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SUPPLEMENTARY-RESULT

Reducing ageism focusing on stereotype embodiment theory: Pre-registered study and Bayesian analysis approach

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Abstract

Ageism has become a social problem in an aged society. This study re-examines an ageism affirmation strategy; the designs and plans for this study were pre-registered. Participants were randomly assigned to either an experimental group (in which they read an explanatory text about the stereotype embodiment theory and related empirical findings) or a control group (in which they read an irrelevant text). The hypothesis was that negative attitudes toward older adults are reduced in the experimental group compared with the control group. Bayesian analysis was used for hypothesis testing. The results showed that negative attitudes toward older adults were reduced in the experimental group. These findings contribute to the development of psychological and gerontological interventions aimed at affirming ageism. In addition, continued efforts to reduce questionable research practices and the spread of Bayesian analysis in psychological research are expected.

Keywords: ageism; Bayesian analysis; pre-registration; questionable research practices; stereotype embodiment theory

Introduction

The aging population is progressing rapidly worldwide, including Japan. While there is a need to create societies in which older adults and younger people can live together comfortably, the attitudes held by younger people toward older adults are generally negative (Harada, 2011; Skipper & Rose, 2021). Given that such attitudes lead to worsening mental health, including depressive tendencies (Bai et al., 2016; Kim et al., 2015), reducing ageism held by younger people is an urgent issue.

Therefore, this study follows the ageism affirmation strategy proposed by Shimizu (2022) and Shimizu et al. (2022)). In these studies, showing explanatory texts about Levy's (2009) stereotype embodiment theory (SET) and related empirical findings to the participants successfully reduced anti-old attitudes. The SET argues that old-age stereotypes are internalized by people over time, leading to decreased self-efficacy (Levy et al., 2000) and diminished cognitive or physical functions (Gale & Cooper, 2018) when they become older adults themselves.

Objective

In this study, participants were randomly assigned to either an experimental group (showing an explanatory text about SET and related empirical findings) or a control group (showing an irrelevant

explanatory text). Negative attitudes toward older adults were measured before and after the experimental manipulation. The hypothesis was that negative attitudes toward older adults are reduced in the experimental group compared with the control group. The experimental designs and plans for this study were pre-registered. The hypothesis was tested using Bayesian analysis, which has been the focus of attention in recent years. Bayesian estimation can help solve the problems faced by traditional hypothesis testing (e.g., p-hacking; Crane, 2018; Fujishima & Higuchi, 2016; Shimizu, 2018).

Methods

Pre-registration

The experimental designs and plans for this study were registered in the Open Science Framework (OSF) repository (https://doi.org/10.17605/OSF.IO/YEQRC) on September 27, 2022. At the time of pre-registration, it was not assumed that the analysis would be conducted by Bayesian analysis; therefore, only the statistical method used in the analysis was modified.

Participants

A total of 134 Japanese university students (aged 19–22 years) participated in the study as part of their coursework. This included 51 male and 83 female students at three universities in Tokyo, with a mean age of 19.88 years (SD = 0.80). Their details have been posted on the OSF (https://osf.io/gqzxs/). This study was approved by the Ethics Committee of the University of Tokyo and was conducted from October to December 2022. Informed consent was obtained from all participants.

Procedure

Participants responded to items on negative attitudes toward older adults (Time 1). Participants were then randomly assigned to either the experimental group (N = 69)—in which they read an explanatory text about SET and related empirical findings—or the control group (N = 65)—in which they read an irrelevant text. After reading one of the texts, participants answered the items on negative attitudes toward older adults (Time 2), subjective time to become older (sense of how far along they are in their senior years), contact experience with older adults (quantitative and qualitative aspects), and demographics.

Vignette (experimental manipulation)

The explanatory text presented in the experimental group was created by referring to Shimizu (2022) and Shimizu et al. (2022): "Everyone will eventually become an older person. However, we could internalize anti-old discriminatory attitudes throughout our lives and turn these attitudes against ourselves. In short, the stronger your current internalized discriminatory attitudes, the worse your own mental and physical health will fare when you become an older person. Here are some examples of this tendency. People with more discriminatory attitudes are more likely to have lower self-efficacy and worse lifestyles and less likely to recover from illnesses when they become older. Therefore, you should avoid anti-old discriminatory attitudes as these will have some undesirable impacts on your own future."

The explanatory text presented in the control group was created by referring to Ikeda (2010): "What is characteristic in consumers' purchasing decisions is the existence of a wide variety of efforts from the sellers. For example, everyone is familiar with the terms 'marketing', 'advertising', and 'branding'; there are efforts mainly on TV and the Internet. These appeal to consumers over the attractiveness of products and services, leading them to make purchases. In this case, it is important not only to focus on the positive

aspects of the product (e.g., 'If you buy this product, you will get such a good thing'), but also to consider the negative aspects (e.g., 'It costs 100,000 yen to buy this product')."

Measurements

For the measurements, Stan (version 2.21.0) was used to estimate the correlation coefficient and reliability coefficient, ω. In particular, the Stan codes for estimating ω were taken from Akiyama (2019). Negative attitudes toward older adults were measured using the Japanese Version of the Fraboni Scale of Ageism (Harada et al., 2004), which consists of 14 items rated on a 5-point Likert scale. Means were calculated as the score (Time 1: estimated $\omega = .84$, 95% credible interval [95%CI] = [.80, .88]; Time 2: estimated $\omega = .86$, 95% CI = [.83, .90]). Subjective time to become older was measured by two items rated on a 7-point Likert Scale, including "I think I am still a long way away from becoming an older person" (Shimizu, 2022). Means were calculated as scores (estimated $r = .87$, 95%CI = [.83, .90]). Regarding contact experience with older adults (Shimizu, 2022), the quantitative aspect was measured by the following item rated on a 7-point Likert scale: "Do you think you have a lot of contact with older adults on a daily basis?" The qualitative aspect was measured using two items rated on a 7-point Likert scale, including "When you have a contact with older adults, do you find it to be a friendly relationship?" Means were calculated as scores (estimated $r = .68$, 95% CI = [.60, .74]). The participants' age and gender were measured as demographic variables.

Analysis

The *brms* package (Bürkner, 2017) was used for the Bayesian generalized linear mixed model (GLMM) for hypothesis testing. The prior distribution followed the default of *brms*, and the probability distribution was normal. Four chains (each length: 2,000) were generated, each warm-up period was set to 1,000, and the posterior distribution was approximated by 4,000 random numbers obtained using the Markov chain Monte Carlo method. Questionnaire items, data used in the analysis, and R and Stan codes were posted on the OSF.

Results

Summary statistics for each indicator were posted on the OSF. To examine the hypothesis, a Bayesian GLMM was conducted with negative attitudes toward older adults as the dependent variable and group (experimental and control), measurement timing (Time 1 and Time 2), an interaction between group and timing, subjective time to become older, contact experience, age, and gender as fixed effects. The factors of the participants and their universities were added as random effects. The results showed that each parameter converged well (*Rhat*s < 1.015), and an interaction effect was observed between group and timing (Table 1; estimated $\beta = -.23$, 95%CI = [$-.39, -.08$]). The probability that the posterior estimated value of the experimental group at Time 2 (estimated $M_{exp2} = 2.21$) was less than the posterior estimated value at Time 1 (estimated $M_{exp1} = 2.36$) was 92.3%. In addition, the probability that the estimated M_{exp2} was less than the posterior estimated value of the control group at Time 2 (estimated $M_{con2} = 2.37$) was 93.4%. In summary, the experimental manipulation of this study tended to reduce negative attitudes toward older adults, which generally supports the hypothesis.

Discussion

In this study, participants were randomly assigned to an experimental group (showing an explanatory text about SET and related empirical findings) and a control group (showing an irrelevant text), and the results showed that negative attitudes toward older adults were reduced in the experimental group. The experimental designs and plans were pre-registered. In addition, Bayesian analysis, which has been rapidly gaining attention in psychological research, was conducted.

Table 1. Bayesian GLMM results on negative attitudes toward older adults and estimated means

GLMM results	ß	95%CI		
Group (0 = control, 1 = exp.)	.06	[−.25, .37]		
Time (0 = control, 1 = exp.)	−.01	[−.12, .10]		
Group × time	−.23	[−.39, −.08]		
Subjective time	.17	[.02, .33]		
Contact (quantity)	−.01	[−.18, .14]		
Contact (quality)	−.46	[−.62, −.30]		
Age	.04	[−.13, .20]		
Gender (0 = female, 1 = male)	.11	[−.05, .27]		
Estimated means	Experimental		Control	
	Est. *M*	95%CI	Est. *M*	95%CI
Negative attitudes (Time 1)	2.36	[2.12, 2.64]	2.38	[2.15, 2.65]
Negative attitudes (Time 2)	2.21	[1.97, 2.47]	2.37	[2.14, 2.64]

Abbreviations: 95%CI, 95% credible interval; Est., estimated; Exp., experimental; GLMM, generalized linear mixed model; β, estimated standardized regression coefficient.

There was no remarkable difference between the experimental and control groups in terms of subjective time to become older (in order, *M* = 4.72, 4.65; see OSF). In contrast, Shimizu (2022) found that the experimental group had a shorter subjective time to become older. One reason for this difference is the participants' age; Shimizu (2022) included people aged 18–39 years, whereas this study included only university students. In this study, younger participants aged approximately 20 years may have had a particularly longer subjective time to become older, with or without experimental manipulation. The limited age of the participants is a major limitation of this study, and a follow-up study with participants of a wide age range is necessary.

Conclusions

This study showed that presenting an explanatory text about SET and related empirical findings reduces participants' anti-old attitudes. These findings will contribute to the development of psychological and gerontological interventions aimed at affirming ageism. In this study, the experimental designs and plans were pre-registered, and Bayesian analysis was conducted (the code used in the analysis is available on the OSF). Continued efforts to reduce questionable research practices and the spread of Bayesian estimation in psychological research are expected.

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