

An Experimental Study on Promotion of Pro-Environmental Behavior Focusing on “Vanity” for Interactive Agent

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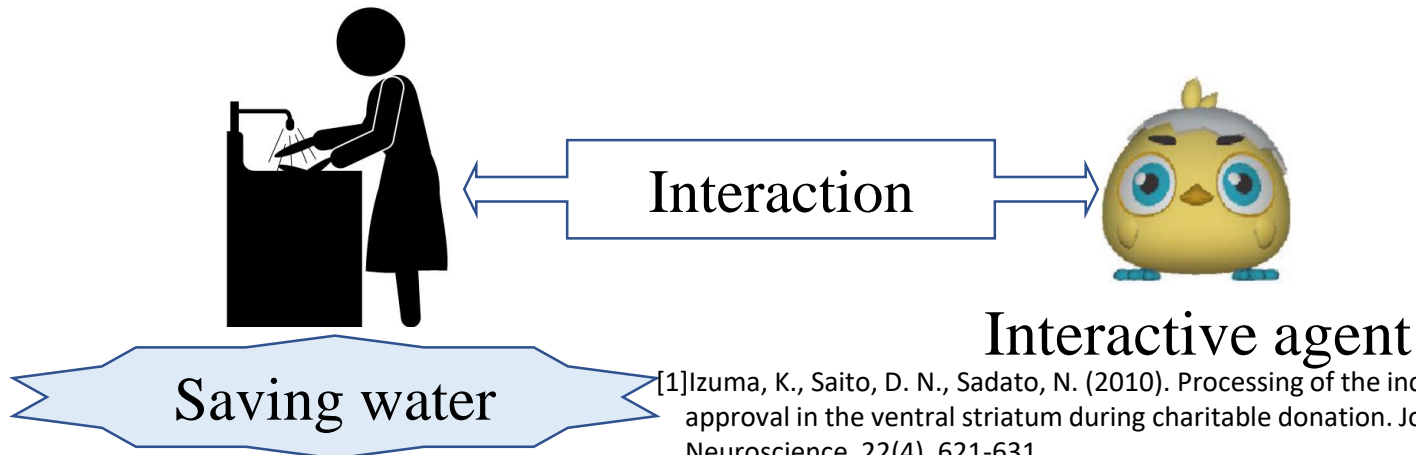
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Introduction

- Individuals need to perform pro-environmental behavior (PEB).
- “Vanity” has a possibility to motivate to do pro-social behaviors(PSB).
e.g. : Presence of observer got donation rate higher^[1]
(“Vanity” is defined as “the desire to show oneself better to the other” in this study.)
 - Focused on“Vanity” as a motivation for PEB.
- By increasing the personification of the observer, one might want to have vanity.
 - Focused on an interactive agent.



[1]Izuma, K., Saito, D. N., Sadato, N. (2010). Processing of the incentive for social approval in the ventral striatum during charitable donation. *Journal of Cognitive Neuroscience*, 22(4), 621-631.

The purpose of this study

① Hypothesis confirmation

Hypothesis 1. They tend to have more vanity for an interactive agent than that for non-interactive agent.

Hypothesis 2. The vanity for an interactive agent promotes prosocial behaviors which value is shared as norms.

Hypothesis 3. Hypothesis 2 can be held even when the prosocial behavior is PEB which is not known to be shared as norms.

② Effect by interaction

Design guidelines of interactive agents to promote PEB

1. Evaluate his/her behavior



2. Has sense of value for Pro-social behavior



3. Seems favorable



A chick type CG character “ Piyota ”



- Non-human-type interactive agent.
- Bold emotional expression. [2]
- 24 types expressing 8 types of emotions with three levels of intensity, based on Plutchik's "wheel of emotions" [3], and 20 expressions.
- Voices were generated by using a prototype of DNN-based parametric TTS (Text-To-Speech) system developed by R&D group of Hitachi, Ltd..

[2] Takashi Numata, Yasuhiro Asa, Tomohiro Kitagaki, Takaaki Hashimoto, Kaori Karasawa, “ Young and elderly users ’ emotion recognition of dynamically formed expressions made by a non-human virtual agent ” in Proc. 7th International Conference on Human-Agent Interaction, T10, pp.253-255, October 2019, Kyoto, Japan

[3] Robert Plutchik, “ The nature of emotions: Human emotions have deep evolutionary roots, a fact that may explain their complexity and provide tools for clinical practice ” American Scientist, 89(4), 344-350, 2011

Items to compare

Contrast experiment between interactive and non-interactive agents

Interactive agent condition



Non-interactive agent condition



Subjective feelings including vanity

Questionnaire

Comparison

Questionnaire

Prosocial behavior



Comparison



PEB



Comparison



Measuring method

Subjective feelings

- The following subjective feelings were asked in seven grade Likert scale from 0 to 6.
 - ① Feeling of interaction
 - ② Feeling of having will
 - ③ Feeling to be evaluated
 - ④ Favor
 - ⑤ Understanding of sense of value for ecological activity
 - ⑥ Understanding of sense of value for species protection
 - ⑦ Vanity

Prosocial behavior

- Give one 500 JPY coin, four 100 JPY coins and ten 10 JPY coins as their reward.
- Asked to donate some money by agent.
- Donation amount is an index.

PEB

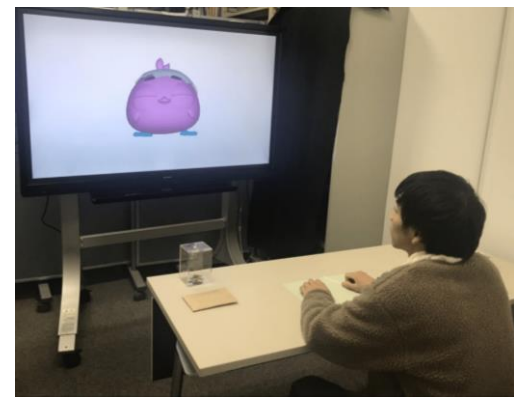
- Asked to wash dishes by agent.
- The amount of water saving is an index.

Procedure

From December 9th to 20th, 2019

33 participants

Average age is 22.3 (SD=2.4)



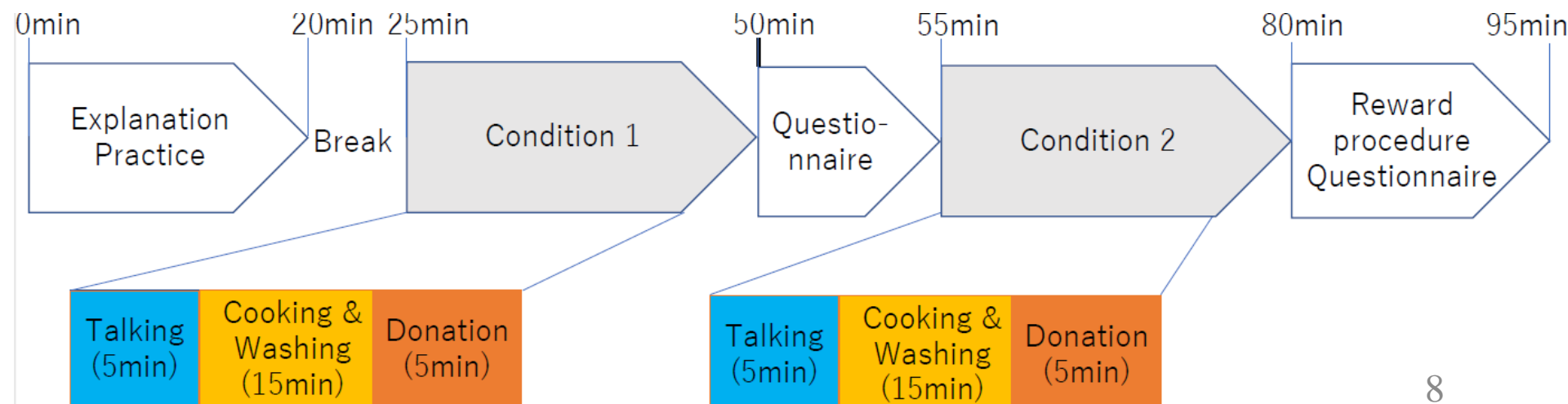
A Scene of experiment

Interactive agent condition



Counter balance

Non-interactive agent condition



Result① Hypothesis confirmation.

Hypothesis verification
by paired t-test

Hypothesis	Measured Item	Interactive agent	Non-interactive agent	p-value
1	Vanity	3.42 ± 1.60	2.67 ± 1.63	0.001
2	Amount of donation(JPY)	80 ± 145	69 ± 131	n.s.
3	Amount of water use(L)	4.40 ± 2.02	4.26 ± 2.22	n.s.

Significant difference	No Significant difference
<p>Vanity</p> <p>Feeling of interaction Feeling to be evaluated Feeling of having will Favor</p>	<p>Amount of donation Amount of water use Understanding values (eco) Understanding values (species protection)</p>

Result ② Affect by interaction.

Structural Equation Modeling(SEM)

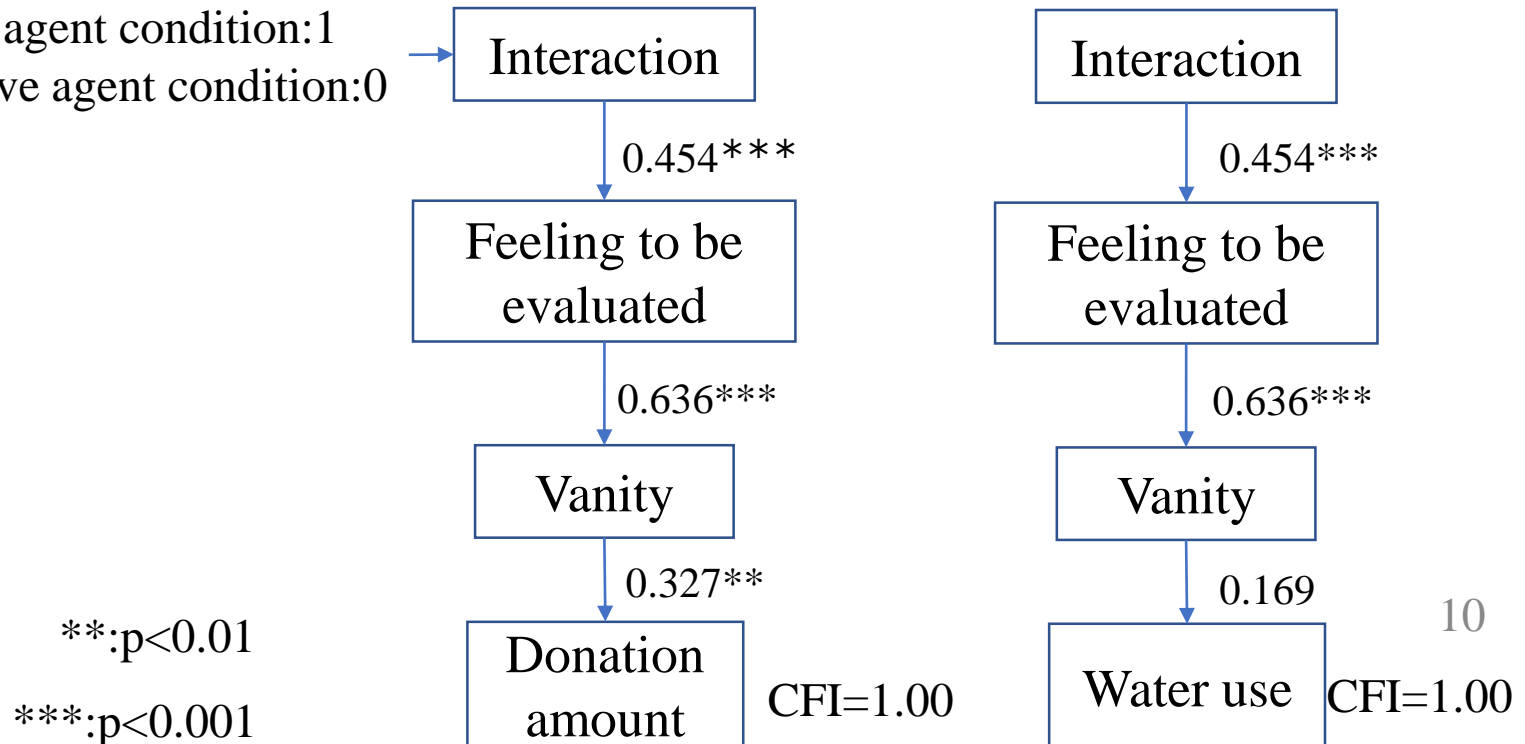
- Examine the relationship between multiple components.
- Phenomena can be analyzed by introducing latent variables

Purpose: See the effects of interactions

Model using only observational variables

Interactive agent condition:1

Non-interactive agent condition:0

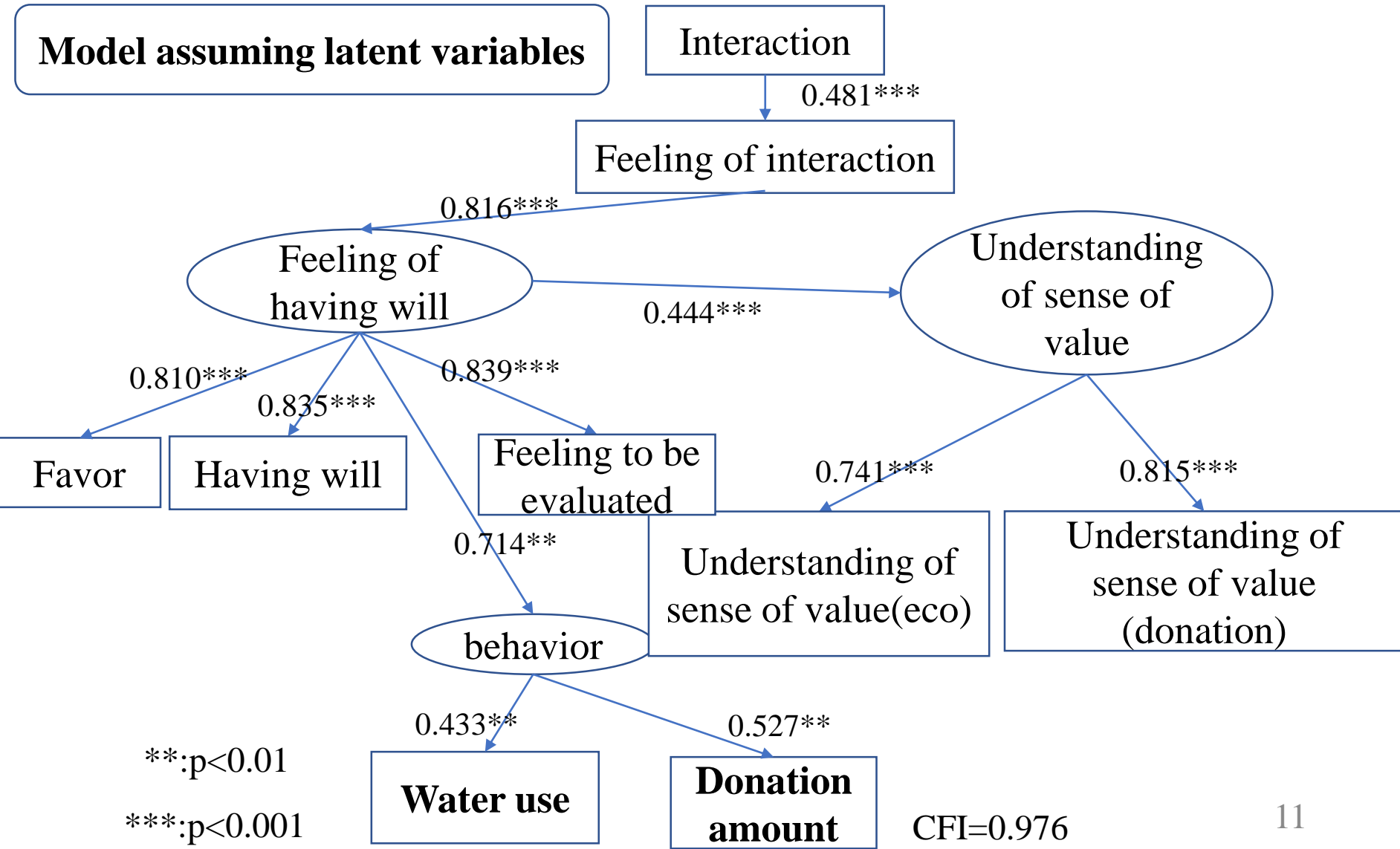


Result②

Structural Equation Modeling(SEM)

Purpose: Assume latent variables and see things that were not known only from observed variables

Model assuming latent variables



Conclusion

- Participants had vanity for interactive agents, however it wasn't confirmed that vanity promoted prosocial behaviors such as donation and PEB.
- Suggestions that dialogue may influence behavior.
- The experimental design to measure the degree of PEB will be redesigned.