NATIONAL HUMAN GENOME RESEARCH INSTITUTE Division of Intramural Research

Using Virtual Reality to Develop and Test Educational Approaches for Abstract Scientific Concepts

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Genomic communication

- Communication about common, complex diseases
  - Both genetic and environmental risk factors
- Possible gene-environment interactions
  - Effect of behaviors might depend on someone's genes
  - Likely to be important in disease prevention

Study background

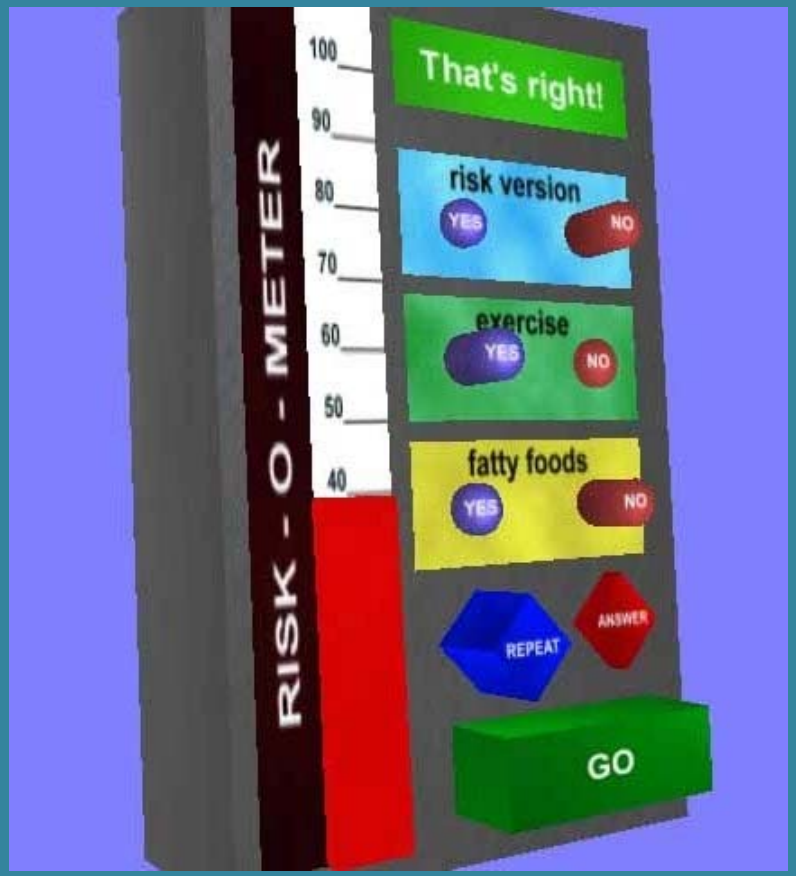
- Focus on gene-environment interactions
  - Limited genomic knowledge in U.S. adults
  - Limited numeracy
- Research in science education suggests active learning for abstract concepts

Research questions

- What is the effect of learning mode on comprehension of G-E concept?
- Is the hypothesized association moderated by health literacy level?
- What are potential mediators of the hypothesized association?

Independent variable: Learning mode

Active learning

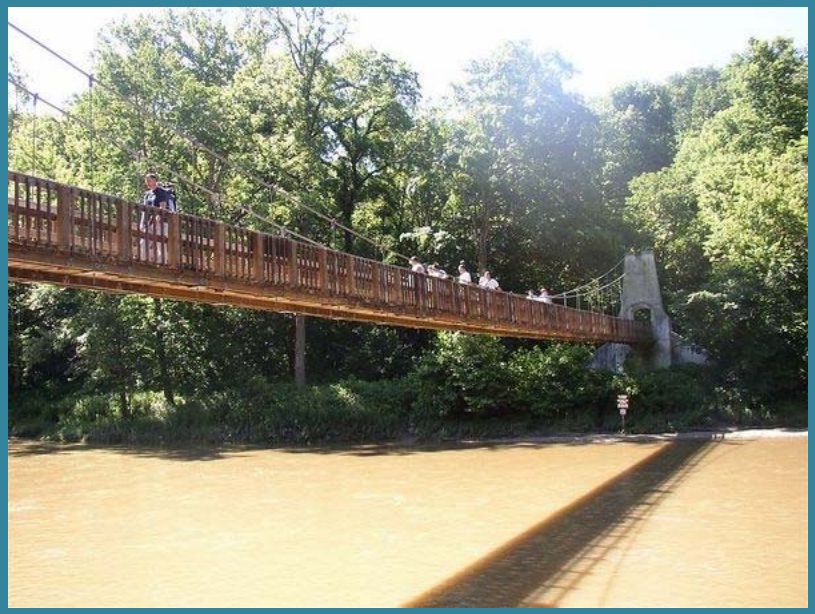


Didactic learning

Metaphor selection

Elevator

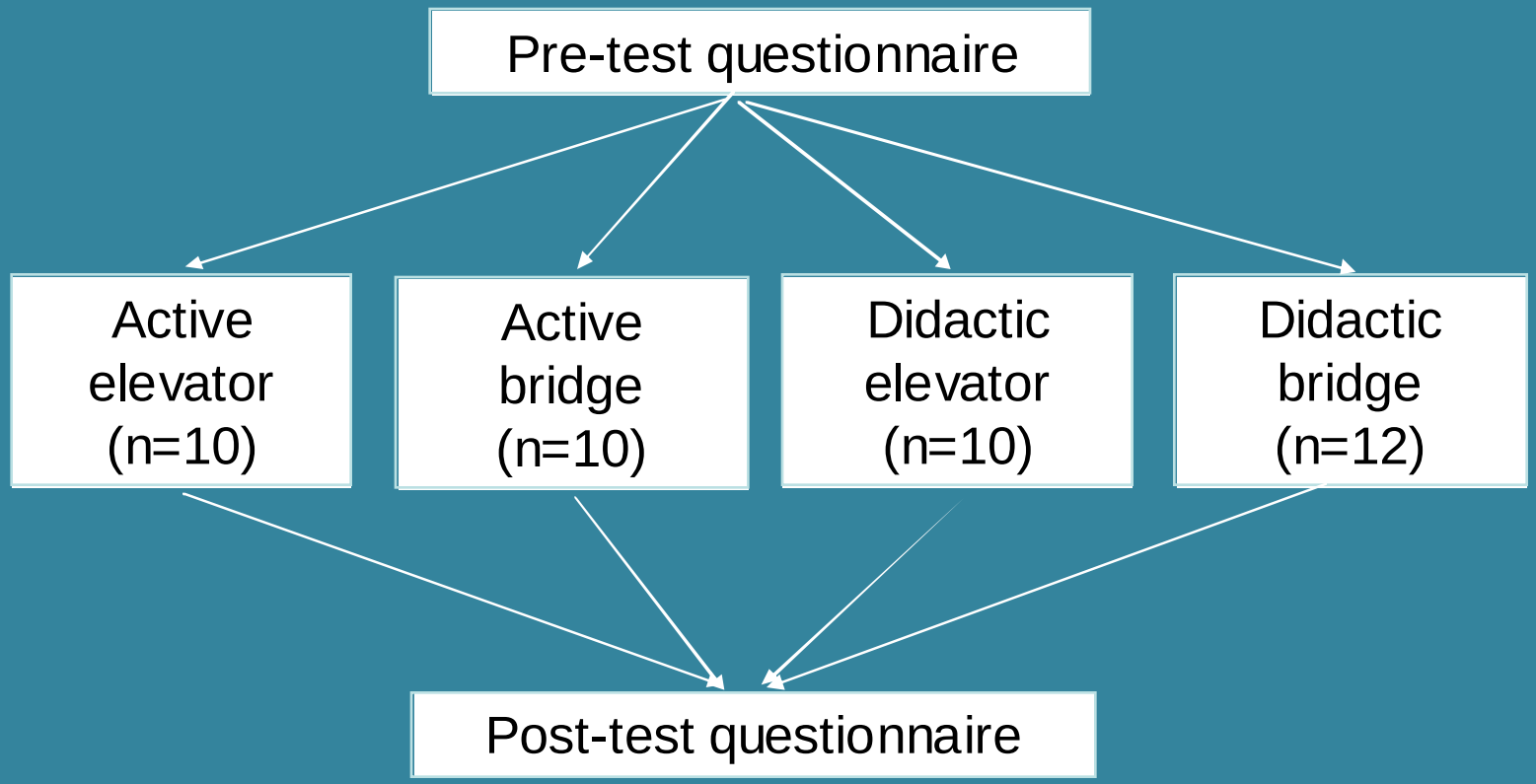
Bridge



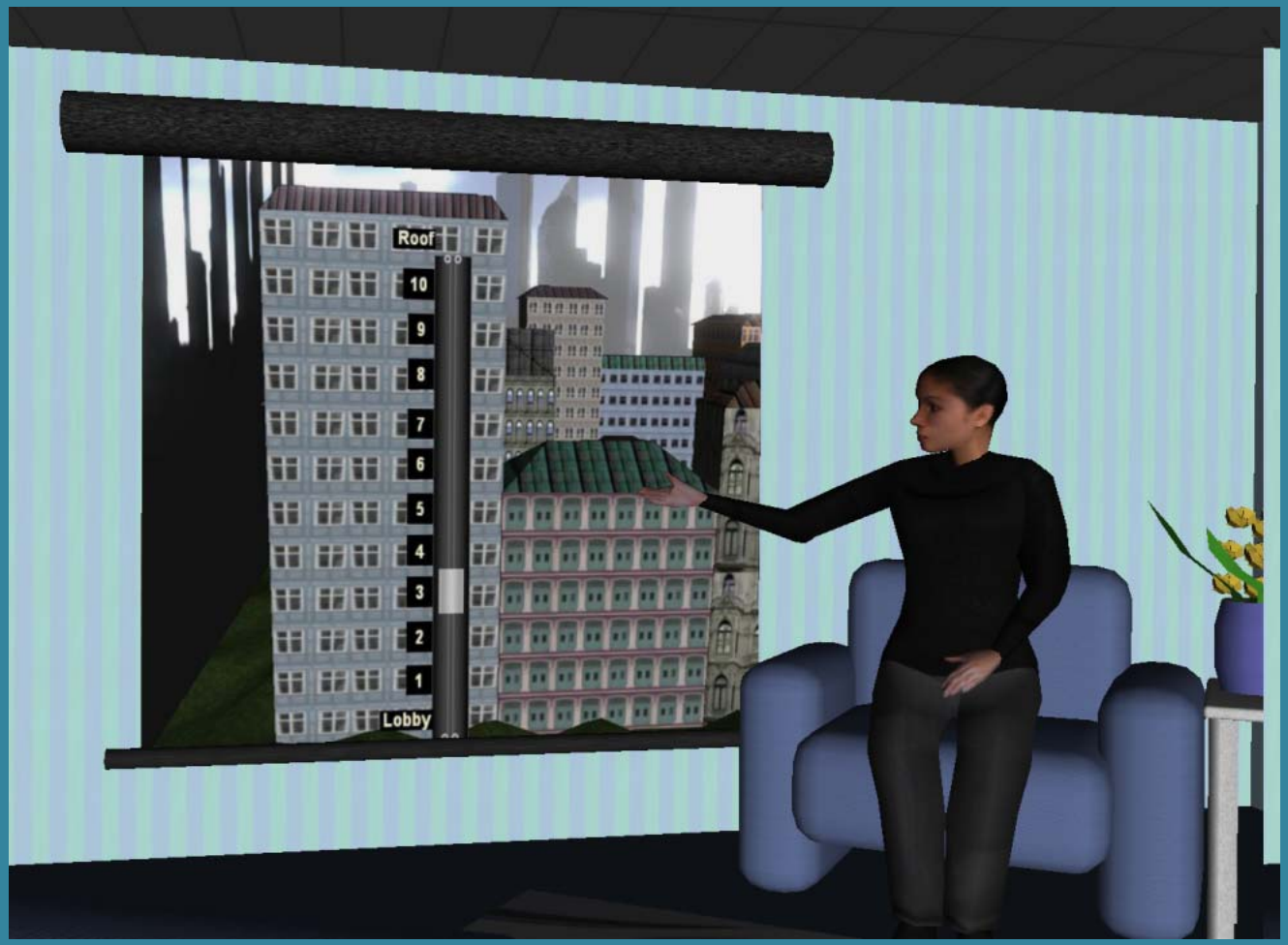
Dependent variables

- Comprehension measures
  - Recall
    - 11-item scale
  - Transfer
    - 4-item scale
  - Open-ended description of concept

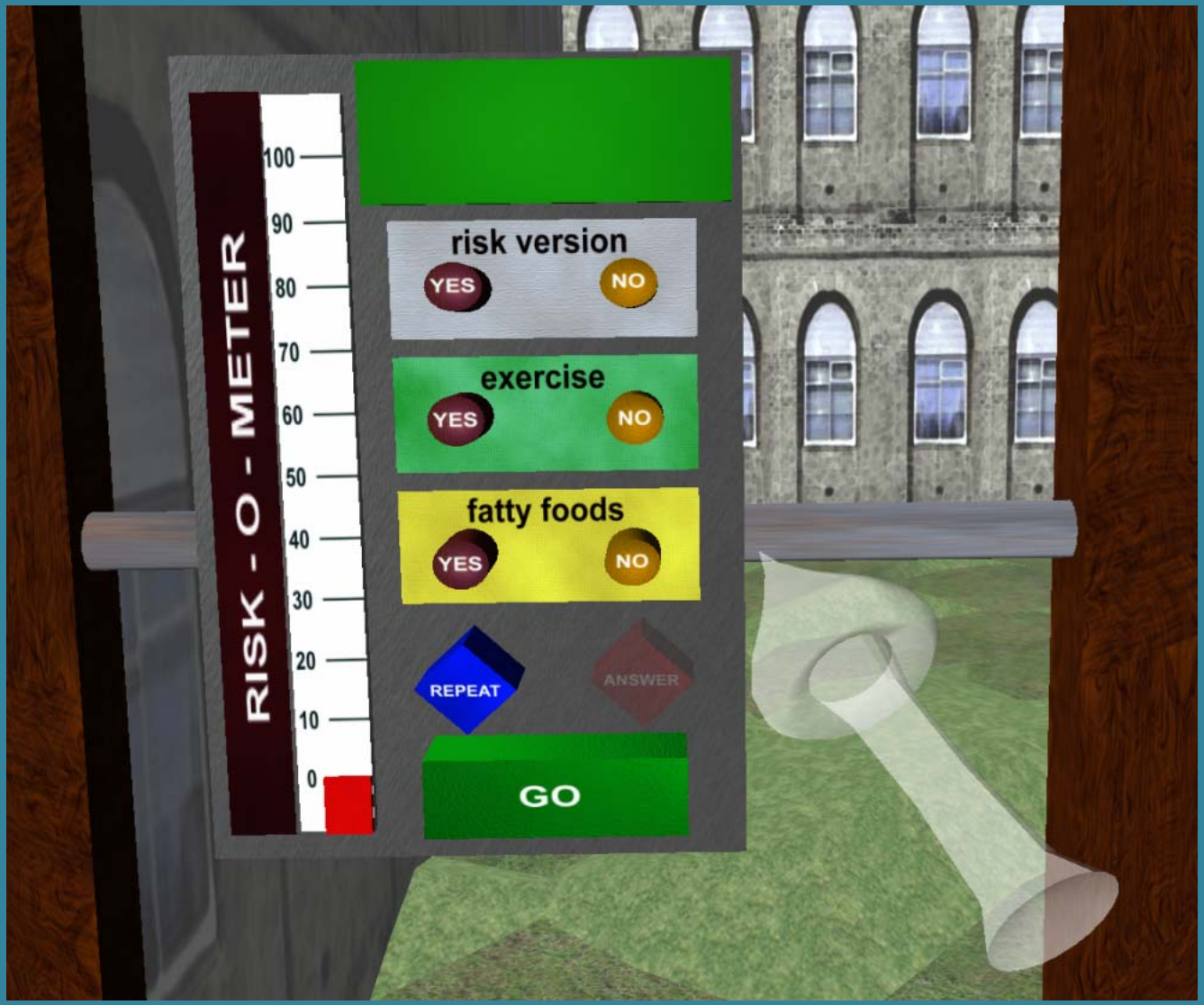
Experimental procedure



Didactic elevator world



Active elevator world



Active bridge world

Comprehension results

Condition	Mean change in recall score	Mean transfer score
Active Elevator	1.7	2.1
Didactic Elevator	3.4	2.5
Active Bridge	1.3	1.8
Didactic Bridge	2.3	2.0

Comprehension results

- Mean transfer scores higher for elevator metaphor than bridge metaphor ($p<.05$)
- Mean change in recall higher for didactic learning than active learning ($p<.05$)

Proposed mediators

Variable	Active Elevator	Didactic Elevator	Active Bridge	Didactic Bridge
Elaboration	4.7	4.6	5.0	5.0
Motivation	5.6	5.1	4.8	4.8
Attention	6.1	5.6	4.9	5.4
Interest	5.0	4.2	4.7	4.5
Perceived difficulty	2.0	1.7	2.4	2.2
Enjoyment of world	5.4	5.1	4.6	4.4
Presence	5.0	3.9	4.5	4.2
Like	5.7	5.1	4.6	4.4
Believability	5.8	5.4	5.6	5.3

Implications

- Simpler, more concrete metaphors may be more effective
- Currently completing phase with 150 healthy adults 18-40
  - Plan to examine characteristics of worlds that affect learning

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System parameters

- HMD-based VE system
  - nVisor SX
- 6 dof tracking system controlled by body movement
  - WorldViz 4-camera Point Position Tracking system
  - InterSense InertiaCube
- Custom software
  - Developed for Vizard (WorldViz)

Recall and transfer

- Recall
  - Eating fatty foods raises someone's chance of getting hyperposia
- Transfer
  - Exercise will lower the chance of getting diabetes more for someone who has a risk version of a gene for diabetes than for someone who does not have a risk version