A comparison of contemporary cultural preferences of American laypeople in cross-race and same-race soft tissue profiles of East Asian and Caucasian models

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Dedication

To my parents, who have poured so much of their love, support, time, energy, and money into their 23rd grade daughter. I don't know how I will ever repay you (or the loan servicer), but I am so grateful and lucky to be born into your family, along with a little brother (Robert) who I am very proud of too.

To my cats Haru and Marble, who provided emotional support by blocking my screen, shutting down my Excel spreadsheets at 3am, and purring into my face prn. I'm allergic to cats.

To my patients, past, present, and future. I hope this research will help me help you, and I promise to treat you to the best of my ability and keep on learning.

To my PI Dr. Havens, who is probably ranked third in the list of people whose majority of white hairs are because of me (after my parents). This is my first long-form research writing! I hope I never have to write 100+ pages again and that you never have to proofread 100+ pages again.

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And to everyone who asked "Are you still working on that?" – yes, but not anymore. Wait, actually, yes again. We're getting more survey responses from East Asia as we speak!

Abstract

Background:

Facial esthetics play a pivotal role in orthodontic diagnosis and treatment planning, but foundational research that informs contemporary orthodontic practice has been predominantly based on Caucasian populations. This limitation creates a gap when treating East Asian patients, who may have distinct esthetic preferences and facial characteristics.

Purpose: To analyze the influence of culture on esthetic preferences of laypeople in cross-race and same-race East Asian (EA) and Caucasian soft tissue profiles, identify differences in contemporary lip position and profile preferences, and evaluate the impact of raters' ethnicity, and gender on preferences.

Design: This pilot experimental survey study involved first- and second-year dental students at Oregon Health & Science University Dental School as representatives for laypeople opinion. A web-based survey was conducted and included self-reported demographic and cultural immersion questions. Using a visually continuous scale of images of Caucasian and Asian females and males, participants selected the range (Min-Max) of images they found to be acceptable, as well as the most ideal image (Ideal). Statistical analyses were performed using descriptive statistics, ANOVA with Tukey's post-hoc test and AVE contrasts, and linear regression.

Results: Statistically significant differences were associated with the judge's gender for male EA model (Ideal) and female Caucasian model (Max), where female judges preferred more retrusive lip positions. Significant differences were also found comparing EA judges to non-EA judges evaluating EA models [male EA model (Min, Ideal)] with EA judges accepting greater lip retrusion. An acculturation gradient was observed across most measures of cultural ties, where judges with greater exposure to East Asian culture preferred more retrusive facial profiles, while those with greater Western cultural exposure accepted more protrusive profiles. Statistically significant correlations were found with strength of cultural identity and age of relocation.

Conclusions: While there is wide individual variation in the esthetic evaluation of lip protrusion, gender, ethnicity, and cultural exposure contribute to individual preference and should be considered in orthodontic treatment planning.

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Introduction

Background & Significance

Facial esthetics play a pivotal role in orthodontic diagnosis and treatment planning. Over the decades, significant variation has been documented in craniofacial structures across different ethnicities and cultures, underscoring the importance of tailoring orthodontic norms to reflect diverse populations. However, much of the foundational research that informs contemporary orthodontic practice has been predominantly based on Caucasian populations, with reference values derived from studies conducted between 1937 and 1969.[1] These studies focused on defining "normal" profiles not as an average of the population but as an average of the most esthetically ideal cases within that group. While these standards have provided a valuable framework, they may not accurately capture the nuances of other ethnicities or cultural preferences.

The quest to define facial esthetics dates back centuries, with recorded ideals from ancient Egyptian art, Greek sculptures, and philosophical interpretations of geometrical laws.[1] Despite the influence of concepts like the golden ratio, modern research has shown that such proportions do not consistently describe the "ideal" face.[2,3] Instead, esthetic preferences are shaped by familiarity and cultural reinforcement. As Peck & Peck[1] noted, "The more often we observe a particular facial pattern, the more likely we perceive it as 'correct.'" Presumably this conditioning affects not only the general public but also orthodontists. Utilizing cephalometric standards may partially alleviate this bias, but relying too heavily on these quantitative values would also present problems, and these cephalometric norms are frequently based on Caucasian populations. Ultimately, a balance between numeric norms, soft tissue relationships, and cultural standards would be ideal for evaluating facial esthetics.

Previous studies have highlighted the variability in esthetic preferences among orthodontists, general dentists, and laypeople. Laypeople typically favor fuller, more protrusive profiles compared to cephalometric norms, which often emphasize retrusive profiles.[1] Peck & Peck[1] observed that while the general public demonstrates remarkable agreement in judgments of facial esthetics, orthodontists' opinions differ, with a tendency to prioritize skeletal harmony over external appearance. Additionally, cultural influences and media play a significant role in shaping these preferences. For example, studies have shown that American whites and American blacks shared a common esthetic standard based on a Caucasian facial model, while African groups rated Caucasian features as less attractive[1].

International comparisons have revealed striking consistency in esthetic preferences across cultures. Studies comparing British and American participants found near-identical rankings of facial attractiveness, with only minor differences.[1] Similar agreement has been observed using works of art as testing media.[1] However, these shared preferences often mask the underlying complexity of facial attractiveness. Rhee[3] emphasized that the "average" face—as defined by cephalometric norms—does not equate to an attractive face. Instead, highly attractive faces often deviate from these averages, representing the composite of esthetically ideal features.

East Asian populations present unique challenges for orthodontic diagnosis and treatment planning due to distinct craniofacial characteristics. Features such as flat or broad faces, midface regression, narrow nasolabial angles, and depressed alar bases are common among Asians[4]. Esthetic ideals within East Asian cultures further complicate this picture. For example, Rhee and Lee[5] found that Japanese attractive faces are described as relatively long with slanted eyes, sharp chins, and chubby cheeks, while Chinese ideals emphasize smaller bizygomatic and bigonial widths, producing an overall slim face with narrower cheeks. Korean preferences focus on less pronounced lower facial features, such as a narrow, short, and small U- or V-shaped

chin.[6] Overall, in East Asian females, a “broad” lower face is considered unattractive because of its masculine appearance, and procedures such as V-line surgeries, where the mandible is contoured and chin augmented, are often sought after. These cultural preferences contrast with Caucasian ideals, which favor fuller lips, protruding cheeks, and square-shaped mandibles[3].

Recent research has explored the role of specific features, such as lips and chin, in shaping perceptions of facial attractiveness. Several studies found that Caucasian, African American, and Turkish laypeople favor a fuller, more protrusive dentofacial pattern than cephalometric standards recommend, with Peck & Peck explicitly stating this as a trend of the “general public.”[1,7,8] However, other studies focusing on Asian populations found that slightly more retruded mandibular profiles with retroclination and retrusion of both the incisors and lips are considered more attractive.[9–11] Studies by Oh et al.,[12,13], which surveyed both Asian and US populations of orthodontists, general dentists, and laypeople, found that orthodontists and laypeople often focus on the lips and chin when evaluating profiles, and all groups, especially Asian judges, showed a preference for retroclination and retrusion of the incisors and lips in Asian populations. These findings reflect deeper cultural preferences in Asian populations, including the traditional Chinese beauty ideal of a "small cherry mouth" (yīngtáo xiǎokǒu). Ancient makeup techniques that achieve this appearance, where parts of the natural lip are concealed to create the appearance of more petite lips, reflect longstanding ideals for a smaller, more delicate lip appearance.[10,14] The divergence in preferences across populations underscores the need for orthodontic practice to prioritize the preferences of patients and the general public over rigid adherence to traditional norms[1].

To assess esthetic preferences, researchers have employed a variety of methodologies, including photographic and radiographic studies, analyses by esthetic surgeons, and computer-generated composites. Oh et al.[12] used CBCT analysis of 40 young Korean female adults with

normal skeletal patterns to construct five composite profiles, which were then evaluated for facial attractiveness via a computer-based questionnaire completed by orthodontists, general dentists, and laypeople. Other photographic studies have analyzed professional models, beauty contest winners, and performing stars renowned for their facial attractiveness.[1,6,15–20,21(p199),22] Some photographic studies utilize photogrammetry, marking facial reference points with black eyeliner to enhance measurement accuracy, with algorithms achieving up to 88% accuracy in predicting facial attractiveness based on these measurements.[17,23]

Comparative studies have also been utilized to examine cultural differences in esthetic preferences. For instance, Nomura et al.[9] examined preferences among European American, Hispanic American, Japanese, and African judges for soft tissue profiles, while Orsini et al.[24] compared preferences for the anteroposterior position of the mandible among white orthodontists, white laypeople, and Japanese-American laypeople. Xu et al.[25] and Liu et al.[26] investigated differences in rankings of facial attractiveness between Chinese and U.S. orthodontists using post-treatment photographs of Chinese and white orthodontic patients. Similarly, Liu et al.[26] explored correlations between cephalometric and photographic measurements of facial attractiveness in Chinese and U.S. patients following orthodontic treatment.

Historical and cultural influences on esthetic standards have also been analyzed through internet film databases, in order to examine changes in public preferences over time. For example, Berneburg et al.[16] measured facial features in 400 photographs of attractive men and women over decades. Miyajima et al.[27] compared esthetic criteria between Japanese and European-American adults with normal occlusions and well-balanced faces. Research has also developed cephalometric standards tailored to specific populations, such as Anatolian Turkish

men and women[28]. Gao et al.[10] provided insights into differences in esthetic facial criteria between Caucasian and East Asian female populations from an esthetic surgeon's perspective.

The current study, titled " A comparison of contemporary cultural preferences of American laypeople in cross-race and same-race soft tissue profiles of East Asian and Caucasian models," aims to address the gaps in racial and cultural differences by investigating esthetic preferences within and across these groups. Dental students were surveyed as representatives of the general lay population, as their perceptions are closer to laypeople than orthodontists due to their limited clinical knowledge on esthetic norms.[29] This research is grounded in the hypothesis that cultural and regional differences influence perceptions of ideal facial profiles. The study seeks to highlight features that should be considered when diagnosing and treatment planning for East Asian patients and ultimately contribute to the development of a comprehensive set of qualitative and quantitative standards tailored to East Asian populations.

The significance of this study lies in its potential to refine orthodontic care by providing practitioners with culturally relevant reference points, moving beyond a one-size-fits-all approach. By identifying and documenting these preferences, this research aims to advance patient-centered care and foster a deeper understanding of the interplay between culture, esthetics, and craniofacial anatomy.

Specific Aims & Hypothesis

The specific aims of this study are:

1. Evaluate the effects of gender on layperson assessment of ideal and acceptable range of East Asian and Caucasian models' lip positions.
2. Evaluate the effects of race/ethnicity on layperson assessment of ideal and acceptable ranges of East Asian and Caucasian models' lip positions.
3. Evaluate the effects of cultural exposure and immersion on layperson assessment of ideal and acceptable ranges of East Asian and Caucasian models' lip positions.

The null hypothesis is that gender, race/ethnicity, and cultural exposure and immersion do not affect layperson assessment of ideal and acceptable ranges of East Asian and Caucasian models' lip positions.

Materials & Methods

Subjects and Recruitment

The protocol for this study was approved by the Oregon Health & Science University (OHSU) Institutional Review Board (OHSU IRB# 00028685, Appendix A). This was a pilot experimental survey study that involved first- and second-year dental students as representatives for laypeople opinion. The first phase of the study focused on students at Oregon Health & Science University (OHSU) Dental School. An invitation to participate in the web-based survey was distributed to students by email (Appendix B). The email informed participants that the survey will collect data for a MS thesis research project, and that survey responses will be anonymous. Those who had not completed the survey after 2 weeks were sent 1 reminder message via email. After 3 weeks the survey was closed, and all completed survey data was gathered for analyses. After completion of the survey the survey-respondent's participation was complete. Respondents were compensated for responding through entry in a gift card raffle.

Construction of Survey

The web-based survey (Appendix C) was conducted using a cloud-based platform that was approved for use at OHSU (Qualtrics, Provo UT). It included self-reported demographic questions, such as information about ethnicity, gender, sociodemographic status, age, and cultural immersion questions. To encourage answering of all questions, an error message was delivered if questions were left unanswered. The questionnaire was formulated with custom-coded image-based sliders, which asked judges to select the range of images they found to be acceptable, as well as the most ideal image. Each image slider question displayed a visually continuous scale of possible choices when the slider bar is manipulated.

Questions 3.5 through 3.8 were only displayed if the respondent selects Japanese, Taiwanese, Korean, or Chinese on Question 2.3; or East Asian – Japanese, East Asian – Taiwanese, East Asian – Korean, or East Asian – Chinese on Question 2.4. Otherwise, respondents skipped directly to Question 4.1, the first image slider question.

Base Image Generation

The "base" side profile images for an Asian female, Asian male, Caucasian female, and Caucasian male were generated using the AI image generator Google ImageFX (Figure 1). The finalized prompt query was "straight-on side profile of young adult (Caucasian/East Asian) (male/female) with head level and eyes open with white background, lips relaxed and closed with no smile, photorealistic."

Figure 1. Base images, generated by Google ImageFX, of an (A) Asian female, (B) Asian male, (C) Caucasian female, and (D) Caucasian male.

Production of Iterations

Subnasale-soft-tissue gnathion (Sn-Gn) measurements based on anthropometric norms[30] were converted to pixels on the digital images to establish a reference scale, allowing for accurate 1.0mm increments to be determined in pixel units. Adobe Photoshop 2025 was used to modify upper and lower lip positions by hand in 1.0mm increments relative to horizontal plane without alteration of Sn and soft-tissue pogonion (Figure 2). Upper and lower lips were modified together as a single unit.

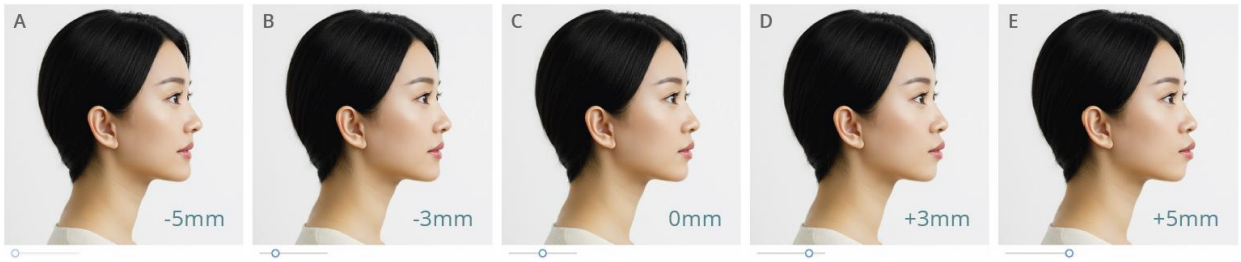


Figure 2. Five of eleven iterations of the Asian female model, with lip position altered by indicated amount relative to base image: (A) -5mm, (B) -3mm, (C) 0mm, (D) +3mm, (E) +5mm.

Statistical Analysis

Statistical analyses were performed using descriptive statistics, ANOVA with Tukey's post-hoc test and AVE contrasts, and linear regression. Data management and preliminary analyses were conducted using Microsoft Excel (Microsoft Corporation, Redmond, WA). Statistical testing was performed using R statistical software (version 4.4.1, R Foundation for Statistical Computing, Vienna, Austria). Data visualization was created using Microsoft Excel.

Results

Response Rate

At OHSU, there are currently 78 enrolled first year dental students and 75 enrolled second year dental students for a total of 153 total students between the two classes. There were 155 responses, and after removing duplicate, incomplete, and nonsensical responses, a total of 112 entries were analyzed, for a net response rate of 73.2%.

Demographics

Of the 112 respondents (Table 1), 52.7% of respondents were female (n = 59) and 47.3% of respondents were male (n = 53). No respondents selected nonbinary or third gender as an option. The overall mean age ± standard deviation of respondents was 23.9 ± 2.56 years old, with a median of 23 years old.

Race/Ethnicity

The majority of respondents were White/Caucasian (55.4%, n = 62), followed by Southeast Asian (19.6%, n = 21), East Asian (15.2%, n = 17), Hispanic/Latino (8.9%, n = 10), Middle Eastern (8%, n = 9), Black/African (3.6%, n = 4), Hawaiian/Pacific Islander (3.6%, n = 4), South Asian (3.6%, n = 4), and Indigenous/Native (1.8%, n = 2). Of the 17 respondents who selected East Asian, there were 9 (52.9%) Chinese, 5 (29.4%) Korean, 2 (11.8%) Japanese, 2 (11.8%) Taiwanese, and 1 (5.9%) Singaporean. Participants were able to select multiple race/ethnicity categories, and 6 respondents selected multiple categories. 4 selected both “East Asian and Southeast Asian,” 1 selected both “East Asian and White/Caucasian,” and 1 selected both “Southeast Asian and White/Caucasian.” The 2 participants who selected “Southeast Asian and White/Caucasian” and “East Asian and White/Caucasian” were excluded from analysis and did not contribute to the n = 112 total.

Overall (N=112)		
Age		
Mean (SD)	23.9	(2.56)
Median [Min, Max]	23.0	[21.0, 38.0]
Gender		
Female	59	52.7%
Male	53	47.3%
Race/Ethnicity*		
East Asian	17	15.2%
Southeast Asian	22	19.6%
South Asian	4	3.6%
Hawaiian/Pacific Islander	4	3.6%
Indigenous/Native	2	1.8%
White/Caucasian	62	55.4%
Black/African	4	3.6%
Hispanic/Latino	10	8.9%
Middle Eastern	9	8.0%

Table 1. Descriptive statistics of judges.
* Participants could select multiple race/ethnicity categories; percentages sum to >100%.

Nationality

A total of 91 Americans, 9 Chinese, 8 Vietnamese, 4 Koreans, 3 Canadians, 3 Indian, 2 Taiwanese, 2 Thai, 1 Filipino, 1 Ghanian, 1 German, 1 Hmong, 1 Indonesian, 1 Iraqi, 1 Japanese, 1 Libyan, 1 “Middle Eastern” (a write in answer for “Other”, where the participant did not specify nationality), and 1 Singaporean were reported. 15 (13.4%) participants had dual citizenship, while 2 (1.79%) participants had triple citizenship.

Countries of Birth and Residence

15 (13.4%) participants were not born in the USA, with 5 (4.5%) born in China, 3 (2.7%) in Vietnam, 2 (1.8%) in Egypt, 1 (0.9%) in Ghana, 1 (0.9%) in India, 1 (0.9%) in Indonesia, 1

(0.9%) in Iraq, and 1 (0.9%) in South Korea. All participants' current country of residence was the USA. The mean age of relocation was 12.9 years old and the median age was 13 years old.

Overall Averages

The evaluation by all judges of ideal lip position (Table 2 and Figure 3) for the East Asian female model led to an overall mean of -1.19mm (retruded) from the AI generated base image, and an overall median of -1mm from the base image. For the Asian male model, the overall ideal mean was -0.39mm (retruded) and 0mm (no change) for median. For the Caucasian female model, the overall ideal mean was -0.25mm (retruded) and 0mm (no change) for median. For the Caucasian male model, the overall ideal mean was +0.59mm (protruded) and +1mm (protruded) for median. When comparing across the four models, the differences in ideal lip position were statistically significant between all groups, except when comparing Asian male and Caucasian female (Figure 4).

RACE	**East Asian**		**Caucasian**	
GENDER	**Female**	**Male**	**Female**	**Male**
Ideal (Mean)	-1.19	-0.39	-0.25	0.59
Ideal (Median)	-1	0	0	1
Upper Lip from E Line (mm)	-2.25	-3	-4.25	-5.5
Lower Lip from E Line (mm)	-0.75	-1.5	0	-3

Table 2. Table of overall ideal means and medians relative to ImageFX-generated base image, and position of upper and lower lips relative to E line.

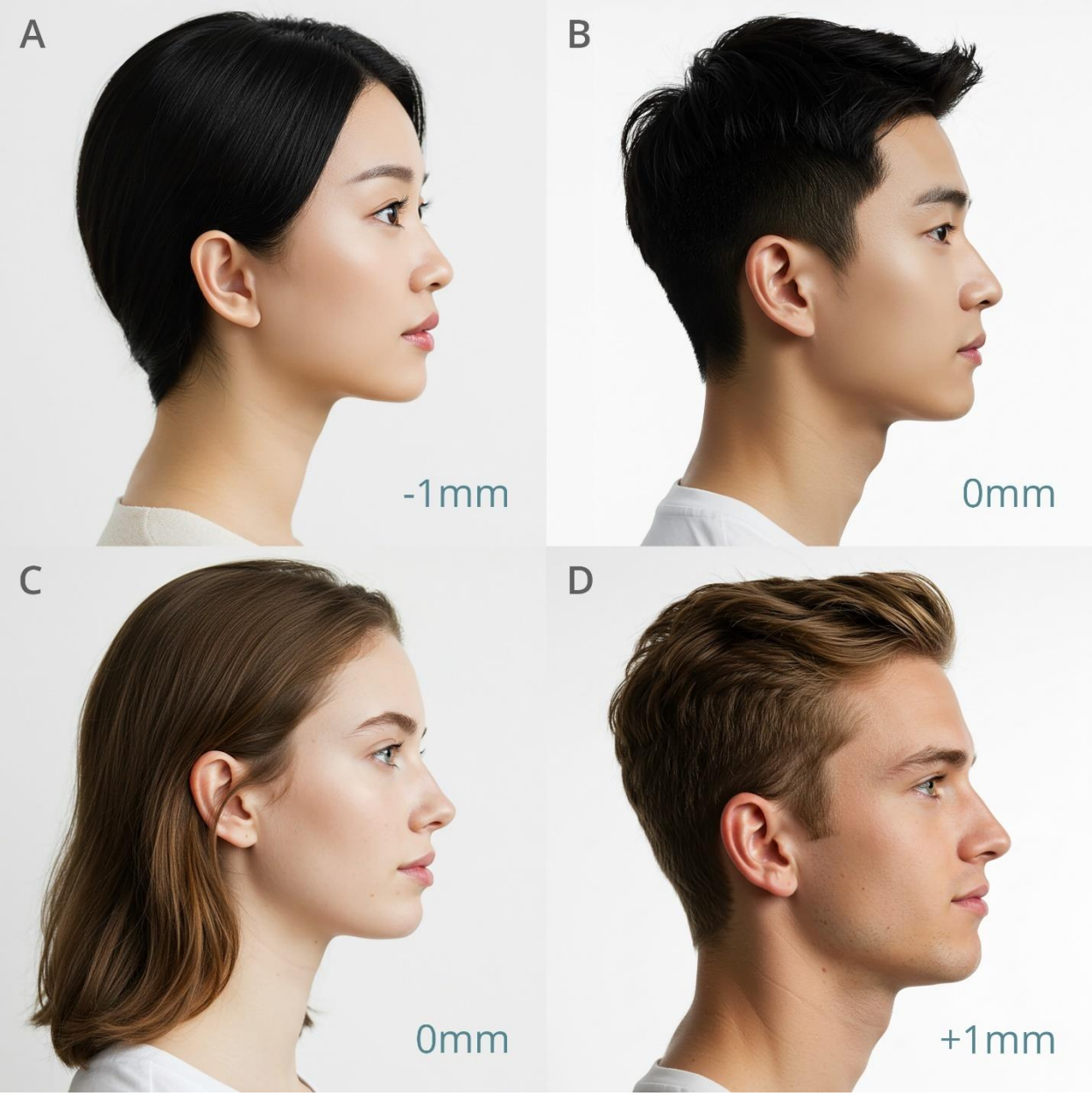
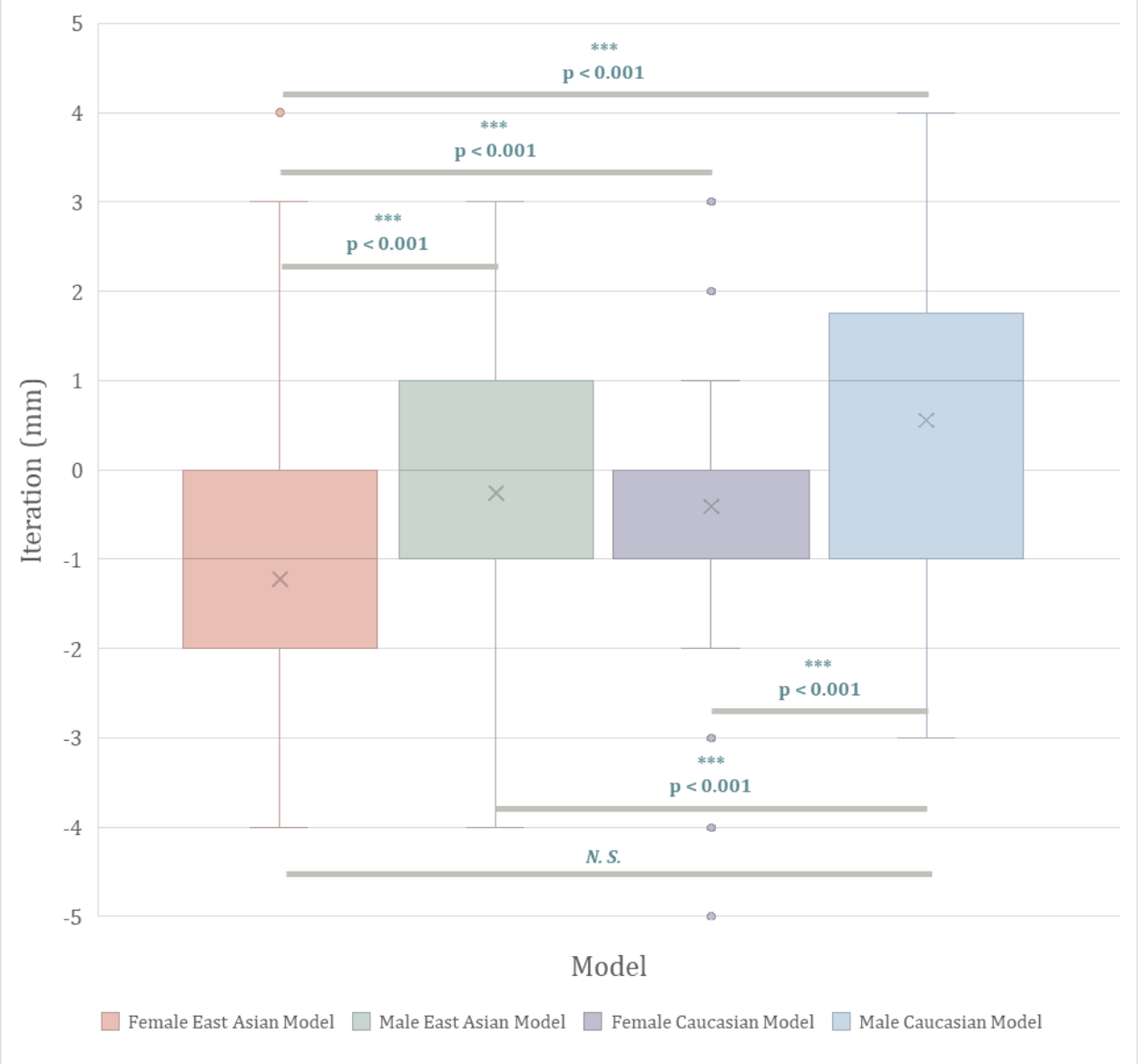


Figure 3. Iterations corresponding with the ideal median results for East Asian female (A), East Asian male (B), Caucasian female (C), and Caucasian male (D). Negative values correspond to upper and lower lip positions posterior to the base image in the horizontal plane without alteration of Sn and soft-tissue pogonion, and positive values correspond to positions anterior to the base image.

Ideal lip positions (using medians) were also quantified into distances from E line (Table 2 and Figure 3). For the Asian female model, the upper lip in the ideal image was -2.25mm from the E line, and lower lip was -0.75mm from the E line. Negative values correspond to lips

posterior to the E line, and positive values correspond to lips anterior to the E line. For the Asian male model, the upper lip was -3mm from the E line, and the lower lip was -1.5mm from the E line. For the Caucasian female model, the upper lip was -4.25mm from the E line, and the lower lip was on the E line. For the Caucasian male model, the upper lip was -5.5mm from the E line, and the lower lip was -3mm from the E line.



Ideal Model Profile Relative to ImageFX-generated Images				
ETHNICITY	**East Asian**		**Caucasian**	
GENDER	**Female**	**Male**	**Female**	**Male**

Maximum	3	3	1	4
Q3	0	1	0	1.75
Mean	-1.22	-0.26	-0.41	0.55
SD	1.54	1.52	1.42	1.45
Median	-1	0	0	1
Q1	-2	-1	-1	-1
Minimum	-4	-4	-2	-3

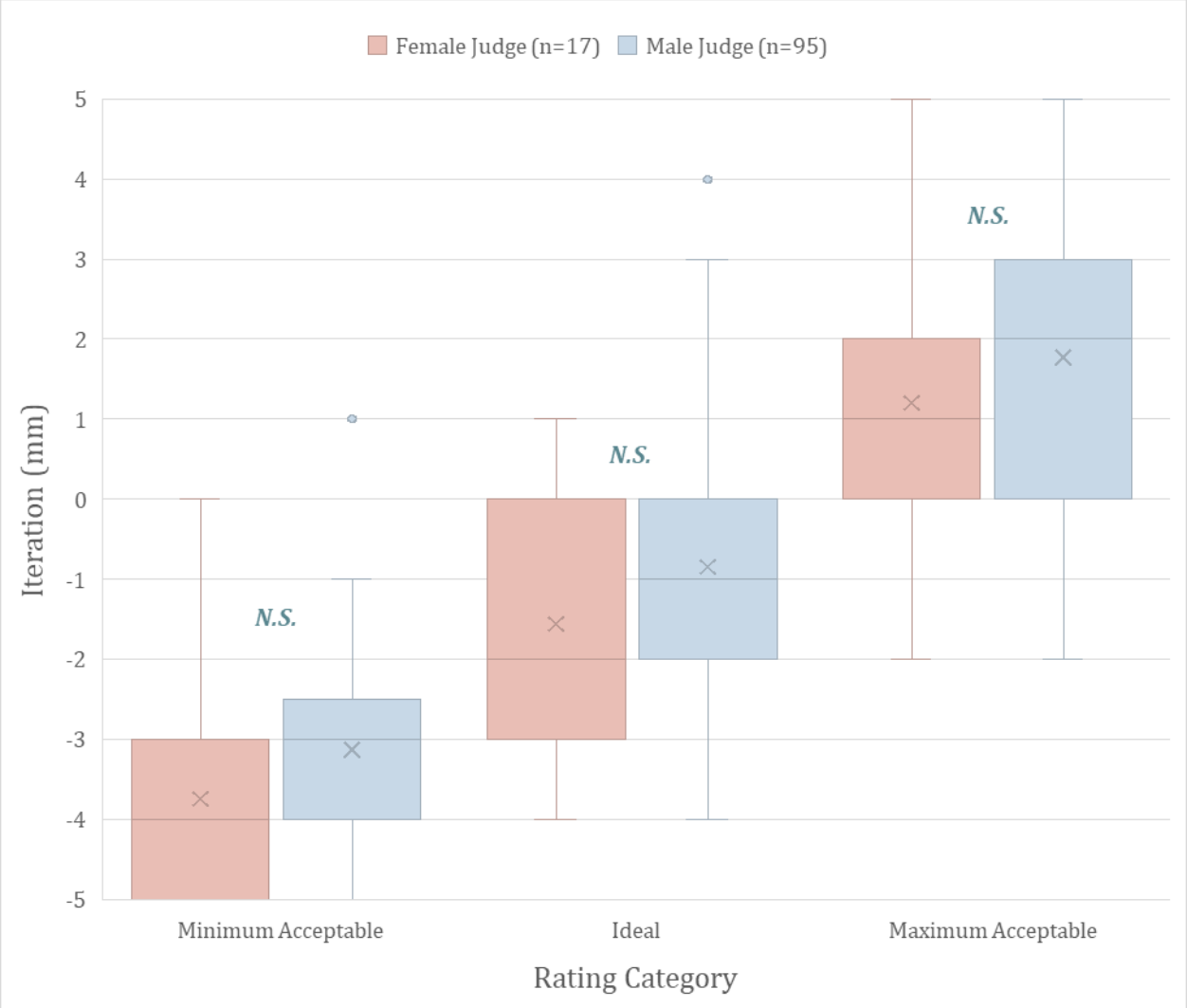
Figure 4. Judges' assessment of ideal lip position relative to AI-generated base image. Significant differences were found between all groups except Asian Male vs. Caucasian Female models.

Effects of Judge's Gender

Statistically significant differences were observed between female (n = 59) and male (n = 53) assessments ($p < 0.05$) of the ideal male East Asian model (Figure 5B), with female judges preferring more lip retrusion than male judges. There were no other significant differences between female and male judges for the East Asian models, although there was a consistent trend of female judges on average preferring more lip retrusion than male judges (Figure 5A, 7B).

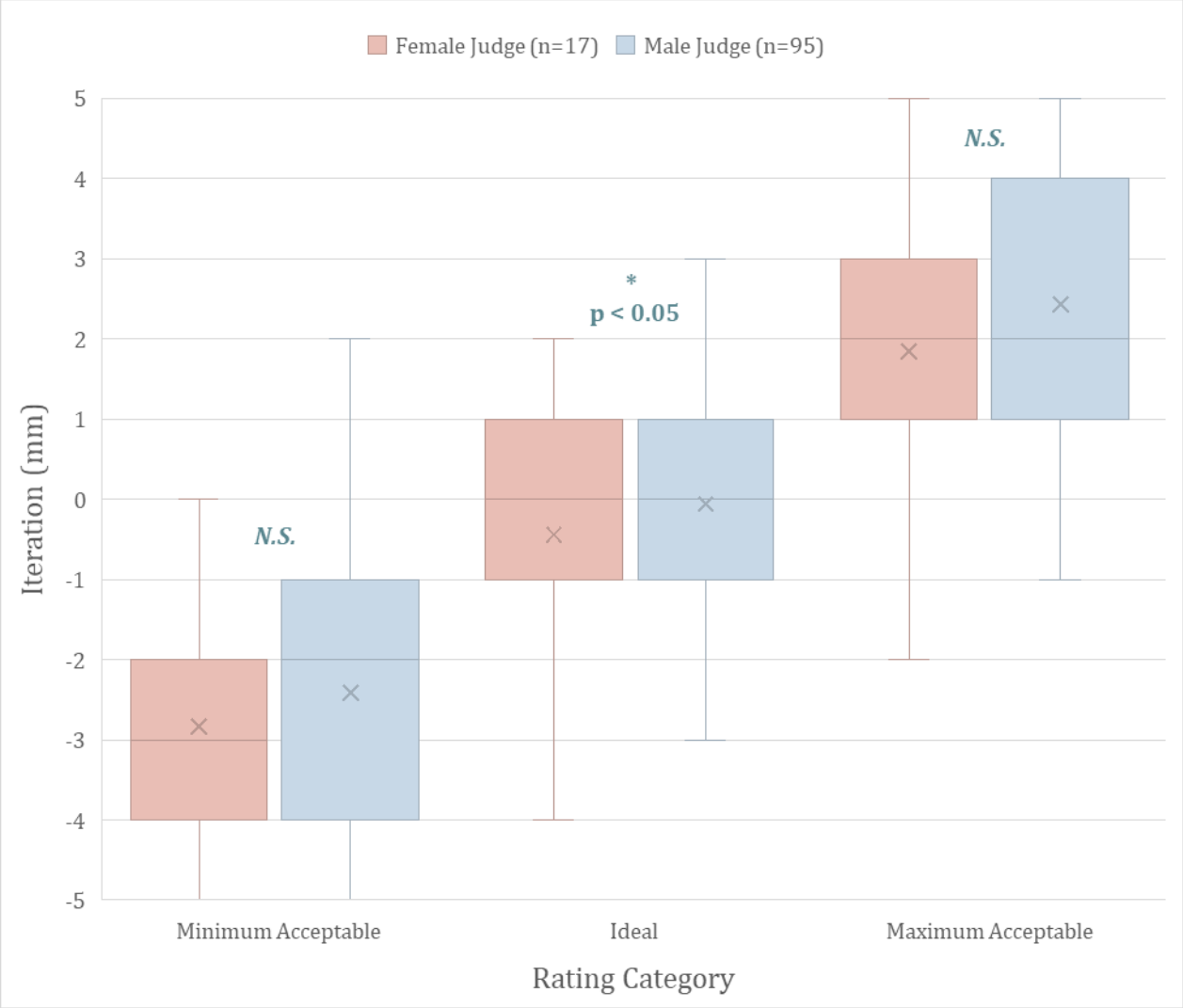
For the female Caucasian model (Figure 5C), male judges accepted significantly more protrusion in the maximum acceptable profile compared to female judges ($p < 0.05$). Additionally, the difference approached significance for the minimum acceptable profile ($p = 0.0791$), with male judges showing greater tolerance for lip retrusion. For the male Caucasian model (Figure 5D), the difference was approaching significance ($p = 0.0963$) for the maximum acceptable lip position, with male judges accepting more protrusion than female judges. Again, there was a consistent trend of female judges on average preferring more lip retrusion than male judges, even if results did not reach significance (Figure 5C, 5D).

A.



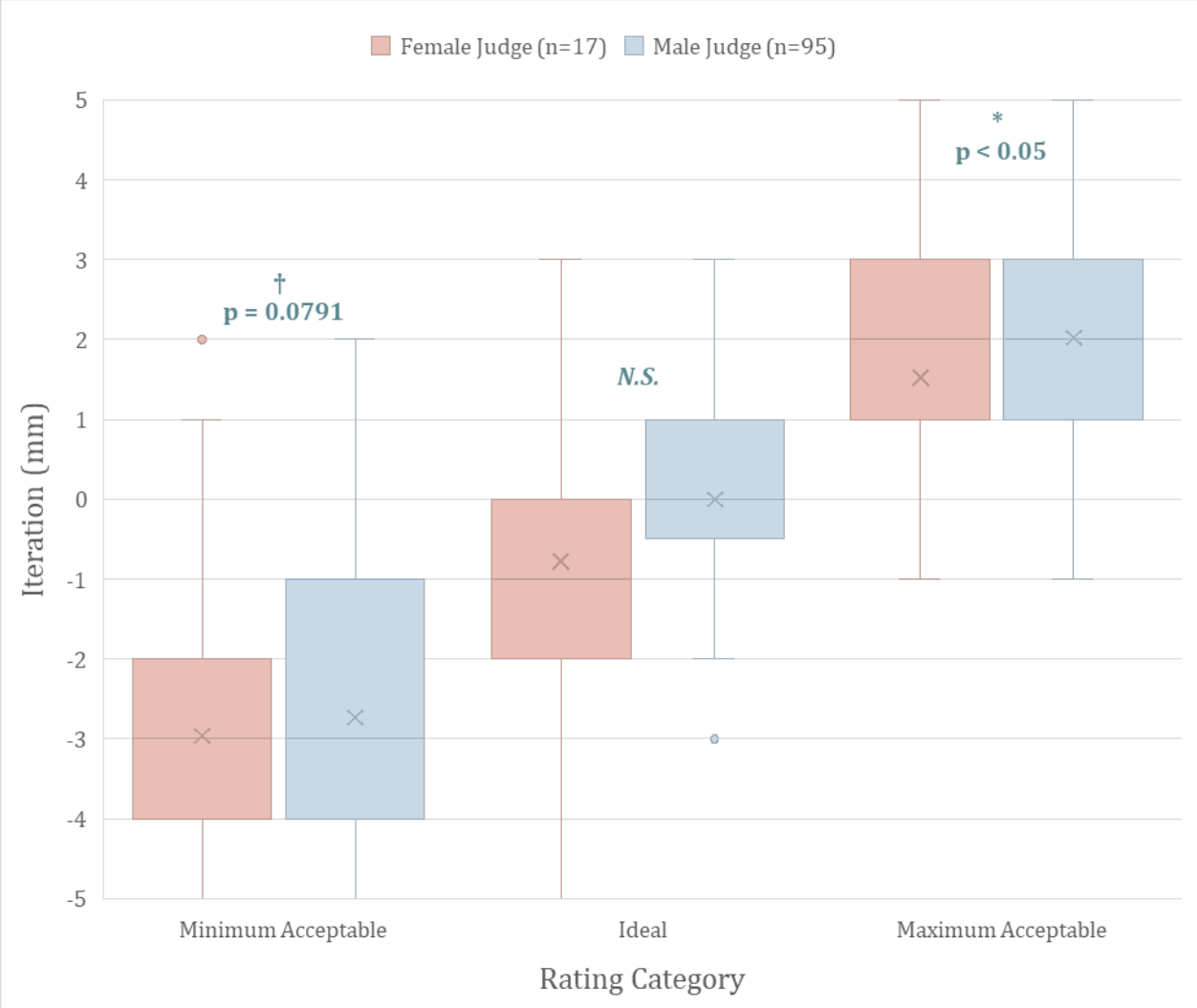
Female East Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Maximum	0	-1	1	3	5	5
Q3	-3	-2.5	0	0	2	3
Mean	-3.75	-3.13	-1.56	-0.85	1.20	1.77
SD	1.11	1.39	1.38	1.63	1.51	1.80
Median	-4	-3	-2	-2	1	2
Q1	-5	-4	-3	-3	0	0
Minimum	-5	-5	-4	-4	-2	-2

B.



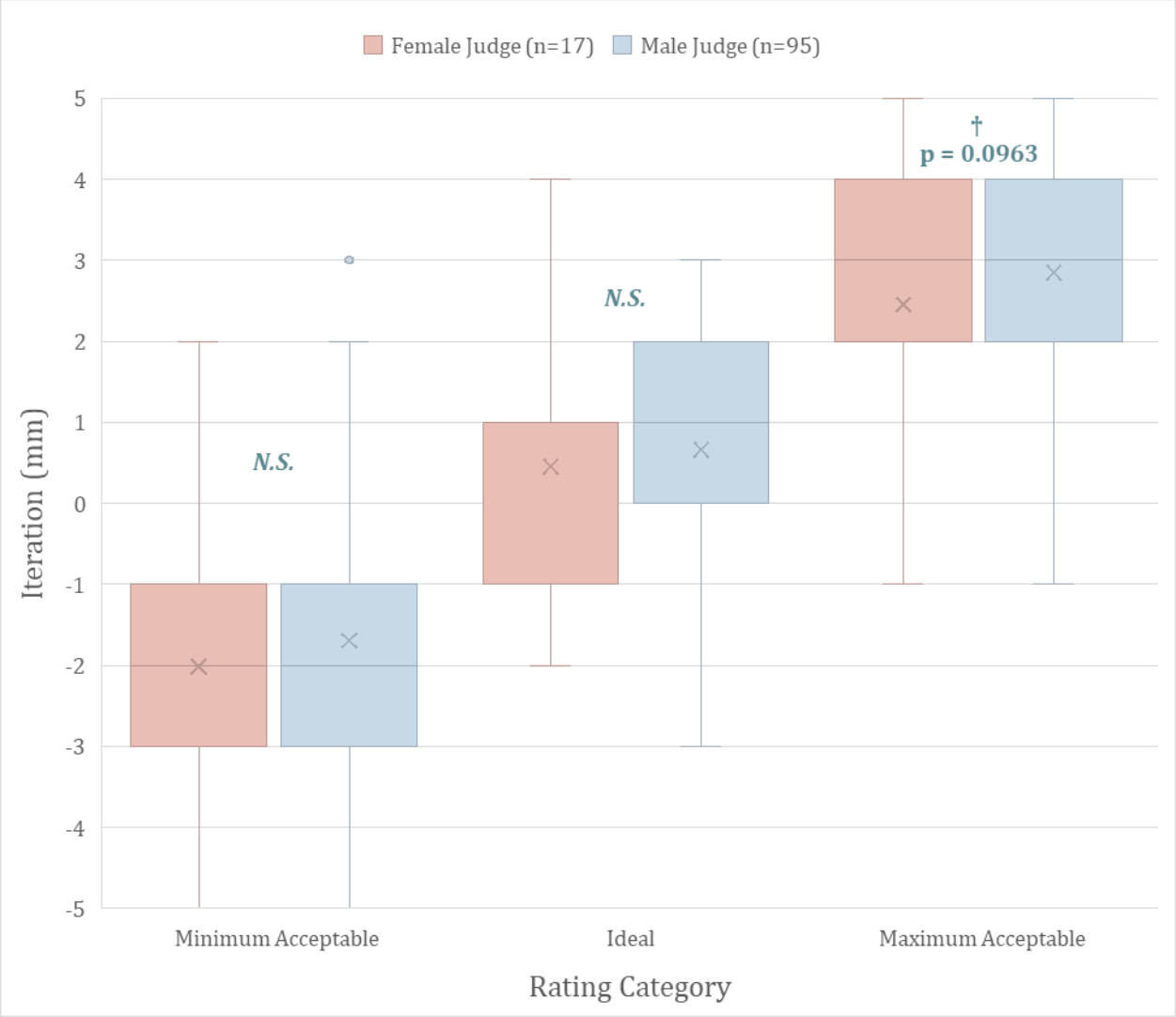
Male East Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Maximum	0	2	2	3	5	5
Q3	-2	-1	1	1	3	4
Mean	-2.83	-2.42	-0.44	-0.06	1.85	2.43
SD	1.51	1.74	1.52	1.50	1.82	1.55
Median	-3	-2	0	0	2	2
Q1	-4	-4	-1	-1	1	1
Minimum	-5	-5	-4	-3	-2	-1

C.



Female Caucasian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Maximum	1	2	3	3	5	5
Q3	-2	-1	0	1	3	3
Mean	-2.97	-2.74	-0.78	0	1.53	2.02
SD	1.64	1.68	1.65	0.98	1.61	1.49
Median	-3	-3	-1	0	2	2
Q1	-4	-4	-2	-0.5	1	1
Minimum	-5	-5	-5	-2	-1	-1

D.



Male Caucasian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Maximum	2	2	4	3	5	5
Q3	-1	-1	1	2	4	4
Mean	-2.02	-1.70	0.46	0.66	2.46	2.85
SD	1.53	1.74	1.56	1.33	1.42	1.63
Median	-2	-2	1	1	3	3
Q1	-3	-3	-2	0	2	2
Minimum	-5	-5	-2	-3	-1	-1

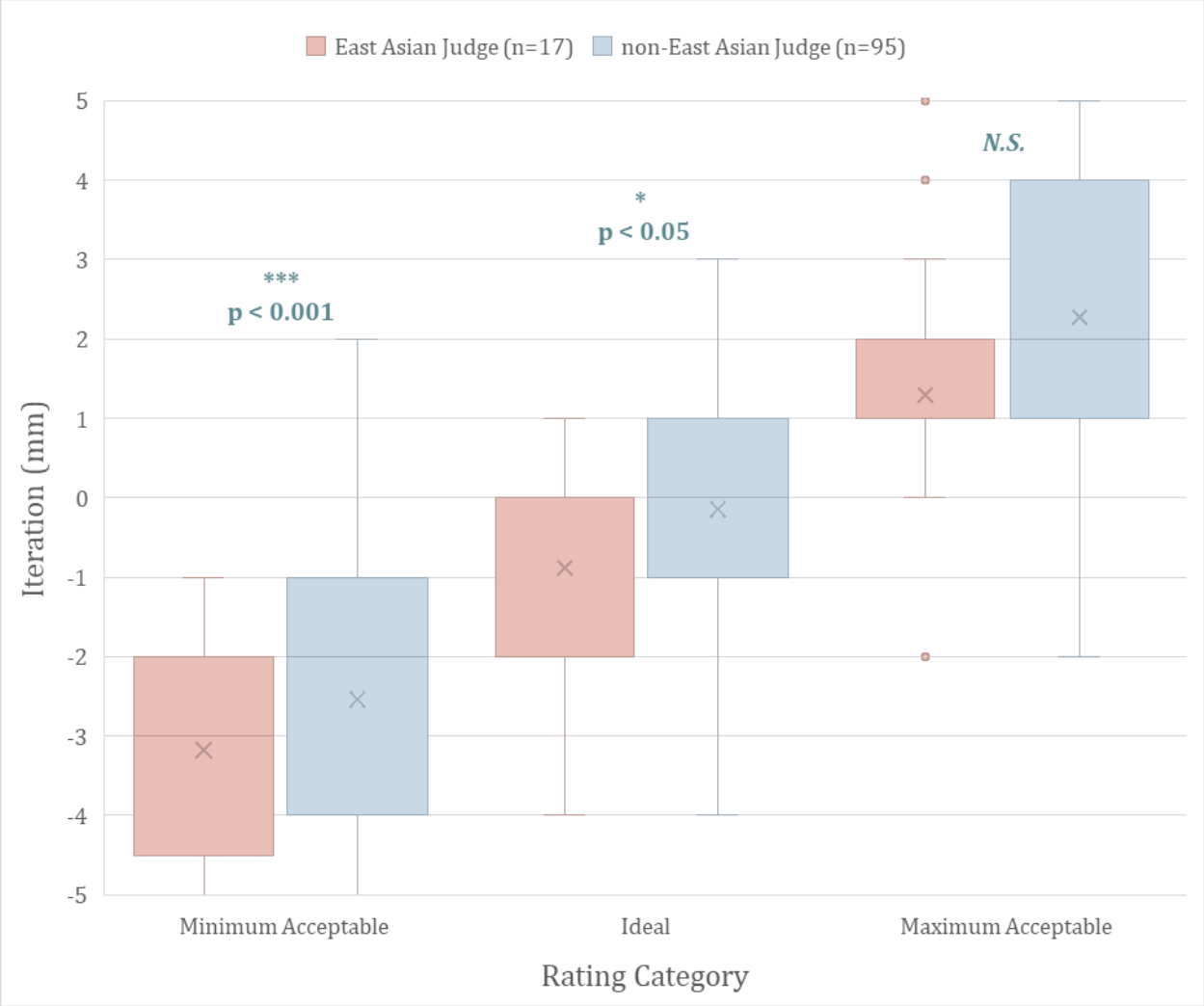
Figure 5. Female vs Male judge assessment of (A) Female East Asian model, (B) Male East Asian model, (C) Female Caucasian model, and (D) Male Caucasian model.

Effects of Judge's Race

Regarding the female East Asian model (Appendix E), there were no statistically significant differences between East Asian judges (n = 17) and non-East Asian judges' (n = 95) perception of minimal acceptable, ideal, or maximum acceptable lip positions ($p = 0.443, 0.71, 0.893$ respectively). However, there were significant differences between East Asian and non-East Asian judges for the assessment of the male East Asian model (Figure 6A). East Asian judges accepted more lip retrusion than non-East Asian judges for both minimum acceptable ($p < 0.001$) and ideal ($p < 0.05$) lip positions, but there was no difference for the maximum acceptable lip position ($p = 0.112$).

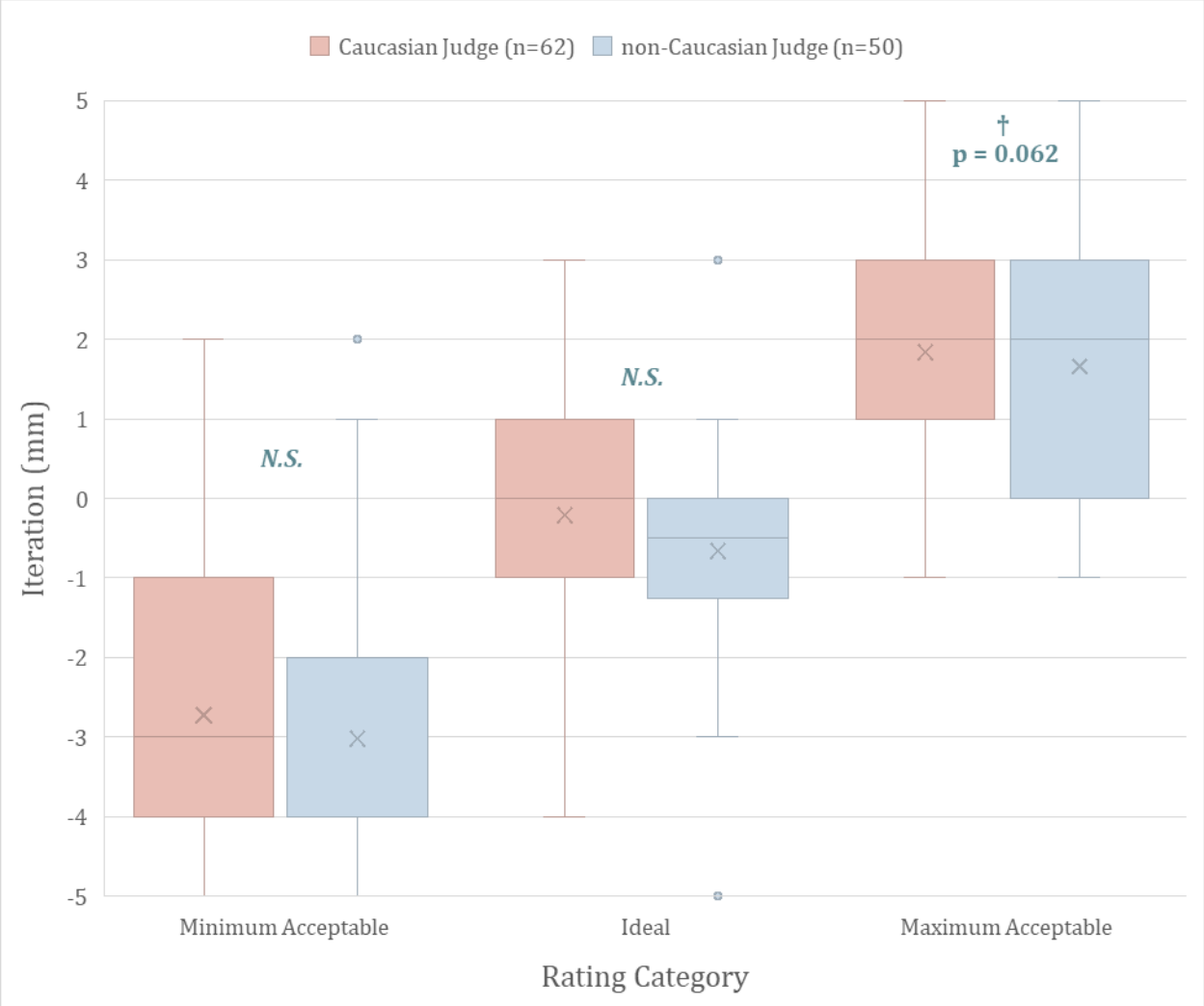
For the female Caucasian model (Figure 6B), there were no significant differences between Caucasian (n = 62) and non-Caucasian (n = 50) judges for the minimum acceptable, ideal, or maximum acceptable lip positions ($p = 0.106, 0.593, 0.062$ respectively). However, results approached statistical significance ($p = 0.062$) for the maximum acceptable lip position, with Caucasian judges accepting more protrusion than non-Caucasian judges. There were no significant differences between Caucasian and non-Caucasian judges for the assessment of the male Caucasian model (Appendix E) for the minimum acceptable, ideal, or maximum acceptable lip positions ($p = 0.968, 0.468, 0.393$ respectively).

A.



Male East Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**East Asian**	**non-East Asian**	**East Asian**	**non-East Asian**	**East Asian**	**non-East Asian**
Maximum	-1	2	1	3	3	5
Q3	-2	-1	0	1	2	4
Mean	-3.18	-2.54	-0.88	-0.14	1.29	2.27
SD	1.38	1.66	1.45	1.51	1.76	1.67
Median	-3	-2	0	0	1	2
Q1	-4.5	-4	-2	-1	1	1
Minimum	-5	-5	-4	-4	0	-2

B.



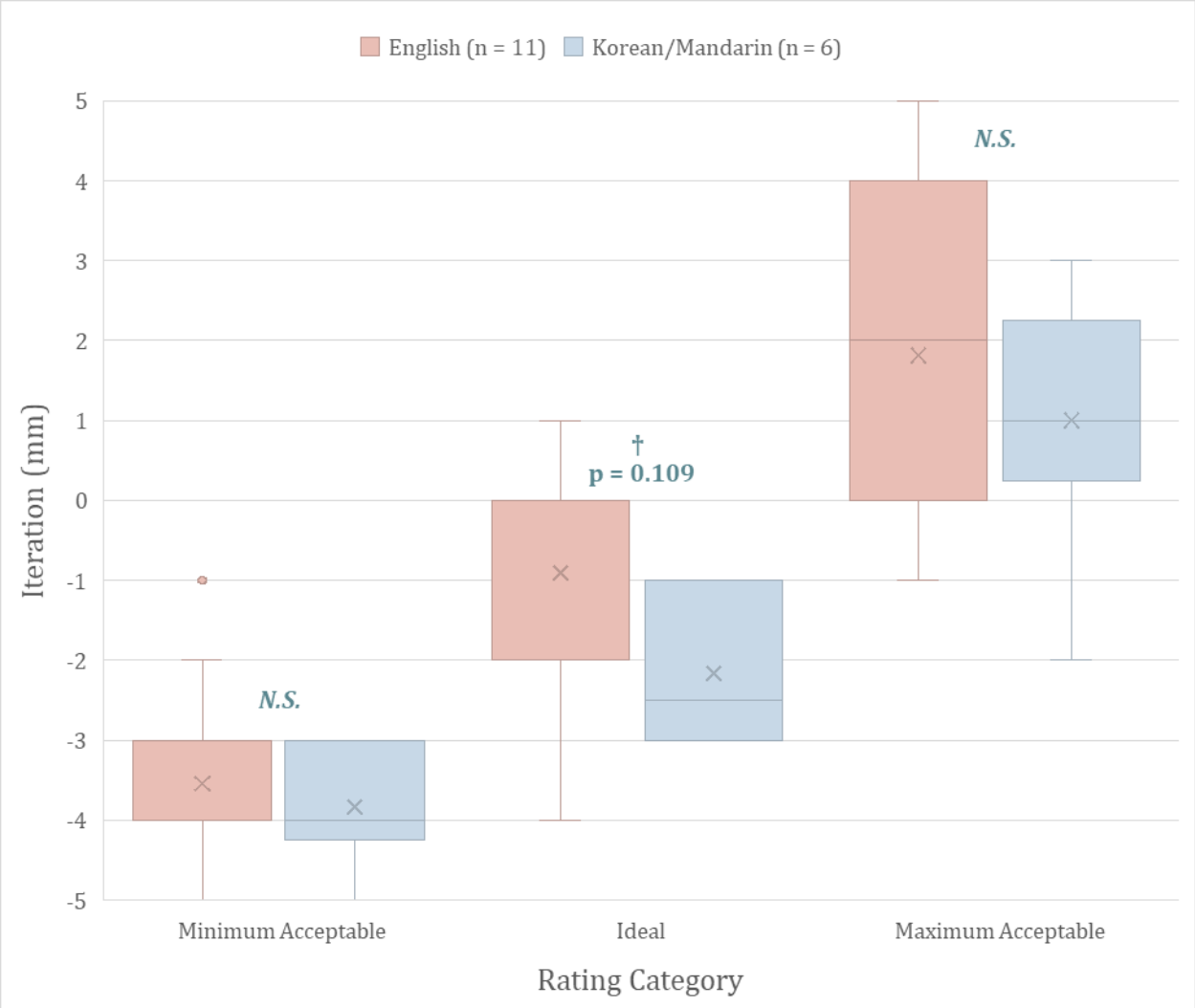
Female Caucasian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**Caucasian**	**non-Caucasian**	**Caucasian**	**non-Caucasian**	**Caucasian**	**non-Caucasian**
Maximum	2	1	3	1	5	5
Q3	-1	-2	1	0	3	3
Mean	-2.73	-3.02	-0.21	-0.66	1.84	1.66
SD	1.59	1.73	1.31	1.53	1.43	1.73
Median	-3	-4	0	-0.5	2	2
Q1	-4	-4	-1	-1.25	1	0
Minimum	-5	-5	-4	-3	-1	-1

Figure 6. Cross-race vs. same-race judge assessment of (A) Male East Asian model and (B) Female Caucasian model.

Effects of Cultural Immersion

Although a total of 17 (15.2%) respondents selected “East Asian” for their race/ethnicity, an additional three (2.7%) of respondents who did not select “East Asian” for race/ethnicity did select a nationality that was East Asian. Specifically, one respondent selected “Chinese” for nationality and “Southeast Asian” for race/ethnicity, one respondent selected “Hispanic/Latino” for race/ethnicity and both “American” and “Japanese” for nationality, and one respondent selected “White/Caucasian” for race/ethnicity and both “American” and “Korean” for nationality. All three respondents reported that they were born in the US and their country of residence is the US.

106 (94.6%) of all respondents indicated that their primary language was English, 3 (2.7%) was Mandarin, and 3 (2.7%) was Korean. 54 (48.2%) of all respondents indicated that they had other languages they were comfortable with. Of the 17 respondents who selected “East Asian” for race/ethnicity, 11 (64.7%) indicated that English was their primary language, 3 (17.6%) indicated Mandarin, and 3 (17.6%) indicated Korean. 11 (64.7%) indicated that they were multilingual, while 6 (35.3%) indicated that their only language was English. Results approached significance ($p = 0.109$) when comparing East Asian judges whose primary languages were English vs. Korean/Mandarin, with Korean/Mandarin speakers preferring more lip retrusion in the ideal East Asian female profile (Figure 7). There were no other significant differences in profile preferences between East Asian judges based on primary language for either the female or male East Asian models, although Korean/Mandarin speakers showed a consistent trend for preferring lip retrusion in the minimum and maximum acceptable East Asian female profile.



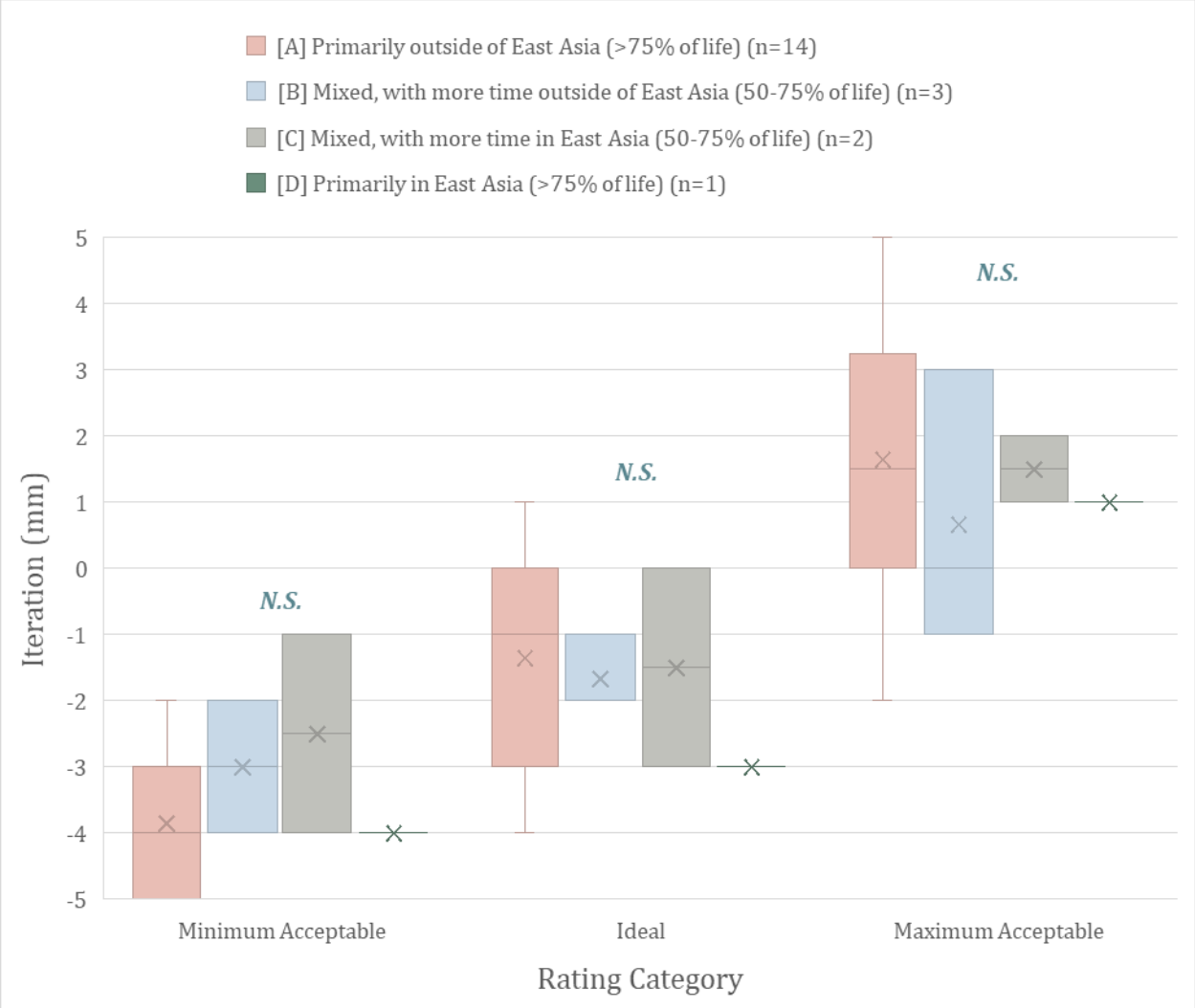
Female Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
Primary Language	**English**	**Korean/ Mandarin**	**English**	**Korean/ Mandarin**	**English**	**Korean/ Mandarin**
Maximum	-2	-3	1	-1	5	3
Q3	-3	-3	0	-1	4	2.25
Mean	-3.55	-3.83	-0.91	-2.17	1.82	1.00
SD	1.21	0.75	1.64	0.98	1.99	1.67
Median	-4	-4	0	-3	2	1
Q1	-4	-4.25	-2	-3	0	0.25
Minimum	-5	-5	-4	-3	-1	-2

Figure 7. East Asian judge assessments of Female East Asian model by primary language (English vs. Korean/Mandarin).

19 respondents who selected any of the East Asian nationalities or selected “East Asian” for race/ethnicity were asked where they had primarily lived. 14 (70%) indicated [A] primarily outside of East Asia (>75% of life), 2 (15%) indicated [B] mixed with more time outside of East Asia (50-75% of life), 2 (10%) indicated [C] mixed with more time in East Asian (50-75% of life), 1 (5%) indicated [D] primarily in East Asia (>75% of life), and 0 selected equal time both inside and outside of East Asia. No statistical significance was found when comparing these judges’ preferences on the female and male East Asian profiles, although participants who lived primarily outside of East Asia (>75% of life) showed a tendency to more retrusive profiles (Figure 8).

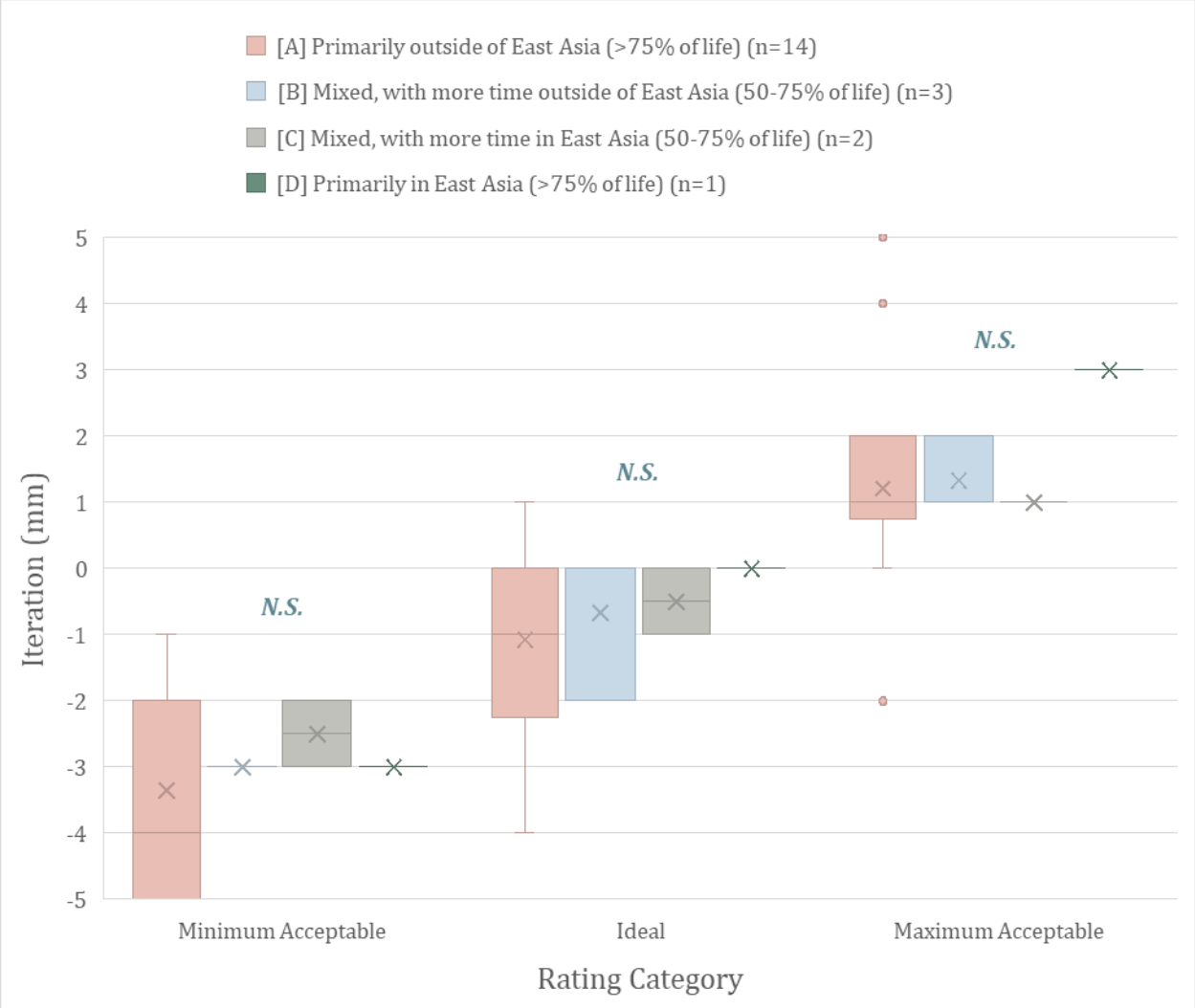
When [B], [C], and [D] were combined into a larger group of [B] “judges who did not primarily live outside of East Asia (≥25% of life in EA)” (n = 6) and compared with [A], “judges who primarily lived outside of East Asia (<25% of life in EA)” (n = 14), results showed trends that [A] accepted more lip retrusion than [B] in the minimum acceptable female East Asian and minimum acceptable, ideal, and maximum acceptable male East Asian models, although results did not reach significance (Figure 9).

A.



Female East Asian Model												
PROFILE	**Minimum Acceptable**				**Ideal**				**Maximum Acceptable**			
CATEGORY	**[A]**	**[B]**	**[C]**	**[D]**	**[A]**	**[B]**	**[C]**	**[D]**	**[A]**	**[B]**	**[C]**	**[D]**
Maximum	-2	-2	-1	-4	1	-1	0	-3	5	3	2	1
Q3	-3	-3	-1	-4	0	-1	0	-3	3.25	3	2	1
Mean	-3.86	-3	-2.5	-4	-1.36	-1.67	-1.5	-3	1.64	0.67	1.5	1
SD	0.95	1.00	2.12	n/a	1.69	0.58	2.12	n/a	1.91	2.08	0.71	n/a
Median	-4	-3	-2.5	-4	-1	-2	-1.5	-3	1.5	0	1.5	1
Q1	-5	-4	-4	-4	-3	-2	-3	-3	0	-1	1	1
Minimum	-5	-4	-4	-4	-4	-2	-3	-3	-2	-1	1	1

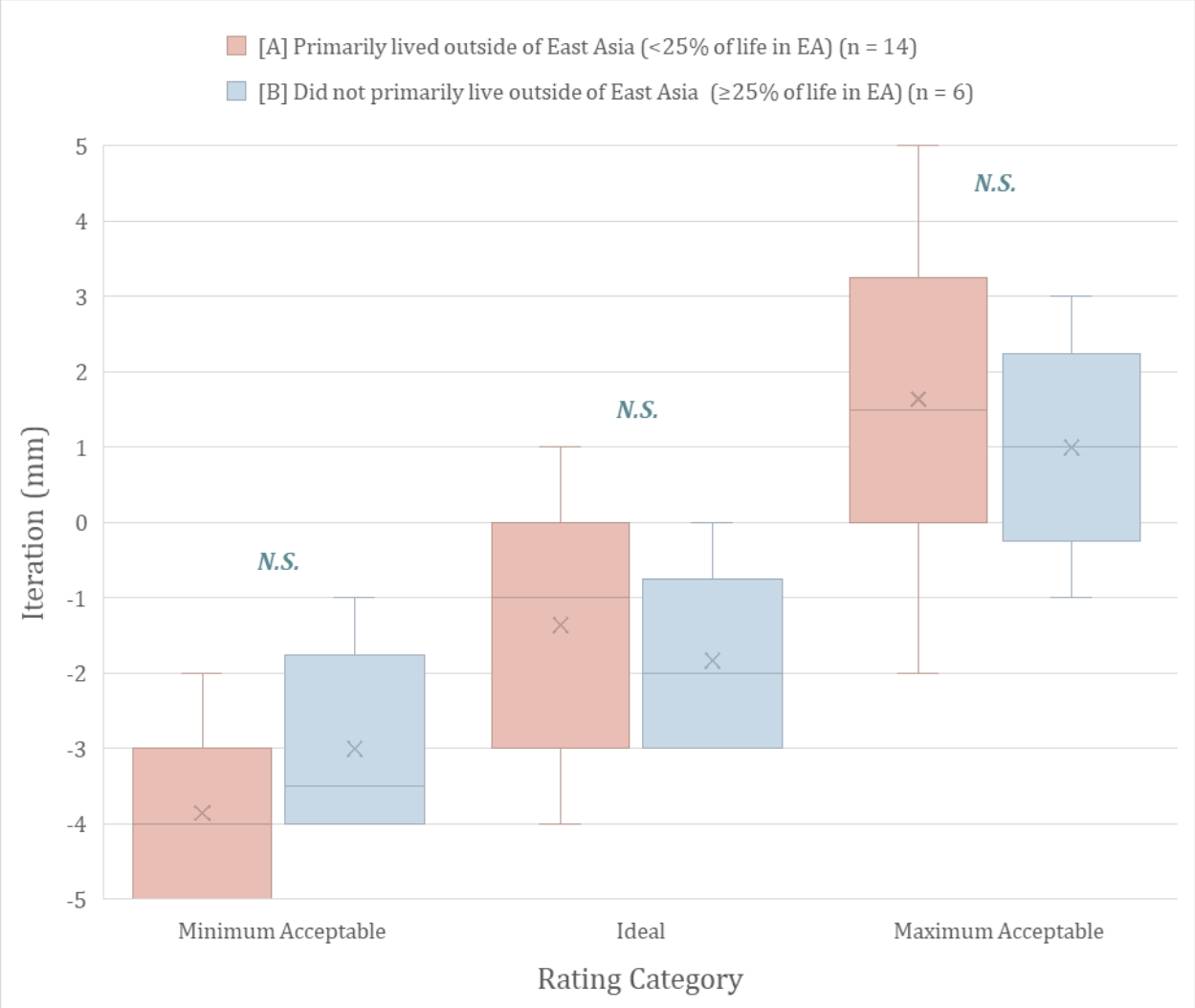
B.



Male East Asian Model												
PROFILE	**Minimum Acceptable**				**Ideal**				**Maximum Acceptable**			
CATEGORY	**[A]**	**[B]**	**[C]**	**[D]**	**[A]**	**[B]**	**[C]**	**[D]**	**[A]**	**[B]**	**[C]**	**[D]**
Maximum	-1	-3	-2	-3	1	0	0	0	2	2	1	3
Q3	-2	-3	-2	-3	0	0	0	0	2	2	1	3
Mean	-3.36	-3	-2.5	-3	-1.07	-0.67	-0.5	0	1.21	1.33	1	3
SD	1.50	n/a	0.71	n/a	1.54	1.15	0.71	n/a	1.89	0.58	n/a	n/a
Median	-4	-3	-2.5	-3	-1	0	-0.5	0	1	1	1	3
Q1	-5	-3	-3	-3	-2.25	-2	-1	0	0.75	1	1	3
Minimum	-5	-3	-3	3	-4	-2	-1	0	0	1	1	3

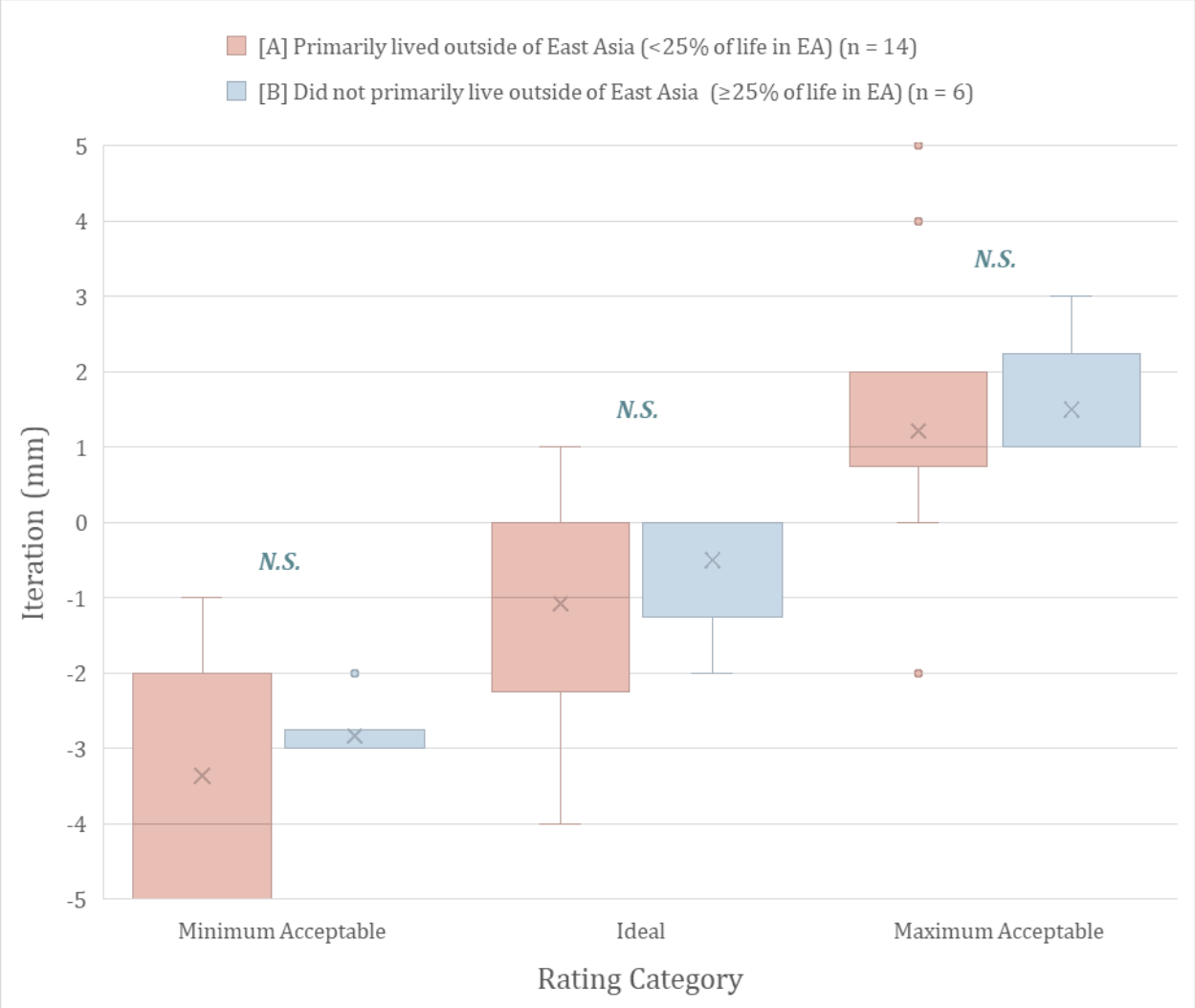
Figure 8. Percentage of life spent living inside or outside of East Asia vs. judge assessment of Female East Asian model (A) and Male East Asian model (B).

A.



Female East Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
CATEGORY	**[A]**	**[B]**	**[A]**	**[B]**	**[A]**	**[B]**
Maximum	-2	-1	1	0	5	3
Q3	-3	-1.75	0	-0.75	3.25	2.25
Mean	-3.86	-3.00	-1.36	-1.83	1.64	1.00
SD	0.95	1.26	1.69	1.17	1.91	1.41
Median	-4	-3.5	-1	-2	1.5	1
Q1	-5	-4	-3	-3	0	-0.25
Minimum	-5	-4	-4	-3	-2	-1

B.



Male East Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
CATEGORY	**[A]**	**[B]**	**[A]**	**[B]**	**[A]**	**[B]**
Maximum	-1	-2.75	1	0	2	3
Q3	-2	-2.75	0	0	2	2.25
Mean	-3.36	-2.83	-1.07	-0.50	1.21	1.50
SD	1.50	0.41	1.54	0.84	1.89	0.84
Median	-4	-3	-1	0	1	1
Q1	-5	-3	-2.25	-1.25	0.75	1
Minimum	-5	-3	-4	-2	0	1

Figure 9. Pooled percentage of life spent living inside or outside of East Asia vs. judge assessment of Female East Asian model (A) and Male East Asian model (B).

The 6 judges who were born in East Asia and immigrated to the United States were asked when they had relocated (Appendix E, Figure A), with a median age of immigration of 12.5 years and a mean age of 8.3 years +/- 5.7 years. For the minimum acceptable male East Asian model (Figure 10), a significant correlation ($p = 0.004$, $R^2 = 0.8963$) was found, where the older the participant was when they immigrated to the US, the less they accepted a retrusive profile. No other significant trends were found for the female or male East Asian models.

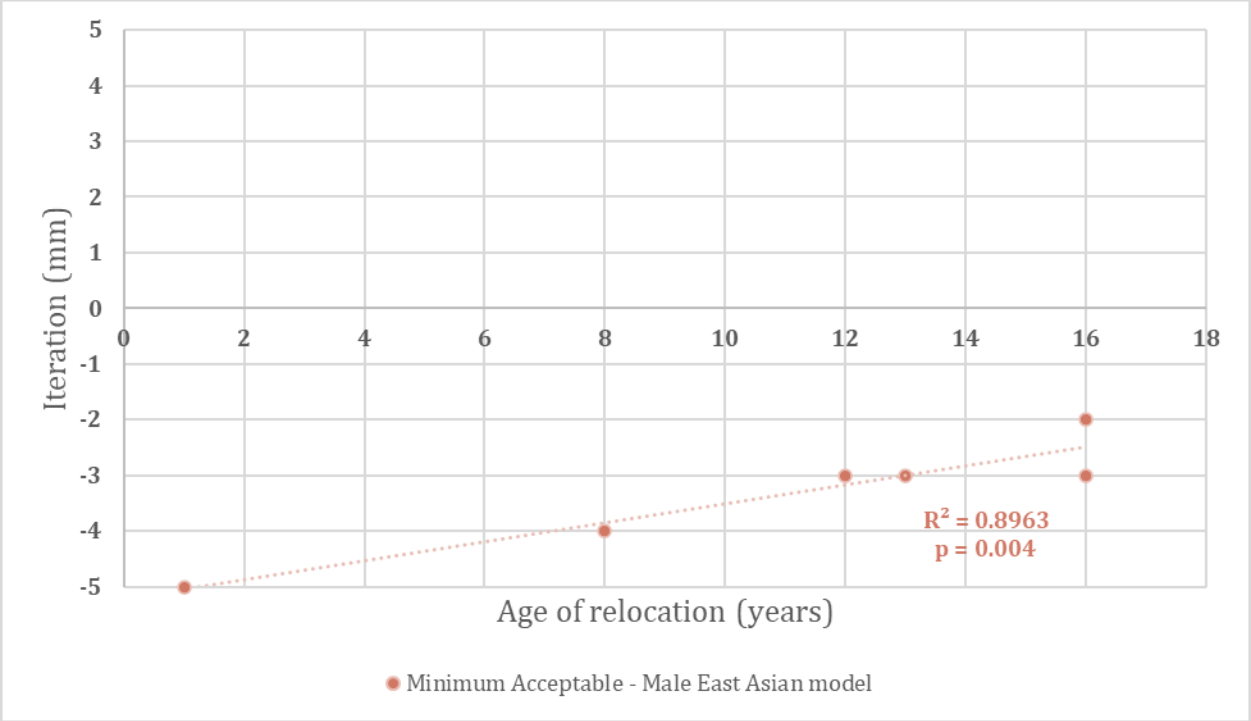


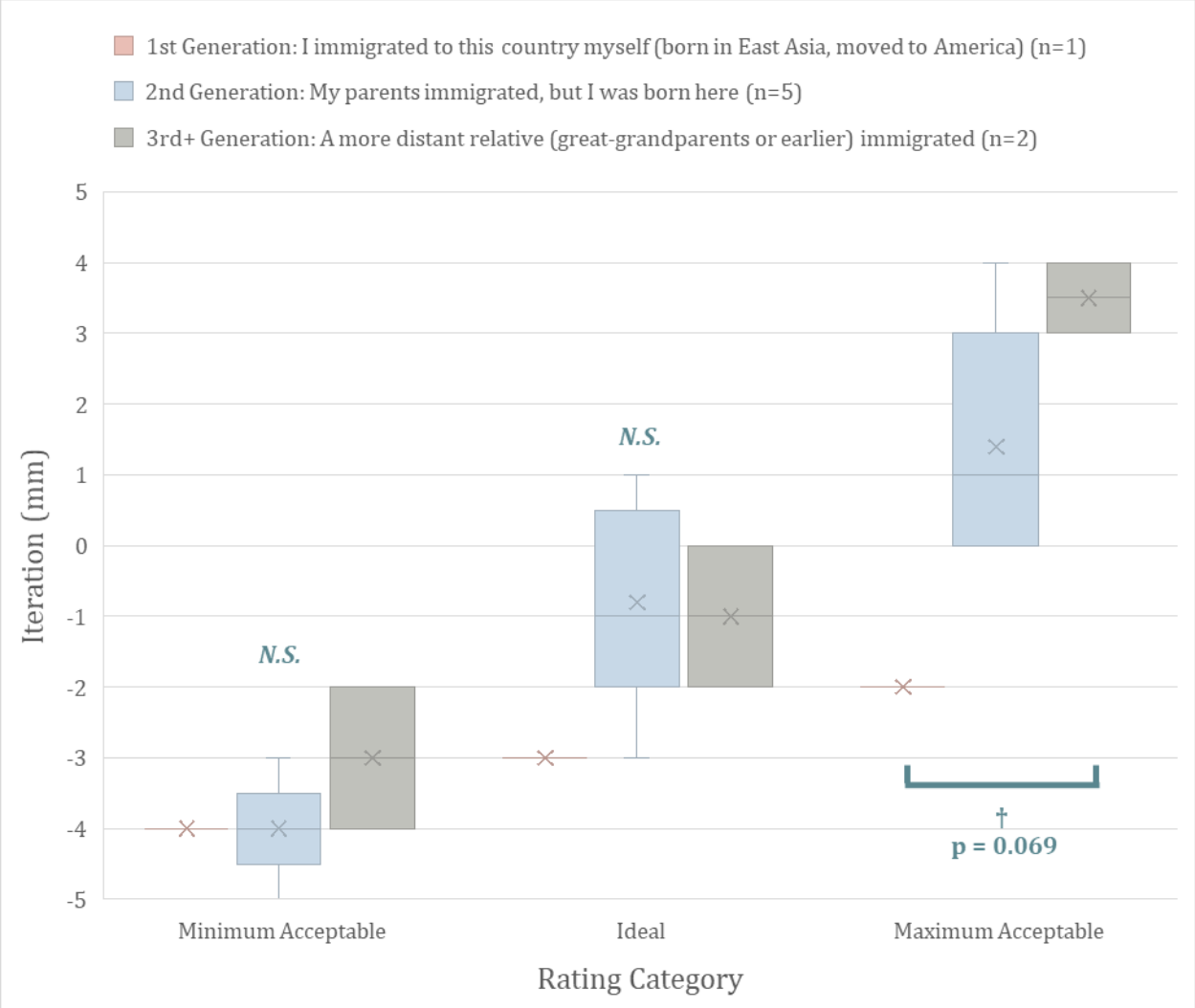
Figure 10. Age of relocation vs. judge assessment of minimum acceptable Male East Asian model.

Results indicated that there were no significant differences between East Asian judges born in East Asia (n=6) and East Asian judges born in the US (n=11) for either the female or male East Asian models (Appendix E).

The 8 respondents who selected both "American" for nationality and "East Asian" for race/ethnicity were asked about which immigrant generation they belonged to. 1 (12.5%) immigrated to the US themselves ("1st generation"), 5 (62.5%) respondents' parents

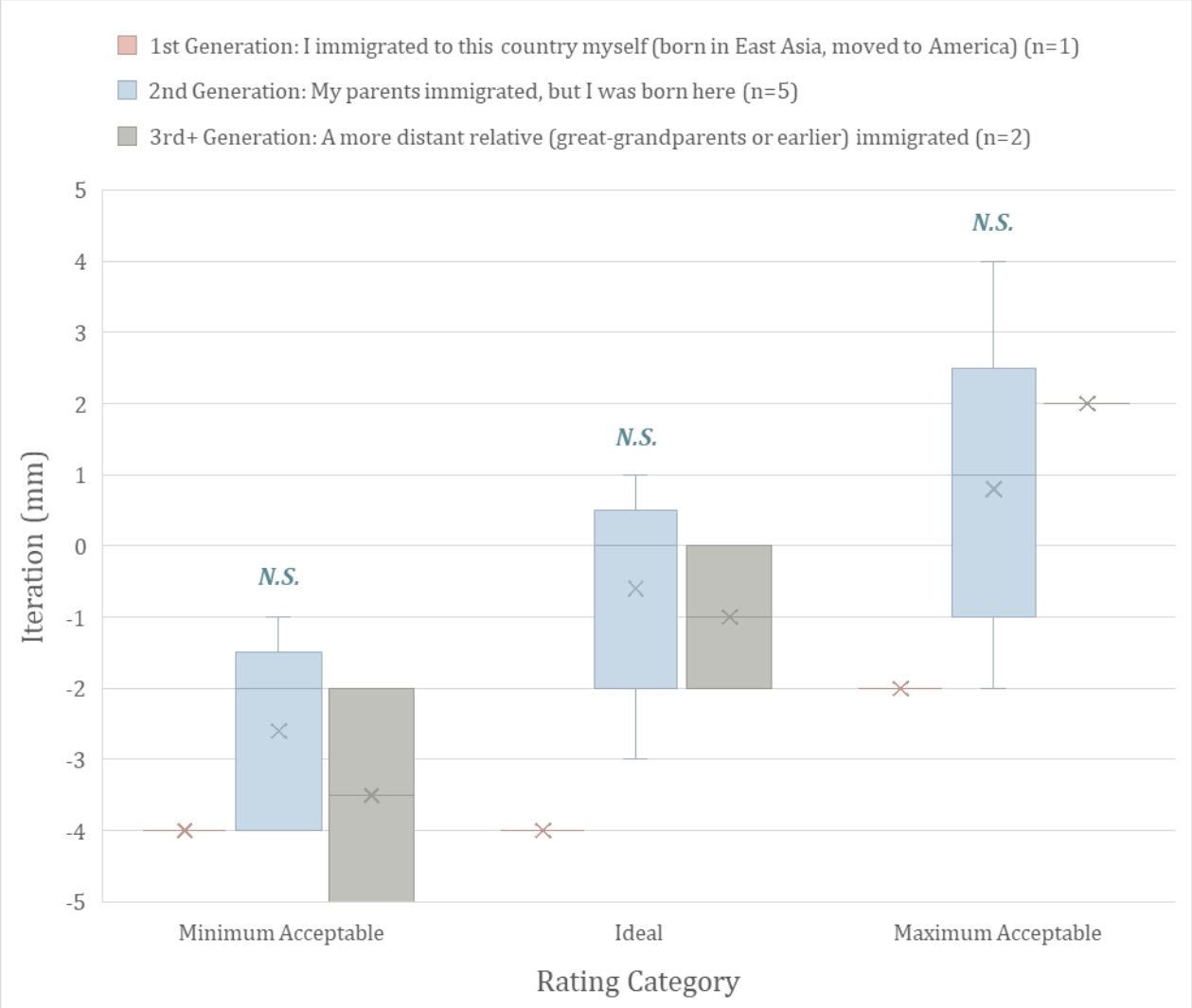
immigrated to the US but the respondents themselves were born in the US ("2nd generation"), 0 (0%) respondents' grandparents immigrated to the US, and 2 (25%) respondents' distant relatives immigrated to the US ("3rd+ generation"). Although results did not reach significance due to the small sample size (n = 1), the 1st-generation individual demonstrated more retrusive preferences across all profile categories compared to 2nd- and 3rd+-generation judges, with minimum acceptable, ideal, and maximum acceptable values all in the retrusive range for both the female and male East Asian models (Figure 11A, 11B). The 3rd+-generation group accepted more protrusion in the maximum acceptable models. Results trended toward significance between the 1st generation and 3rd generation groups for the maximum acceptable female East Asian model, with the 1st generation individual preferring a significantly more retrusive profile than the 3rd generation group (Figure 11A).

A.



Female East Asian Model									
PROFILE	**Minimum Acceptable**			**Ideal**			**Maximum Acceptable**		
GENERATION	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**
Maximum	-4	-3	-2	-3	1	0	-2	4	4
Q3	-4	-3.5	-2	-3	0.5	-1	-2	3	4
Mean	-4	-4	-3	-3	-0.8	-1	-2	1.4	3.5
SD	n/a	0.71	1.41	n/a	1.48	1.41	n/a	1.67	0.71
Median	-4	-4	-3	-3	-1	-1	-2	1	3.5
Q1	-4	-4.5	-4	-3	-2	-2	-2	0	3
Minimum	-4	-5	-4	-3	-3	-2	-2	0	3

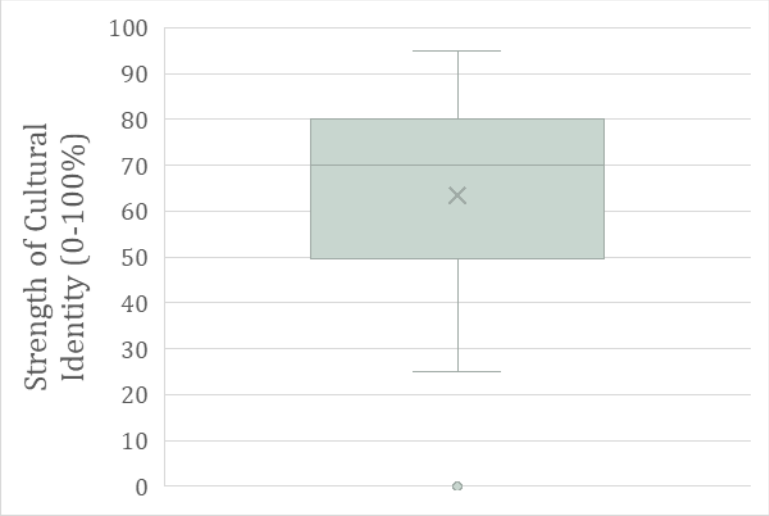
B.



Male East Asian Model									
PROFILE	**Minimum Acceptable**			**Ideal**			**Maximum Acceptable**		
GENERATION	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**
Maximum	-4	-1	-2	-4	1	0	-2	4	2
Q3	-4	-1.5	-2	-4	0.5	0	-2	2.5	2
Mean	-4	-2.6	-3.5	-4	-0.6	-1	-2	0.8	2
SD	n/a	1.34	2.12	n/a	1.52	1.41	n/a	2.17	n/a
Median	-4	-2	-3.5	-4	0	-1	-2	1	2
Q1	-4	-4	-5	-4	-2	-2	-2	-1	2
Minimum	-4	-4	-5	-4	-3	-2	-2	-2	2

Figure 11. Immigrant generation vs. judge assessment of (A) Female East Asian model and (B) Male East Asian model.

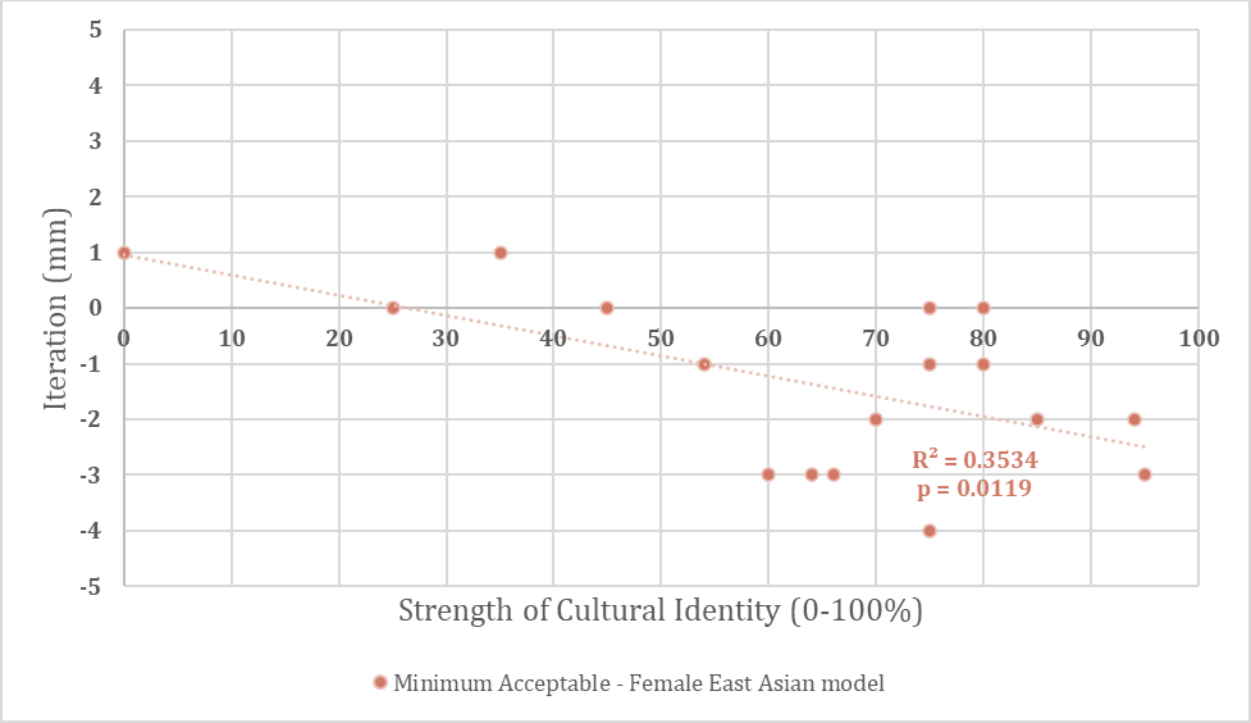
Of the 17 respondents who selected East Asian as a race/ethnicity, when asked how strongly they identified with East Asian culture on a scale of 0 (don't relate at all) to 100 (strongly identify with the culture), the mean was 63.4 and the median was 70, with most answers ranging from 25 to 95 and one outlier at 9 (Figure 12). When correlating strength of cultural identity with the minimum acceptable, ideal, and maximum acceptable female and male East Asian models (Figure 13), similar trends were noted in the minimum acceptable female East Asian model (Figure 13A, $p = 0.0119$, $R^2 = 0.3534$) and maximum acceptable female East Asian model (Figure 13B, $p = 0.0638$, $R^2 = 0.2107$), where the stronger the judge's sense of cultural identity, the more they preferred a retrusive profile. A positive correlation was found between age of relocation and strength of cultural identity (Figure 14).



Strength of Cultural Identity	
Maximum	95
Q3	80
Mean	63.4
SD	25.2
Median	70
Q1	49.5
Minimum	25

Figure 12. Box-and-whisker plot showing the distribution of how strongly East Asian judges identified with East Asian culture. Judges were asked how strongly they identified with their ethnicity's culture.

A.



B.

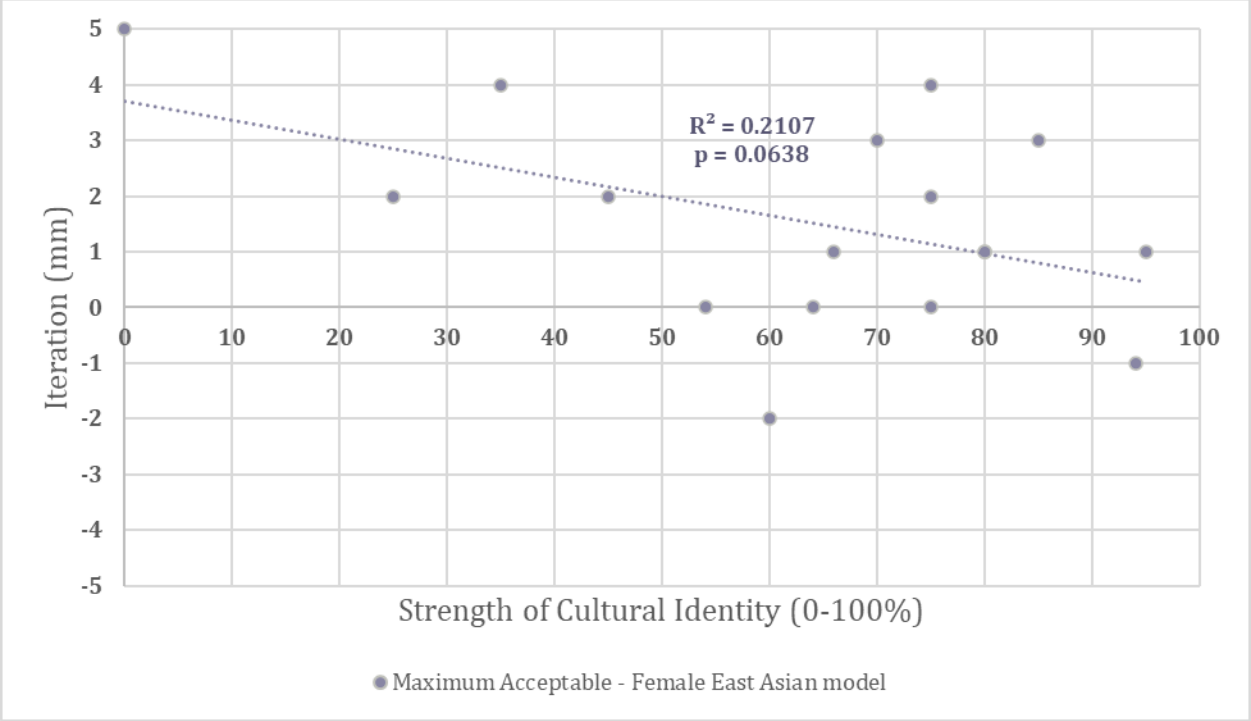


Figure 13. Strength of cultural identity on a scale of 0-100% vs. judge assessment of (A) minimum acceptable Female East Asian model and (B) maximum acceptable Female East Asian model.

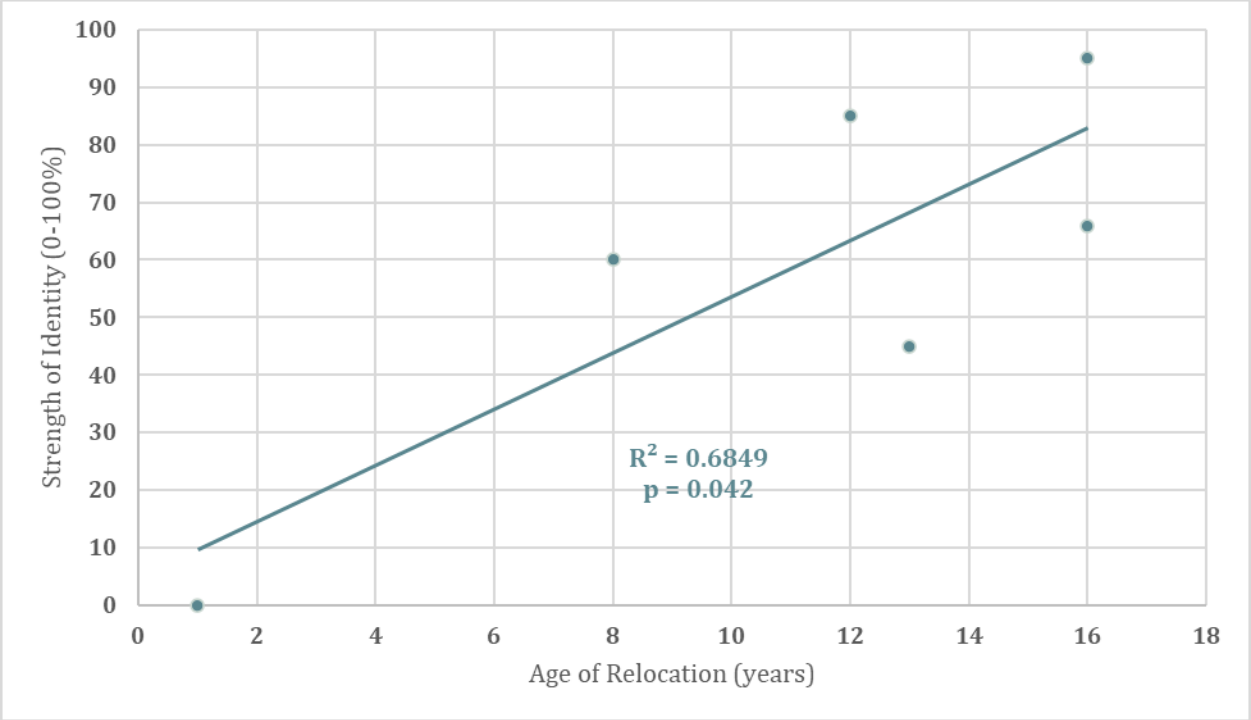
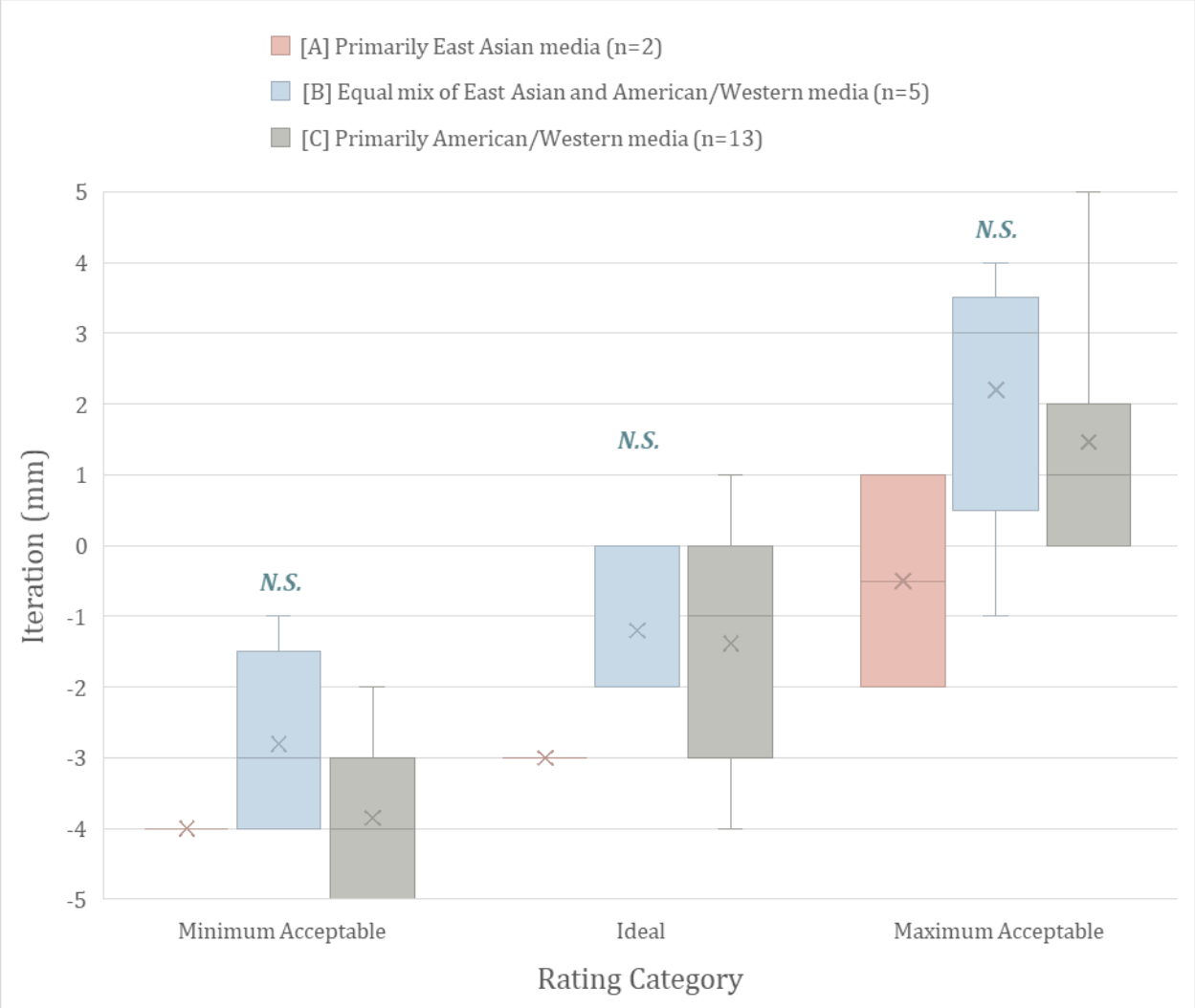


Figure 14. Age of relocation (years) vs. strength of cultural identity (0-100%).

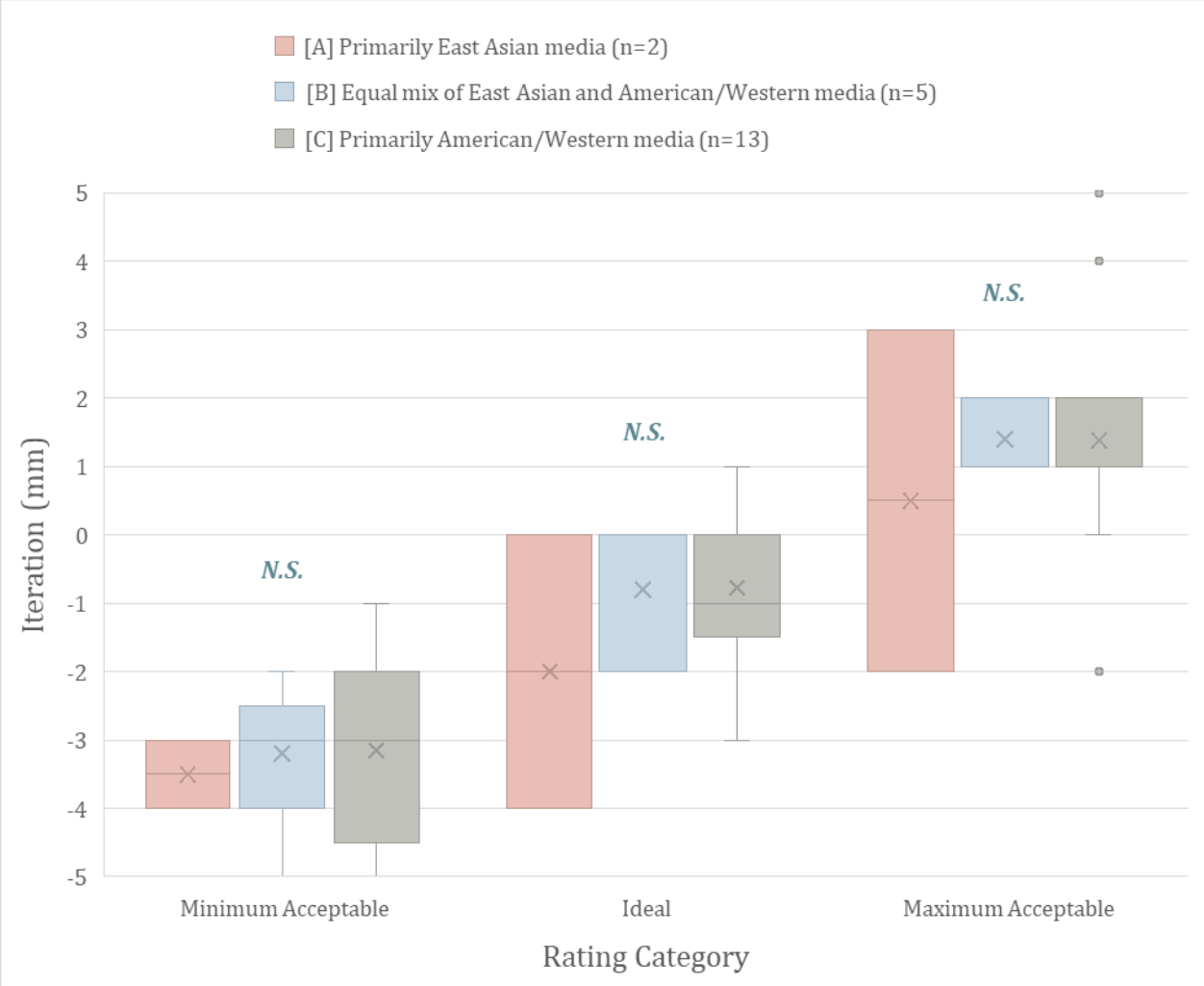
The 20 respondents who selected any of the East Asian nationalities or "East Asian" for race/ethnicity were also asked what types of visual media they primarily consumed, and 2 (10%) selected [A] primarily East Asian media, 5 (25%) selected [B] an equal mix of both, and 13 (65%) selected [C] primarily American/Western media. Judges who selected [A] consistently preferred more lip retrusion across all models, although results did not reach significance (Figure 16A, 16B).

A.



Female East Asian Model									
PROFILE	**Minimum Acceptable**			**Ideal**			**Maximum Acceptable**		
CATEGORY	**[A]**	**[B]**	**[C]**	**[A]**	**[B]**	**[C]**	**[A]**	**[B]**	**[C]**
Maximum	-4	-1	-2	-3	0	1	1	4	5
Q3	-4	-1.5	-3	-3	0	0	1	3.5	2
Mean	-4	-2.8	-3.85	-3	-1.2	-1.38	-0.5	2.2	1.46
SD	n/a	1.30	0.99	n/a	1.10	1.71	2.12	1.92	1.56
Median	-4	-3	-4	-3	-2	-1	-0.5	3	1
Q1	-4	-4	-5	-3	-2	-3	-2	0.5	0
Minimum	-4	-4	-5	-3	-2	-4	-2	-1	0

B.



Male East Asian Model									
PROFILE	**Minimum Acceptable**			**Ideal**			**Maximum Acceptable**		
CATEGORY	**[A]**	**[B]**	**[C]**	**[A]**	**[B]**	**[C]**	**[A]**	**[B]**	**[C]**
Maximum	-3	-2	-1	0	0	1	3	2	2
Q3	-3	-2.5	-2	0	0	0	3	2	2
Mean	-3.5	-3.2	-3.15	-2	-0.8	-0.77	0.5	1.4	1.38
SD	0.71	1.10	1.46	2.83	1.10	1.30	3.54	0.55	1.71
Median	-3.5	-3	-3	-2	0	-1	0.5	1	1
Q1	-4	-4	-4	-4	-2	-1.5	-2	1	1
Minimum	-4	-5	-5	-4	-2	-3	-2	1	0

Figure 15. Percentages of East Asian and American/Western visual media consumption vs. judge assessment of (A) Female East Asian model and (B) Male East Asian model.

Discussion

Overall Averages

With the assumption that the AI-generated base models represented an averaged ideal facial profile, these images were regarded as a baseline to generate further iterations. Judges' opinions on what was considered ideal did not necessarily correlate with the AI-generated base images. Relative to the AI-generated models, judges preferred more lip retrusion for the female Asian model and more protrusion for the male Caucasian model. However, when measuring from the E line, the female and male East Asian models were still more protrusive compared to the female and male Caucasian models. This reflects anthropometric norms, where East Asian populations tend to have more protrusive lips than Caucasian populations.

Research examining various reference lines for assessing lip position has demonstrated the reliability of specific measurements. When evaluating six different reference lines including the B line, S line, E line, glabella vertical, nasion vertical, and subnasal vertical, Ng et al.[29] determined that the S, E, and B lines were the most consistent indicators of esthetic lip position, with the S and E lines demonstrating particularly high sensitivity and specificity for detecting esthetic lip position in both sexes.

The E line, defined as the tangent line extending from the nasal tip to the soft tissue pogonion,[31,32] has been extensively studied across different populations. Ricketts proposed that an esthetically pleasing Caucasian profile should feature an upper lip (UL) positioned -4mm from the E line and lower lip (LL) -2mm from the E line, where negative measurements indicate lips posterior to the E line, and positive measurements indicate lips anterior to the E line.[31] Comparative analysis of well-balanced Japanese and European-American populations through retrospective cephalometric examination of adults with ideal occlusions revealed significant differences.[27] In Japanese men, both the UL and LL were positioned +3-4mm from the E line,

and the nasolabial angle was more acute. European-American males averaged an UL position of -6.4mm and LL of -4.3mm from the E line, while European-American females measured -5.7mm for the UL and -3.2mm for the LL. In contrast, Japanese males averaged -2.9mm for the UL and -0.3mm for the LL and Japanese females measured -2.5mm and +0.9mm from the E line.[27] Our study found (Table 2) that for the East Asian female model, ideal UL position was -2.25mm and LL -0.75mm from the E line; for the East Asian male model, ideal UL was -3mm and LL -1.5mm; for the Caucasian female model, UL -4.25mm and LL 0mm; and for the Caucasian male model, UL -5.5mm and LL -3mm. Ranges of acceptability existed within groups, but generally, these measurements follow similar trends to previous research, with ideal lip positions for females being more anterior than those for males, and ideals for East Asians being more protrusive than those for Caucasians.

Nezu observed that Japanese subjects tend to exhibit more protrusive profiles due to retruded chin positions and advised caution against excessive anterior tooth movement during orthodontic treatment given the tendency toward incisor and bilabial protrusion. Because measurements from E line are relative to the nasal tip and pogonion, differences in structures such as a prominent nose or chin can affect lip protrusion or retrusion. These researchers also noted that improvement of the soft tissue profile during growth should not be expected in Japanese patients.[27,33]

Studies of Chinese patients have revealed similar patterns. Photographic survey analysis found that lips deemed attractive in Chinese individuals were positioned posterior to the E line in both sexes, with males showing upper lip measurements of -4.5 to -2.0mm and lower lip of -2.6 to -0.3mm, and females measuring -3.4 to -1.9mm for the upper lip and -1.6 to 0.0mm for the lower lip.[29] When judges evaluated silhouette profiles of European American, Japanese, and African American orthodontic patients, mean preferred lip positions were -3.9mm for European

American patients, -2.71mm for Japanese patients, and -1.97mm for African American patients. The anteroposterior range of acceptability was widest for African American patients and narrowest for European American patients.[9]

Further evidence of population-specific preferences comes from comparative studies of attractive versus unattractive Chinese profiles. Analysis of profiles considered attractive, such as those of movie star idols, demonstrated more retrusive UL and LL positions relative to the E line compared to unattractive profiles. Attractive profiles averaged an UL position of -1.31mm and LL of +0.26mm, whereas unattractive profiles measured -0.20mm for the UL and +2.4mm for the LL.[12]

Effects of Judge's Gender

Overall, a consistent trend was found where female judges preferred a more retrusive lip positions, while male judges preferred more protrusive lip positions (Figure 5). However, results were only statistically significant for some categories. These findings suggest that the judge's gender may influence esthetic preferences, though the effects appear to be model-specific rather than universal across all face types, indicating that gender differences in esthetic preferences may be moderated by the race and gender of the face being judged.

Research on gender-based facial preferences has revealed several key patterns. Women's preferences for male faces demonstrate cyclical variation, shifting toward relatively more masculine faces during the fertile phase of the menstrual cycle.[34] Masculine facial features may serve as indicators of protective qualities or immunocompetence.[35] Interestingly, men's preferences for feminine faces tend to be less pronounced in countries with harsher environmental conditions.[35] Evidence suggests that highly masculinized male faces may be preferred for short-term mating contexts, whereas less masculine faces, which are perceived as warmer and more cooperative, may be preferred for long-term partner selection.[34]

Gender differences have also been documented in profile preferences. Males demonstrated greater preference for slightly convex profiles and bialveolar protrusion in female faces compared to female judges, while females showed stronger preference for concave profiles than males did.[8] The current study finds similar patterns; while female judges significantly preferred more lip retrusion than male judges for the male East Asian model ($p < 0.05$), a similar directional pattern was observed across all other models without reaching statistical significance. The literature on the relationship between sex and profile preferences has yielded conflicting results. Some studies have reported that sex has no effect on profile preferences,[29,30] while Cochrane et al.[31] found that females rated orthognathic profiles as more attractive than other profile types. One study that found significant sex-based differences noted that although overall profile rankings by females and males were similar, males preferred convex female profiles (specifically profiles D and E in their study) more than females did, while females showed greater preference for concave female profiles (profiles F and G) compared to males.[8] Like lip position relative to the E-line, facial convexity is also influenced by chin position; thus, more convex facial profiles may correspond to more protrusive lip positions due to this shared anatomical reference point.

Effects of Judge's Race

Of the six participants who selected multiple races, four selected the combination of "East Asian and Southeast Asian" and were grouped into the "East Asian" group. The two participants who selected "East Asian and Caucasian" and "Southeast Asian and Caucasian" were excluded from the analysis. For both combinations, the sample size of $n = 1$ was too small to stand alone as a separate subgroup when comparing visual survey responses, and complications arose when comparing same-race and cross-race answers. In future iterations, when the sample size increases in these subgroups, participants in these categories will be re-included in the analysis.

In general, East Asian judges preferred more lip retrusion than non-East Asian judges when evaluating the East Asian models, while Caucasian judges preferred more protrusion than non-Caucasian judges when evaluating the Caucasian models. These findings align with previous research documenting racial differences in profile preferences. Chinese judges have been shown to prefer more retrusive profiles compared to White judges,[36] while African judges demonstrated preference for more protrusive profiles than both Hispanic American and Japanese judges.[9]

The current analysis compared broad racial categories (East Asian versus non-East Asian judges; Caucasian versus non-Caucasian judges), which may mask meaningful variation within these groups. Notably, even among groups with statistically significant differences, substantial within-group variation was observed. For example, for the minimum acceptable male East Asian model (Figure 6A), East Asian judges (mean = -3.18mm, SD = 1.38) and non-East Asian judges (mean = -2.54mm, SD = 1.66) showed standard deviations two to three times greater than the difference in means (0.64mm), indicating considerable heterogeneity within each racial category. With future iterations and greater sample sizes in subgroups, esthetic preferences could be examined across specific racial and ethnic categories such as those captured in this study, including East Asian, Southeast Asian, South Asian, Hawaiian/Pacific Islander, Indigenous/Native, White/Caucasian, Black/African, Hispanic/Latino, and Middle Eastern populations. Furthermore, categories such as "East Asian" could be further stratified into more specific ethnic groups including Chinese, Korean, Japanese, and others. This more granular approach would allow for detection of subtle differences in esthetic preferences that may exist between distinct ethnic groups currently bundled into broader racial categories.

Effects of Cultural Immersion

This study found relatively consistent evidence of an acculturation effect on facial profile esthetic preferences among East Asian and East Asian American participants. Across multiple measures of cultural background, including birth country, immigrant generation, and media consumption patterns, participants with stronger ties to East Asian culture demonstrated preferences for more retrusive facial profiles.

US-born East Asian participants preferred less retrusive ideal profiles compared to East Asia-born participants for both the female and male East Asian models, though this did not reach statistical significance (Appendix E). This suggests that being born and raised in the US versus East Asia influences esthetic ideals, with US-born participants preferring profiles closer to Western orthodontic norms.

Although formal statistical comparisons did not reach significance due to small and unequal sample sizes, participants who lived primarily outside of East Asia (>75% of life) showed a tendency to more retrusive minimum acceptable thresholds compared to those who spent substantial time in East Asia (Figure 8). This pattern was in the opposite direction compared to the birth country analysis for ideal profiles, suggesting that different aspects of acculturation may influence minimum acceptable thresholds versus ideal preferences differently. Specifically, those with more time outside East Asia may have internalized Western preferences for more protrusive profiles as their minimum acceptable standard, while still maintaining individual variation in their ideal preferences.

Exploratory analysis of immigrant generation (Figure 11) revealed descriptive patterns consistent with the acculturation hypothesis. The 1st-generation participant demonstrated the most retrusive preferences across all profile categories for both models. The 2nd-generation participants showed intermediate preferences, while the 3rd+-generation group demonstrated

a wider range of acceptability overall. While subgroup sample sizes were very small and precluded statistical testing, these descriptive patterns showed a potential generational gradient that warrants further investigation with adequately powered samples.

Media consumption patterns (Figure 16) showed trends with facial profile preferences, although results did not reach statistical significance. Participants who primarily consumed East Asian media consistently demonstrated more retrusive ideal profile preferences compared to those who consumed mixed or primarily Western media. The pattern showed a clear gradient, with East Asian media consumers preferring the most retrusive ideals, mixed media consumers showing intermediate preferences, and Western media consumers preferring the least retrusive profiles.

Exploratory correlation analysis examined the relationship between self-reported strength of East Asian cultural identity (0-100 scale) and profile preferences (Figure 13). Results showed partial support for the acculturation hypothesis. For the female model, a significant negative correlation was found between cultural identity strength and minimum acceptable profile, indicating that participants with stronger East Asian cultural identity preferred more retrusive minimum acceptable thresholds. However, no significant correlations were observed for ideal profiles or for any male model comparisons. These mixed results suggest that self-reported cultural identity may be a less reliable predictor of esthetic preferences than objective demographic measures such as birth country, time lived in different cultural contexts, or media consumption patterns. The subjective nature of cultural identity assessment and potential variability in how participants interpret cultural connection may account for the weaker and less consistent associations observed. However, when comparing the age of relocation and profile preferences (Figure 10), an unexpected relationship was noted: judges who relocated to the US at older ages demonstrated preferences for more protrusive lip positions. This finding

contradicted the hypothesis that longer cultural immersion in the US would lead to greater acceptance of protrusive profiles. To explore this discrepancy, the relationship between age of relocation and self-reported cultural identity strength was examined. A positive correlation was found (Figure 14), indicating that later relocation was associated with stronger East Asian cultural identity. The contradictory directional relationships, where stronger objective cultural ties such as relocation corresponded with more protrusive preferences, while stronger subjective cultural identity corresponded with more retrusive preferences, may reflect the limited sample size or suggest that these measures capture different dimensions of cultural influence on esthetic preferences.

Taken together, some of these findings reveal a potential acculturation gradient: participants with greater exposure to and identification with East Asian culture, whether through birth country, time lived in East Asia, immigrant generation, media consumption, or cultural identity, consistently preferred more retrusive facial profiles. Conversely, participants with greater exposure to Western culture preferred less retrusive, straighter profiles that align more closely with contemporary Western orthodontic ideals. The consistency of this pattern across multiple independent measures of acculturation strengthens confidence in the overall finding and suggests that cultural background represents a meaningful factor in facial esthetic preferences that should be considered in orthodontic treatment planning.

Limitations

Several limitations of this study should be considered when interpreting the results. The sample size (n = 112) was sufficient for analysis of overall trends, but insufficient for comprehensive subgroup analyses, such as specific combinations of mixed-race judges. Out of the 6 mixed race judges, 2 judges who had selected "East Asian and Caucasian" and "Southeast Asian and Caucasian" had to be excluded because they could not be sorted into either the East Asian or Caucasian groups for same- and cross-race comparisons, and n = 2 was not sufficient to separate them into their own subgroup. However, a comparison of this group to East Asian and Caucasian groups could yield interesting results, especially if results correlated with differences in answers to the cultural demographics questions. A formal power analysis would be valuable to determine the sample size needed to detect statistically significant differences across these subgroups. For example, when comparing East Asian-born vs. US-born East Asian judge opinions on the minimum acceptable, ideal, and maximum acceptable profiles, to detect a medium effect (d = 0.5, difference in scores = 0.805mm) with 80% power and $\alpha = 0.05$, 64 judges would be needed for each group, for a total of 128. To detect a small effect (d = 0.2, difference in scores = 0.322mm) with 80% power and $\alpha = 0.05$, 393 judges would be needed for each group, for a total of 786.

Second, potential confusion existed regarding the two questions asking participants about their race/ethnicity and their nationality. Three respondents did not select "East Asian" for race/ethnicity but did select East Asian countries for nationality: all three reported being born in the US with the US as their current country of residence. One respondent selected "Southeast Asian" for race/ethnicity and "Chinese" for nationality while reporting that they lived primarily outside of East Asia (75% of the time). The other two respondents reported non-Asian races/ethnicities (Hispanic/Latino and White/Caucasian) along with dual nationalities (US and

Japanese, and US and Korean, respectively). These respondents may have acquired nationality in East Asian countries after birth, as both indicated having lived in East Asia for a period of time, or one or both parents may have been Japanese or Korean citizens. Alternatively, respondents may have mistakenly interchanged their responses to the race/ethnicity and nationality questions. To address this issue, future iterations of the survey, including those distributed to HKU and Yonsei University, have reworded the nationality question as "Please select your nationality/nationalities (passport)" with the ethnicity question immediately following.

Third, the anthropometric norms[30] used for scaling the profile images were not sex-specific, which may have introduced variability in the measurements and increments of -1mm and +1mm used for creating iterations. Additionally, the East Asian anthropometric measurements were derived exclusively from Chinese young adults, as comparable data from other East Asian populations (such as Japanese or Korean groups) were not available to create a more representative average. This may limit the generalizability of our findings to the broader East Asian population.

Fourth, a technical limitation of the Qualtrics software was the number of iterations allowed per question. Despite the use of custom coding, only 11 iterations could be programmed into a single question. To capture a reasonable range of realistic lip positions with reasonably small increments between images, 1.0mm was determined to be ideal, resulting in a minimally retrusive profile of -5.0mm behind the base image lip position and a maximally protrusive profile of +5.00mm ahead of the base images in the horizontal plane. Some judges selected the minimum and maximum images as still acceptable, which may indicate that the range of acceptability extended beyond -5.0mm and +5.0mm, although these selections tended to be outliers. Ideally, smaller increments, a slightly wider range of iterations, and more images

would allow for a more comprehensive and fluid image progression. Spanning more iterations across two or three questions was considered (for example, three questions to include 30 iterations of the East Asian female profile). However, this would quickly compound the number of questions the respondent would have to answer and may lead to survey fatigue and failure to complete the survey, or potentially cause confusion or consistency problems if there were overlap or lack of overlap of images between questions. An ideal solution would be a more advanced software that could implement more than 11 images per set, or one that would allow for expansion to more retrusive or more protrusive profiles if the judge selected the most retrusive or most protrusive profiles as still acceptable.

Fifth, another technical limitation of the image manipulation protocol was that the upper and lower lips were adjusted as a single unit, rather than independently, because of the technical limitation on the number of iterations per question. This approach was necessary for consistency given the limitations of the software, but it meant that any disharmony between the upper and lower lip positions in the AI-generated base images was preserved across all profile variations. For example, for the Caucasian female model, the lower lip appeared more protrusive relative to the upper lip when comparing with the other base models, which may have influenced esthetic ratings for that particular image series. Future studies using more advanced software could address this by developing protocols that allow for independent adjustment of each lip.

Future Directions

The findings of this study reveal the need for further research to better understand how cultural and demographic factors influence esthetic preferences in orthodontic treatment. An immediate priority is to expand recruitment to additional dental schools, both domestically and internationally. Increasing the sample size beyond dental students at OHSU would enable more robust subgroup analyses and allow for regional comparisons within the United States, which could reveal whether geographic location influences esthetic preferences independently of ethnicity, or even within ethnic groups. Although regional differences were not found in [find this article], there could be changes in the current generation, especially with the accessibility of social media across countries, leading to greater exposure of different cultures. Expanding recruitment internationally to dental schools in East Asian countries, such as China, Japan, South Korea, and other regions, would allow for direct examination of how nationality and degree of cultural immersion affect profile preferences among East Asian judges. This international expansion would help clarify whether the preferences observed in East Asian judges in the United States are shaped more by ethnicity itself or by exposure to Western esthetic ideals. As of writing, HKU in Hong Kong and Yonsei University in South Korea (Appendix E) have granted IRB approval for expansion to their respective dental students.

A key area for future analysis involves correlating judges' responses on the cultural demographics questions with their image slider selections. Specifically, examining variables such as country of birth, country of residence, age at immigration, self-identified cultural identity, language proficiency, degree of cultural immersion, media consumption patterns, and generational status could reveal which cultural factors most strongly predict esthetic preferences. For example, do East Asian judges who immigrated at a younger age show preferences more similar to Caucasian judges? Do those who consume primarily East Asian

media demonstrate different preferences than those who consume primarily Western media? These analyses could provide valuable insights into the mechanisms through which culture shapes esthetic perception and could help clinicians better understand how to approach treatment planning conversations with patients from diverse backgrounds.

Beyond cultural demographics, stratifying the data by other variables such as year in dental school and specific East Asian ethnicity (Chinese, Korean, Japanese, etc.) may reveal additional patterns. For instance, more advanced dental students may show preferences that differ from first-year students due to increased exposure to orthodontic education and treatment norms. Similarly, examining whether preferences vary among specific East Asian ethnic groups would help determine whether it is appropriate to consider "East Asian" as a monolithic category or whether more nuanced, ethnicity-specific considerations are needed in clinical practice.

Finally, this methodology could be extended to investigate other facial features beyond lip position, such as facial convexity, chin projection, nasolabial angle, and mandibular plane angle. Each of these features contributes to overall profile esthetics and may be influenced by cultural preferences in unique ways. Additionally, expanding the survey to include other racial and ethnic groups would create a more comprehensive understanding of esthetic diversity and help move the field toward truly patient-centered, culturally sensitive orthodontic care.

Conclusion

1. Judge opinions on the ideal lip position did not necessarily correlate with the AI-generated base model. For ideal lip position, judges preferred more retrusive lips for the East Asian female, East Asian male, and Caucasian female profile, and more protrusive lips for the Caucasian male profile than what was generated by AI.
2. Female judges tended to prefer more lip retrusion, and male judges tended to prefer more lip protrusion. For the (Ideal) male East Asian model and (Max) female Caucasian model, female judges preferred a more retrusive lip position. Although not reaching statistical significance, female judges consistently showed lower mean preference values across all model comparisons, indicating a pattern toward preferring more retrusive profiles.
3. East Asian judges accepted more lip retrusion than non-East Asian judges for the male East Asian model (Min, Ideal). There were no significant differences between East Asian and non-East Asian judge preferences for the female East Asian model. There were no statistically significant differences between Caucasian and non-Caucasian judge preferences for the male and female Caucasian model, but the difference approached significance for the female Caucasian model (Max) ($p=0.062$).
4. An acculturation gradient was observed in most measures of cultural ties, where some judges with greater exposure to East Asian culture tended to prefer more retrusive facial profiles, while those with greater Western cultural exposure accepted more protrusive profiles.
5. Overall, orthodontists should be sensitive to the significant cultural differences regarding beauty and not impose their own preferences on outcomes.
6. Even within racial groups, there was significant variation, so involving the patient's individual perspective in determining treatment goals is vital.

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Comprehensive Literature Review

Historical Foundations and Evolution of Facial Esthetic Standards

Historical standards of beauty have changed substantially over time, with underlying biological principles of attraction such as averageness, symmetry, and youthfulness appearing universal,[34,37,38] while specific ideals remain dynamic and culturally specific.[22,23,37,39–41] Environmental factors, racial background, and upbringing significantly influence perceptions of facial attractiveness, though characteristics perceived as unattractive show greater cross-cultural consistency.[22,35]

Greek philosophy emphasized perfect proportion as the key to facial beauty,[34,40] with sculptors like Polycleitus defining proportions based on Egyptian ideals and developing complicated formulas for ideal faces that detailed eye size, space between eyes, hairline, and nose-to-lip distance. Renaissance artists formulated and documented these neoclassical canons derived from Greek and Roman art, using numbers like the Golden Ratio.[10,34,42–44] However, modern studies indicate that these canons do not actually represent average facial proportions and are not definitive formulas for beauty in real populations or across diverse ethnic groups; these canons do not even conform to the norms of North American Caucasians.[45,46] Overall, these canons are no longer considered targets to aim for, but merely guides in facial analysis, with adjustments according to an individual's age, ethnicity, culture, and personal preferences.

Art from the Middle Ages displayed proportions that deviated significantly from the European norm, hypothesized to be influenced by Nubian/East African populations. This deviation first appeared in Egyptian art, and was likely referenced in European art.[47] Beginning in the early 20th century, several notable trends emerged, including fuller and more anteriorly positioned lips, with the general public preferring more protrusive dentofacial patterns compared to cephalometric standards.[1,19,48] Standards of physical appearance became less rigid

and faces with unusual features became acceptable and even desirable, particularly in models with striking and pleasing features.[49] Contemporary trends show movement towards more androgynous features, with less pronounced male facial features such as a decrease in chin size and length, and the opposite albeit smaller trend in female faces. Overall, in the "ideal" depiction, lip areas increased, the nasolabial angle decreased, and the profile became more convex in both men and women.[16]

The development of modern orthodontic norms began when Broadbent and Hofrath simultaneously introduced x-ray cephalometry in 1931, though its clinical application in orthodontic treatment planning gained traction with the development of the Downs, Tweed, and Steiner analyses.[50,51] Attempts were made to integrate soft tissue measurements into these analyses, including Burstone's "integumental profile" and lip posture, along with work by Rickets, Stoner, Neger, Bowker and Meredith, Merrifield, and Andrews.[52] Early cephalometric ethnic comparisons by Cotton, Takano, and Wong in 1951 showed distinct ethnic differences between groups and the need for population-specific norms.[53] Numerous studies unequivocally state that cephalometric norms and soft tissue profile values are specific to ethnic and racial groups and cannot be indiscriminately applied across different populations.

Professional vs. Lay Perspectives on Facial Attractiveness

The social significance of facial attractiveness extends far beyond esthetic preferences, with attractive individuals often earning relatively higher salaries, receiving less severe punishments for some crimes, and assigned more positive personal qualities and life outcomes.[54] Throughout history, healthy- and good-looking teeth have represented youth, good health, and natural beauty, underscoring the profound impact of facial and dental esthetics on social perception and treatment.[54]

Detectable discrepancies exist between dental professionals, including orthodontists and general dentists, and laypeople in their evaluation of facial attractiveness. While both groups can identify smile characteristics that either enhance or detract from a smile, their specific preferences and priorities often differ.[55] Orthodontists and general dentists are more likely to prioritize the profile view, while laypeople focus on the frontal view.[12] When evaluating attractiveness, orthodontists predominantly focus on the lips, while general dentists and laypeople focus on the chin.[12] Additionally, laypeople are less discriminating than dental professionals for many smile characteristic variables.[55]

Specific preference differences demonstrate consistent patterns across studies. Orthodontists prefer the mandible to be more anterior than lay groups[24] and prefer the lips to be more retrusive,[29] while laypeople tend to prefer fuller, more protrusive profiles.[1,19,39] Differences also exist between orthodontists of different races.[36,39] However, both orthodontists and laypeople do agree on some characteristics; for example, all judges (European American, Hispanic American, Japanese, and African) consistently preferred lip positions posterior to Ricketts' E-line for all patient groups evaluated.[9]

Professional bias towards skeletal harmony versus external, soft tissue appearance represents a significant consideration in contemporary orthodontic practice. Orthodontic treatment traditionally emphasizes achieving optimal functional occlusion alongside harmonious facial esthetics, but an overreliance on internal osseous landmarks can occur. Ideal osseous norms may represent an average or "normal" facial pattern, but they may not necessarily reflect what is most beautiful in the eyes of a given population.[7,12,15,28,52] Even strict adherence to a cephalometric standard will not always result in desirable esthetic outcomes.[56]

However, the ideal face is not necessarily the most attractive face. Studies have found that the general population prefers an “average” face – not necessarily the average of all faces of a

population, but the average of the attractive faces of that population. This preference appears to be generalized across different cultures and, in terms of evolution, can reflect developmental stability, genetic heterozygosity, and good health.[1,3,35,38,40,41]

Cultural Influences on Facial Esthetic Perception

Preferences emerge early in development before cultural standards are fully assimilated, suggesting a biological basis. However, no universal standard of facial esthetics applies across all populations. While high agreement of cross-cultural attractiveness standards exists, with some correlations in the range of 0.8 to 0.96, the perception of attractiveness is still influenced by cultural context, environmental factors, and visual experience.[34,35]

Recently, digital media and globalization has led to esthetic standards being "gradually established by the mass media",[56] where fashion magazines and internet databases depict high-profile people universally admired for their attractiveness. Globalization of society and technology has led to a shift in the perception of beauty, with Japan experiencing a shift towards a flatter profile, partly due to the influence of Europeans and Americans in native media. If ethnic minority groups living within a dominant culture assimilate, they may adopt the dominant culture's ideals, leading to a convergence of esthetic preferences over time.[10,44,57]

Population-specific differences in facial characteristics and esthetic preferences demonstrate the importance of cultural considerations in orthodontic treatment planning. African American/Black populations exhibit soft tissue profiles that are more protrusive and convex than White profiles. However, both laypersons and orthodontists prefer a straighter profile than the anthropometric norm, although still more protrusive than white standards.[58] East Asian populations present with characteristics including a less prominent nose, less obtuse nasolabial angle, more protrusive upper and lower lips, and more convex facial profiles compared to Caucasians.[27] Within East Asian populations, Chinese and Korean judges preferred

more retrusive lip positions compared to their population norm, while Japanese women preferred thinner lips.[11,36] Middle Eastern populations demonstrate characteristics including convex profiles, more retrusive chins, more obtuse face-throat angle, increased nasolabial angle, deeper mentolabial sulcus, and more maxillary incisor exposure compared to Caucasians.[59]

Methodological Approaches in Facial Esthetic Research

Facial esthetic research employs diverse methodological approaches, each with distinct advantages and limitations. Photographic methods are quick and economical, making them widely used in esthetic research.[13,46,60] Photogrammetry provides an objective, non-invasive, and radiation-free method that quantifies facial metrics, proportions, and angular features from photographs taken under controlled conditions.[23,59] Radiographic approaches, including cephalometric and CBCT analyses, aim to reduce subjectivity when assessing a face, though early analyses were primarily based on European-American populations, limiting their applicability to other ethnic groups.[12,27,53,59,61]

Computer-generated composites utilize software to blend multiple individual faces into averaged composite faces, allowing researchers to study idealized facial characteristics.[3,40,41] Algorithmic prediction models represent an emerging technological approach, with these machine learning algorithms demonstrating high accuracy (up to 88%) in classifying attractive versus normal faces based on photogrammetric measurements.[23]

Survey methodologies and rating scales provide systematic approaches to quantifying esthetic preferences. Visual Analogue Scales (VAS), Likert scales, and other numerical scales are commonly used for rating facial attractiveness.[6(p201),12,62] The perceptometrics method allows subjects to interactively modify a face along a continuum to achieve an optimal esthetic result, providing a range of acceptable morphologies.[24] The Implicit Association Test (IAT) measures unconscious biases related to facial appearance, revealing attitudes not captured by self-report

measures.[24] Surveys that involve rater panels typically include diverse groups of judges, incorporating opinions from orthodontists, general dentists, plastic surgeons, and laypersons, and can have groups varying in race and ethnicity.

Analyses can also utilize subjects such as professional models, actresses, or beauty contest winners, who are specifically selected as representatives of esthetically pleasing faces. These subjects are then compared to average populations to identify distinguishing characteristics of facial attractiveness.[17,22,63]

Implications for Clinical Practice

The collective body of research underscores that while some common tenets of facial beauty exist, there is significant variability in ideal facial features and proportions across different ethnic groups, which necessitates patient-centered, culturally sensitive care in esthetic and reconstructive procedures.[40] Contemporary orthodontic practice must therefore move beyond universal treatment standards toward approaches that acknowledge and incorporate cultural diversity in esthetic preferences.

The need for culturally relevant reference points has become increasingly apparent as research demonstrates the limitations of traditional cephalometric norms derived primarily from European-American populations. Patient-centered treatment planning should prioritize the preferences of patients and their cultural communities over rigid adherence to population averages that may not reflect contemporary esthetic ideals. This approach requires balancing quantitative measures with cultural preferences, integrating objective cephalometric data with subjective assessments that consider ethnicity, cultural background, and individual patient desires. Given these considerations, facial attractiveness should largely be based on perception of laypeople and patients, with clinicians adopting a culturally sensitive, patient-centered

approach that integrates both objective measurements and subjective, ethnically-influenced perceptions of beauty.

The development of population-specific standards represents a critical advancement in orthodontic care, moving toward evidence-based norms that reflect the diverse facial characteristics and esthetic preferences of different ethnic groups. Such standards would provide clinicians with appropriate reference points for treatment planning while maintaining sensitivity to the cultural context in which patients exist. This paradigm shift from norm-based to patient-centered care acknowledges that optimal treatment outcomes must satisfy not only functional requirements but also the esthetic expectations of patients within their cultural framework.

Appendices

A: IRB Approval of Submission

OREGON HEALTH & SCIENCE UNIVERSITY

IRB MEMO

Research Integrity Office
3181 SW Sam Jackson Park Road - L106RI
Portland, OR 97239-3098
(503)494-7887 irb@ohsu.edu

APPROVAL OF SUBMISSION

June 4, 2025

Dear Investigator:

On 6/4/2025, the IRB reviewed the following submission:

IRB ID:	STUDY00028685
Type of Review:	Initial Study
Title of Study:	A comparison of contemporary cultural preferences of laypeople from America vs. East Asia in cross-race and same-race soft tissue profiles
Principal Investigator:	Bruce Havens
Funding:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• Consent - Information Sheet_060325_BH.pdf • OHSU IRB Protocol- final3_060325_BH.docx • Recruitment Email_060325_BH.pdf • Survey_060325_BH.docx

The IRB granted final approval on 6/4/2025. The study requires you to submit a check-in before 6/2/2028.

Review Category: Exempt Category #2

Copies of all approved documents are available in the study's **Final** Documents (far right column under the documents tab) list in the eIRB. Any additional documents that require an IRB signature (e.g., IIAs and IAAs) will be posted when signed. If this applies to your study, you will receive a notification when these additional signed documents are available.

Ongoing PI Responsibilities:

- Six to ten weeks before the eIRB system expiration date, submit a check-in.
- Submit changes to the project for IRB approval prior to implementation.
- Submit Reportable New Information per OHSU policy.
- Submit a check-in to close the study when your research is completed.

THE UNIVERSITY OF HONG KONG

香 港 大 學

August 20, 2025

Professor Andrew Kyle Nalley
Applied Oral Sciences and Community Dental Care of the Faculty of Dentistry

Dear Professor Nalley,

Application for Ethics Approval
HREC's Reference Number: EA250508

I refer to your application for ethics approval of your project entitled "A comparison of contemporary cultural preferences of laypeople from America vs. East Asia in cross-race and same-race soft tissue profiles".

2. I am pleased to inform you that the application has been approved by the Human Research Ethics Committee (HREC) regarding the ethical aspect of the above-mentioned research project, and the expiration date of the ethical approval is August 19, 2027.

3. Please be reminded of the following points concerning the approved project:

(a) The HREC reference number of your project (EA250508) has to be shown in all materials sent to potential and actual participants to enable participants to link the materials to an approved project.

(b) You should report to the HREC any amendments and new information on the project through the Human Research Ethics Application System (HREAS) (select "Prepare/Revise Application for Amendment" under "Project"). Application for extension should be submitted well before the initially approved expiration date.

(c) Any deviation from the study protocol or compliance incident that has occurred during a study and may adversely affect the rights, safety or well-being of any participant or breaches of confidentiality should be reported to the HREC within 15 calendar days from the first awareness of the deviation/incident by the Principal Investigator.

Yours sincerely,

Secretary
Human Research Ethics Committee

c.c. Co-Investigator(s) of the project


R-BAY 과제조회(상세) - Chrome
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B: Recruitment Email

Hi 1st year and 2nd year students at OHSU,

First off, congratulations and welcome to the wonderful world of dentistry!

My name is Kira Chen and I am one of the orthodontic residents at OHSU. As a part of my graduate program, I am conducting a master's research project with Dr. Bruce Havens, on profile esthetics of East Asians and Caucasians using a survey and am using your classes as my study population (IRB#_STUDY00028685). This research will help orthodontists to better treat our patients by looking at cultural differences in esthetic preferences. Your responses will be used to investigate which combinations of specific facial features are perceived as the most attractive or visually pleasing. The survey should take approximately 5-10 minutes.

Please note that all responses are voluntary. All responses will be treated confidentially, and the investigators will make no attempt to identify individuals through the collected demographic information. Please see attached Consent Information Sheet for further information regarding the use of the collected data in this study. We will consider completion of the survey an acknowledgement of your consent.

At the end of the survey there will be a space to leave feedback/comments that may be used to improve this survey for future versions. As a thank you, all participants will be eligible to enter a $50 gift card drawing. If you have any concerns or questions, please feel free to contact me at chenzix@ohsu.edu

Please know that your time and contribution to research is valued and appreciated.

All the best,

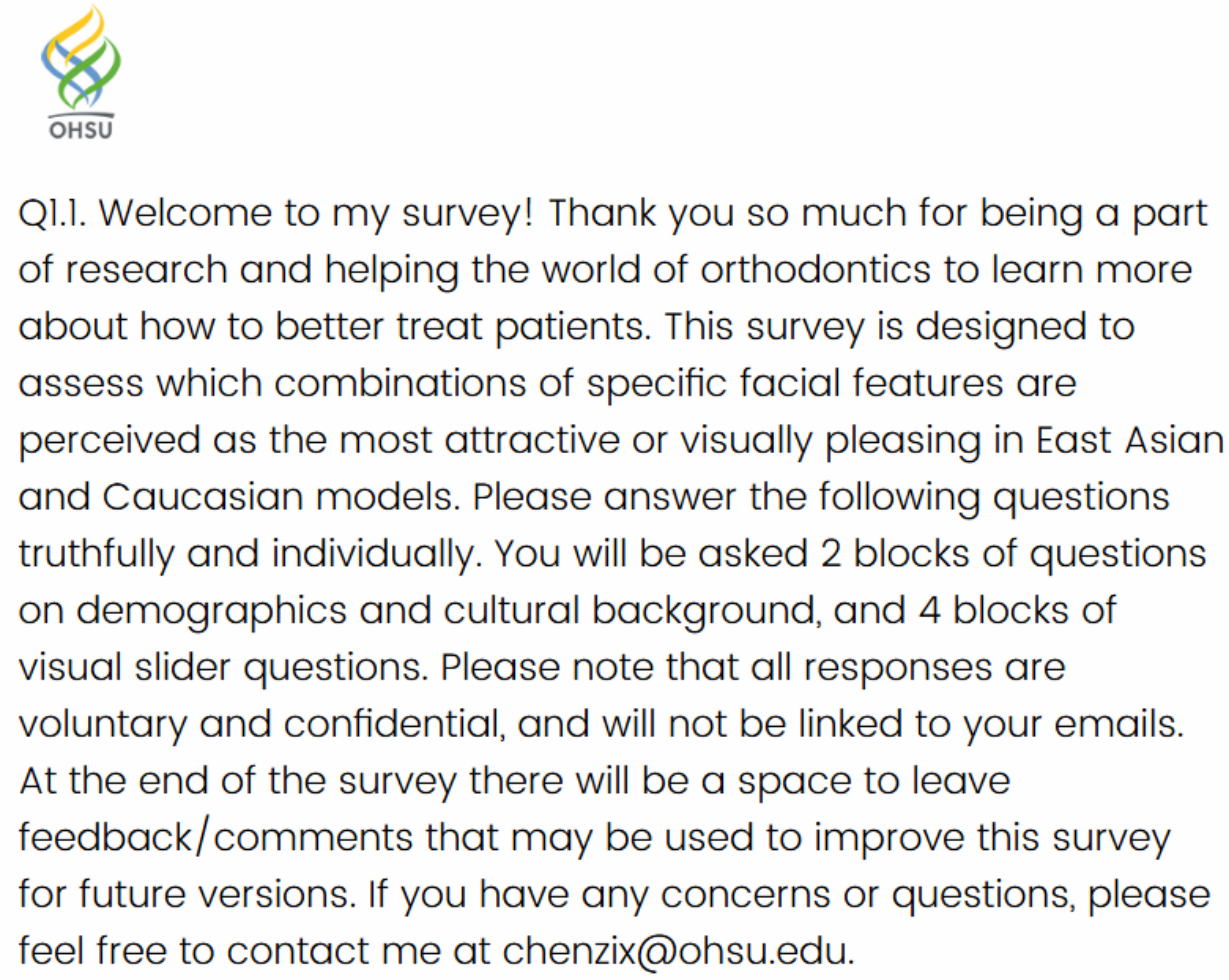
Dr. Kira Chen

C: Base Images

The following images are used as a base for all altered images.

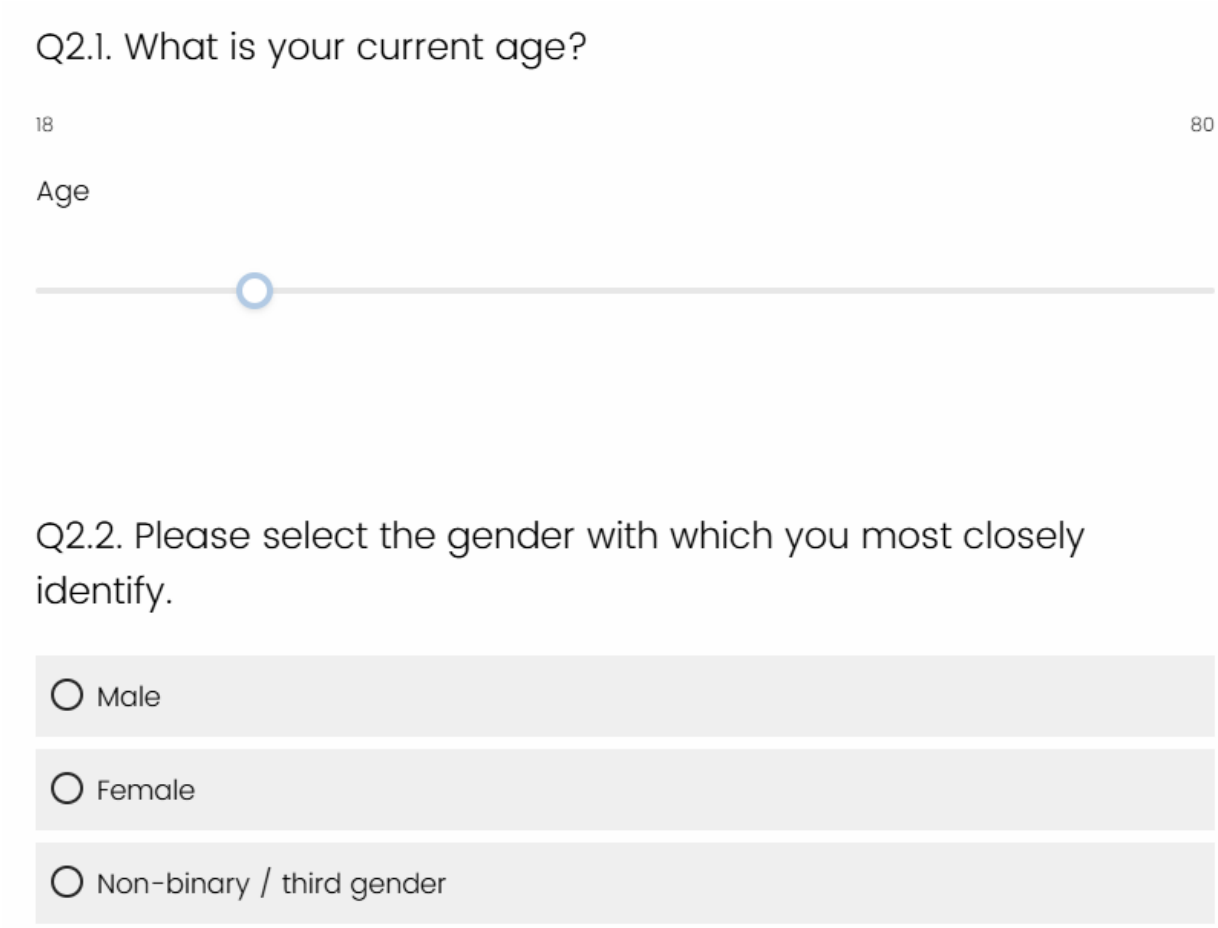
D: Survey

Start of Block: Introduction Page



End of Block: Introduction Page

Start of Block: Demographic Questions



Q2.3. Please select your nationality/nationalities. Select all the apply.

- [ ] American
- [ ] Canadian
- [ ] Japanese
- [ ] Taiwanese
- [ ] Korean
- [ ] Chinese
- [ ] Other (please specify):

Q2.4. Please select the ethnicity/ethnicities with which you most closely identify. Select all the apply.

- [ ] East Asian - Japanese
- [ ] East Asian - Taiwanese
- [ ] East Asian - Korean
- [ ] East Asian - Chinese
- [ ] Southeast Asian
- [ ] South Asian
- [ ] White/Caucasian
- [ ] Black/African
- [ ] Hispanic/Latino
- [ ] Indigenous/Native
- [ ] Pacific Islander
- [ ] Middle Eastern/North African
- [ ] Other (please specify):

Q3.1. In which country were you born?

Q3.2. In which country do you currently reside?

Q3.3. If different from birth country, at what age did you relocate?

0 100

Age

Q3.4. Please drag the slider and select how strongly you identify with your ethnicity's culture.

0 10 20 30 40 50 60 70 80 90 100

0 = don't relate to at all, 100 = strongly identify with the culture

Q3.5. Languages: What languages are you relatively comfortable with (conversational, writing, and/or reading)? Select all that apply.

- ☐ English
- ☐ Mandarin Chinese
- ☐ Cantonese
- ☐ Japanese
- ☐ Korean
- ☐ Other (please specify):

Q3.6. Cultural immersion: Where have you primarily lived?

- ○ Primarily in East Asia (>75% of life)
- ○ Primarily in America (>75% of life)
- ○ Mixed, with more time in East Asia (50-75% of life)
- ○ Mixed, with more time in America (50-75% of life)
- ○ Equal time in both regions
- ○ Other pattern (please explain):

Q3.7. Media consumption: Which types of media do you primarily consume?

- ○ Primarily East Asian media
- ○ Primarily American/Western media
- ○ Equal mix of East Asian and American/Western media
- ○ Other pattern (please explain):

Q3.8. In your family, which generation was the first to be born in the United States?

- ○ I immigrated to this country myself (born in East Asia, moved to America)
- ○ My parents immigrated, but I was born here
- ○ My grandparents immigrated, but my parents and I were born here
- ○ A more distant relative (great-grandparents or earlier) immigrated, and my family has been here since
- ○ Other (please specify):

End of Block: Demographic Questions

Start of Block: Images Asian Female

Q4.1. These images show profiles ranging from most retruded (left) to most protruded (right). Use the slider to browse through different variations and click to select your preference. You'll be asked to indicate your **IDEAL** profile, **MINIMUM** acceptable profile, and **MAXIMUM** acceptable profile.

Q4.2. Please move the slider to the position that represents what you consider to be the **IDEAL** profile for this facial feature. Select the image that you find most aesthetically pleasing.

Q4.3. Please move the slider to the leftmost position that represents the **MINIMUM** acceptable profile that is still within the range of acceptability. Any images farther left than this choice would be considered aesthetically unacceptable (too retruded/too far back/too flat/small).

Q4.4. Please move the slider to the rightmost position that represents the **MAXIMUM** acceptable profile that is still within the range of acceptability. Any images farther right than this choice would be considered aesthetically unacceptable (too protruded/prominent/large).

End of Block: Images Asian Female

Start of Block: Images Caucasian Female

Q5.1. These images show profiles ranging from most retruded (left) to most protruded (right). Use the slider to browse through different variations and click to select your preference. You'll be asked to indicate your **IDEAL** profile, **MINIMUM** acceptable profile, and **MAXIMUM** acceptable profile.

Q5.2. Please move the slider to the position that represents what you consider to be the **IDEAL** profile for this facial feature. Select the image that you find most aesthetically pleasing.

Q5.3. Please move the slider to the leftmost position that represents the **MINIMUM** acceptable profile that is still within the range of acceptability. Any images farther left than this choice would be considered aesthetically unacceptable (too retruded/too far back/too flat/small).

Q5.4. Please move the slider to the rightmost position that represents the **MAXIMUM** acceptable profile that is still within the range of acceptability. Any images farther right than this choice would be considered aesthetically unacceptable (too protruded/prominent/large).

End of Block: Images Caucasian Female

Start of Block: Images Asian Male

Q6.1. These images show profiles ranging from most retruded (left) to most protruded (right). Use the slider to browse through different variations and click to select your preference. You'll be asked to indicate your **IDEAL** profile, **MINIMUM** acceptable profile, and **MAXIMUM** acceptable profile.

Q6.2. Please move the slider to the position that represents what you consider to be the **IDEAL** profile for this facial feature. Select the image that you find most aesthetically pleasing.

Q6.3. Please move the slider to the leftmost position that represents the **MINIMUM** acceptable profile that is still within the range of acceptability. Any images farther left than this choice would be considered aesthetically unacceptable (too retruded/too far back/too flat/small).

Q6.4. Please move the slider to the rightmost position that represents the **MAXIMUM** acceptable profile that is still within the range of acceptability. Any images farther right than this choice would be considered aesthetically unacceptable (too protruded/prominent/large).

End of Block: Images Asian Male

Start of Block: Images Caucasian Male

Q7.1. These images show profiles ranging from most retruded (left) to most protruded (right). Use the slider to browse through different variations and click to select your preference. You'll be asked to indicate your **IDEAL** profile, **MINIMUM** acceptable profile, and **MAXIMUM** acceptable profile.

Q7.2. Please move the slider to the position that represents what you consider to be the **IDEAL** profile for this facial feature. Select the image that you find most aesthetically pleasing.

Q7.3. Please move the slider to the leftmost position that represents the **MINIMUM** acceptable profile that is still within the range of acceptability. Any images farther left than this choice would be considered aesthetically unacceptable (too retruded/too far back/too flat/small).

Q7.4. Please move the slider to the rightmost position that represents the **MAXIMUM** acceptable profile that is still within the range of acceptability. Any images farther right than this choice would be considered aesthetically unacceptable (too protruded/prominent/large).

End of Block: Images Caucasian Male

Start of Block: Post-Survey Questions

Q8. How challenging did you find it to distinguish your preferences between the images in order to rank them?

- ○ Extremely challenging
- ○ Very challenging
- ○ Moderately challenging
- ○ Slightly challenging
- ○ Not challenging at all

Q9. Please use this space to write any comments or feedback. This will be especially valuable for improving this survey for future versions!

End of Block: Post-Survey Questions

Start of Block: Raffle Link (optional)

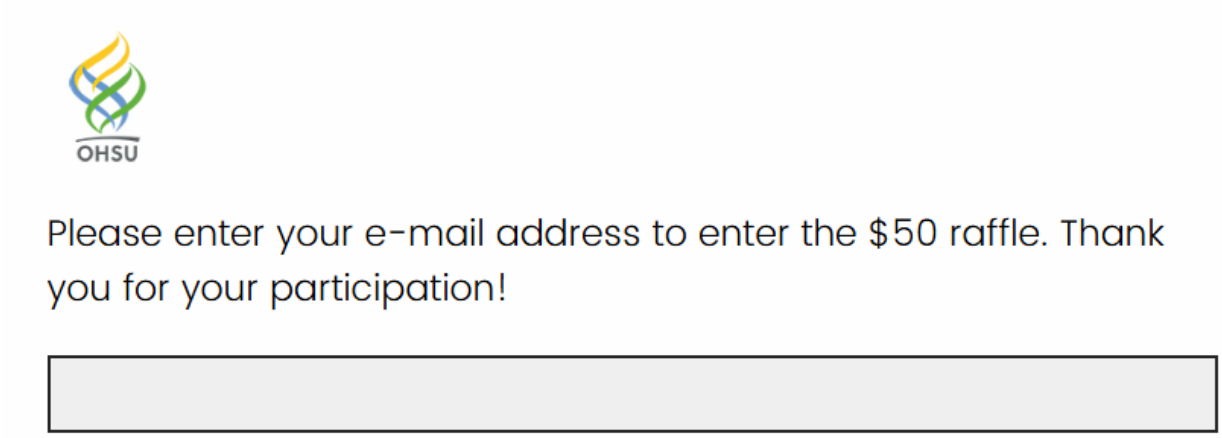
We thank you for your time spent taking this survey. Your response has been recorded.

If you would like to enter the raffle for a $50 gift card, please fill out your email here:
Raffle Link
Your email will not be linked to your responses.

End of Block: Raffle Link (optional)

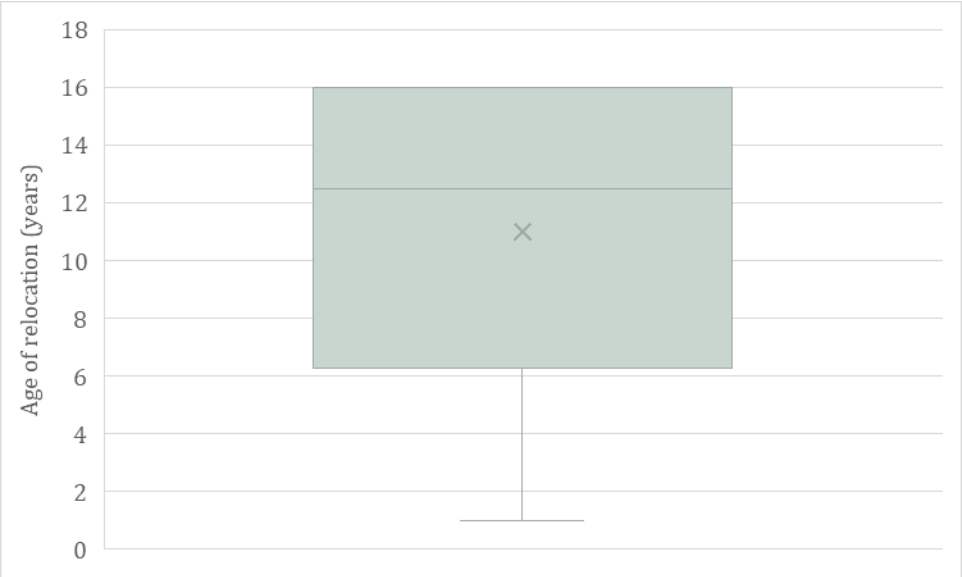
Raffle Email Survey

Start of Block: Raffle Email (optional)



End of Block: Raffle Email (optional)

E: Miscellaneous Figures



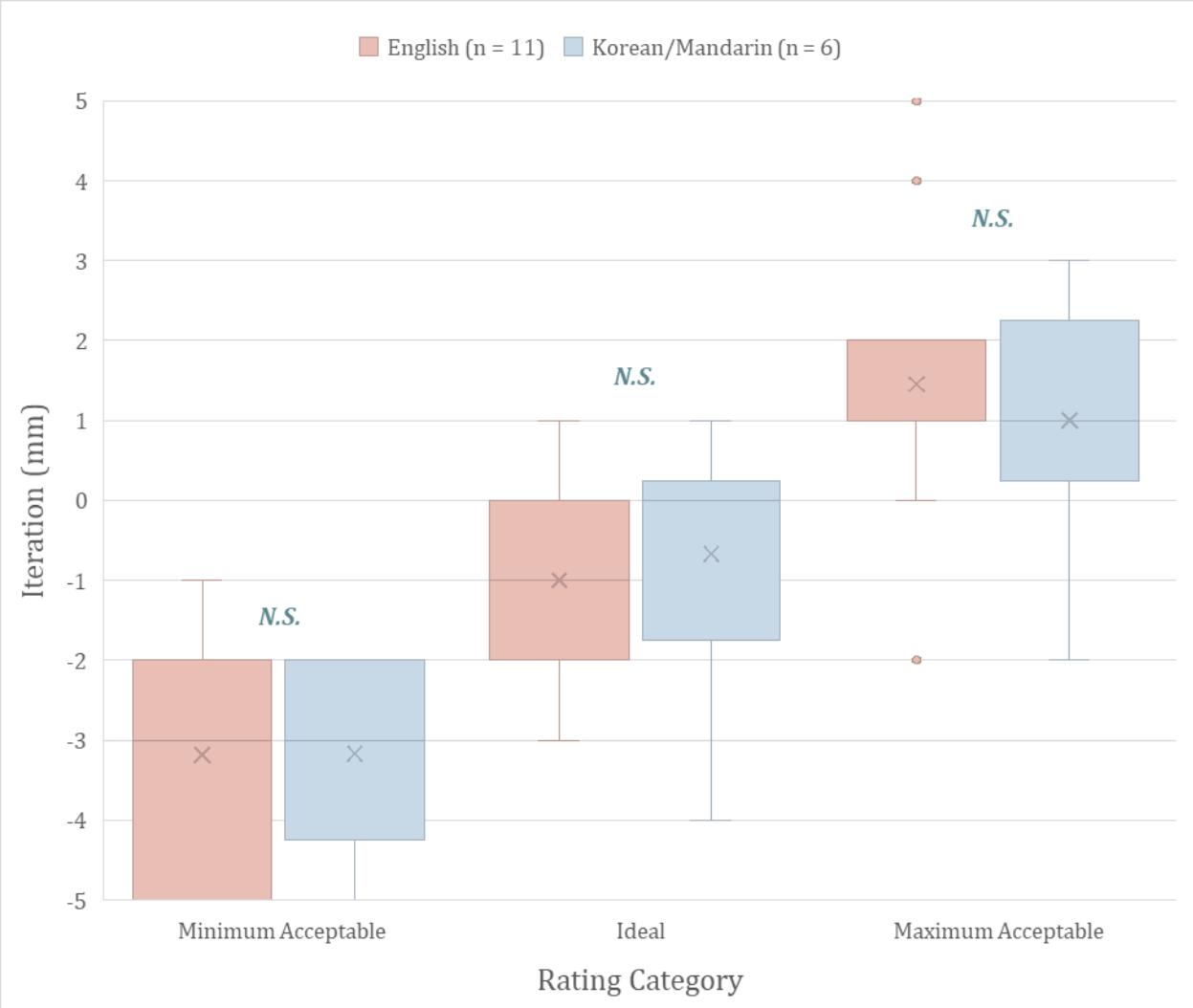
Age of relocation in judges.

Female East Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**East Asian**	**non-East Asian**	**East Asian**	**non-East Asian**	**East Asian**	**non-East Asian**
Maximum	-2	-2	1	3	5	5
Q3	-3	-3	0	0	3	3
Mean	-3.65	-3.42	-1.35	-1.2	1.53	1.46
SD	1.06	1.32	1.54	1.55	1.87	1.64
Median	-4	-4	-1	-1	1	1
Q1	-4	-4	-3	-2	0	0
Minimum	-5	-5	-4	-4	-2	-2

Cross-race vs. same-race judge assessment of Female East Asian model.

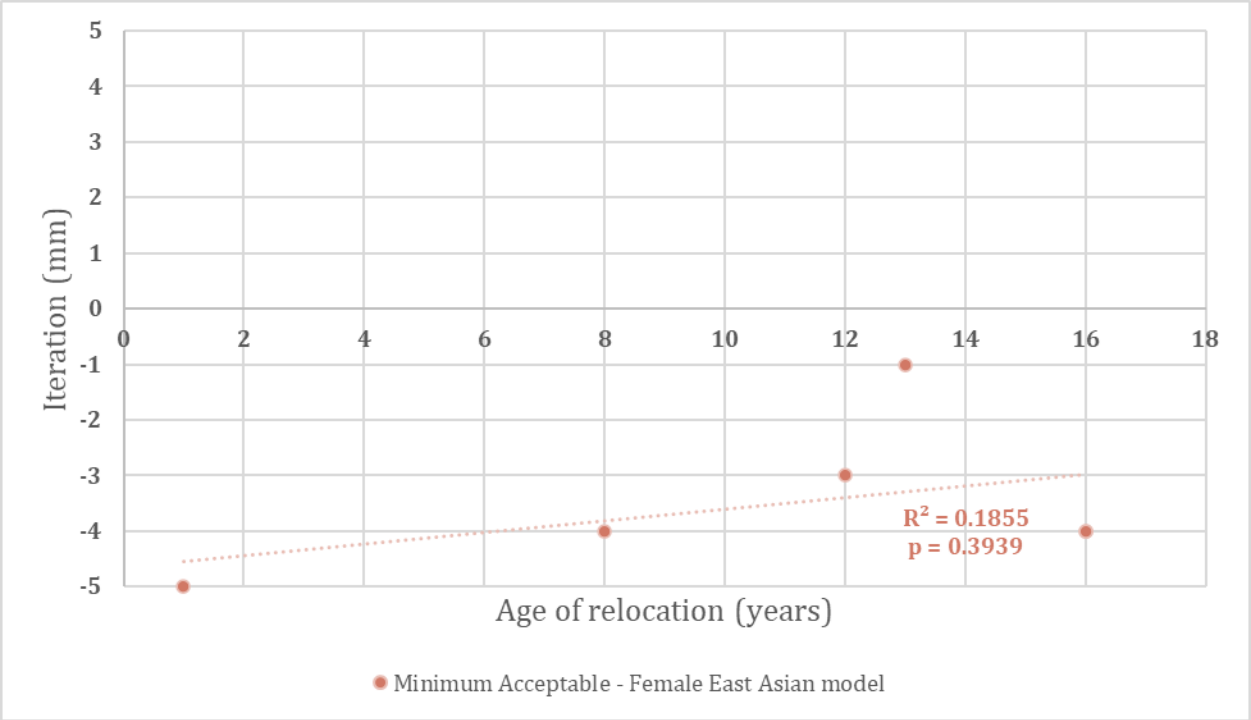
Male Caucasian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
JUDGE	**Caucasian**	**non-Caucasian**	**Caucasian**	**non-Caucasian**	**Caucasian**	**non-Caucasian**
Maximum	2	2	2	4	5	5
Q3	-1	-1	1	2	4	4
Mean	-1.97	-1.74	0.55	0.56	2.76	2.5
SD	1.59	1.69	1.26	1.67	1.30	1.78
Median	-2	-2	1	1	3	3
Q1	-3	-3	0	-1	2	1
Minimum	-5	-5	-1	-3	-1	-1

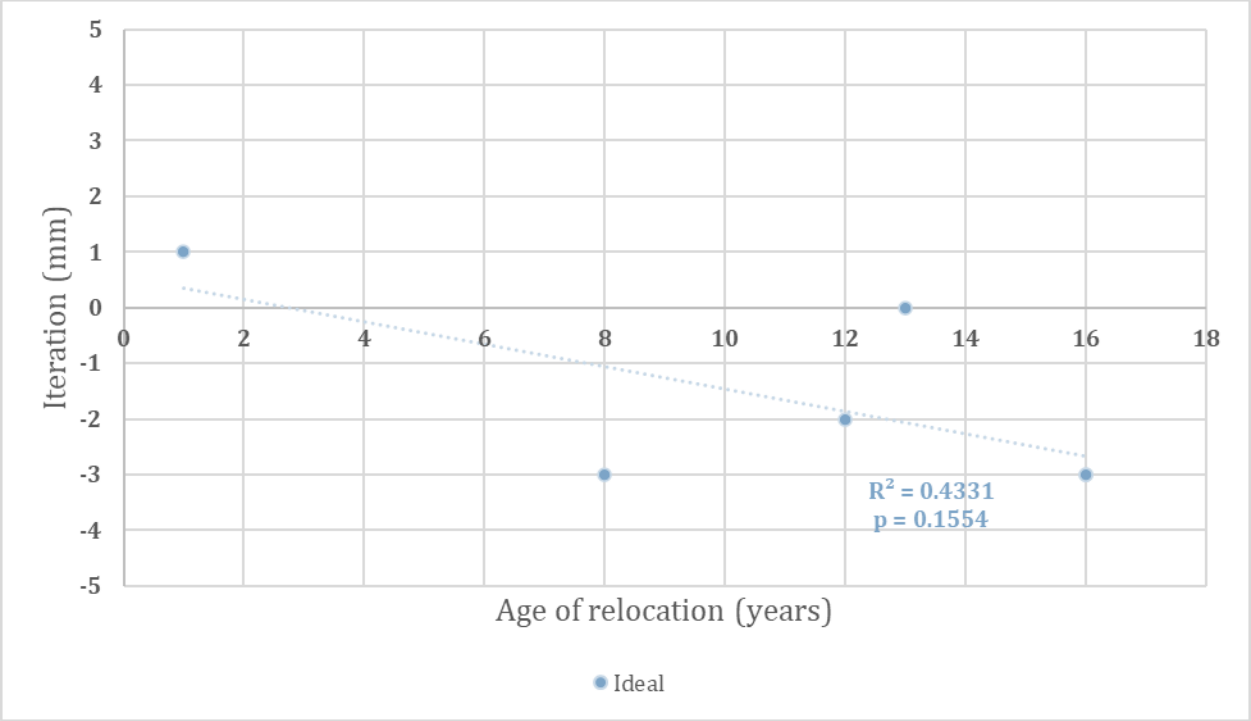
Cross-race vs. same-race judge assessment of Male Caucasian model.

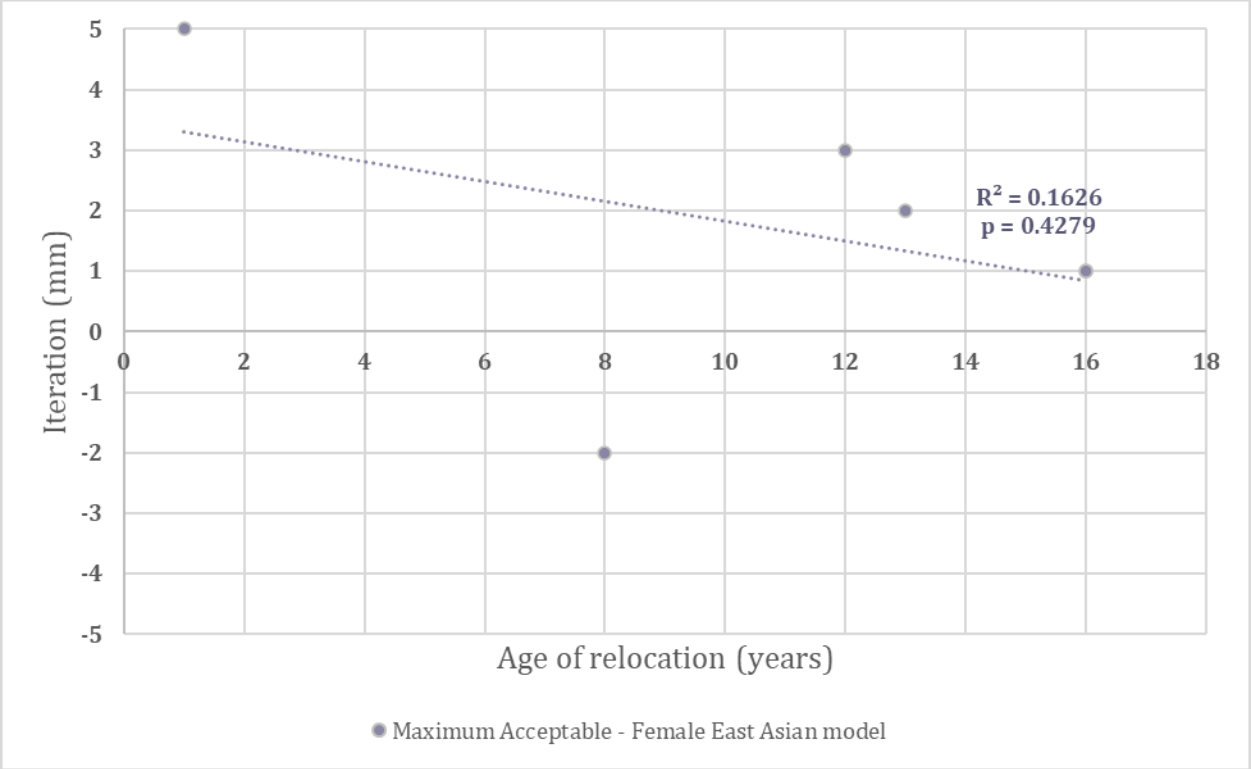


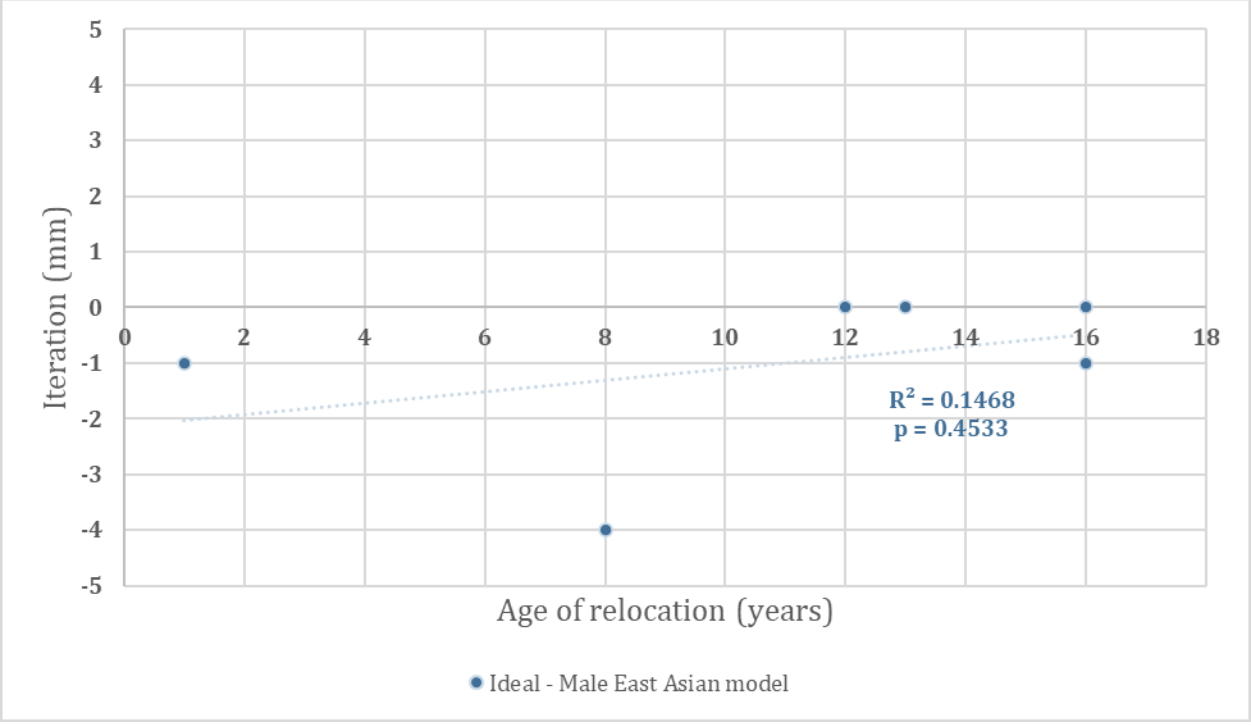
Male Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
Primary Language	**English**	**Korean/ Mandarin**	**English**	**Korean/ Mandarin**	**English**	**Korean/ Mandarin**
Maximum	-1	-2	1	1	2	3
Q3	-2	-2	0	0.25	2	2.25
Mean	-3.18	-3.17	-1.00	-0.67	1.45	1.00
SD	1.54	1.75	1.34	1.75	1.86	1.67
Median	-1	0	-3	-3	1	1
Q1	-5	-4.25	-2	-1.75	1	0.25
Minimum	-5	-5	-3	-4	0	-2

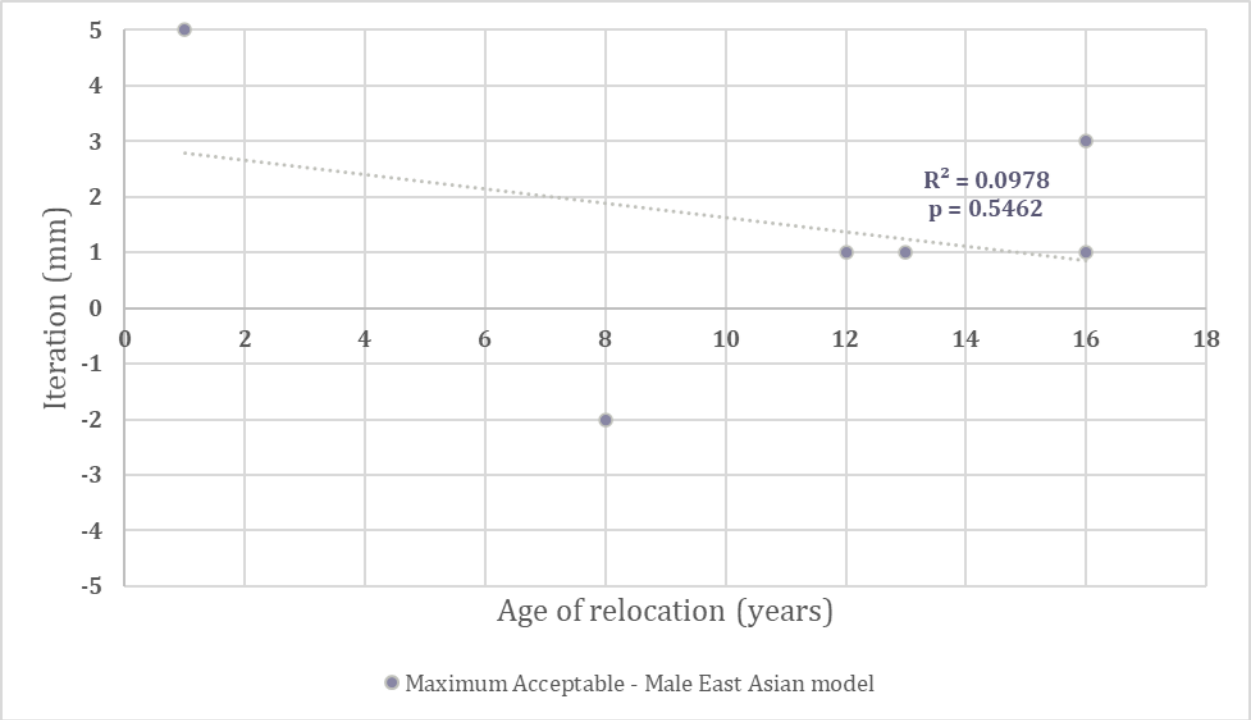
East Asian judge assessments of Male East Asian model by primary language (English vs. Korean/Mandarin).


Iteration (mm)
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
R² = 0.1855
p = 0.3939
Age of relocation (years)
Minimum Acceptable - Female East Asian model

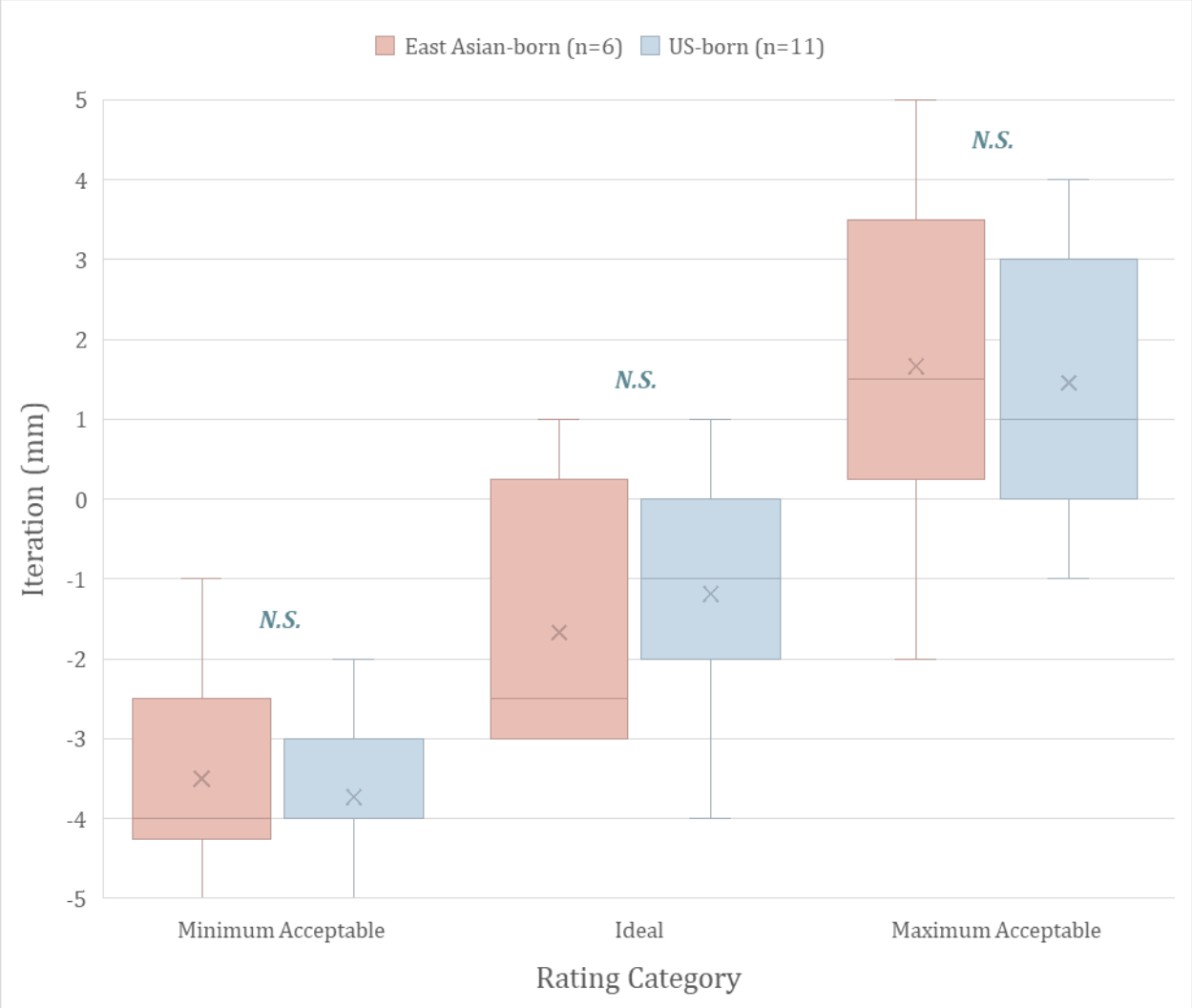

Iteration (mm)
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
R² = 0.4331
p = 0.1554
Age of relocation (years)
Ideal


5
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
Iteration (mm)
Age of relocation (years)
R² = 0.1626
p = 0.4279
Maximum Acceptable - Female East Asian model

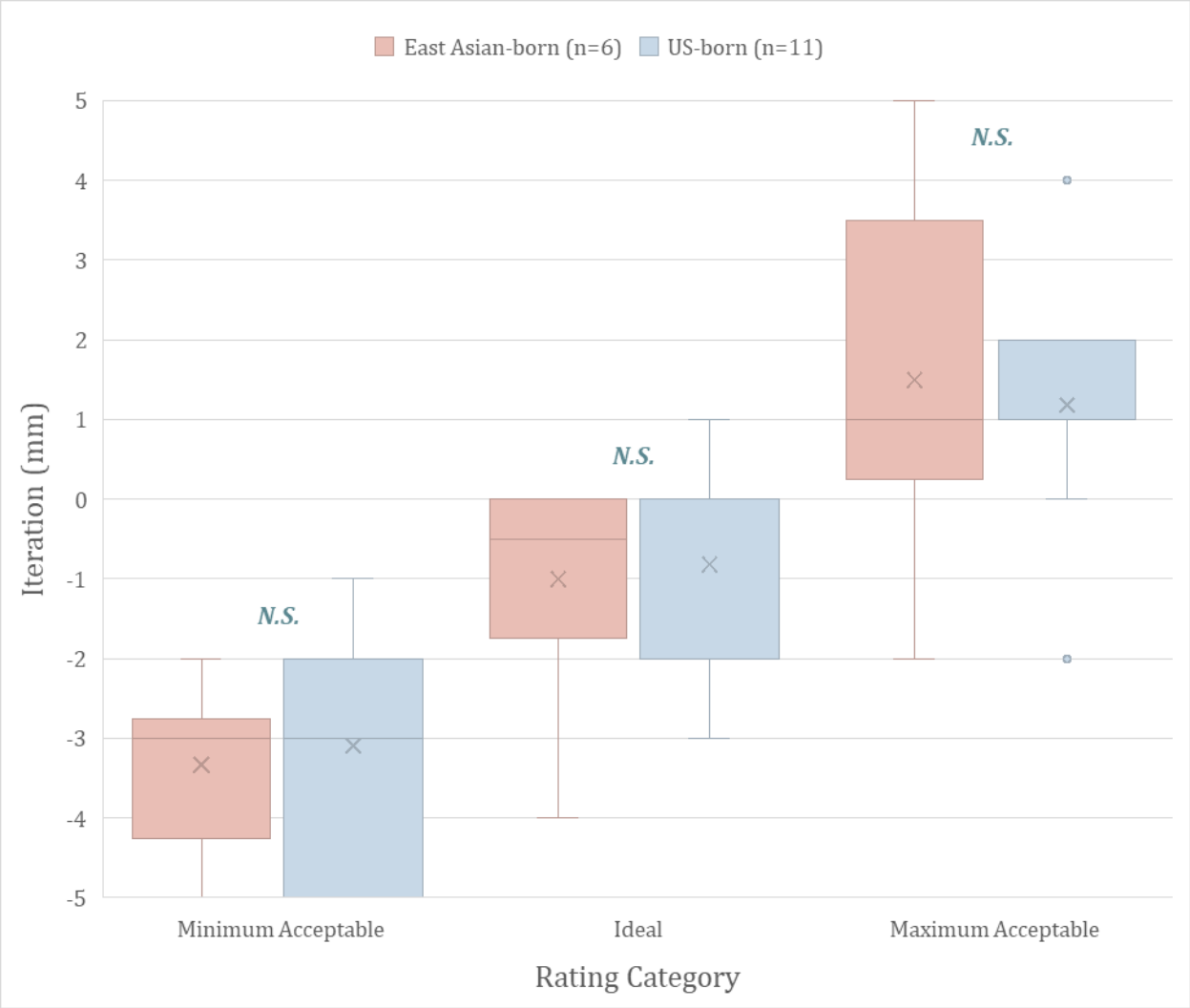

5
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
Iteration (mm)
Age of relocation (years)
R² = 0.1468
p = 0.4533
Ideal - Male East Asian model



Age of relocation vs. judge assessment of minimum acceptable, ideal, and maximum acceptable Female East Asian model and ideal and maximum acceptable Male East Asian model.

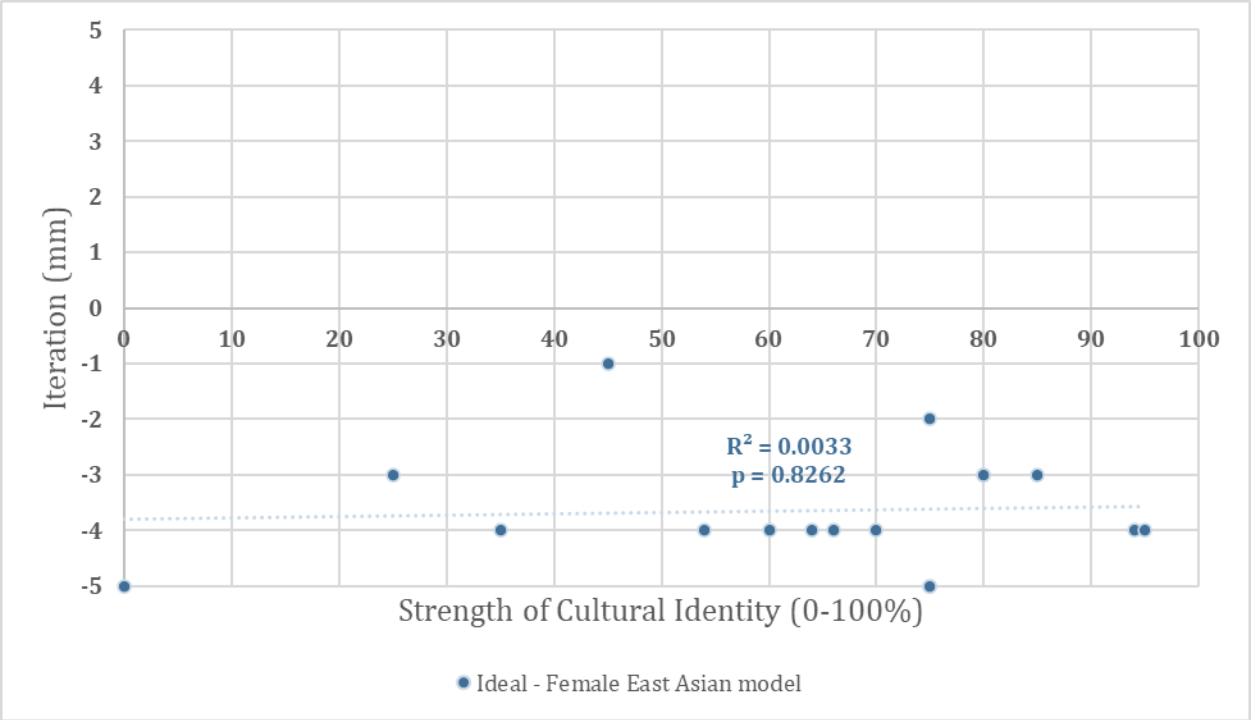


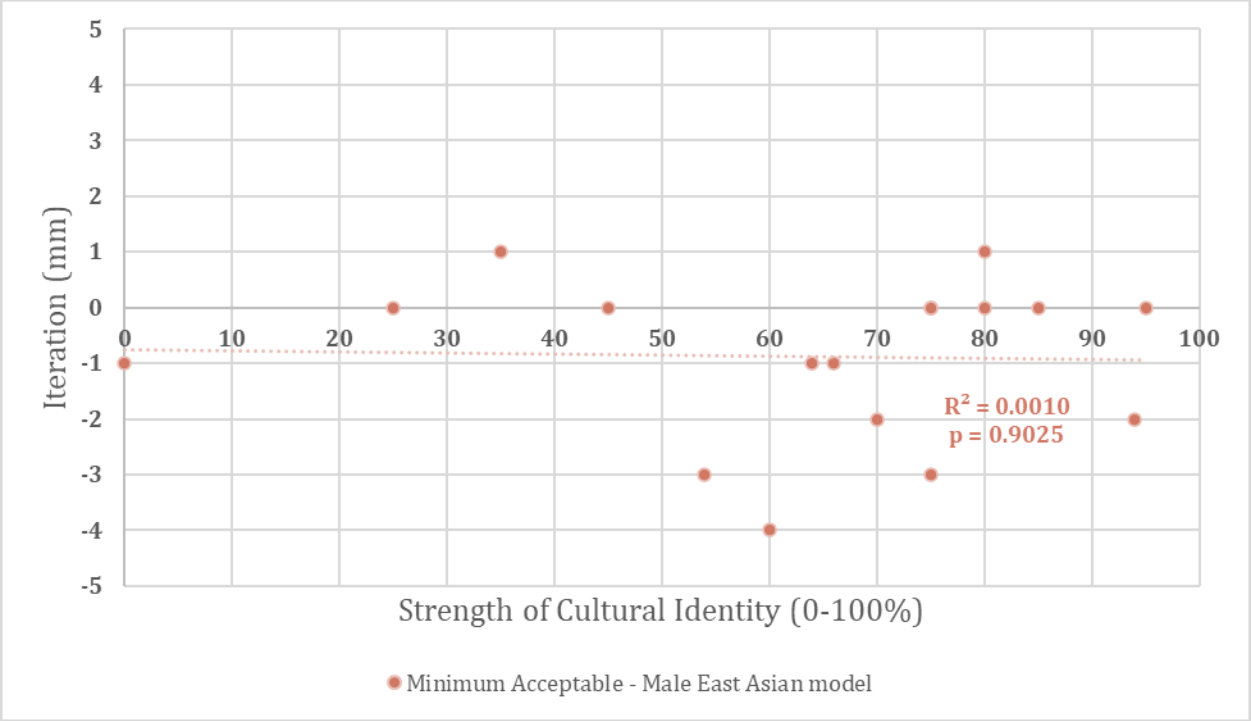
Female Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
BIRTH COUNTRY	**East Asia**	**United States**	**East Asia**	**United States**	**East Asia**	**United States**
Maximum	-1	-2	1	1	5	4
Q3	-2.5	-3	0.25	0	3.5	3
Mean	-3.5	-3.73	-1.67	-1.18	1.67	1.45
SD	1.38	0.90	1.75	1.47	2.34	1.69
Median	-4	-4	-2.5	-1	1.5	1
Q1	-4.25	-4	-3	-2	0.25	0
Minimum	-5	-5	-3	-4	-2	-1

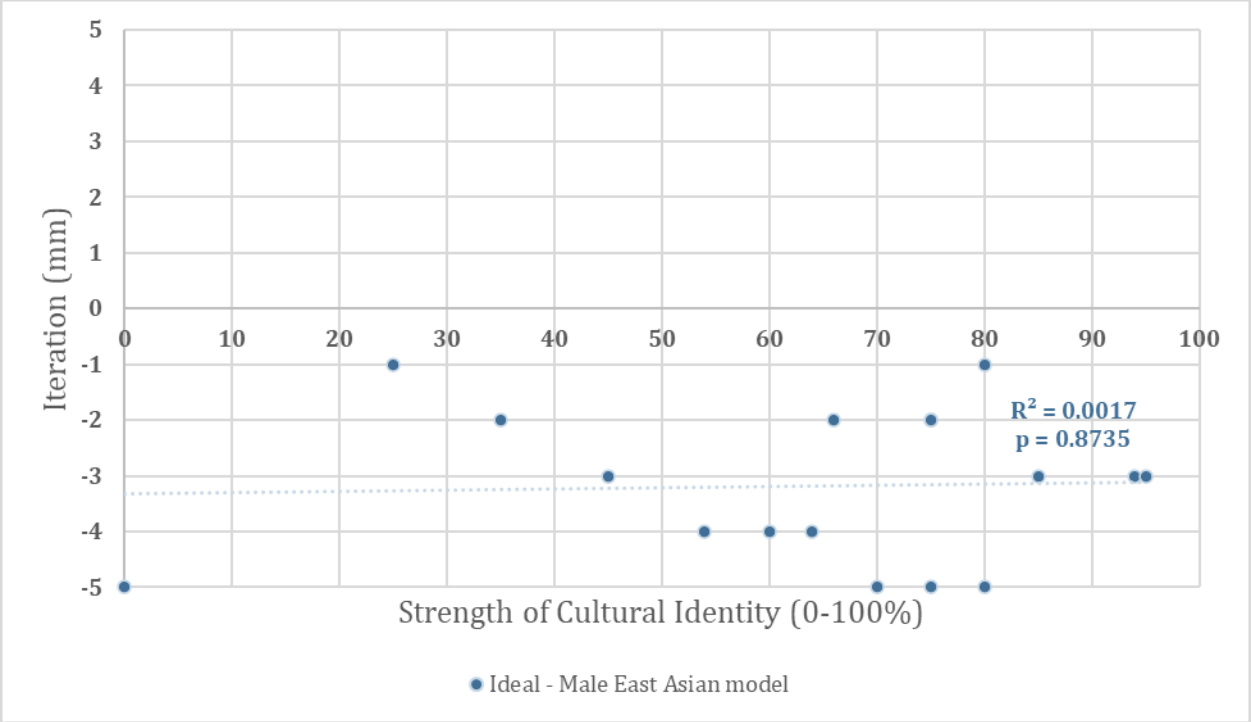


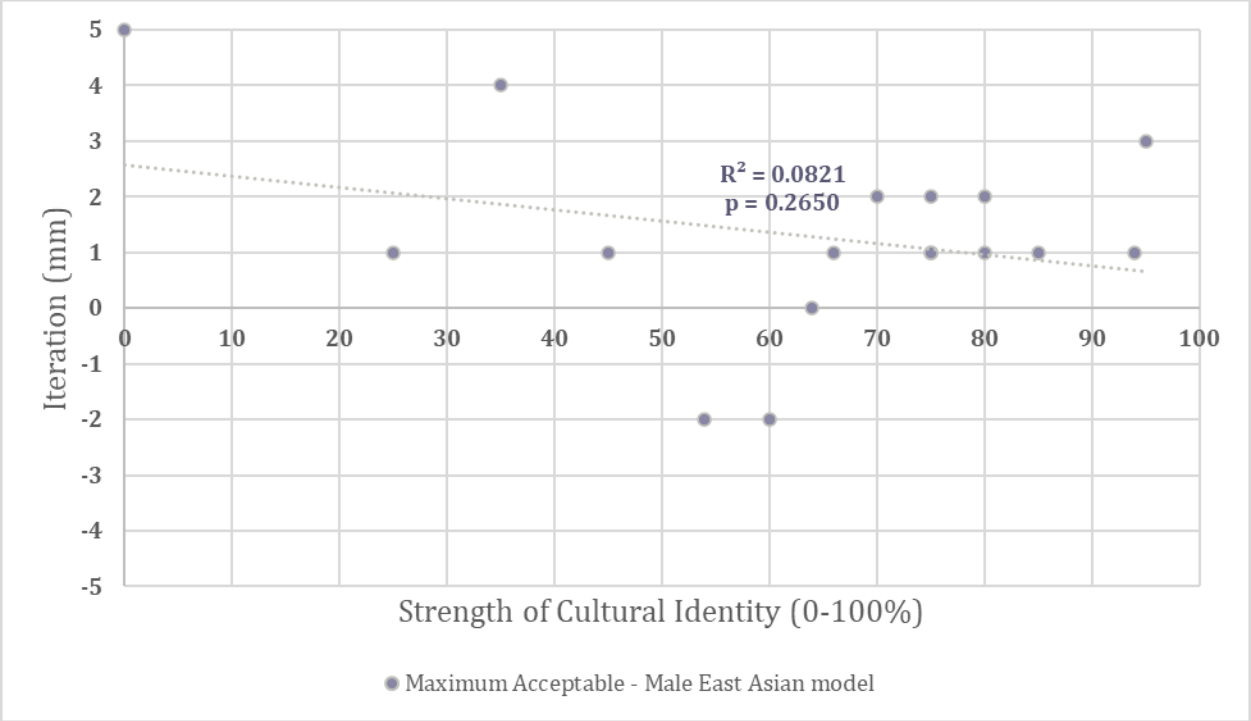
Male Asian Model						
PROFILE	**Minimum Acceptable**		**Ideal**		**Maximum Acceptable**	
BIRTH COUNTRY	**East Asia**	**United States**	**East Asia**	**United States**	**East Asia**	**United States**
Maximum	-2	-1	0	1	5	2
Q3	-2.75	-2	0	0	3.5	2
Mean	-3.33	-3.09	-1	-0.82	1.5	1.18
SD	1.03	1.58	1.55	1.47	2.35	1.47
Median	-3	-3	-0.5	0	1	1
Q1	-4.25	-5	-1.75	-2	0.25	1
Minimum	-5	-5	-4	-3	-2	0

East Asian-born vs. US-born East Asian judge assessment of Female East Asian model and Male East Asian model.


Iteration (mm)
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
10
20
30
40
50
60
70
80
90
100
R² = 0.0033
p = 0.8262
Strength of Cultural Identity (0-100%)
Ideal - Female East Asian model


Iteration (mm)
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
10
20
30
40
50
60
70
80
90
100
R² = 0.0010
p = 0.9025
Strength of Cultural Identity (0-100%)
Minimum Acceptable - Male East Asian model





Strength of cultural identity on a scale of 0-100% vs. judge assessment of ideal Female East Asian model, minimum acceptable Male East Asian model, ideal Male East Asian model, and maximum acceptable Male East Asian model.