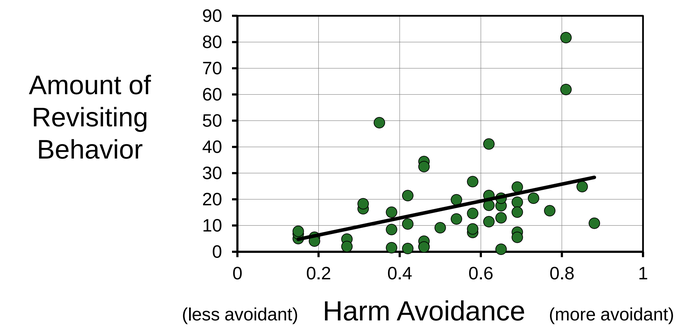
Questionnaires included:

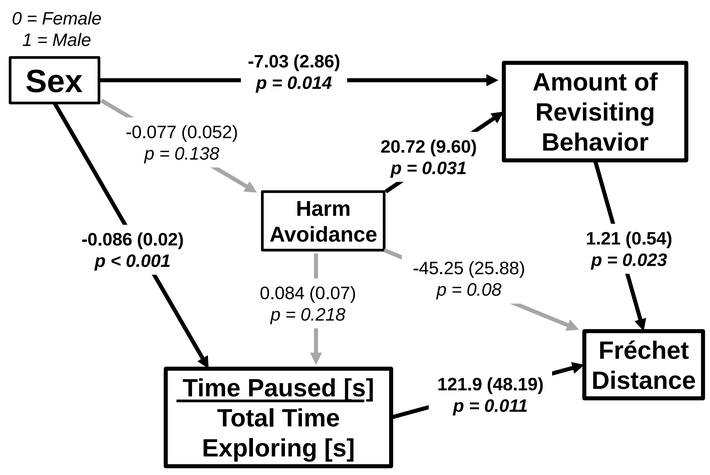
1. Harm Avoidance (MPQ subscale)
2. *Spatial Anxiety (Lawton)*
3. *Santa Barbara Sense of Direction*
4. *Navigation Strategy (Lawton)*

Study 2: Results

Multiple regression revealed that *only* Harm Avoidance and Sex *uniquely* predicted Exploration Behavior.







Discussion

Study 1: Sex differences were observed in exploration behaviors, which accounted for the *sex difference in navigation efficiency, but not pointing errors.*

Study 2 : Harm avoidance tendencies predict revisiting behaviors, but did not account for navigation efficiency.

For copies of the poster or additional information regarding this project please visit: www.scanproject.org

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