

Evaluation of the Effect of VR Disaster Experience in Familiar Environment

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**Wataru Asaba, Kimi Ueda,
Hirotake Ishii and Hiroshi Shimoda**

**Graduate School of Energy Science,
Kyoto University, Japan**

1. Background & Purpose

1.1 Background

As disaster education to raise awareness, VR has been attractive.



Cost-effective
High sense of presence



Reproduce disasters that are
difficult to experience

- It was difficult to feel a sense of reality and fear that a disaster might occur
- From the viewpoint of reviewing disaster countermeasures, there were few points that could be used as references

1. Background & Purpose

1.2 Purpose

[1] W. Asaba, Y. Harazono, H. Ishii and H. Shimoda. (2021).

- Develop a system that automatically creates a VR space that enables users to experience disaster based on images captured by cameras[1]
 - Experience disaster in familiar environment becomes very easy

Purpose

- Evaluate how VR disaster experience in familiar environment affect the experienter's awareness of disaster prevention
- Build a psychological model for VR disaster experience

Method



Capture familiar environment



Experience



Questionnaire

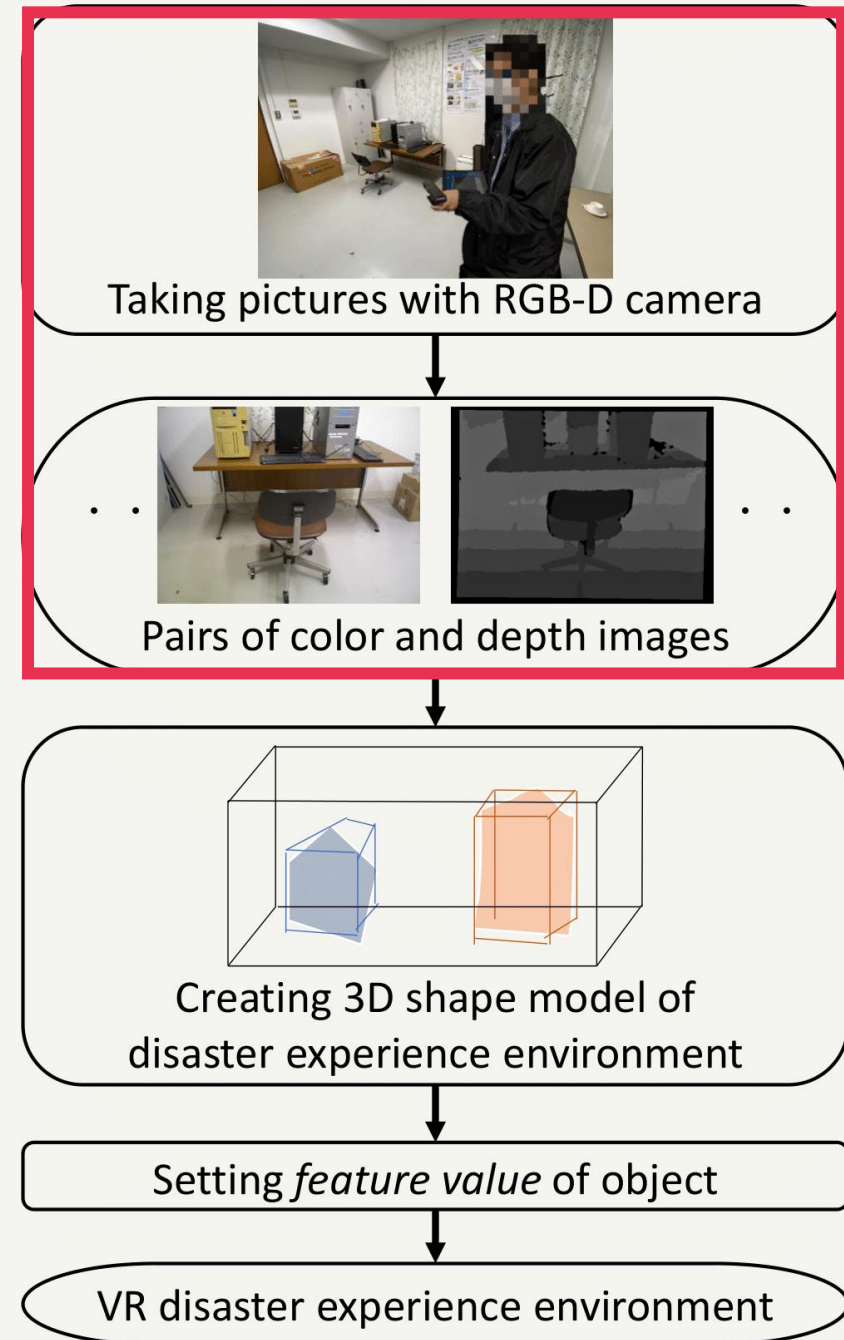
2. Construction Method

2.1 Flow of Construction Method

The indoor environment of the target of the disaster experience is captured multiple times from various angles with RGB-D camera

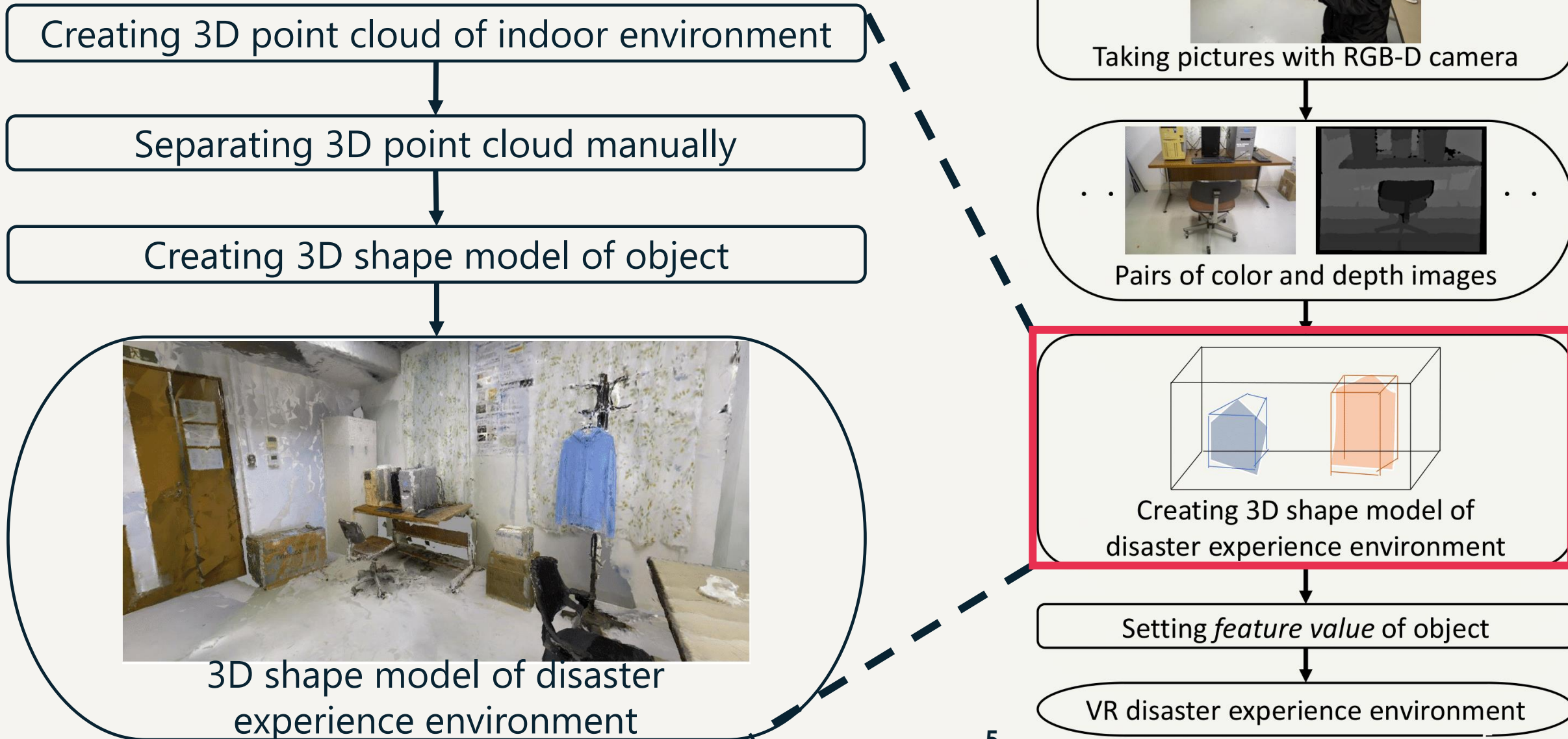


RGB-D camera



2. Construction Method

2.1 Flow of Construction Method



2. Construction Method

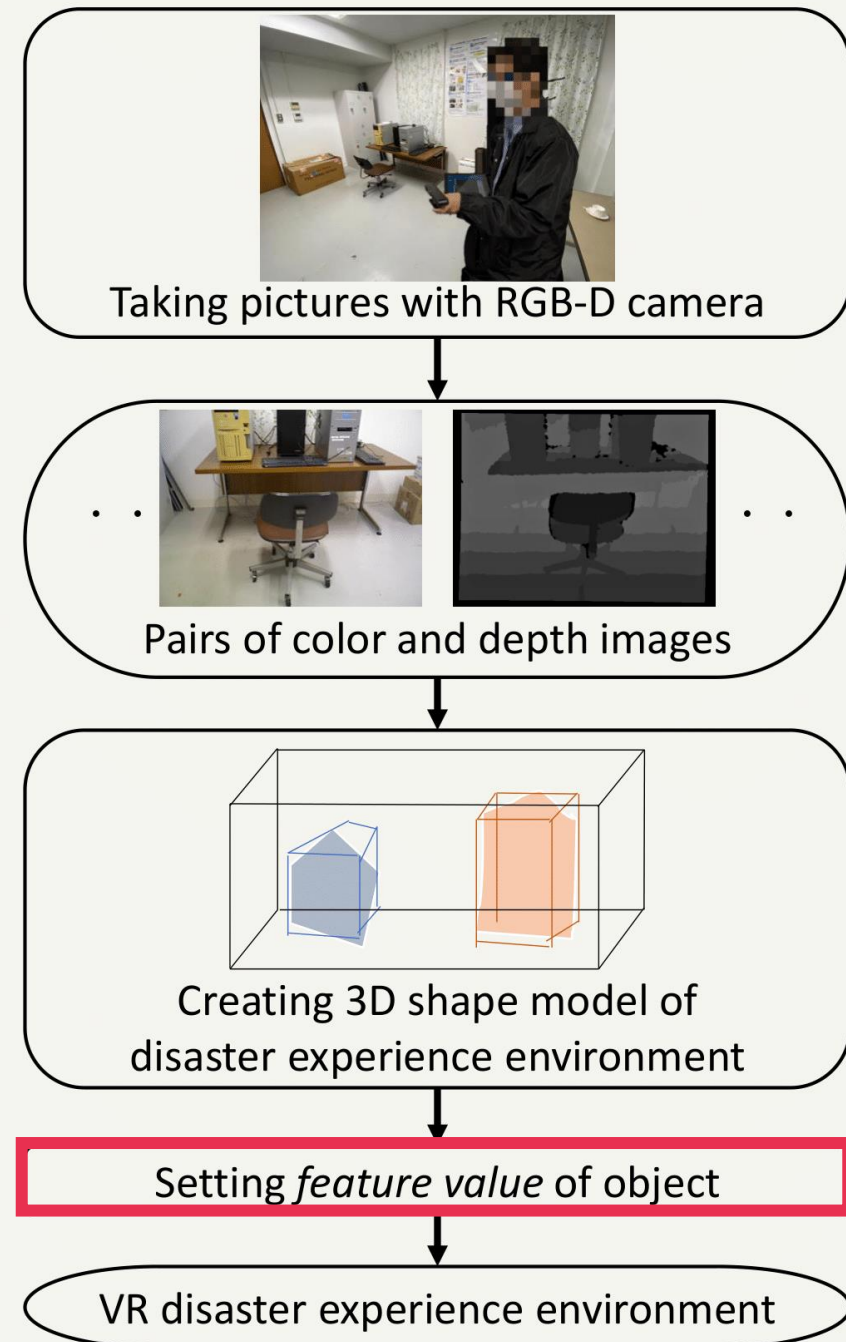
2.1 Flow of Construction Method

Feature values

- Representing the physical behavior characteristic

Set *feature values* manually based on the material and intended use of the object

Disaster	Feature values	Object's behaviour
Earthquake	<i>Proportion of material</i> (glass/wood/metal/plastic)	Sound of collision and rupture
Fire	<i>Flammability</i> <i>Proportion of material</i> (glass)	Non-flammable, slowly flammable, well flammable and intensely flammable Sound of glass rupture



2. Construction Method

2.2 VR Disaster Experience Video

Earthquake



2. Construction Method

2.2 VR Disaster Experience Video

Fire



3. Evaluation Experiment

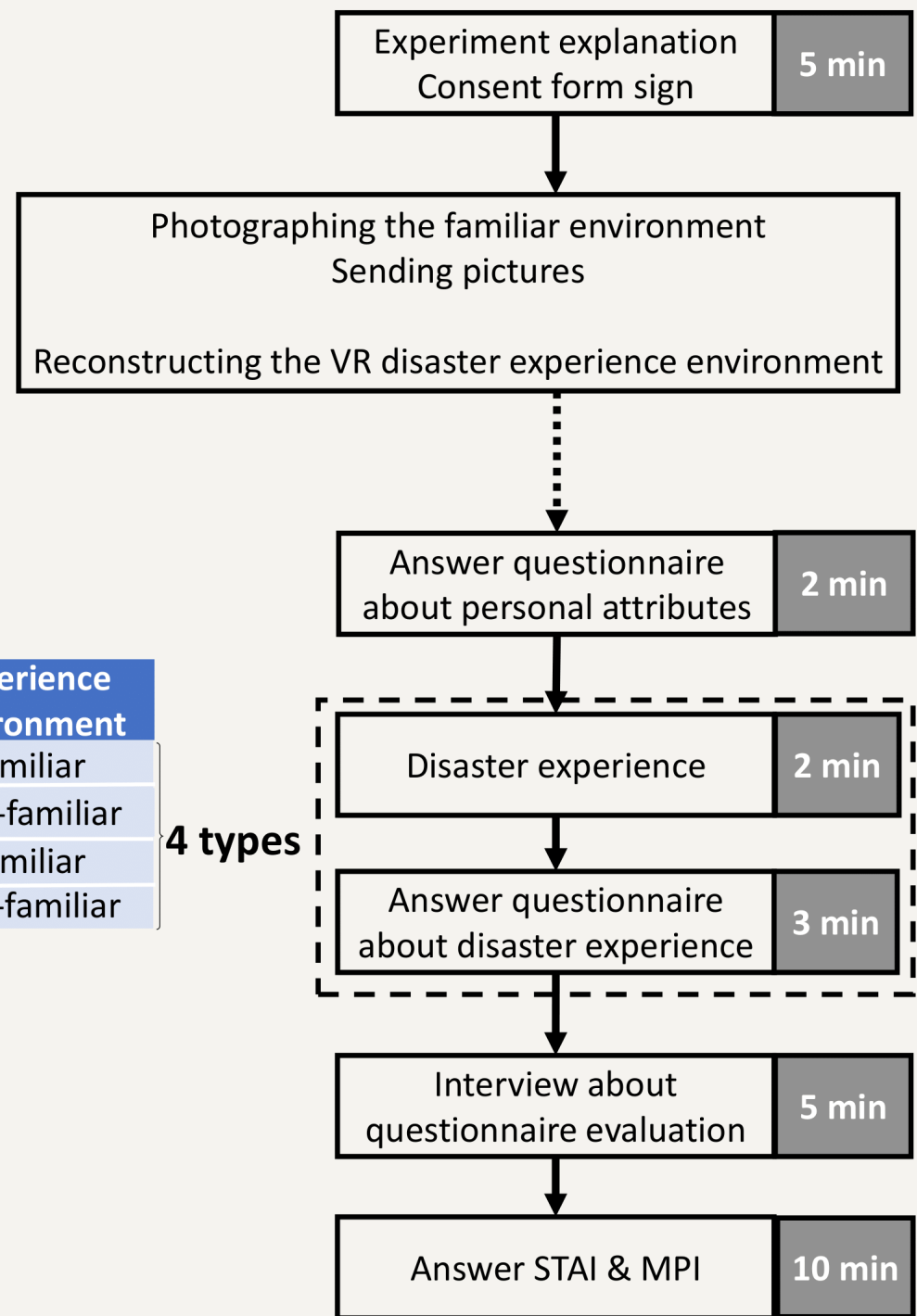
3.1 Flow of Experiment

The order of experiences of earthquake and fire, familiar and non-familiar disaster experience environments were counterbalanced



Disaster	Experience environment
Earthquake	Familiar
	Non-familiar
fire	Familiar
	Non-familiar

4 types



3. Evaluation Experiment

3.2 Questionnaire

7-point scale from "1: I don't agree at all" to "7: I agree very much"

Set questionnaire items based on previous studies[4][5]

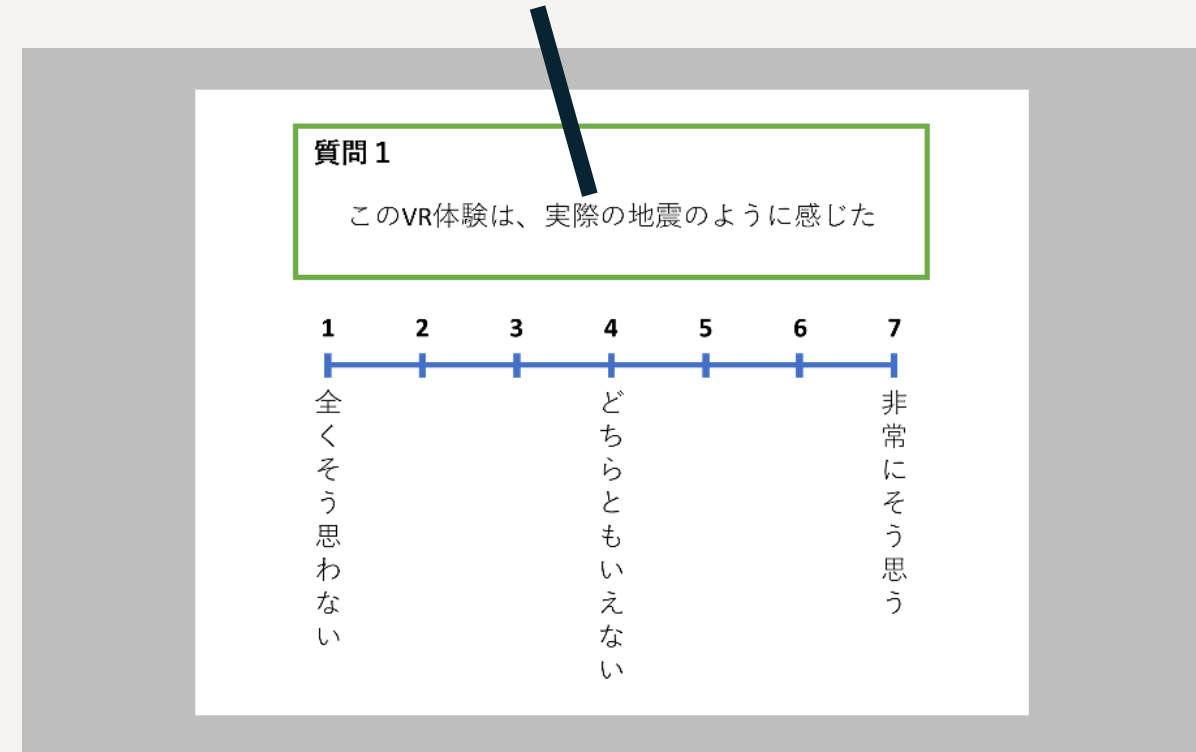
Questionnaire item

1. A sense of reality
2. A sense of fear
3. A sense of familiar environment
4. Communication intention
5. Disaster risk perception
6. Anxiety
7. Disaster prevention behavioral intention

[4] J. Toyosawa, K. Karasawa and N. Fukuwa. (2010).

[5] T. Motoyoshi, K. Takao and S. Ikeda. (2008).

The VR experience felt like a real earthquake



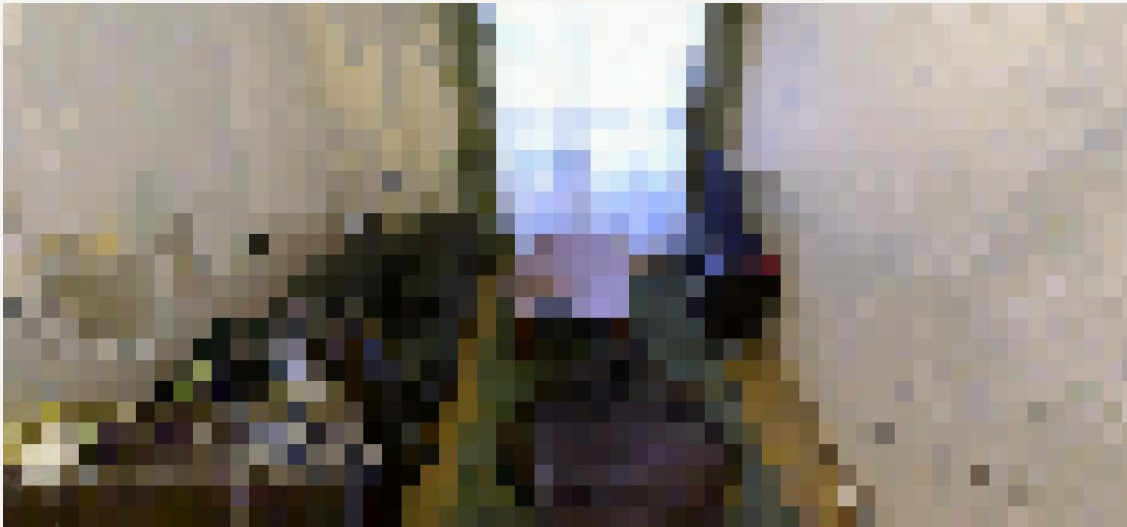
Example of questionnaire screen displayed on HMD

3. Evaluation Experiment

3.3 Non-familiar Environment

In order to properly evaluate the effect of the familiar environment, it is necessary to minimize the difference in physical characteristics

Set up the non-familiar environment with similar characteristics to familiar environment



Familiar environment
(Participant's room)



Non-familiar environment
(other people's room)

3. Evaluation Experiment

3.4 Participant

Participant

- Kyoto University and Kyoto University Graduate School students over 18 years old
- Naked eye or wearing contacts

Number

24 participants (12 males, 12 females)

Age

22.2 ± 2.36 years old

Experimental period

2022/6/18 ~ 2022/12/5

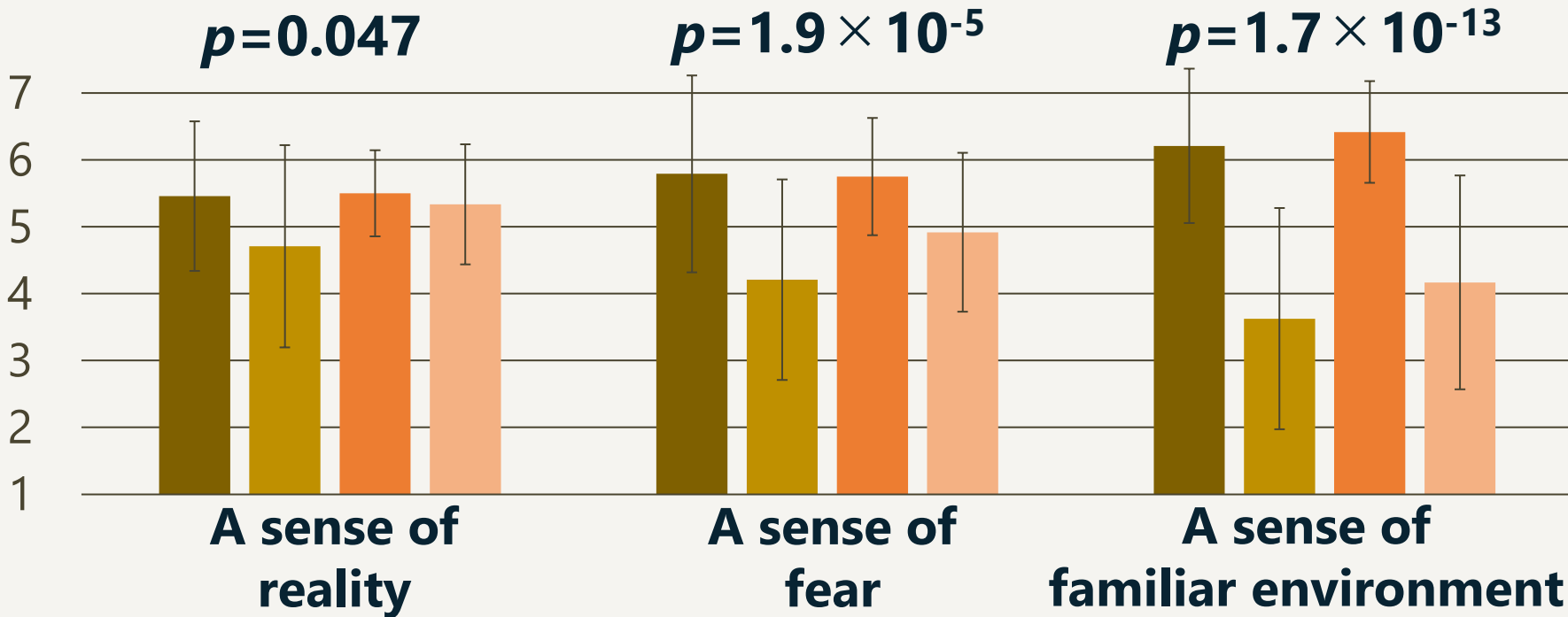
3. Evaluation Experiment

3.5 Result (N=24)

Two-way ANOVA

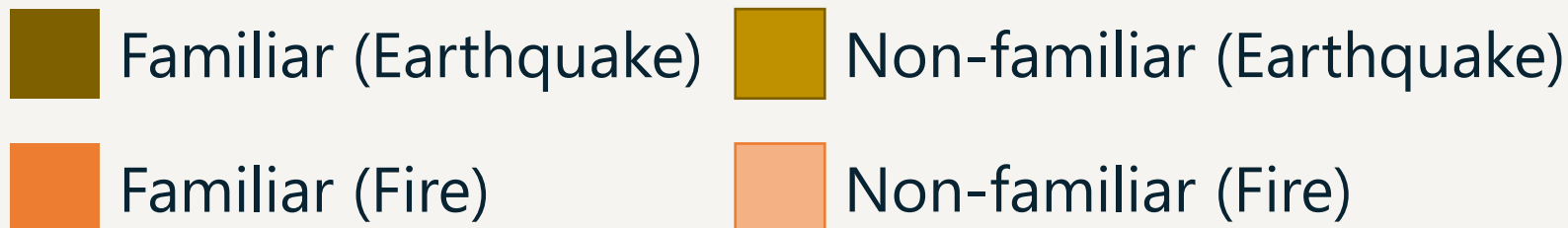
Disaster(Earthquake vs Fire) × Environment(Familiar vs Non-familiar)

Significantly difference only in environment factor



Comment

- I felt a sense of crisis and reality because it was my room.
- I was terrified that familiar and thoughtful objects had fallen.



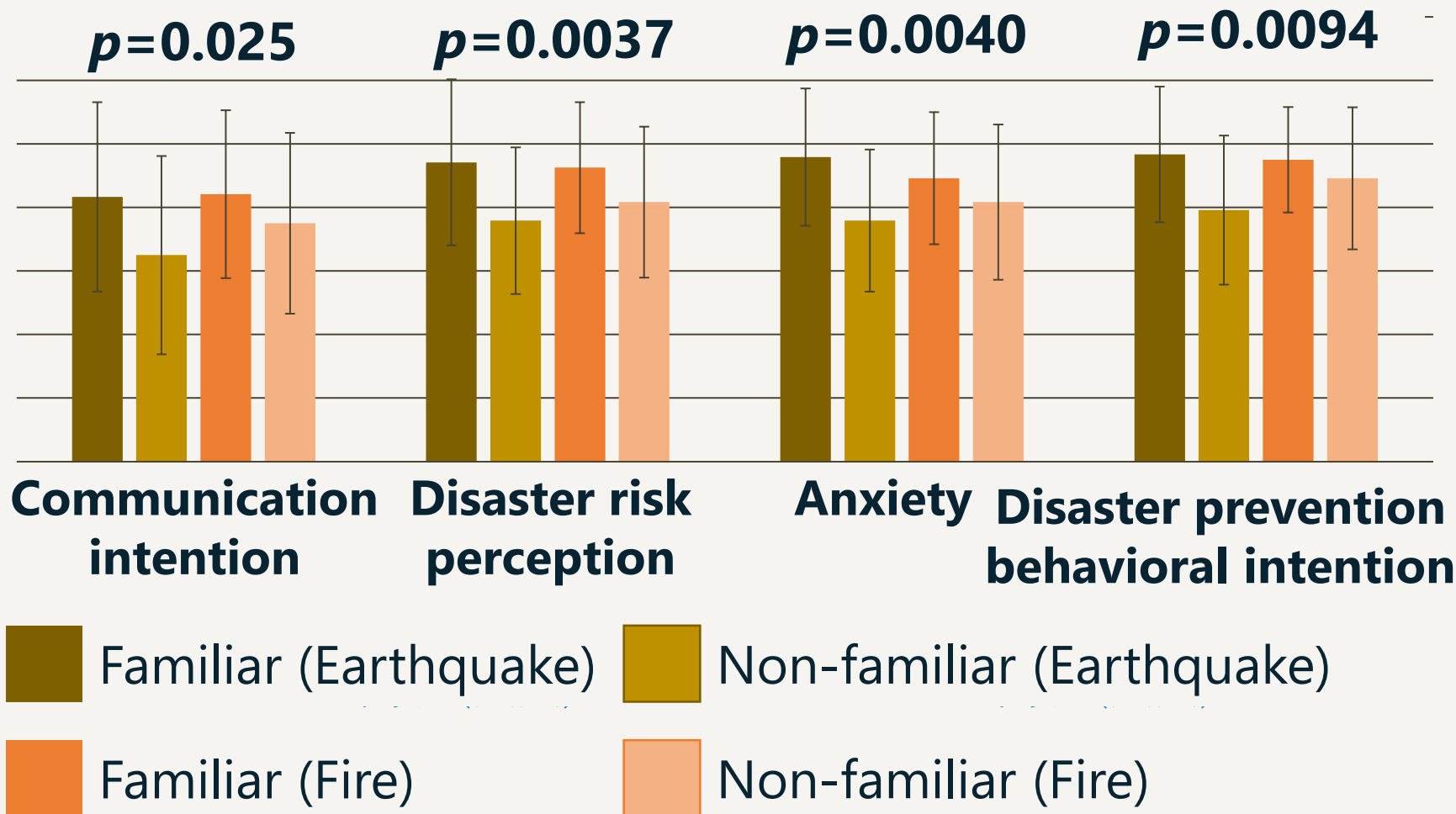
3. Evaluation Experiment

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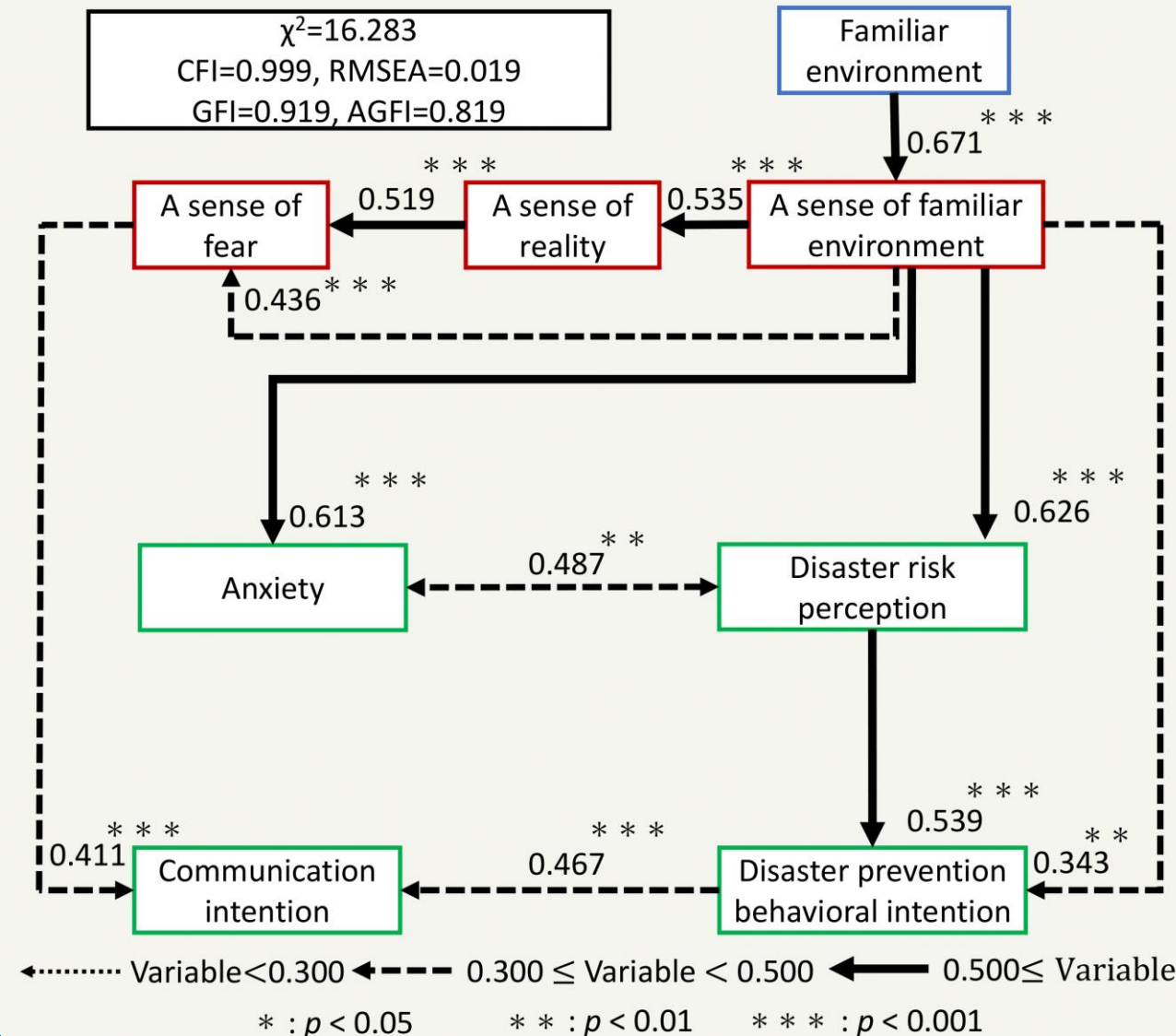
Comment

- I thought about what actions and countermeasures I would take if earthquake happened in my room.
- My room was full of flammable objects, so I decided to take countermeasures.

Earthquake

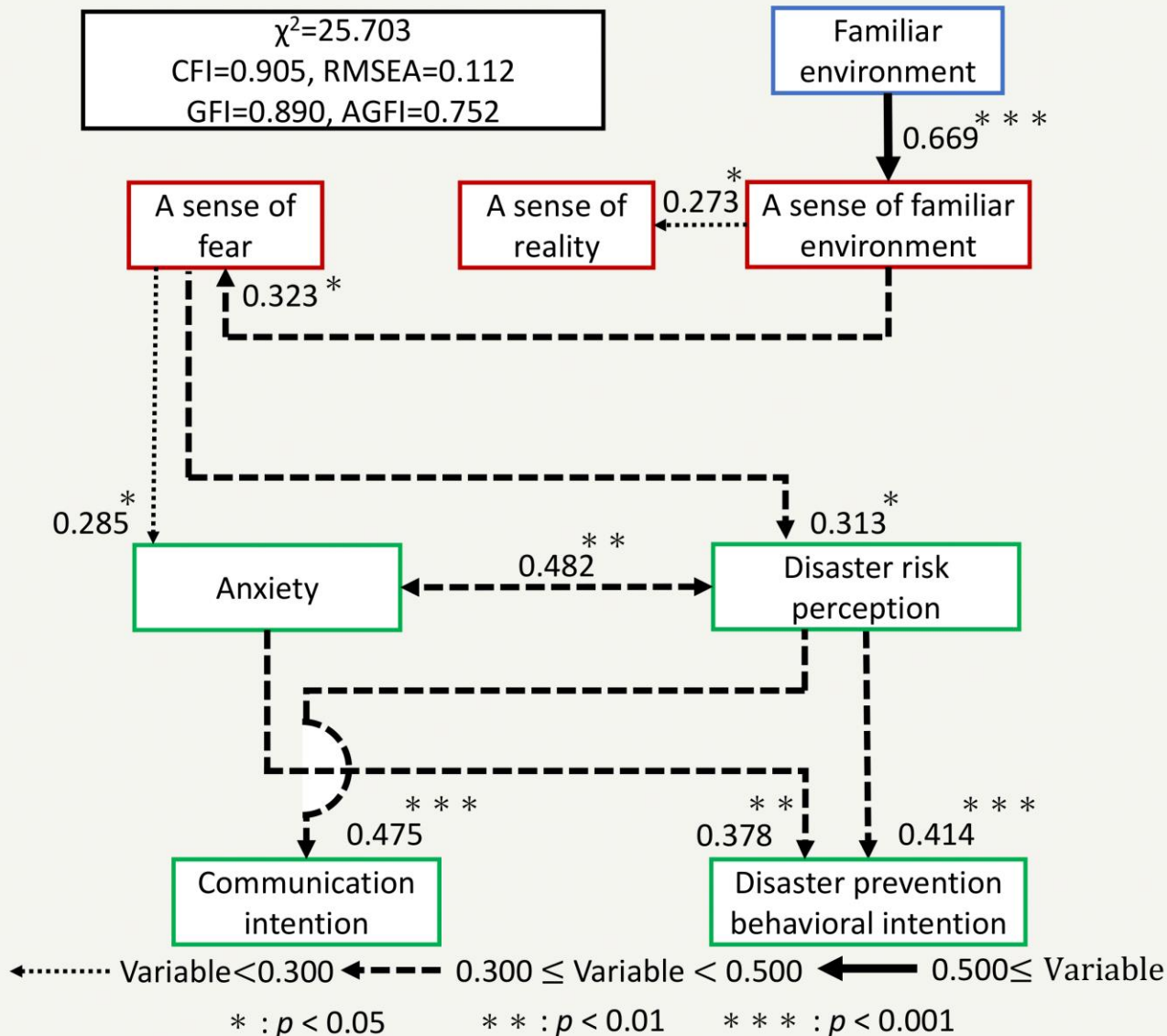
4 Psychological Model

- Reproducing a familiar environment can increase a sense of reality and fear.
- Reproducing a familiar environment can inform people of the danger, make them feel anxiety and make them think about taking disaster prevention actions.
- In the case of non-familiar environment, it may not be possible to expect an increase in the awareness of disaster prevention.



4 Psychological Model

- Reproducing a familiar environment can increase a sense of reality and fear, but its effect is small.
- Increasing a sense of fear can inform people of the danger, make them feel anxiety and make them think about taking disaster prevention actions.
- Non-familiar environment is also effective in perception of fire risk and promotion of disaster prevention behavior.



5 Conclusion & Future Work

Conclusion

- Participants experienced earthquake and fire in familiar and non-familiar environments.
- In all questionnaire items, the responses in familiar environment were found to be significantly higher than that in non-familiar environment.
- The reproduction of familiar environment in VR experience was found to have an effect on a sense of reality, fear and the awareness of disaster prevention.

Future Work

- To compare the effects of VR disasters on the awareness of disaster prevention by having participants experience VR disasters in various kinds of familiar environments.