Journal of Cross-Cultural Psychology
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Journal of Cross-Cultural Psychology 2011 42: 131
DOI: 10.1177/0022022110392229

The online version of this article can be found at:
http://jcc.sagepub.com/content/42/1/131

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On behalf of:
IACCP
International Association for Cross-Cultural Psychology

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42(1) 131–139

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Piotr Sorokowski[1], Andrzej Szmajke[1], Agnieszka Sorokowska[1], Maryann Borg Cunen[2], Marharyta Fabrykant[3], Kiumars Zarafshani[4], Manochehr Amiri[4], Saeideh Bazzazian[5], Biljana Blazevska-Stoilkovska[6], Veronica Casellas[7], Hakan Cetinkaya[8], Berenice Lopez Coutino[9], Maria Chavez[10], Cecilia Cheng[11], Ioana Cristea[12], Daniel David[12], Seda Dural[13], Anna Dzięcioł[14], Sofian Fauzee[15], Ana Frichand[6], Evrim Gulbetekin[13], Ivana Hromatko[16], Tina Javahishvili[17], Anna Jgenti[17], Sandi Kartasasmita[18], Khadijeh Moradi[4], Bojan Musil[19], Sonia Nongmaithem[20], Ekundayo Oladipo[21], Ojedokun Oluyinka[22], Kanak Patil[23], Wanda Schell[7], Hasmig Serpekian[24], Borislav Slavchev[25], Stanislava Stoyanova[25], Meri Tadinac[16], Nachiketa Tripathi[20], and Tzu Fang[26]

Abstract

The leg-to-body ratio (LBR) is a morphological index that has been shown to influence a person's attractiveness. In our research, 3,103 participants from 27 nations rated the physical attractiveness of seven male and seven female silhouettes varying in LBR. We found that male and female silhouettes with short and excessively long legs were perceived as less attractive across all nations. Hence, the LBR may significantly influence perceptions of physical attractiveness across nations.

Keywords

physical attractiveness, leg-to-body ratio, cross-national, aesthetic judgments

The attractiveness of the human body is related to such morphological traits as weight, height, and body shape (review: Pawlowski, 2000). Another morphological feature that may influence judgments of attractiveness is the leg-to-body ratio (LBR). It has been shown that people perceived a relatively high LBR as attractive in women (Bertamini & Bennett, 2009; Rilling et al., 2009; Sorokowski & Pawlowski, 2008; Swami, Einon, & Furnham, 2006; but see also Frederick, Hadji-Michael, Furnham, & Swami, 2010), whereas in the case of men, results have been ambiguous—either low (Swami et al., 2006) or relatively high LBR (Bertamini & Bennett, 2009; Sorokowski & Pawlowski, 2008) has been perceived as attractive.

Such phenomena were explained in adaptive terms such as the following: (a) Relative leg length might be a credible indicator of health status (e.g., Davey Smith et al., 2001) and individual early

childhood environmental influences (illnesses, malnutrition) (e.g., Wadsworth, Hardy, Paul, Marshall, & Cole, 2002); (b) short legs in women might be a sign of lower reproductive capabilities (Fielding et al., 2008); (c) leg length might be an indicator of biomechanical efficacy (e.g., due to running or swimming ability; e.g., Cavanagh & Kram, 1989) that were important during human evolution. Results of these studies might suggest that rather high LBR should be attractive, for it is a marker of an individual's biological quality.

To date, it has only been shown how the LBR influences attractiveness judgments in the United Kingdom (Bertamini & Bennett, 2009; Swami et al., 2006), Poland (Sorokowski & Pawlowski, 2008), the United States (Frederick et al., 2010; Rilling et al., 2009), and Malaysia (Swami, Einon, & Furnham, 2007). The main purpose of our study was to investigate the impact of the LBR on attractiveness in a much wider range of countries than what has been previously documented. This would enable researchers to examine whether perceptions of LBR are relatively similar or dissimilar in different national contexts.

Method

Participants

The research reported in this article is a result of a collaborative effort made by researchers from 27 regions across five continents (see Table 1). A total of 3,103 participants (1,532 females and 1,571 males) participated in this joint study. Information about some demographic variables (religion, sample background type, and language) were taken only for a national group as a whole. The majority of our sample consisted of students from urban areas (age: $M = 22.05$, $SD = 5.52$).

[1]University of Wroclaw, Institute of Psychology
[2]University of Malta
[3]Belarusian State University
[4]Razi University
[5]Islamic Azad University
[6]University "Sts. Cyril and Methodius"
[7]University of Puerto Rico
[8]Izmir University of Economics
[9]University of Guadalajara
[10]Independent scholar
[11]University of Hong Kong
[12]Babes-Bolyai University
[13]İzmir University
[14]University of Glasgow
[15]University Putra Malaysia
[16]University of Zagreb
[17]Tbilisi State University
[18]Tarumanagara University
[19]University of Maribor
[20]Indian Institute of Technology Guwahati
[21]Tai Solarin University of Education
[22]Lead City University
[23]University of Pune
[24]University of Jordan
[25]South-West University Neofit Rilski
[26]University in Taiwan

Corresponding Author:
Piotr Sorokowski, University of Wroclaw, Dawida 1, Wroclaw 50-527 Poland.

Table 1. Attractiveness Scores for Men and Women Silhouettes with Different Leg Length

		Female Silhouettes							Male Silhouettes						
Region		LBR .438	LBR .464	LBR .489	LBR .515	LBR .541	LBR .567	LBR .592	LBR .438	LBR .464	LBR .489	LBR .515	LBR .541	LBR .567	LBR .592
Europe and Canada	*M*	1.67a	2.54b	3.81d	5.05f	**5.26g**	4.41e	3.19c	1.61a	2.33b	3.57d	4.87f	**5.34g**	4.37e	2.99c
	SD	1.06	1.26	1.44	1.45	1.48	1.84	1.97	1.12	1.34	1.55	1.54	1.49	1.74	1.85
Belarus	*M*	1.85f	2.7e	4.03c	**5.33**a	**5.49**a	4.8b	3.56d	2.04f	2.64e	4.21c	**5.22**a	**5.32**a	4.57b	3.3d
	SD	1.38	1.25	1.52	1.40	1.38	1.68	1.85	1.51	1.37	1.55	1.61	1.56	1.86	1.73
Bulgaria	*M*	1.37i	2.13h	3.31f	4.78c	**5.13**ab	**4.89**bc	3.67e	1.41i	1.91h	3.04g	4.50d	**5.24**a	4.81c	3.53ef
	SD	0.78	1.35	1.46	1.60	1.64	1.98	2.28	0.98	1.16	1.79	1.65	1.64	1.76	2.10
Croatia	*M*	1.61i	2.34g	3.88d	**5.63**a	**5.63**a	4.00cd	2.68f	1.34j	1.93h	3.28e	4.93b	**5.47**a	4.13c	2.63f
	SD	1.04	1.18	1.51	1.37	1.23	1.81	1.75	0.68	1.05	1.50	1.62	1.47	1.80	1.68
Czech	*M*	1.92j	2.53gh	3.48e	**4.85**ab	**4.96**ab	4.49c	3.22f	2.06ij	2.29hi	3.95d	**4.88**ab	**5.05**a	4.26cd	3.1f
	SD	1.21	1.12	1.32	1.30	1.42	1.69	1.77	1.31	1.39	1.43	1.52	1.45	1.6	1.78
Germany	*M*	1.84g	2.74e	3.96c	**5.08**a	**5.15**a	4.37b	3.30d	2.14f	2.78e	3.90c	**5.00**a	**5.07**a	4.05bc	2.83e
	SD	1.24	1.27	1.32	1.31	1.32	1.92	1.98	1.49	1.45	1.37	1.48	1.57	1.80	1.75
Macedonia	*M*	1.90h	2.56g	3.49e	4.61c	**4.99**b	4.46c	3.35e	1.15i	1.73h	3.08f	4.48c	**5.31**a	4.13d	2.61g
	SD	1.0	1.15	1.20	1.38	1.47	1.62	2.14	0.38	0.72	1.22	1.31	1.32	1.56	1.74
Malta	*M*	2.15e	3.20d	4.30c	**4.87**b	**5.05**ab	4.19c	3.12d	2.12e	3.00d	4.15c	**5.19**ab	**5.35**a	4.43c	3.18d
	SD	1.75	1.68	1.53	1.69	1.84	1.82	2.14	1.65	1.51	1.72	1.61	1.49	1.88	2.08
Poland	*M*	1.77j	2.66i	3.48ef	4.13d	**4.93**b	4.35d	3.13gh	1.94	2.89hi	3.59e	4.66c	**5.39**a	4.75bc	3.30fg
	SD	1.00	1.08	1.25	1.24	1.57	1.75	1.71	1.23	1.44	1.31	1.37	1.28	1.41	1.79
Romania	*M*	1.51h	2.57g	4.08d	**5.56**a	**5.66**a	4.57c	3.04e	1.67h	2.63fg	3.84d	5.12b	**5.48**a	4.41c	2.92ef
	SD	0.98	1.26	1.50	1.23	1.24	1.74	1.90	1.05	1.70	1.73	1.56	1.34	1.76	1.97
United Kingdom	*M*	2.11i	3.09f	4.38c	**5.37**a	4.9b	3.84d	2.76h	2.31i	3.06fg	4.22c	**4.96**b	**4.76**b	3.51e	2.3i
	SD	1.28	1.42	1.38	1.31	1.33	1.68	1.78	1.58	1.60	1.45	1.53	1.62	1.58	1.44
Slovenia	*M*	1.6g	2.78e	4.55c	**5.84**a	5.32b	3.51d	2.46f	1.61g	2.54ef	4.3c	**5.43**b	**5.53**ab	3.78d	2.37f
	SD	1.07	1.40	1.72	1.20	1.62	1.79	1.62	0.94	1.33	1.50	1.53	1.67	1.69	1.46
Spain	*M*	1.34i	2.23h	3.99e	5.59b	**5.93**a	4.52d	3.06g	1.29i	1.98h	3.45f	5.30b	**6.01**a	4.83c	3.25fg
	SD	0.74	1.05	1.29	1.27	1.22	1.87	1.81	0.70	1.08	1.40	1.50	1.04	1.81	1.85
Canada	*M*	2.02h	2.98f	4.31c	**5.26**a	4.89b	3.64de	2.56g	2.04h	3.03f	3.96d	**4.76**b	4.31c	3.3ef	2.51g
	SD	1.29	1.53	1.49	1.53	1.53	1.89	1.94	1.6	1.67	1.81	1.8	1.92	1.88	1.99
Africa	*M*	2.21b	2.94c	3.91e	4.66f	**4.91g**	4.31ef	3.49d	1.6a	2.11b	3.42d	4.30ef	**5.08g**	4.41ef	3.48d
	SD	1.60	1.65	1.71	1.79	1.78	1.97	2.32	1.51	1.60	1.80	1.82	1.64	1.92	2.35

(continued)

Table 1. (continued)

		Female Silhouettes							Male Silhouettes						
Region		LBR .438	LBR .464	LBR .489	LBR .515	LBR .541	LBR .567	LBR .592	LBR .438	LBR .464	LBR .489	LBR .515	LBR .541	LBR .567	LBR .592
Nigeria	*M*	2.49f	3.27e	4.27c	**4.71**ab	**4.84**a	4.17c	3.63de	1.87g	2.43f	3.68d	4.45bc	**4.89**a	**4.66**ab	4.26c
	SD	1.18	1.42	1.69	1.68	1.51	1.92	2.26	1.11	1.44	1.64	1.75	1.56	1.75	1.88
Tunisia	*M*	1.90h	2.56g	3.49e	4.61c	**4.99**b	4.46c	3.35ef	1.25i	1.73h	3.08f	4.48bc	**5.31**a	4.13d	2.61g
	SD	1.22	1.37	1.55	1.68	1.81	1.9	2.27	0.86	1.12	1.42	1.55	1.54	1.57	1.96
Asia	*M*	1.87a	2.67b	3.74d	**5.07g**	**5.14g**	4.07e	3.02c	1.80a	2.44b	3.50d	4.68f	**5.04g**	4.42e	3.22c
	SD	1.26	1.37	1.52	1.57	1.54	1.85	1.95	1.28	1.39	1.58	1.64	1.54	1.86	1.98
Georgia	*M*	1.25i	1.76h	2.78f	4.09d	**5.15**ab	**5.23**a	4.09d	1.23i	1.5i	2.21g	3.55e	4.54c	**4.96**b	3.98d
	SD	0.60	0.88	1.20	1.42	1.39	1.61	1.96	0.81	0.93	1.11	1.41	1.45	1.74	2.03
Hong Kong	*M*	2.71e	3.31d	4.08b	**4.63**a	**4.55**a	3.9bc	2.73e	2.63e	3.09d	3.76c	**4.56**a	**4.54**a	3.72c	2.76e
	SD	1.16	1.17	1.32	1.20	1.42	1.49	1.29	1.13	1.08	1.12	1.16	1.13	1.20	1.24
India	*M*	1.72h	2.56f	3.84d	**5.51**a	5.16b	3.79d	2.52f	1.62h	2.17g	3.38e	4.74c	**5.37**ab	4.49c	3.14e
	SD	1.51	1.53	1.84	1.71	1.82	2.03	2.02	1.40	1.48	1.74	1.99	1.75	2.02	2.14
Indonesia	*M*	1.82f	3.08e	3.68d	**5.08**ab	**5.33**a	4.57c	4.38c	2.2f	2.88e	4.41c	**5.15**ab	**4.78**bc	**4.81**bc	3.77d
	SD	1.26	1.54	1.75	1.86	1.54	1.55	1.97	1.45	1.63	1.78	1.79	1.71	1.60	2.04
Iran	*M*	2.21h	3.01f	4.17d	**5.35**a	**5.19**ab	3.95d	2.71g	1.73i	2.62g	3.61e	**5.09**b	**5.33**ab	4.8c	3.47e
	SD	1.51	1.33	1.37	1.44	1.41	1.96	1.92	1.33	1.35	1.38	1.45	1.45	1.96	2.04
Jordan	*M*	1.44i	2.9g	4.38d	**5.97**a	**5.74**a	4.25de	2.64g	1.79h	3.3f	4.77c	**5.84**a	5.34b	3.96e	2.1h
	SD	0.79	1.32	1.36	1.13	1.24	1.85	1.82	1.29	1.49	1.46	1.28	1.47	1.76	1.50
Malaysia	*M*	1.51ij	2.07h	3.1f	5.44b	**5.81**a	4.58c	3.66e	1.37j	1.78hi	2.56g	4.44cd	**5.81**a	5.34b	4.25d
	SD	0.93	1.43	1.39	1.45	1.42	1.79	2.00	0.94	1.02	1.28	1.78	1.26	1.90	1.99
Taiwan	*M*	2.87g	3.26f	4.07d	4.73bc	**5.11**a	**4.85**ab	4.01d	2.70g	3.00fg	3.71e	4.52c	**5.07**a	4.64bc	3.69e
	SD	1.15	1.01	0.97	1.05	1.11	1.43	1.58	1.42	1.34	1.35	1.21	1.09	1.36	1.59
Turkey	*M*	1.83f	2.55de	3.47c	**4.45**a	**4.60**a	3.34c	2.73d	1.81f	2.39e	3.45c	**4.14**b	**4.40**ab	3.63c	2.69d
	SD	0.99	1.30	1.47	1.55	1.56	1.60	1.76	1.19	1.20	1.49	1.36	1.52	1.78	1.85
Latin	*M*	2.0 a	3.11c	4.38ef	**5.11g**	**4.89g**	3.57d	2.58b	2.12a	3.18c	3.95e	**4.88g**	4.58f	3.49d	2.59b
America	*SD*	1.66	1.61	1.77	1.78	1.79	1.76	2.00	1.73	1.71	1.78	1.99	1.96	1.80	2.01
Argentina	*M*	2.02g	3.04e	3.36e	**5.11**a	4.83bc	3.29e	2.52f	2.08g	3.12e	3.82d	**4.96**ab	4.45c	3.36e	2.61f
	SD	1.66	1.45	1.73	1.7	1.74	1.72	1.96	1.66	1.64	1.65	1.8	1.88	1.85	2.02
Mexico	*M*	1.78f	2.73e	3.80c	**4.56**a	**4.24**ab	3.24d	2.46e	1.86f	2.57e	3.23d	**4.15**bc	**4.08**bc	3.17d	2.67e
	SD	1.52	1.79	1.99	1.91	1.94	1.93	2.01	1.65	1.84	1.89	2.03	1.81	1.99	2.19
Puerto	*M*	2.18g	3.37e	4.81bc	**5.55**a	**5.39**a	3.81d	2.59f	2.39fg	3.70de	4.60c	**5.58**a	5.02b	3.83d	2.55f
Rico	*SD*	1.79	1.36	1.45	1.52	1.59	1.58	1.95	1.84	1.4	1.39	1.65	1.89	1.57	1.94

a,b,c… = average values without common letters marking are different when $p < .05$ (at least); (post hoc LSD Fisher tests), those analyses were conducted on data from separate countries. The highest means are marked in bold.

We did not ask about the sexual orientation of the participants. LBR (the method of assessment can be found in Dangoury, Schilg, Hulse, & Cole, 2002), height, and weight of participants were measured. Participants were not remunerated for their contribution to the research. Further details on sampling methods within each nation are available from the authors.

Procedure

In this study, we used 7 male and 7 female stimuli (the original picture—LBR = .515, pictures with legs elongated by 5%—LBR = .541, 10%—LBR = .567, and 15%—LBR = .592 and pictures with legs shortened by 5%—LBR = .489, 10%—LBR = .464, and 15%—LBR = .438). The pictures were taken from a study conducted by Sorokowski and Pawlowski (2008).

The participants were asked to rate the attractiveness of silhouettes using a 7-point scale ("Please assess the attractiveness of each of these silhouettes on a 1-7 scale" ranging from 1 = *I do not like it* to 7 = *I like it very much*; this question targets participants' preferences, whereas if they were asked about the attractiveness, it could have been understood as regarding the general attractiveness patterns—as shown on television, in magazines, etc.). The silhouettes were presented individually, randomly, and for as long as each participant needed in order to make an assessment on the paper-and-pencil questionnaire. The participants were informed of the manipulated leg length of the stimuli. All instructions were presented in the native language of the participants.

Results

Effects of Nationality on Participants' Age and LBR

Differences in participants' age and LBR between the groups from various countries were investigated. One-way ANOVAs showed that examined populations differed both in case of the LBR, $F(3, 3{,}099) = 170.8$, $p < .0001$, $\eta^2_p = .15$, and age, $F(3, 3{,}099) = 93.2$, $p < .0001$, $\eta^2_p = .08$ of the participants.

Effects of Participants' Age and LBR on Their LBR Preferences

Because of the relation described above, correlations of participants' age and their LBR on each silhouette's assessment was computed (separately for male and female silhouettes). That analysis showed that the participants' LBR did not correlate significantly with assessments of any male or female silhouette (all r from .00 to .03, all $ps > .05$). Age, however, proved to correlate significantly with assessments of female stimuli, with LBR = .438 ($r = -.04$, $p = .01$), LBR = .464 ($r = -.08$, $p < .001$), LBR = .489 ($r = -.12$, $p < .001$), LBR = .515 ($r = -.04$, $p = .02$), LBR = .541 ($r = .06$, $p = .002$), LBR = .567 ($r = .1$, $p < .001$), LBR = .592 ($r = .12$, $p < .001$), and of male stimuli, with LBR = .438 ($r = -.07$, $p < .001$), LBR = .464 ($r = -.12$, $p < .001$), LBR = .489 ($r = -.11$, $p < .001$), LBR = .515 ($r = -.07$, $p < .001$), LBR = .541 ($r = .04$, $p = .047$), LBR = .567 ($r = .14$, $p < .001$), and LBR = .592 ($r = .16$, $p < .001$). Each correlation was calculated for 3,103 participants. The described correlation shows that in general older participants preferred higher LBR.

Effects of Participants' Nationality and Gender on LBR Preferences

To present the results more clearly, we divided all the nations on four regions (continents): Europe and Canada (as Western culture) and Africa, Asia, and Latin America (in Table 1 exact differences

Table 2. The Main Effects of Participants' Continent, Participants' Sex, Stimuli Sex, Stimulus' Leg-to-Body Ratio (LBR), and Their Interactions

Source	*df*	*F*	*p*	η^2_p
Continent	3	6.9	.0001	.04
Participant sex	1	8.9	.002	.02
Stimuli sex	1	28.6	.0001	.02
LBR	6	1,311.4	.0001	.58
Continent × Participant Sex	3	5.2	.001	.03
Continent × Stimuli Sex	3	1.9	.12	.003
Participant Sex × Stimuli Sex	1	9.4	.002	.001
Continent × LBR	18	23.8	.0001	.07
Participant Sex × LBR	6	7.6	.0001	.01
Stimuli Sex × LBR	6	18.0	.0001	.01
Continent × Participant Sex × Stimuli Sex	3	2.6	.14	.01
Continent × Participant Sex × LBR	18	1.3	.2	.004
Continent × Stimuli Sex × LBR	18	8.6	.0001	.01
Participant Sex × Stimuli Sex × LBR	6	1.5	.17	.000
Continent × Participant Sex × Stimuli Sex × LBR	18	1.3	.19	.002

between assessments of male and female stimuli in particular populations are shown). To test the effect of region and gender of participants on attractiveness assessments of different stimuli, Multivariate Analysis of Covariance (MANCOVA) was used. Design of this study was a 4 (Continent) × 2 (Participant Sex) × 2 (Stimuli Sex) × 7 (Stimuli LBR) with participants' age and LBR as covariates, stimuli sex and stimuli LBR as a within-subject variables, and both continent and participants' sex as a between-subjects variable.

Additive influence of covariates participants' LBR and age on assessments of silhouettes' attractiveness proved to be significant, $F(28, 6{,}358) = 4.32$, $p < .0001$; Wilks's Lambda = .962. However, conducting analysis of covariance enables one to exclude the influence of covariates on the obtained results. All remaining main and interaction effects are presented in Table 2. All main effects were significant, but except for "stimuli LBR," they were very weak (all $\eta^2_p < .05$). The most complex significant interaction effect was: "Stimuli LBR" × "Stimuli Sex" × "Continent" ($p < .0001$, $\eta^2_p = .01$). It shows that LBR preferences were moderated by continent and stimuli sex. Among Europeans together with Canadians and Africans, a pattern of LBR .438 < LBR .464 < LBR .489 < LBR .515 < LBR .541 > LBR .567 > LBR .592 and LBR .464 < LBR .592 was observed both for male and female stimuli (symbols < and > mean significantly lower or higher attractiveness of particular stimuli; post hoc test, *p*s < .05). The same pattern was observed in Asia in the case of male stimuli assessments. Preferences for female stimuli were similar, but the difference between LBR .515 and LBR .541 was not significant. In Latin America a pattern of LBR .438 < LBR .464 < LBR .489 < LBR .515 > LBR .541 > LBR .567 > LBR .592 was observed for male stimuli. Preferences for female stimuli were similar, but the difference between LBR .515 and LBR .541 was not significant. Unlike in the other continents, participants in Latin America rated LBR .592 as more attractive than LBR .438 only (but not LBR .464) (Figure 1).

Europeans together with Canadians (for both stimuli sexes) and Africans (for female stimuli) rated the lowest LBR (.438) lower than Asians and Latin Americans. The highest LBR (.592) was perceived as more attractive in Europe (with Canada) and Africa than in Asia. At the same time, Latin Americans rated it even lower (for both stimuli sexes) (Figure 1).

To test if similar results would be obtained if 27 nationalities (instead of four continents) were taken into account, we conducted the following analysis: 27 (Nationality) × 2 (Participant Sex) × 2 (Stimuli Sex) × 7 (Stimuli LBR) with participants' age and LBR as covariates. There was a main

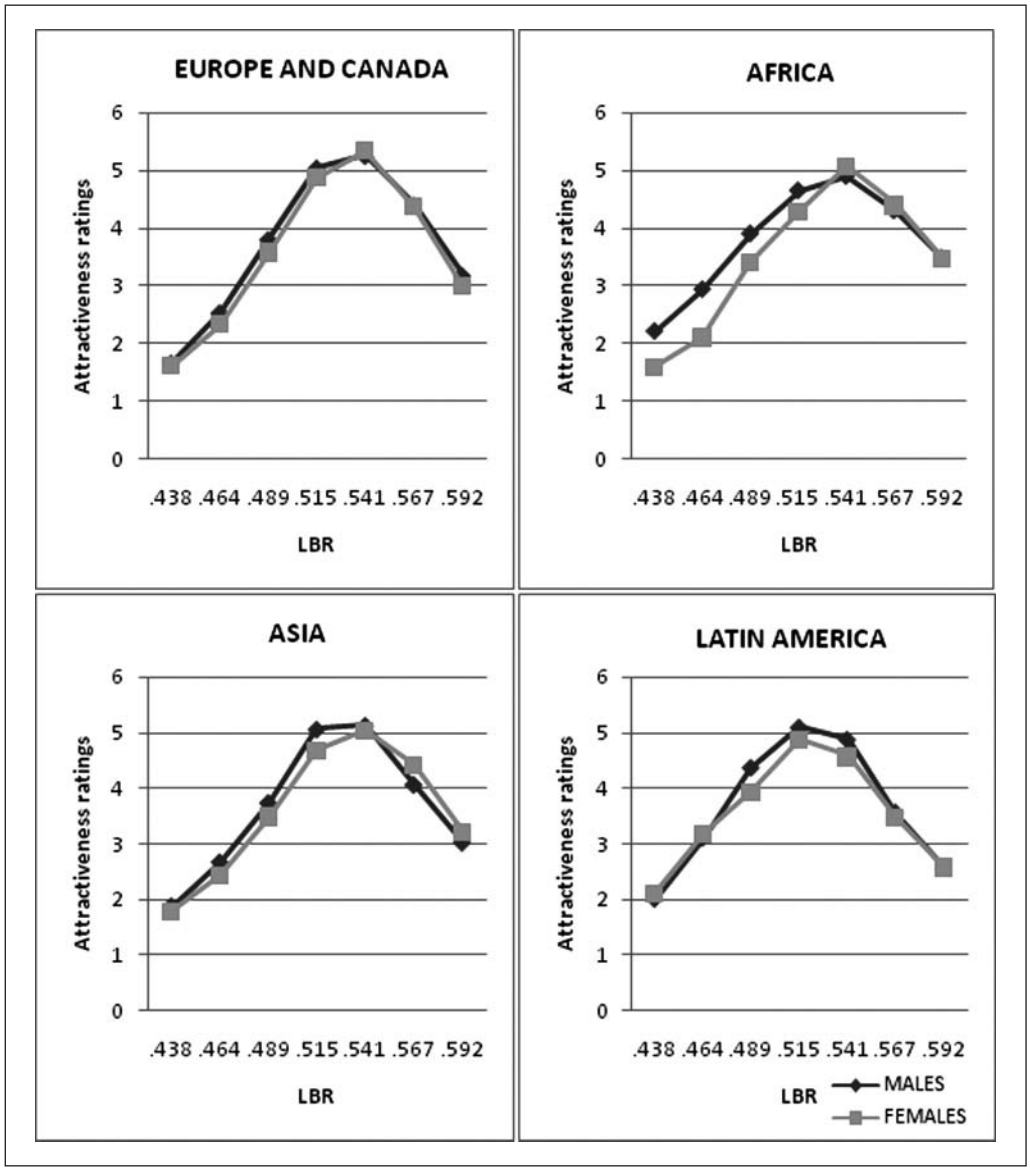

Figure 1. Attractiveness Scores for Men and Women Silhouettes With Different Leg Length in Four Regions

effect of "LBR," $F(6, 18{,}294) = 2{,}819.6$, $p < .0001$, $\eta^2_p = .48$, as well as an interaction effect of "LBR—nationality," $F(150, 18{,}294) = 16.2$, $p < .0001$, $\eta^2_p = .12$. Other main and interaction effects were extremely weak ($\eta^2_p < .02$).

Discussion

The most important finding of our study was that male and female silhouettes with LBRs close to the average were perceived as more attractive than more extreme LBRs. While the silhouettes with short and excessively long legs were perceived as less attractive across all nations, too long

legs were generally more attractive than those too short. These findings confirmed the results obtained previously by Sorokowski and Pawlowski (2008). Although differences in the investigated aesthetical preferences between nations/continents proved to be significant, effect sizes (η^2) indicate that the aesthetic preferences for the various LBRs were only slightly modified by the participants' origin. Certain cross-culture differences in LBR preferences exist. Europeans together with Canadians and Africans preferred relatively high LBR. On the contrary, Latin Americans rated higher relatively low LBR. This is evident not only in the LBRs that they found the most attractive but also by their ratings of the highest and the lowest LBR. Unfortunately at this stage of research, it is impossible to point out any factors that could possibly explain the observed differences in preferences. However, the preferences for LBR seem not to be directly related to Western culture (as Nigerians and Georgians preferred higher LBR than the United Kingdom and Canada).

Some limitations of the described research need to be pointed out. Participants were "informed of the manipulated nature of the stimuli"; therefore, they probably focused on changes in the LBR of presented stimuli. Another limitation is the fact that the majority of our participants came from urban areas within their respective countries, so they might have had frequent contact with the Western culture. Therefore, it should be pointed out that future research on more rural social groups needs to confirm our results.

Our participants rated stimuli that were designed specifically on Polish norms. The authors intended to control the above-mentioned problem and controlled for participants' LBR (it proved to have no influence on the results). Also, the blackened stimuli used in this study decreased its ecological validity. Nevertheless, it enabled us to use the same set in every country (participants rated stimuli without visible racial characteristics). In a recent study, Frederick et al. (2010) used computer-designed silhouettes, which seems to be a promising method of designing LBR stimuli (at the same time, their results were similar to Sorokowski and Pawlowski, 2008, whose stimuli we used in the present study).

It is important to state that the observed preferences cannot be explained with a tendency to choose the "middle stimuli." Our participants preferred the most the silhouettes of LBR average or higher than the average but not lower than the average. What is more, Sorokowski and Pawlowski (2008) showed that when people assessed only the average picture and pictures with legs shortened by 5%, 10%, and 15% (in such cases, the "middle stimuli" would be of LBR—10%), the highest LBR in that set of stimuli was rated as the most attractive. This shows that preferences exist for certain LBRs and that these preferences are not solely a byproduct of the middle of the set of stimuli.

In conclusion, the obtained results enable us to state that there exists a similar (but not identical) model of the relative length of attractive legs worldwide. In Europe and Africa, people prefer longer legs than in Latin America, but generally the most attractive are the silhouettes of LBR higher than 0.5.

Acknowledgments

We would like to thank R. Mitchell, M. Filipska, A. Patin, A. Szumiński, and L. Krejèová for help with the data collection. We are also grateful to the Editor, Ute Schönpflug, the reviewers, and R. Nathan Pipitone, whose suggestions allowed us to improve this manuscript.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interests with respect to their authorship or the publication of this article.

Financial Disclosure/Funding

The authors declared that they received no financial support for their research and/or authorship of this article.

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Bios

Piotr Sorokowski received his PhD in psychology from the University of Wroclaw (Poland). His main research interests include human mating strategies, physical attractiveness, and markers of reproductive success in indigenous populations.