Title:

Experiencing respect elongates the orienting response

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Abstract:

Respect is an emotion that promotes self-improvement, often experienced when recognizing superior traits in others. The present study aimed to investigate one of its action tendencies. Since previous studies have suggested that respected persons are role models, we hypothesized that respect prolongs the orienting response of paying attention to the persons and examined the related phasic decrease in heart rate (HR). We presented a stimulus (an episode followed by a photograph) about each participant's parents, teachers, affectively respected persons (other than parents and teachers), and the unknown persons as a control. Participants read the episode, looked at the photo, and rated the extent of experiencing respect. As a result, we found that the averaged HR across conditions declined during stimulus presentation but that the change scores of HRs from the minimum value increased only in the control condition: the HRs of the other conditions (parents, teachers, and affectively respected persons) did not recover. Furthermore, we confirmed a significant correlation between respect ratings and the reduction in HRs by performing a partial correlation analysis that controlled for familiarity with the persons. These results suggest that respect elongates the orienting response.

Keywords: respect, action tendency, heart rate, attention, orienting response

Declarations

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Conflicts of interest:

The authors have declared that no competing interests exist.

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The data will be available after acceptance of this manuscript.

Code availability:

Not applicable

Authors' contributions:

KO organized the research project. SK, TF, SM, YN and KO designed the study. SK performed the experiments and analyzed the data. SK, TF, HN, SM, YN, and KO discussed the results. SK drafted the original version of the paper. SK, TF, HN, SM, YN and KO revised and edited the paper. All authors approved the final version of the manuscript.

Ethical approval

All procedures were approved by the Ethics Review Committee on Experimental Research with Human Subjects of the Graduate School of Arts and Sciences, the University of Tokyo. Written informed consent was obtained from all participants.

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Abstract:

Respect is an emotion that promotes self-improvement, often experienced when recognizing superior traits in others. The present study aimed to investigate one of its action tendencies. Since previous studies have suggested that respected persons are role models, we hypothesized that respect prolongs the orienting response of paying attention to the persons and examined the related phasic decrease in heart rate (HR). We presented a stimulus (an episode followed by a photograph) about each participant's parents, teachers, affectively respected persons (other than parents and teachers), and the unknown persons as a control. Participants read the episode, looked at the photo, and rated the extent of experiencing respect. As a result, we found that the averaged HR across conditions declined during stimulus presentation but that the change scores of HRs from the minimum value increased only in the control condition: the HRs of the other conditions (parents, teachers, and affectively respected persons) did not recover. Furthermore, we confirmed a significant correlation between respect ratings and the reduction in HRs by performing a partial correlation analysis that controlled for familiarity with the persons. These results suggest that respect elongates the orienting response.

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Introduction

Respect is an emotion that facilitates self-improvement. It is often experienced when one recognizes excellence in others [1-9]. Respect focuses on the whole of others based on their superior behaviors, skills, achievements, or virtues. For instance, when a student interacts with a professor, the student acknowledges the professor's wisdom or accomplishments and then experiences respect. Previous studies have suggested that admiration, which is an emotion directed at the outstanding behaviors of others, promotes one's sociality and self-improvement [10-19]. Respect is considered to motivate us in the same way [2, 20, 21].

To better understand the positive aspect of respect, we investigated one of its action tendencies. Action tendency is a component of emotion and urges one to perform certain behaviors [4, 22-24]. According to previous research, the respected person is seen as a role model [2], and a person with prestige can be a model for a lower one and is stared at longer [25]. Furthermore, the *Oxford English Dictionary* says that the English word *respect* comes from the Latin word *re* (back) and *specere* (to look at), indicating that respect is related to looking at others. Interestingly, when participants experienced respect for a lecturer on the Test of English for International Communication (TOEIC), their TOEIC scores increased, suggesting that they looked carefully at the lecturer and tried to get information from the lecturer to improve their TOEIC scores [9]. We therefore hypothesized that respect would promote and elongate an orienting response of paying attention to the person. To test this hypothesis, we measured the heart rate (HR), which is an index of the orienting response. When processing stimuli, such as looking at photograph, there is an orienting response (also called "sensory intake") associated with attention to the stimuli, and HRs show a phasic decrease [24, 26-31].

Previous studies of respect and other related emotions have used common stimuli across participants [7-9, 12, 17, 32, 33]. However, considering that respecting someone is a subjective phenomenon [4], it is appropriate to use personalized stimuli, such as retrospectives of respected individuals. While parents and teachers are considered respected persons, some may feel that respecting them is a duty [2]. We thus asked the participants to list any person they affectively respect (other than their parents and teachers) in order to induce strong affect-respect. In the present study, each participant provided us with stimuli about their parents, teachers, and affectively respected persons, and we presented them during the measurement of HR. Our primary interest was in the

affect-respected person condition. We additionally examined the parent and teacher conditions.

Respect is often experienced as a long-term emotional attitude as well as an emotional state [3-6], which may be unlikely to elicit acute HR changes. Furthermore, the mere presentation of a photograph of a respected person might evoke emotions other than respect. Therefore, we first presented the participants with a respect-related episode about the person (written by each participant) and then showed the person's photo so that they gradually felt and focused on respect eliciting the orienting response.

As a control, we presented a stimulus of unknown individuals unrelated to respect. Parents, teachers, and affectively respected people were familiar to the participants, whereas unknown persons were not. Thus, the contrast in the familiarity of the stimulus could also influence the orienting response. To test whether respect or familiarity influences the response, we controlled for the effect of one variable and then examined the relationship between the other and HRs.

Methods

Participants

Twenty-six university students participated in the experiment (12 females, 20.9 ± 2.9 years old). All experimental procedures were approved by the Ethics Review Committee on Experimental Research with Human Subjects of the Graduate School of Arts and Sciences, The University of Tokyo, Japan (#397), and written informed consent was obtained from all participants. All participants had a normal or corrected-to-normal vision. We removed one participant's HR data due to an irregular pulse.

Stimuli

A stimulus consisted of an episode and a photograph of a person. We made four conditions with two stimuli in each: *parents*, *teachers*, *affect-respect* (persons respected affectively other than parents and teachers), and *control* (unknown persons). The first three conditions were personalized, and the other was common to all participants. The episodes and photographs of parents, teachers, and affect-respected persons were obtained in advance from each participant. We asked participants to write an episode about why they respect the person (150-200 characters in Japanese). The following is an example of the

affect-respect condition translated into English:

He is a senior member of the choir I belong to. Not only does he sing very well, but he also talks passionately about music. Furthermore, he plays the piano very well, making my singing lessons exciting. When I have struggled to improve my singing, he often cheered me on and told me never to give up. Everyone in the choir loves him. I want to become a singer like him one day. That is why I respect him.

We prepared the episodes and photos of unknown people as a control. Here is an example of an episode:

He is an office worker. He was born in Chiba and graduated from a university in Tokyo. He currently works in the sales department of a PC parts manufacturer in Tokyo and has an average sales performance. He often goes to bookstores after work to look for new comic books he likes. He lives alone in Tokyo but usually visits his parents' home in Chiba at the end of the year to spend time with them.

Measures and apparatus

The experiment was programmed and run with Presentation 18.1 (Neurobehavioral Systems Inc., USA). Stimuli were presented on a 21-inch LCD monitor (EIZO FlexScan L797; Eizo, Japan). The background color of the screen was black. The episodes were in white on the whole screen (font size = 55 points). The photographs were gray-scaled, and the visual angle was $15.02^{\circ} \times 26.46^{\circ}$. The distance between the participant and the monitor was 80 cm. All physiological signals were amplified, filtered, and digitized using NeXus-10 MK2 and BioTrace+ (Mind Media Inc., The Netherlands).

ECGs were recorded at a rate of 256 sample/s with pre-gelled Ag/AgCl electrodes (EXG Sensor, Nexus-10 MK2, Mind Media Inc., Netherlands). Three electrodes were placed on the surface of the chest. The ECG signals were bandpass filtered between 0.5 and 35 Hz.

Procedure

In one trial (Fig. 1), we presented a fixation point for 5 s, an episode for 20 s, a photograph for 5 s, and then a blank screen for 10 s. Participants received the following instructions: “Read each episode and look at the photo.” We instructed participants to press the keys to rate their respect toward the presented person using a 5-point scale within 5 s after the blank screen. Each stimulus (an episode and a photograph) was presented twice within a block, and there were eight stimuli, so we presented 16 trials in one block. We conducted

two blocks. The order of the stimuli was randomized across participants. After the measurement, we asked participants to rate familiarity with the persons in the stimuli on a 5-point scale using a questionnaire to perform a partial correlation analysis described in the following section.

Analysis

To check that respect was elicited the most in the *affect-respect* condition, we first tested whether there was a significant difference in the respect ratings among conditions with a one-way repeated measures analysis of variance (ANOVA).

HRs were calculated from R-R intervals from electrocardiograms (ECGs) with AcqKnowledge 4.1 (BIOPAC Systems Inc., USA). As the orienting responses cause a decline of HRs during an episode and photo presentation, we calculated the averaged HRs using the normalized data per participant and confirmed its minimal value. Then we assessed the change scores of HRs from the minimum. We evaluated the data per second and analyzed differences among conditions over time by a two-way repeated-measures ANOVA.

To examine whether respect or familiarity affected the orienting response, we calculated a partial correlation between respect ratings and the change scores of HRs after controlling for familiarity ratings. By contrast, we performed a partial correlation analysis between familiarity ratings and HRs scores controlling for respect ratings. We focused on the *affect-respect* and the *control* conditions and analyzed the data of HRs from the time frame when the difference was the largest. The orienting response is associated with decreased HRs, and our interest was whether residuals of HRs decrease as those of respect or familiarity increase. We set the significance level α at 0.05 in all statistical tests.

Results

We performed one-way repeated-measures ANOVA using the respect ratings (Table 1) and found that there was a significant difference among conditions, $F(3, 72) = 62.51$, $p < 0.001$, $\eta_p^2 = 0.72$. Multiple comparisons for conditions revealed that the rating of the *affect-respect* condition was higher than the *parents*, $t = 2.74$, $df = 24$, $p = 0.027$, the *teachers*, $t = 2.84$, $df = 24$, $p = 0.027$, and the *control*, $t = 16.40$, $df = 24$, $p < 0.001$. The

results showed that the participants experienced respect the most to the affectively respected persons. Additionally, the analysis revealed that the rating of the *parents* condition was higher than the *control*, $t = 9.48$, $df = 24$, $p < 0.001$, that of the *teachers* was also higher than the *control*, $t = 10.26$, $df = 24$, $p < 0.001$, but there was no significant difference between the *parents* and *teachers*, $t = 0.17$, $df = 24$, $p = 0.867$, suggesting that parents and teachers were respected more than unknown individuals though not as much as the affectively respected persons. We adjusted p -values in the multiple comparisons with Holm's method.

Table 1. Respect and familiarity ratings for each condition

condition	respect ratings (mean $\pm$ SD)	familiarity ratings (mean $\pm$ SD)
<i>parents</i>	4.04 $\pm$ 0.63	4.66 $\pm$ 0.57
<i>teachers</i>	4.07 $\pm$ 0.75	3.88 $\pm$ 0.70
<i>affect-respect</i>	4.53 $\pm$ 0.54	4.00 $\pm$ 0.99
<i>control</i>	2.46 $\pm$ 0.71	1.92 $\pm$ 0.84

We set a baseline of 1 s before the onset of an episode and calculated the averaged HRs of all conditions using normalized data. The HRs reached the minimum value at 22 s (Fig. 2A). Thus, we assessed the change scores from the value (Fig. 2B). We conducted a 4 (condition: *parents*, *teachers*, *affect-respect*, and *control*) $\times$ 3 (time: 23, 24, and 25 s) repeated-measures two-way ANOVA, and obtained a significant interaction of conditions and time, $F(6, 144) = 2.95$, $p = 0.010$, $\eta_p^2 = 0.11$, but not significant for the effects of the condition, $F(3, 72) = 0.74$, $p = 0.530$, $\eta_p^2 = 0.03$ or time, $F(2, 48) = 0.82$, $p = 0.448$, $\eta_p^2 = 0.03$. Analysis of simple effects for the interaction (Table 2) revealed that the change scores of the *control* condition were significantly different among time, $F(2, 48) = 4.34$, $p = 0.019$, $\eta_p^2 = 0.15$. Thus, we performed multiple comparison analyses for time (23, 24, 25 s) at the *control* condition and found significant differences between 23 s and 24 s, $t = 2.94$, $df = 24$, $p = 0.022$, but not between 23 s and 25 s, $t = 1.63$, $df = 24$, $p = 0.232$, and 24 s and 25 s, $t = 1.23$, $df = 24$, $p = 0.232$. We adjusted p -values in the multiple comparisons through Holm's method. In summary, the HRs of the *control* condition significantly recovered from the minimal value, but those of the other conditions did not. These results suggest that the orienting responses of the *parents*, *teachers* and *affect-respect* conditions were prolonged.

Table 2. Analysis of simple effects for the interaction (time $\times$ condition).

	<i>df</i>	<i>F</i> -ratio	<i>p</i> -value	η_p^2
condition at 23 s	3, 72	0.29	0.833	0.01
condition at 24 s	3, 72	1.43	0.241	0.06
condition at 25 s	3, 72	1.38	0.256	0.05
time at <i>parents</i>	2, 48	1.76	0.183	0.07
time at <i>teachers</i>	2, 48	2.50	0.093	0.09
time at <i>affect-respect</i>	2, 48	0.07	0.930	0.00
time at <i>control</i>	2, 48	4.34	0.019*	0.15

The effect of time at the *control* condition was significant (* $p < 0.05$).

To assess whether the extension of orienting responses is due to respect or familiarity with the person, we focused on *affect-respect* and *control* conditions and calculated the partial correlations among the rating of respect, that of familiarity (see Table 1), and the change scores of HRs. We used the data of each participant at 24 s when the difference between the conditions was the largest. There was a significant correlation between respect and the scores of HRs after controlling for familiarity, $r = -0.33$, $p = 0.041$ (Fig. 3A), while a correlation between familiarity and the HRs scores which controlled for respect was not significant, $r = 0.07$, $p = 0.609$ (Fig. 3B). We adjusted the p -values of the two correlation tests by Holm's method. The results indicate that not familiarity but respect involves the prolongation of the orienting response.

Discussion

The purpose of the present study was to investigate one of the action tendencies of respect. The respect rating was the highest in the *affect-respect* condition. The averaged normalized HRs reached the minimal value during stimulus presentation, and the change scores recovered only in the *control* condition. Furthermore, we obtained a significant partial correlation between respect ratings and HR change scores (controlling for familiarity) but not between the familiarity ratings and HRs (removing the effect of the respect ratings).

The normalized HRs decreased during stimulus presentation, indicating that the orienting response occurred [24, 26-31]. Then, the change scores of the HRs from the minimal value differed among conditions: the scores did not increase in the *parents*, *teachers*, and *affect-respect* conditions. The data suggest that experiencing respect enhances and elongates the orienting response of paying attention to the person. Respected people are role models [2, 25], and one looks at the models carefully to learn from them [9]. Therefore, participants paid attention to their parents, teachers, and other affectively respected persons, and the orienting responses were prolonged.

As participants knew their respected individuals well, the contrast in familiarity could have also affected the orienting response. However, our results of the partial correlation analyses demonstrated that not familiarity but respect involved its elongation. Previous studies have suggested that the emotion of awe, which is induced by a novel, vast and complex stimulus that cannot be explained by one's current way of view, directs one's attention to the stimuli [34-42]. Importantly, awe is one of the subcategories of respect for the Japanese [3-9]. Hence, in the present study, experiencing respect motivated participants to focus on the stimulus and extract information from it. We consider that familiarity was not a motivator for obtaining information in the present study and therefore did not induce the orienting response.

The respect rating of parents and teachers was higher than that of the unknown individuals but lower than that of the affectively respected persons, suggesting that one does not always respect parents and teachers affectively. Some participants probably did not respect their parents or teachers or may have experienced respect for them as a duty [2]. The results further support that respecting someone is subjective and that personalized stimuli should evoke respect.

The current study has several limitations. First, the participants were university students in the process of learning and improving their skills. Therefore, they may be more likely to pay attention to people they respect. We cannot determine whether the elongation of the orienting response is consistent in other samples, and future studies should examine the orienting response of respect by recruiting various participants. Second, the measurements of HRs did not reveal where attention was directed. Investigating where attention was directed during the stimuli presentation would provide further information about the trigger for eliciting respect. Combining HR measurements with techniques such

as eye-tracking is necessary to understand attention with respect in more detail. Finally, although presenting the stimuli of episodes and photos about respected persons enabled us to induce respect in the participants, they would experience it more strongly when interacting with the persons. Future research investigating the action tendency of respect in real-life situations will reveal how one establishes or maintains a relationship with the respected person and obtains the motivation to improve oneself.

The present results provide evidence that experiencing respect prolongs the orienting responses of attending to the persons. This finding would be key to clarifying the properties of respect and other related emotions. Furthermore, the method of using personalized stimuli successfully induced respect and can be adapted to induce other personal emotions. In addition, we contributed to assessing the positive aspects of respect, which can support learning in our daily lives; for example, students can learn more from the teachers they respect at school.

References

1. Kuranaga H, Higuchi M. An analysis of the psychological characteristics of respect. *Japanese Journal of Research on Emotions*, 2014; 21(3): 133-142.
<https://doi.org/10.4092/jsre.21.133>
2. Li J, Fischer KW. Respect as a positive self-conscious emotion in European Americans and Chinese, in *The self-conscious emotions: Theory and research*, Tracy JL, Robins RW, and Tangney JP, editors. 2007, Guilford Press: New York. p. 224-242.
3. Muto S. The hierarchical semantic structure of respect-related emotions in modern Japanese people. *Shinrigaku Kenkyu: The Japanese Journal of Psychology*. 2016; 87(1): 95-101.
<https://doi.org/10.4992/jjpsy.87.15304>
4. Muto S. Action tendencies of respect-related emotions: Focus on emotion episodes in Japanese university students. *Shinrigaku Kenkyu: The Japanese Journal of Psychology*. 2016; 87(2): 122-132.
<https://doi.org/10.4992/jjpsy.87.15011>
5. Muto S. Development of the trait respect-related emotions scale for late adolescence. *Shinrigaku Kenkyu: The Japanese Journal of Psychology*, 2016; 86(6):566-576.
<https://doi.org/10.4992/jjpsy.86.15205>
6. Muto S. The concept structure of respect-related emotions in Japanese university students. *Shinrigaku Kenkyu: The Japanese Journal of Psychology*, 2014; 85(2): 157-167.
<https://doi.org/10.4992/jjpsy.85.13021>
7. Nakatani H, Nonaka Y, Muto S, Asano M, Fujimura T, Nakai T, Okanoya K. Trait respect is linked to reduced gray matter volume in the anterior temporal lobe. *Front Hum Neurosci*, 2020; 14:344.
<https://doi.org/10.3389/fnhum.2020.00344>
8. Nakatani H, Muto S, Nonaka Y, Nakai T, Fujimura T Okanoya K. Respect and admiration differentially activate the anterior temporal lobe. *Neurosci Res*, 2019;

144: 40-47.

<https://doi.org/10.1016/j.neures.2018.09.003>

9. Kondoh S, Okanoya K. Performance in a task improves when subjects experience respect, rather than admiration, for those teaching them. *Discover Psychology*, 2022; 2(1):38.
<https://doi.org/10.1007/s44202-022-00051-5>
10. Algoe SB, Haidt J. Witnessing excellence in action: The 'other-praising' emotions of elevation, gratitude, and admiration. *J Posit Psychol*. 2009; 4(2): 105-127.
<https://doi.org/10.1080/17439760802650519>
11. Haidt J. The moral emotions, in *Handbook of affective sciences*, Davidson RJ, Scherer KR, Goldsmith HH, editors. 2003, Oxford University Press: Oxford. p. 852-870.
12. Immordino-Yang MH, Yang X-F, Damasio H. Correlations between social-emotional feelings and anterior insula activity are independent from visceral states but influenced by culture. *Front Hum Neurosci*, 2014; 8:728.
<https://doi.org/10.3389/fnhum.2014.00728>
13. Immordino-Yang MH, Sylvan L. Admiration for virtue: Neuroscientific perspectives on a motivating emotion. *Contemp Educ Psychol*, 2010; 35(2): 110-115.
<https://doi.org/10.1016/j.cedpsych.2010.03.003>
14. Immordino-Yang MH, McColl A, Damasio H, Damasio A. Neural correlates of admiration and compassion. *Proc Natl Acad Sci U S A*, 2009; 106(19): 8021-8026.
<https://doi.org/10.1073/pnas.0810363106>
15. Onu D, Kessler T, Smith JR. Admiration: A conceptual review. *Emot Rev*, 2016; 8(3): 218-230.
<https://doi.org/10.1177/1754073915610438>
16. Schindler I, Zink V, Windrich J, Menninghaus W. Admiration and adoration: Their different ways of showing and shaping who we are. *Cogn Emot*, 2013; 27(1): 85-118.
<https://doi.org/10.1080/02699931.2012.698253>

17. Sweetman J, Spears R, Livingstone AG, Manstead ASR. Admiration regulates social hierarchy: Antecedents, dispositions, and effects on intergroup behavior. *J Exp Soc Psychol*, 2013; 49(3): 534-542.
<https://doi.org/10.1016/j.jesp.2012.10.007>
18. van de Ven N. Envy and admiration: emotion and motivation following upward social comparison. *Cogn Emot*, 2017; 31(1):193-200.
<https://doi.org/10.1080/02699931.2015.1087972>
19. Immordino-Yang MH. Toward a microdevelopmental, interdisciplinary approach to social emotion. *Emot Rev*, 2010; 2(3): 217-220.
<https://doi.org/10.1177/1754073910361985>
20. Kitayama S, Mesquita B, Karasawa M. Cultural affordances and emotional experience: Socially engaging and disengaging emotions in Japan and the United States. *J Pers Soc Psychol*, 2006; 91(5): 890-903.
<https://doi.org/10.1037/0022-3514.91.5.890>
21. Kitayama S, Markus HR, Kurokawa M. Culture, emotion, and well-being: Good feelings in Japan and the United States. *Cogn Emot*, 2000; 14(1): 93-124.
<https://doi.org/10.1080/026999300379003>
22. Frijda NH, Kuipers P, ter Schure E. Relations among emotion, appraisal, and emotional action readiness. *J Pers Soc Psychol*, 1989; 57(2):212-228.
<https://psycnet.apa.org/doi/10.1037/0022-3514.57.2.212>
23. Frijda NH: Emotion, cognitive structure, and action tendency. *Cogn Emot*, 1987; 1(2):115-143.
<https://doi.org/10.1080/02699938708408043>
24. Scherer KR. and Moors A. The emotion process: Event appraisal and component differentiation. *Annu Rev Psychol*, 2019; 70(1): 719-745.
<https://doi.org/10.1146/annurev-psych-122216-011854>
25. Henrich J, Gil-White FJ. The evolution of prestige: Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. *Evol Hum Behav*, 2001; 22(3): 165-196.
[https://doi.org/10.1016/s1090-5138\(00\)00071-4](https://doi.org/10.1016/s1090-5138(00)00071-4)

26. Bradley MM. Natural selective attention: Orienting and emotion. *Psychophysiology*, 2009; 46(1): 1-11.
<https://doi.org/10.1111/j.1469-8986.2008.00702.x>
27. Bradley MM, Codispoti M, Cuthbert BN, Lang PJ. Emotion and motivation I: defensive and appetitive reactions in picture processing. *Emotion*, 2001; 1(3): 276-298.
<https://doi.org/10.1037/1528-3542.1.3.276>
28. Graham FK, Clifton RK. Heart rate changes as a component of the orienting response. *Psychological Bulletin*, 1966; 65(5): 305-320.
29. Lacey BC, Lacey JL. Two-way communication between the heart and the brain: Significance of time within the cardiac cycle. *Am Psychol*, 1978; 33(2): 99-113.
<https://doi.org/10.1037//0003-066x.33.2.99>
30. Nieuwenhuis S, De Geus EJ, Aston-Jones G. The anatomical and functional relationship between the P3 and autonomic components of the orienting response. *Psychophysiology*, 2011; 48(2): 162-175.
<https://doi.org/10.1111/j.1469-8986.2010.01057.x>
31. Sokolov EN. Orienting Response, in *International Encyclopedia of the Social & Behavioral Sciences*, Smelser NJ, Baltes PB, editors. 2001, Pergamon. p. 10978-10981.
<https://doi.org/10.1016/B0-08-043076-7/03536-1>
32. Englander ZA, Haidt J, Morris JP. Neural basis of moral elevation demonstrated through inter-subject synchronization of cortical activity during free-viewing. *PLoS ONE*, 2012; 7(6):1-8.
<https://doi.org/10.1371/journal.pone.0039384>
33. Fox GR, Kaplan J, Damasio H, Damasio A. Neural correlates of gratitude. *Front Psychol*, 2015; 6:1491.
<https://doi.org/10.3389/fpsyg.2015.01491>
34. Campos B, Shiota MN, Keltner D, Gonzaga GC, Goetz JL. What is shared, what is different? Core relational themes and expressive displays of eight positive emotions. *Cogn Emot*, 2013; 27(1): 37-52.
<https://doi.org/10.1080/02699931.2012.683852>

35. Gottlieb S, Keltner D, Lombrozo T. Awe as a scientific emotion. *Cogn Sci*, 2018; 42(6): 2081-2094.
<https://doi.org/10.1111/cogs.12648>
36. Guan F, Chen J, Chen O, Liu, L, Zha, Y. Awe and prosocial tendency. *Curr Psychol*, 2019; 38(4): 1033-1041.
<https://doi.org/10.1007/s12144-019-00244-7>
37. Monroy M, Keltner D, Awe as a Pathway to Mental and Physical Health. *Perspect Psychol Sci*, 2022.
<https://doi.org/10.1177/17456916221094856>
38. Nakayama M, Nozaki Y, Taylor PM, Keltner D, Uchida Y. Individual and cultural differences in predispositions to feel positive and negative aspects of awe. *J Cross Cult Psychol*, 2020; 51(10):771-793.
<https://doi.org/10.1177/002202212095982>
39. Keltner D, Haidt J, Approaching awe, a moral, spiritual, and aesthetic emotion. *Cogn Emot*, 2003; 17(2): 297-314.
<https://doi.org/10.1080/026999303002297>
40. Nakayama M, Uchida Y: Meaning of awe in Japanese (con)Text: Beyond fear and respect. *Psychologia*. 2020; 62(1):46-62.
<https://doi.org/10.2117/psysoc.2020-B004>
41. Shiota MN, Neufeld SL, Yeung WH, Moser SE, Perea EF, Feeling good: Autonomic nervous system responding in five positive emotions. *Emotion*, 2011; 11(6): 1368-1378.
<https://doi.org/10.1037/a0024278>
42. Shiota MN, Keltner D, Mossman A, The nature of awe: Elicitors, appraisals, and effects on self-concept. *Cogn Emot*, 2007; 21(5): 944-963.
<https://doi.org/10.1080/02699930600923668>

Figure captions

Fig. 1 The procedure of one trial. One stimulus consisted of an episode and a photograph of the person, one of the parents, teachers, affectively respected persons of each participant, and unknown persons. We presented participants with a fixation point for 5 s, an episode for 20 s, a photograph for 5 s, and a blank screen for 10 s. Then, participants evaluated the extent of respect they experienced to the person by a 5-point scale within 5 s.

Fig. 2 **A.** Averaged HRs among conditions during an episode and photo presentation using normalized data per participant. The baseline was set at 1 s before episode onset. The HRs reached the minimum value at 22 s. **B.** Change scores of HRs from the minimal value. A two-way repeated-measures ANOVA revealed that the interaction of time (23, 24, 25 s) and condition (*parents*, *teachers*, *affect-respect*, and *control*) was significant. Multiple comparison analyses for time at the control condition revealed a significant difference between 23 and 24 s (* $p < 0.05$, adjusted by Holm's method), suggesting that the orienting responses of the other conditions were prolonged. Error bar indicates the standard error across participants in both panels.

Fig 3 Partial correlation analyses among respect, familiarity, and change scores of HRs, using data of each participant at 24 s in the *affect-respect* and *control* conditions. **A.** The partial correlation between the ratings of respect and change scores of HRs, after controlling for the familiarity ratings. The correlation was significant ($r = -0.33$, $p = 0.041$). **B.** The partial correlation between the familiarity ratings and change scores of HRs controlling for the ratings of respect. The correlation was not significant ($r = 0.07$, $p = 0.609$). The regression lines are shown in black. These results suggest that not familiarity but respect involved the declining HRs, which is the index of the orienting response. We adjusted the p -values in two correlation tests through Holm's method.

Fig.1

Fig.2

Fig.3