

Introduction

The Present Study

Evacuation in Underground facilities is problematic [1]. In case of fire occupants need to go to Rescue Chambers (RCs). Design aspects of RC may play an important role in use of RCs and psychological well-being inside RC.

Research Objectives:

1. Evaluate VR as a research tool to study human behavior in fire
2. Study influence of design of a RC door the **choice of RC**
3. Study influence of design of a RC **arousal, perceived control, clarity of the situation** during a fire alarm

Vitual Reality (VR)

VR is a Research Tool for Human Behavior in [2] [3]. Immersive VR gives the user the feeling of „being there“ (Presence).

Benefits:

- Experimental control in complex scenarios
- Enables reproducable standardized testing
- High resolution behavioral data from human behavior in fire scenarios
- Low costs compared to field experiments
- Ecological validity without risking the participants health

Introduction

Method

The VR Laboratory



Figure 1: A participant immersed into the virtual world (screenshot from a different study)

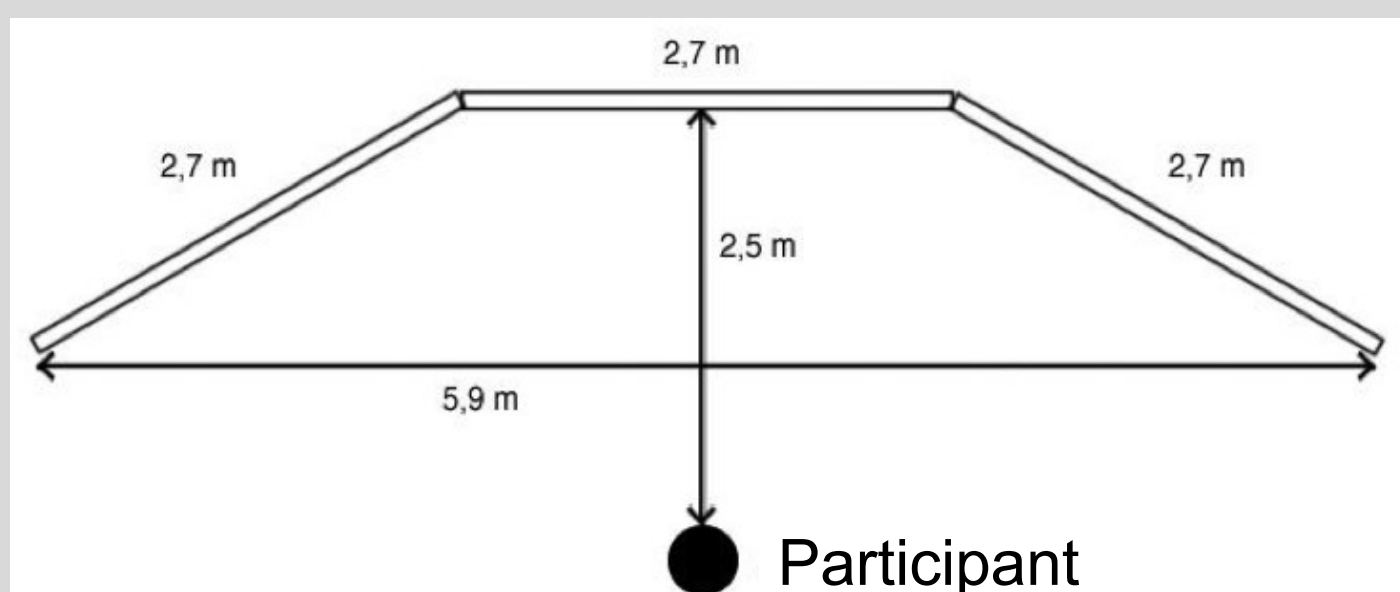


Figure 2: Schematic overview of the VR System and position of the participant.

Phase 1: RC Choice

A RC was modeled in VR based on a real RC (Fig. 6)

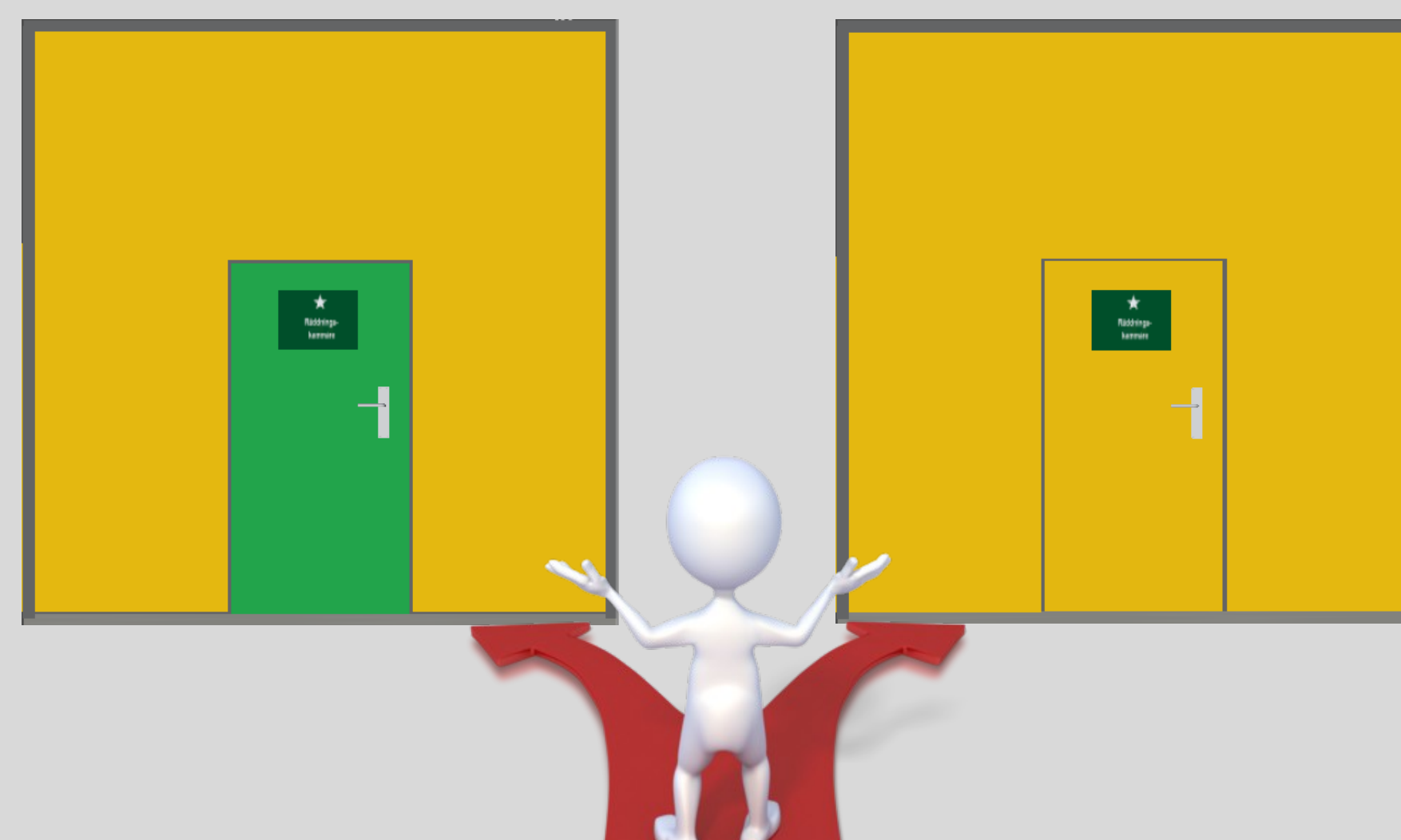


Figure 3: Screenshots of the RCs, and illustration of RC choice task in phase 1

Participants are in a dark underground facility and hear a fire alarm. They can choose between 2 RCs. One RC has a green door and one a yellow door.

Phase 2: Ratings Inside RC

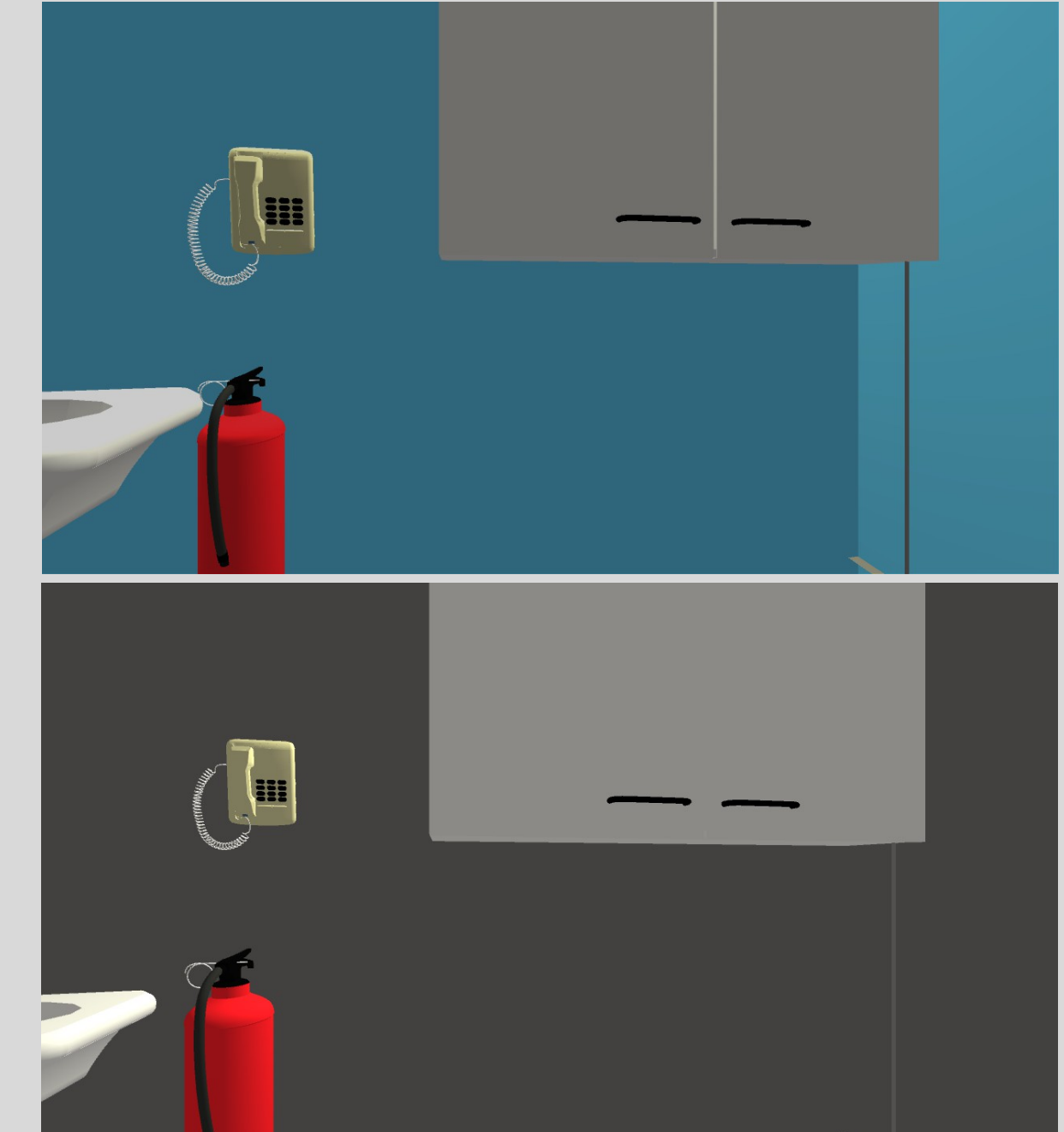


Figure 4: Screenshots of the blue and grey inside of the RC in phase 2

Participants are inside the RC and rated anxiety, clarity of the situation, perceived control, and quality of the design on a scale from 0 to 10.

Sample

- 25 participants
- 23.24±2.29 years
- 9 female, 15 male

VR Setting

- VR System „The Stage“ at LTH
- Unity3D game engine
- Active stereoscopic projection

Independent Variables

- Design of Resuce Chamber
 - Green vs.yellow door
 - Blue vs .grey interior color

Dependent Variables

- Choice of Rescue Chambers
- Subejective ratings inside of the Rescue Chambers

Method

Results

Phase 1: RC Choice

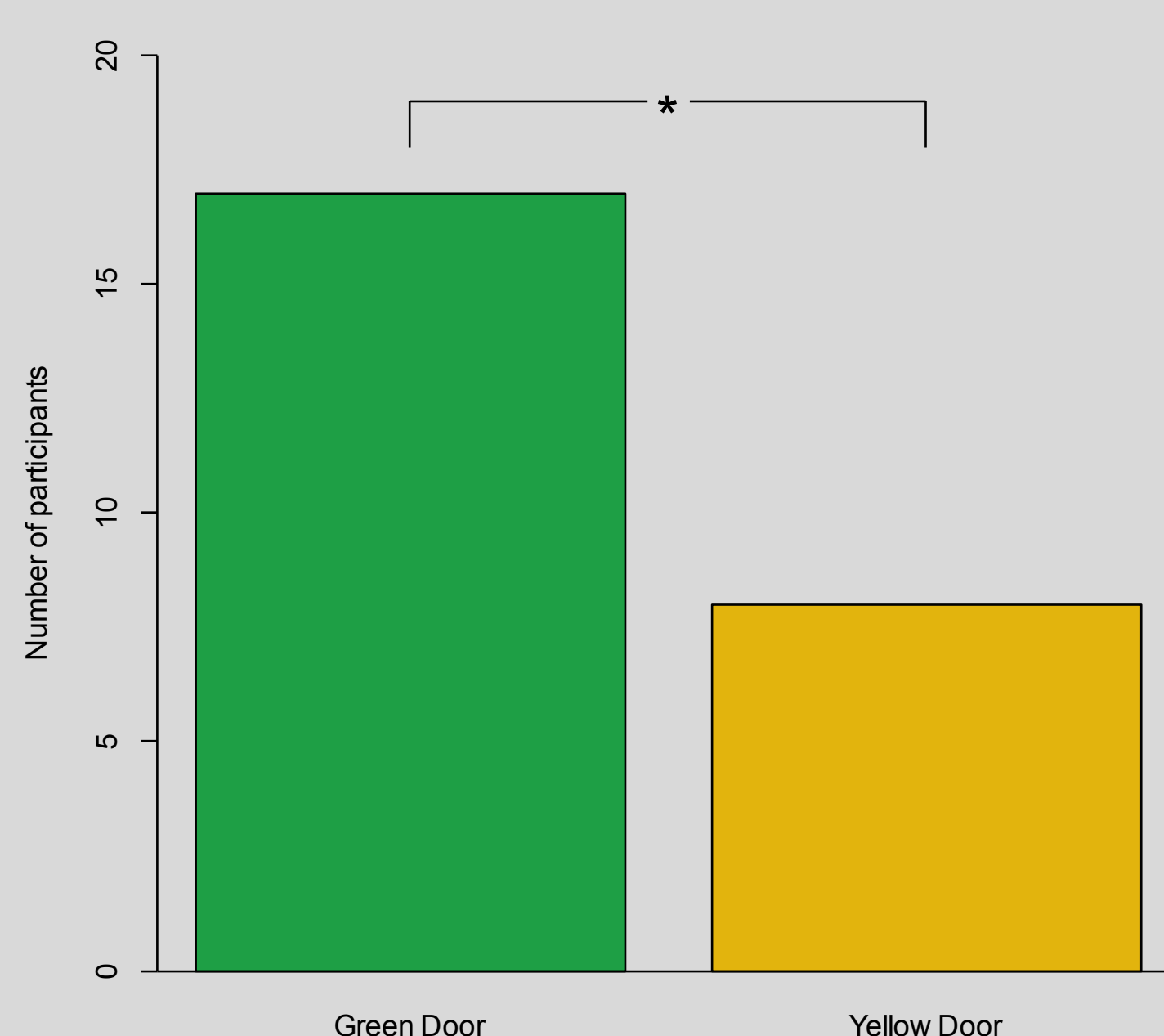


Figure 5: Results from phase 1: Number of participants choosing either the green or the yellow door during a fire alarm



Figure 6: A real RC that served as a model for the VR RC

Eight participants decided to go to the RC with a yellow door, 17 picked the RC with the green door, $\chi^2(1) = 3.24; p = .07$.

Phase 2: Ratings Inside RC

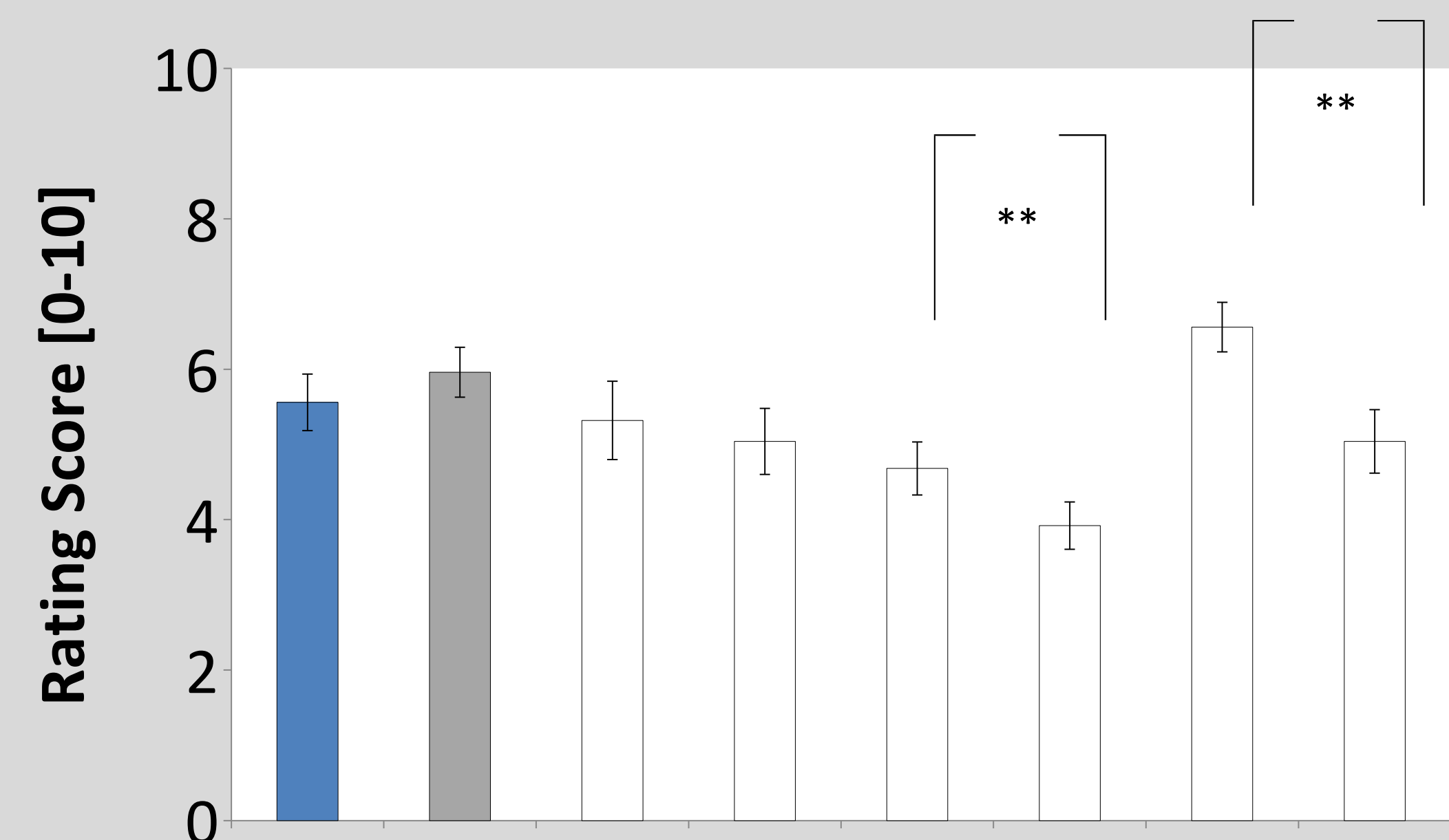


Figure 7: Results from phase 2: Ratings of anxiety, clarity of the situation, perceived control and quality of design of the RC. All ratings were on a sclae from 0-10.

Ratings of percieved control, $Z = -3.04, p < .01$, and quality of the RC's design, $Z = -3.23, p < .01$, were higher in the blue RC.

Results

Disussion

Implications

- VR is a usefull method to study human behavior in fire
- Green is a more suitabel color for a door for a RC
- Blue RC wall color was rated better than the grey version
- Simple (and cheap) design variations already can improve acceptance, use and perception of RC

Limitations

- Small sample size
- Participants were mainly students and not familiar with underground facilities
- Repeated measures design

Disussion