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Predictors of enhancing human physical attractiveness: Data from 93 countries

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ABSTRACT

People across the world and throughout history have gone to great lengths to enhance their physical appearance. Evolutionary psychologists and ethologists have largely attempted to explain this phenomenon via mating preferences and strategies. Here, we test one of the most popular evolutionary hypotheses for beauty-enhancing behaviors, drawn from mating market and parasite stress perspectives, in a large cross-cultural sample. We also test hypotheses drawn from other influential and non-mutually exclusive theoretical frameworks, from biosocial role theory to a cultural media perspective. Survey data from 93,158 human participants across 93 countries provide evidence that behaviors such as applying makeup or using other cosmetics, hair grooming, clothing style, caring for body hygiene, and exercising or following a specific diet for the specific purpose of improving ones physical attractiveness, are universal. Indeed, 99% of participants reported spending >10 min a day performing beauty-enhancing behaviors. The results largely support evolutionary hypotheses: more time was spent enhancing beauty by women (almost 4 h a day, on average) than by men (3.6 h a day), by the youngest participants (and contrary to predictions, also the oldest), by those with a relatively more severe history of infectious diseases, and by participants currently dating compared to those in established relationships. The strongest predictor of attractiveness-enhancing behaviors was social media usage. Other predictors, in order of effect size, included adhering to traditional gender roles, residing in countries with less gender equality, considering oneself as highly attractive or, conversely, highly unattractive, TV watching time, higher socioeconomic status, right-wing political beliefs, a lower level of education, and personal individualistic attitudes. This study provides novel insight into universal beauty-enhancing behaviors by unifying evolutionary theory with several other complementary perspectives.

1. Introduction

The ubiquitous human interest in improving one's physical appearance seems to have deep historical and evolutionary roots. The human tendency for appearance enhancement might have originated from phylogenetically conserved primate tendencies for self-grooming (Boccia, 1983; Prokop, Fančovičová, and Fedor, 2014; Valentova, Mafra, & Varella, 2022). Since the Middle Pleistocene period, the potentially ornamental use of red ochre was found in Neanderthals as long as 200–250 thousand years ago (Kya; Roebroeks et al., 2012), and around 164 Kya in early sapiens (Marean et al., 2007). The use of marine shell beads for possible personal decoration in humans dates back 70–120 Kya (d'Errico et al., 2009). During the Upper Pleistocene period (dating between 50 and 10 Kya), some materials are hypothesized to be precious due to their use as adornments (Clark, 1986; Liu, 2006). By 50 Kya, Neanderthals used pigmentation, shell bead adornments, eagle talons, and feathers most likely to alter their appearance (Finlayson et al., 2012; Mellars, 2010; Romandini et al., 2014; Zilhão, 2012). During the Holocene, ancient Egyptians cared for their faces (Lerner, 1932; Murube, 2013) and used cosmetics such as oils, moisturizers, black powders, and dyes to improve their appearance (Hunt, Fate, and Dodds, 2011), whereas ancient Romans enhanced their beauty through hairstyles and makeup (Chaudhri and Jain, 2009).

Such a long tradition in human's tendency for appearance enhancement indicates that it might serve essential functions, related, for example, to increasing one's reproductive fitness or social status. This is perhaps why so many evolutionary scholars have deemed this topic of critical importance and have endeavored to investigate its roots and roles (see, e.g., Arnocky, Bird, and Perilloux, 2014; Buss, 1989, 2015; Buss and Schmitt, 1993; DelPriore, Prokosch, and Hill, 2017; Fink, Butovskaya, Sorokowski, Sorokowska, and Matts, 2017; Gangestad and Simpson, 2000; Miguel and Buss, 2011; Perilloux and Buss, 2008; Sugiyama, 2005; Symons, 1995; Tybur and Gangestad, 2011; Walter et al., 2020). The available evidence has given rise to many influential evolutionarily-driven hypotheses, aimed at explaining the origins of differences in beauty investments as a function of, for example, gender, relationship status, and parasite stress. Notably, other disciplines have also tackled the topic of self-modification, attempting to predict who might be the most interested in improving one's appearance and why. In the present study, we aim to test these predictions jointly, including evolutionary hypotheses driven from mating market and pathogen stress perspectives, alongside cultural and biosocial hypotheses, on a large, cross-cultural sample.

1.1. Mating market perspective

The mating market perspective draws on the assumptions that people actively choose and are chosen as partners by members of the opposite sex (Edward, 2015). These choice processes occur on a hypothesized 'mating market' where individuals seek out mates (Whyte, Brooks, and Torgler, 2019). Some people in the mating market have traits that are in high demand, such as physical attractiveness. In the classic 37 culture study by Buss, both men and women ranked 'good looks' as one of the top ten traits they value in a partner (Buss, 1989), and more recent studies suggest that people have been placing increasing importance on physical looks in their mate preferences over the last few decades (Fales et al., 2016; Walter et al., 2020). These preferences create an incentive for men and women to engage in strategies that enhance their physical appearance in the eyes of the opposite or preferred sex.

However, one gender might receive more benefits in the mating market by enhancing their looks than the other. To understand why, one could go back to our distant ancestors, wherein men and women are hypothesized to have faced divergent adaptive challenges (Buss, 1989). Namely, women have a more constrained period of fertility than men do, and the reproductive success of a man who partners with one woman is dictated by her remaining reproductive years. It is hypothesized that this selective pressure led human males to evolve a perceptive bias; that is, being predisposed to finding cues of youth in women attractive, because this could translate into increasing men's reproductive success. In contrast, women's reproductive success has traditionally been more

heavily constrained by choosing investing partners who help maximize their and their offspring's survival (in addition to those of high genetic quality), particularly in the context of a long-term mate. Thus, women are hypothesized to prioritize male cues of high status, prestige, and formidability (Buss and Schmitt, 1993, 2019).

These divergent adaptive challenges are hypothesized to have resulted in salient gender differences in mate competition and attraction strategies (Davis and Arnocky, 2020). To attract potential partners, women are predicted to be more interested in enhancing their physical attractiveness than men are. In contrast, men are predicted to be more interested in displaying their resources than women are (Shackelford and Liddle, 2014). However, this does not necessarily entail that men will be uninterested in their physical appearance. On the contrary, some hypothesize that modern culture encourages men to care about and invest in their attractiveness (Ricciardelli, 2011), while others highlight that men have long been attentive to maximizing their muscularity (Lennon and Johnson, 2021). This converges with evolutionary theory, which posits that upper body strength might have benefited our male ancestors in intra- and inter-sexual competition (von Rueden, Gurven, and Kaplan, 2008). Male muscularity and formidability might have also helped men gain higher status and sexual interest from women (Frederick and Haselton, 2007; Sell, Tooby, and Cosmides, 2009). Thus, it is reasonable to expect some men to feel more pressure to gain lean and muscular bodies compared to some women, and, when not fulfilling these ideals, to feel some level of body dissatisfaction (Lei and Perrett, 2021).

Furthermore, improving physical attractiveness can be especially paramount during reproductive years when finding a potential mate is one of the most crucial developmental life tasks (Buss, 2015; Griskevicius and Kenrick, 2013). At this age, fertility potential is the highest (Fitzgerald, Zimon, and Jonesa, 1998; WHO, 2006), and thus, efficient pair-bonding might translate into higher reproductive success (i.e., more offspring). Unsurprisingly, intra- and inter-individual competition among individuals of reproductive age is more pronounced than among individuals not of reproductive age (Massar, Buunk, and Rempt, 2012; Semenyna, 2020).

One way to attract potential mates is by improving one's physical appearance (Mafra et al., 2020). For similar reasons, single individuals are more motivated to attract a potential partner than are those in romantic relationships (Fisher, Cox, and Gordon, 2009). Indeed, remaining single could constrain inclusive fitness if unpartnered individuals never find mates with whom to reproduce (Cronk, 1991).

1.2. Pathogen prevalence

Pathogen prevalence is yet another factor that may predict who will spend more time improving their appearance and why. As transmittable diseases have posed a considerable challenge in mammalian history (Hurtado, Frey, Hurtado, Hill, and Baker, 2008), including human evolution (Fumagalli et al., 2011), organisms have developed a wide range of mechanisms to protect themselves from infectious agents. One such mechanism is the behavioral immune system (Kavaliers and Colwell, 1995), which governs responses to potentially pathogenic stimuli. It has been hypothesized that mammals have evolved aversions to specific cues connected with pathogens. To illustrate, selection has shaped human's preferences for specific indices of health and the absence of pathogens (Duncan and Schaller, 2009; Penton-Voak, Jacobson, and Trivers, 2004; Sorokowski, Kościński, and Sorokowska, 2013).

Attractiveness has been widely hypothesized to be a proxy or indicator of health (Fink et al., 2017; Tybur and Gangestad, 2011), however many studies have challenged these notions (see, e.g., Cai et al., 2019; Rantala et al., 2013), and some suggest that the relationship between physical attractiveness and health may not be linear. Unattractiveness could be a stronger cue of poor health than attractiveness is a cue of good health. For instance, Klebi, Greenaway, Rhee, and Bastian (2021) showed that relatively less attractive human faces elicit disgust responses and, reciprocally, cues of pathogens reduce attractiveness judgments. This may explain why humans universally place a high value on attractiveness among potential mates (Buss, 1989). Beauty might attract, while the opposite might evoke avoidance (Park, Van Leeuwen, and Chochorelou, 2013). Preferences for attractive partners and aversions for unattractive partners might motivate individuals with visual imperfections (concerning, e.g., skin condition) to conceal them by using cosmetics and make-up. Such a tactic might be more critical in pathogen-rich environments (Penton-Voak et al., 2004).

1.3. Biosocial role theory

Biosocial role theory (formerly known as social role theory; Eagly and Wood, 1999, 2016; Wood and Eagly, 2012) attempts to explain, inter alia, salient gender differences across cultures. Sexually dimorphic biological characteristics of women and men (women's childbearing and nursing of infants and men's size and strength) are said to underlie the division of labor between human sexes (Eagly, 1987). This biological division interacts with social factors. In particular, the greater the gap between gender roles in a given society (i.e., norms and shared beliefs about how men and women should act; Wood and Eagly, 2012), the stronger the pressure to conform to gender-typical behaviors. These stereotypical gender roles are reinforced from early childhood through socialization (Sani and Quaranta, 2017) and remain an active force into adulthood (Wood and Eagly, 2012), ultimately becoming prevalent beliefs in the given society (Eagly, Wood, and Diekman, 2000).

Stereotypically, beauty is often a vital part of the feminine gender role across a broad range of cultures (Buote, Wilson, Strahan, Gazzola, and Papps, 2011; Fredrickson and Roberts, 1997). This aligns with the mating market perspective. However, while the mating market perspective hypothesizes such sex/gender differences to be found in equal terms everywhere (regardless of cultural background), the biosocial role theory emphasizes that such differences might be more pronounced in countries with more gender inequality. Similarly, on an individual level, women adhering to more gender-unequal (vs. more gender-equal) views are hypothesized to more readily endorse gender-specific social expectations including those of beauty ideals. One of the ways in which gender inequality manifests itself is via income inequality. That is, women, on average, earn less than men do (Avram & Popova, 2022). Blake, Bastian, Denson, Grosjean, and Brooks (2018) found some support for such claims, showing that areas in the USA with higher income inequality were related to relatively more intense body modifications. Another experimental study provided evidence for a causal relationship: when exposed to cues of higher income inequality, women expressed increased intentions to wear revealing clothing (Blake and Brooks, 2019).

1.4. Cultural media perspective

Following a cultural media perspective (Murnen and Seabrook, 2012; Stephens, Hill, and Hanson, 1994; Xu et al., 2010), many scholars appeal to the influence of mass media when explaining the pursuit of good looks. According to Festinger's (1954) social comparison theory, humans have an innate drive to compare themselves with others. Further, it is surmised that the Western canon of beauty is responsible for pressuring women to conform to the expected feminine beauty ideal. Notably, this beauty ideal is unattainable for most women (Grogan, 2016), but this does not prevent women from internalizing cultivated patterns of beauty (Brownell, 1991). In line with this reasoning, Fredrickson and Roberts (1997) laid the foundations of the objectification theory, which posits that women internalize others' perspectives as a primary view of themselves and their bodies. Initially, scholars focused on the adverse effects of objectification experienced by women (Moradi and Huang, 2008). However, it is now widely accepted that men are likewise subject to objectification and can struggle with its adverse effects (Davids, Watson, and Gere, 2019). For instance, treating oneself as

an object fosters body monitoring and body anxiety (Fredrickson and Roberts, 1997).

Social media provides an increasing array of opportunities to compare oneself with others and to receive objectified comments about oneself (Fardouly, Diedrichs, Vartanian, and Halliwell, 2015). Furthermore, social media offers readily available knowledge on current beauty products, technologies, and procedures. Such products may be easily accessible for purchase online. Notably, social media usage is now a nearly universal phenomenon (Kowal et al., 2020). As such, numerous concerned voices have been raised about how mass media's potentially negative impact has progressed in recent years (Wiederhold, 2019). For instance, it has been shown that more frequent use of social media is linked to increased self-objectification and body image concerns (Fardouly, Willburger, and Vartanian, 2018). A recent meta-analysis confirmed a positive link between social media use and disturbances in body image (Saiphoo and Vahedi, 2019).

1.5. Individualism-collectivism continuum

We also investigated the link between behaviors aimed at improving physical attractiveness and the individualism-collectivism dimension, namely, how people construct their identity in relation to others (Markus and Kitayama, 1991). A collectivistic attitude pertains to conformity, cooperation, and favoring group interests above one's individual interests (Triandis, McCusker, and Hui, 1990). Individualistic values refer to valuing self-interest above group interest, emphasizing the importance of independence and pursuing one's goals (Morand and Walther, 2018). These can include self-actualizing one's beauty potential. Considering that the theme of beauty is salient in Western societies, and Westernized societies tend to be highly individualistic (Henrich, Heine, and Norenzayan, 2010; Hofstede, 1984, 2001), it is reasonable to assume that people from more individualistic cultures may grow up in environments filled with messages conveying beauty-enhancing ideals. O'Garo et al. (2020) showed that the internalization of Western ideals among Caribbean adolescents was associated with lower self-esteem and increased depressive symptoms. One way to improve one's self-esteem is to increase body satisfaction (Lennon and Rudd, 1994), for instance through self-modification (Fares et al., 2019).

1.6. Other factors

While most of the above-cited studies examining predictors of beauty-enhancing behaviors were performed on one specific population and tested hypotheses drawn from only one particular framework, self-enhancing activities are complex behaviors that can depend on numerous factors. Here, in addition to testing each of the frameworks described above (see Fig. 1 for the hypotheses' overview), we also control for national- and individual-level factors that were previously shown to interact with the intensity of beauty-enhancing behaviors, namely: socioeconomic status (Peterson and Palmer, 2017), self-assessed physical attractiveness (Antonova and Merenkov, 2020), education (Converse et al., 2016), and political beliefs (Peterson and Palmer, 2017).

2. Material and methods

The study's protocol was approved by the Principal Investigator's Institutional Review Board (IRB) at the Institute of Psychology, University of Wrocław. All team members who collected data followed the ethical guidelines of their IRBs, acting either on the ethical approval of the Principal Investigator's IRB or ethical approval received from their local IRBs. Further, all participants provided informed consent to

Mating Market Perspective:

H1: Women spend more time enhancing their beauty than do men.

H2: Individuals of reproductive age spend more time enhancing their beauty than do individuals not of a reproductive age.

H3: Single individuals spend more time enhancing their beauty than do individuals in romantic relationships.

Pathogen Prevalence:

H4: Individuals from countries with higher pathogen prevalence spend more time enhancing their beauty than do individuals from countries with lower pathogen prevalence.

H5: Individuals with a more severe history of pathogenic diseases spend more time enhancing their beauty than do individuals with a less severe history of pathogens.

Biosocial Role Theory:

H6: Women from countries with higher gender inequality spend more time enhancing their beauty than do women from countries with lower gender inequality.

H7: Women conforming to traditional gender roles spend more time enhancing their beauty than do women who conform less to traditional gender roles.

Cultural Media Perspective:

H8: Individuals who spend more time on social media spend more time enhancing their beauty than do individuals who spend less time on social media.

H9: Individuals who spend more time watching television spend more time enhancing their beauty than do individuals who spend less time watching television.

Individualism-Collectivism Continuum:

H10: Individuals from more individualistic countries spend more time enhancing their beauty than do individuals from more collectivist countries.

H11: Individuals with more individualistic attitudes spend more time enhancing their beauty than do individuals with more collectivist attitudes.

Fig. 1. Overview of postulated hypotheses on the origins of differences in beauty investments.

participate in the survey.

2.1. Participants

Out of 118,320 participants who gave their consent to participate in the survey, 93,158 individuals (from 93 countries with a minimum sample size of 30 individuals per country; Arend and Schäfer, 2019; Lieberoth et al., 2021) passed the attention check and their data were thus included in further analyses. The sample included 62,410 (67%) self-identified women, 29,501 (31.7%) self-identified men, 884 (0.9%) non-binary individuals, and 363 (0.4%) individuals who preferred not to indicate their gender. Age ranged from 18 to 90+ years ($M = 30.11$, $SD = 12.37$). Furthermore, 37,515 (40.3%) of individuals reported being single, 12,266 (13.2%) were dating, 23,764 (25.5%) were in a committed relationship, 19,550 (21%) were married, and 63 (0.001%) did not answer this item. For a detailed description of demographic characteristics per country, see Table S1 in Supplementary Materials. Most participants were not compensated for their participation (~6% of participants were reimbursed for their participation and ~9% received partial course credit). Because our sample overwhelmingly consisted of cis-gender individuals, we only included them in subsequent analyses.

2.2. Procedure

Using a forward-back translation procedure (Brislin, 1970, 1983), the survey was translated into 43 languages. Detailed instructions for all translating teams are given in Supplementary Materials. After the translation process was completed, the study for that given language was launched. Data collection spanned 5 months from April to August 2021. Data were collected mostly online (with a few exceptions, outlined in the Supplementary Materials). Collaborators were asked to invite participants from as diverse sample pools as possible (older and younger, men and women, from small and large cities, from the community and university samples, and so forth). We encouraged participants to share the link to the survey on their social media. Approximately 6% of the data were collected using outsourcing platforms (e.g., Prolific, mTurk).

2.3. Materials

2.3.1. Beauty-enhancing behaviors

A literature review, coupled with a pilot study (see Supplementary Materials for details), allowed us to identify eight common categories of beauty-enhancing behaviors, including: (1) applying makeup, (2) body hygiene, (3) using cosmetics, (4) exercising, (5) hair grooming, (6) clothing style, (7) following a specific diet, and (8) other (in which participants could describe what other activities they perform). In the current study, participants were asked to indicate whether and how often they performed the given beauty-enhancing activity (out of the list above). Importantly, participants were instructed to choose the given activity only if they performed it to look better (and not for other reasons, such as health concerns) and to indicate the time spent on a typical day performing the given activity.

The response-slider ranged from 0 min to 6 h and more per day, with 1-min scale points. We created two beauty-enhancing indices (see Supplementary Materials). The first (core) index included four activities most commonly viewed as aimed at improving attractiveness (i.e., applying makeup, body hygiene, using cosmetics, and hair grooming). The second (extended) index included these same core four behaviors, plus the remaining types of behaviors (i.e., exercising, clothing style, caring for diet, and any others that were manually reported by participants). Both indices comprised a sum of all minutes (to a maximum of 12 h per day) within each of the categories (core–consisting of traditional activities associated with enhancing beauty, McDonald's $\omega = 0.90$, and extended–consisting of all types of behaviors indicated as improving one's appearance, McDonald's $\omega = 0.95$). See Supplementary Materials for the Beauty-enhancing Behavior Scale.

2.3.2. Individual-level predictors

Endorsement of gender role equality was measured with the Gender subscale from the Gender Equitable Men Scale (Levtov, Barker, Contreras-Urbina, Heilman, and Verma, 2014). The subscale consists of three items (e.g., *A woman's most important role is to take care of her home and cook*), with responses ranging from 1–*definitely disagree* to 7–*definitely agree*. The scale was statistically reliable (McDonald's $\omega = 0.85$). The mean of the three items was calculated and reverse coded such that a higher score would indicate a higher endorsement of gender equality.

Individualism was measured by four reverse coded items (e.g., *Group success is more important than individual success*) from the Collectivism Scale (Wu, 2006), which aligns with Hofstede's cultural dimensions (Hofstede, 1984, 2001). Responses ranged from 1–*definitely disagree* to 7–*definitely agree*. After exploring the individualism scale, it became evident that one item (i.e., *Being accepted by members of the workgroup is very important*) may not reliably represent general attitudes toward individualism. Instead, it may be constricted to a work context. We performed an exploratory factor analysis, and as this single item loaded onto the individualism attitudes substantially less than did the other items (0.37 as compared to 0.83, 0.87, and 0.50), and fell below the usually recommended criterion (i.e., below 0.40; Costello and Osborne, 2019), we removed it and used the mean of the remaining three items in all subsequent analyses. The three-item individualism scale was statistically reliable (McDonald's $\omega = 0.79$).

Individual-level pathogen history was measured with nine items from the Pathogen Prevalence Index (Murray and Schaller, 2010). All items were modified so that they would pertain to an individual's history of nine infectious diseases, initially identified by Murray and Schaller (2010) when computing their country-level history of pathogen prevalence (the question was: *Have you ever contracted (been sick with) any of the following diseases? Leishmaniasis, Schistosomes, Trypanosomes, Leprosy, Malaria, Typhus, Filariae, Dengue, Tuberculosis*). Possible answers were: 0–*never*, 1–*once*, and 2–*multiple times*. A sum of the responses to each of the nine diseases comprised an individuals' pathogen history score.

Furthermore, gender, age, relationship status (transformed as 0–single individuals and 1–individuals in a relationship), time spent on social media, time spent watching TV, self-assessed attractiveness (from 1–*extremely physically unattractive* to 11–*extremely physically attractive*), attained education (from 1–*no formal education* to 7–*primary school through PhD, MD, JD, or other advanced degrees*), socioeconomic status (from to 1–*lower* to 5–*upper*), and political views (from 1–*far left* to 5–*far right*) were each measured with a single-item question (see Supplementary Materials for full list of questions).

2.3.3. Country-level predictors

Data on Gross Domestic Product (per capita) were obtained from the International Monetary Fund (2018), individualism scores from the Hofstede index (Hofstede, 2001; Hofstede, Hofstede, and Minkov, 2010), gender equality from the United Nations' Gender Inequality Index (GII), and pathogen prevalence from Murray and Schaller (2010) and from Fincher, Thornhill, Murray, and Schaller (2008). The latter index differs from the former in that it is based on contemporary and not historical epidemiological information and on seven rather than nine diseases (i.e., *Leishmaniasis, Trypanosomes, Malaria, Schistosomes, Filariae, Spirochetes, and Leprosy*).

2.4. Statistical analyses

As a first step, Pearson correlations across the variables of interest were computed and the reliability of the gender role equality and individualism scales were tested using McDonald's ω *(as reported above)*. In the next step, we tested for measurement equivalence between the

gender role equality and individualism scales (see Supplementary Materials for details).

The Mahalanobis Distance for an outcome variable was calculated relying on the usually recommended cutoff (i.e., < 0.001; Mahalanobis, 1960; Penny, 1996) when screening for potential outliers. Data from 1478 participants were excluded based on this criterion. Multilevel analyses with a maximum likelihood estimator were then conducted. Participants were nested within countries to account for the non-independence between inhabitants of the same geographical territories. Then, self-reported individual-level predictors were group-mean centered, including time spent on social media and watching TV, age, self-assessed physical attractiveness, attained education, adherence to gender role equality, individualism, pathogen history, socioeconomic status, and political beliefs. Country-level predictors were grand-mean centered, including Gross Domestic Product (GDP) per capita, individualism score, gender equality score, and pathogen prevalence. After investigating the countries' residuals (the joint distribution of the random intercepts and slopes), it was decided to dummy out five countries (i.e., Ghana, Morocco, Nigeria, Thailand, Tunisia), as they violated the assumption of normality in the multivariate group-level distribution of the residuals (Jones and Subramanian, 2019). This method controls for variability and potential biases linked in the data (Jones and Subramanian, 2019), while still retaining all participants in those countries ($N = 4446$) in our models.

In the first models, indices of the time spent enhancing one's beauty (both the core and extended behaviors) were regressed on individual level predictors (gender, age, relationship status, time spent on social media, watching TV, self-assessed attractiveness, attained education, socioeconomic status, and political views). In the second model, random slopes of gender and age were estimated. The third model introduced country-level variables (GDP per capita, individualism score, gender equality score, and pathogen prevalence). When comparing the three models, the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC) were employed. The recommended guidelines were adhered to, that is, the change in the BIC between the two models (when $\Delta BIC > 10$, the latter model indicates a better fit; Raftery, 1995) and the change in the AIC between the two models (similarly as in the BIC; Burnham and Anderson, 2004). Next, relationship status was re-coded into four categories (single, dating, committed relationship, married) and post-hoc comparisons with Tukey correction were performed. Then, we tested the final model with time spent exercising as an outcome variable. In the last step, we compared the BIC and AIC of the models derived from each of the perspectives against a full model including all predictors. All analyses were performed in R (Version 4.1.0; for the list of R packages, see Supplementary Materials).

3. Results

Correlations between time spent enhancing one's beauty and other variables of interest are presented in Table S2 in Supplementary Materials. Fig. 2 illustrates the standardized time spent on beauty-enhancing behaviors (extended index) across countries, and Fig. 3 shows gender differences across countries. See Supplementary Materials for figures showing standardized time spent enhancing beauty across countries and gender, independently for each of the eight types of activities aimed at increase one's appearance (Figs. S1–S9).

As described in the statistical analysis section, the equivalence of invariance of the two scales, namely gender role equality and individualism, was first investigated. Detailed descriptions of the multigroup confirmatory factor analyses are presented in Table S3 and Table S4 in the Supplementary Materials, respectively. In short, our results indicated that partial scalar invariance was reached for both the gender role

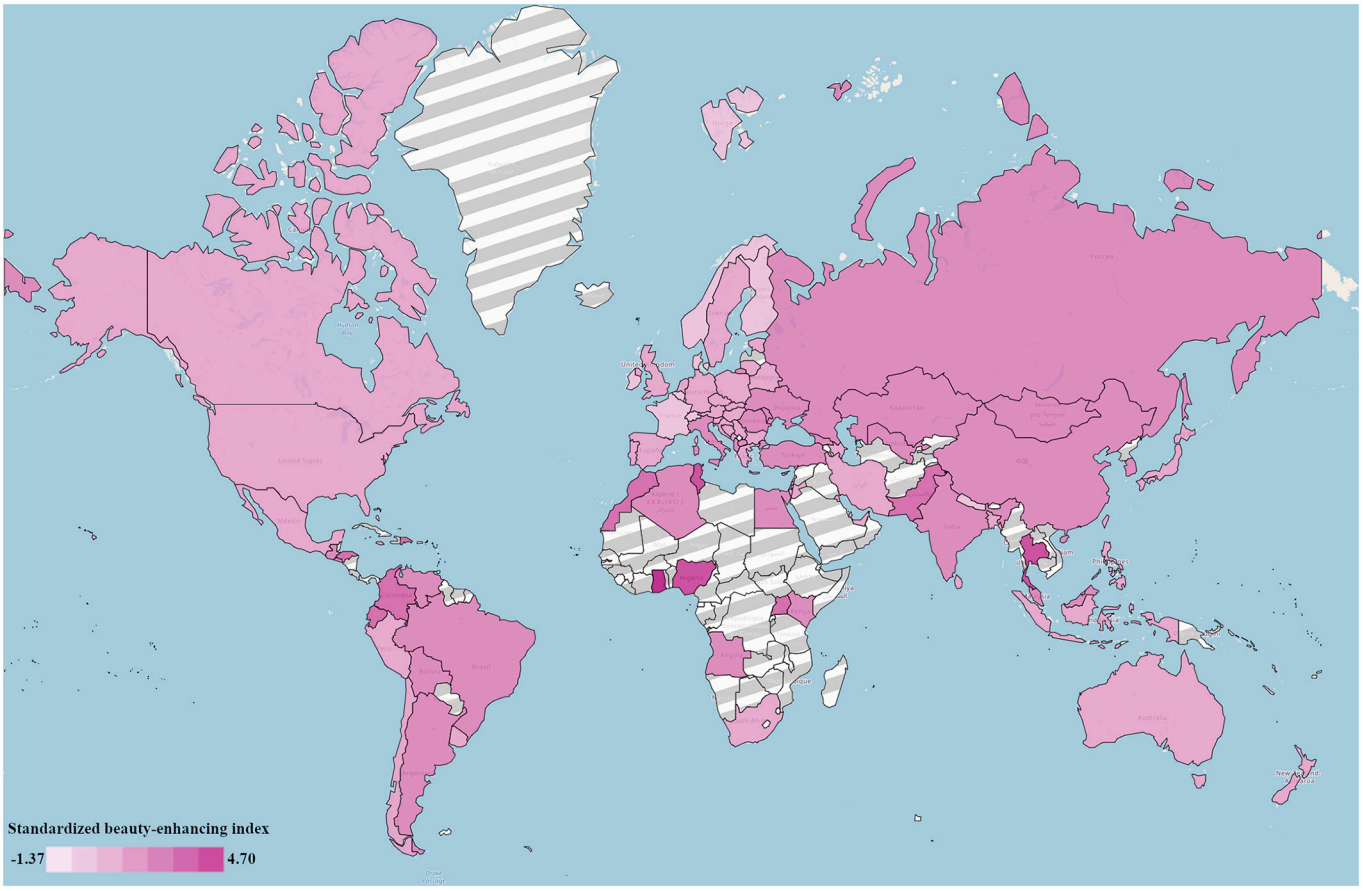

Fig. 2. Standardized time spent on beauty-enhancing behaviors across countries (gray strips indicate a lack of data for a given region).

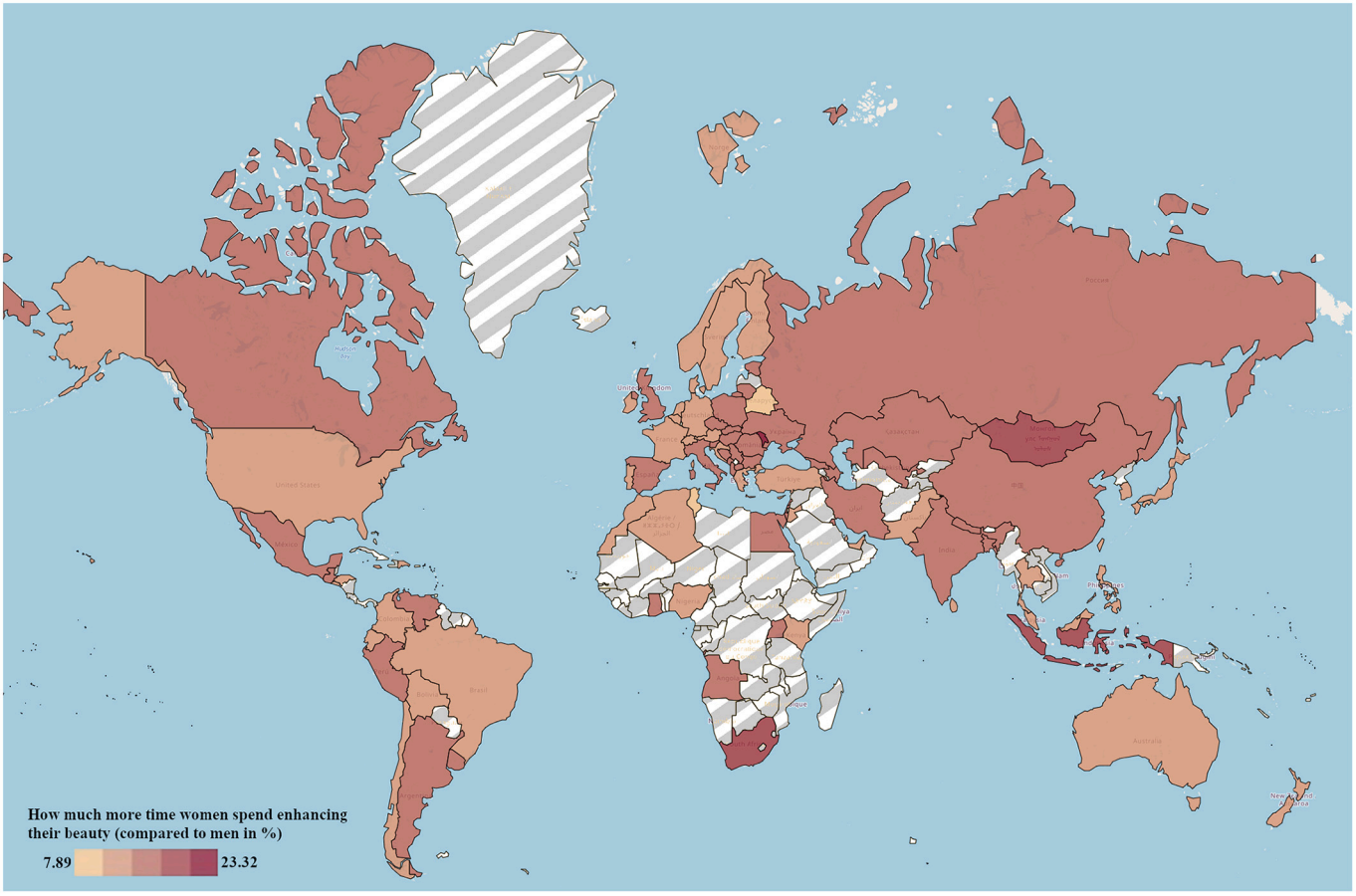

Fig. 3. Gender differences (in percentages) in time spent enhancing beauty across countries (gray strips indicate a lack of data for a given region).

equality and individualism scales.

The results of the models with core and extended indices of beauty-enhancing behaviors as outcome variables showed the same pattern of results. Thus, here we present the results of the model with the extended index, as it captures more variety of behaviors aimed at improving one's appearance (for results of the model with the core attractiveness index as an outcome variable, see Table S5 in Supplementary Materials). Furthermore, when comparing the three multilevel models (the first, with individual-level predictors, the second, with freed slopes of age and gender, and the third, with country-level predictors), the second model showed a superior fit compared with the first (ΔBIC = 573), but the third model showed a superior fit compared with both the second (ΔBIC = 10), and the first (ΔBIC = 563). Similar results were yielded by the AIC. Each subsequent model provided a better fit to the data (ΔAIC = 477 between the first and second model, ΔAIC = 17,712 between the second and third model, and ΔAIC = 18,189 between the third and first model). Thus, herein, we report the results of the third, best fitting model.

As illustrated in Table 1, we examined the predictors of investing time on beauty-enhancing behaviors (see also Fig. 4). Consistent with Hypothesis 1, more time on beauty enhancing behaviors was spent by women than by men. Whereas women spend an average of 238 min a day (approximately 4 h) enhancing their attractiveness when all eight types of behaviors are considered, men spend an average of 215 min a day (approximately 3.6 h daily). In an explorative vein, when we regressed the time spent exercising on the predictors from the final model, men invested more time in this beauty-enhancing activity than did women ($\beta = -0.139$, $SE = 0.010$, $p < 0.001$; see Table S6 for detailed results). However, when physical exercise was excluded, women still spent more time overall enhancing their attractiveness (mean 211 min) than did men (182 min).

Partly in accord with Hypothesis 2, there was a curvilinear relationship between beauty-enhancing behaviors and age, meaning that the youngest and oldest individuals spent more time enhancing their appearance than did those of intermediate age (see Fig. 5). Contrary to Hypothesis 3, there was a positive relationship between time spent improving one's attractiveness and relationship status (i.e., being single vs. non-single). However, when we broke down the relationship status into the four original categories (single, dating, in a committed relationship, and married), post-hoc analyses revealed that dating individuals spent more time enhancing their beauty than did people in the three remaining categories ($z > 6.075$, $p < 0.001$; see Fig. 6).

Contrary to Hypothesis 4, there was no relationship between beauty investments and a countries' pathogen prevalence. However, when we examined the robustness of this finding using an alternative measure of pathogen prevalence (Fincher et al., 2008), we observed a positive relationship ($\beta = 0.096$, $SE = 0.036$, 95%CI [0.025, 0.167], $p = 0.008$) between countries' index of pathogen prevalence and time spent enhancing physical attractiveness (controlling for other predictor variables from the model). Consistent with Hypothesis 5, individuals with a relatively more severe history of pathogenic diseases spent more time enhancing their beauty (see Table 1). To test Hypotheses 6 and 7, we regressed the predicted values of the final model on both country- and individual-level gender role equality scores among women only (see Table S7 in the Supplementary Materials). Results revealed that women from less gender-equal countries ($\beta = -0.186$, $SE = 0.022$, $p < 0.001$), and with less equal gender-role attitudes ($\beta = -0.130$, $SE = 0.004$, $p < 0.001$) spent relatively more time enhancing their beauty. This result is consistent with both Hypotheses 6 and 7. Furthermore, the same pattern of results emerged when running the analysis on the full sample, with both men and women included (see Table 1).

Table 1
Results of the multilevel linear model regressing time spent on beauty-enhancing behaviors (the extended index with eight behaviors) on variables of interest with participants nested within countries.

Fixed effects	β	SE	95% CI	p
Country-level predictors				
GDP (per capita)	–0.015	0.038	[−0.090, 0.060]	0.694
Country's Individualism	–0.050	0.034	[−0.117, 0.017]	0.146
Country's Gender Equality	–0.073	0.033	[−0.137, −0.009]	0.025
Country's Pathogen Prevalence	0.044	0.033	[−0.021, 0.109]	0.185
Individual-level predictors				
Gender[a]	0.083	0.010	[0.064, 0.103]	<0.001
Age	–0.103	0.021	[−0.144, −0.061]	<0.001
Age^2	0.114	0.019	[0.077, 0.151]	<0.001
Relationship Status[b]	0.013	0.004	[0.006, 0.020]	<0.001
Individual Pathogen History	0.056	0.003	[0.049, 0.063]	<0.001
Gender Role Equality	–0.123	0.004	[−0.130, −0.116]	<0.001
Time on Social Media	0.143	0.004	[0.136, 0.150]	<0.001
Time Watching TV	0.066	0.003	[0.059, 0.072]	<0.001
Individualism	0.016	0.003	[0.009, 0.022]	<0.001
Self-assessed Attractiveness	0.089	0.003	[0.083, 0.096]	<0.001
Education	–0.027	0.004	[−0.034, −0.019]	<0.001
Political Views	0.032	0.003	[0.025, 0.039]	<0.001
Socioeconomic Status	0.049	0.003	[0.042, 0.056]	<0.001
Random effects	*Variance*	*SD*		
Intercept	0.027	0.164		
Gender	0.019	0.137		
Age	0.005	0.068		

[a] Men as a reference group.
[b] Single individuals as a reference group, $ICC = 0.036$, Pseudo $r^2 = 0.164$, $df_{residuals} = 71{,}081$, deviance = 176,329.4, all VIFs below 4.49 ($M = 1.01$, $SD = 1.19$).

Consistent with Hypotheses 8 and 9, individuals who spent more (vs. less) time on social media and watching TV invested more time improving their appearance. Contrary to Hypothesis 10, there was no relationship between beauty-enhancing activities and countries' individualism scores. Consistent with Hypothesis 11, individuals with more individualistic (vs. collectivistic) attitudes spent more time enhancing their physical attractiveness (see Table 1 for full results). We also tested the robustness of these results by running a model in which all individual-level predictors were permitted to vary. Freed coefficients remained virtually the same (except the binary coded relationship status, which ceased to be significantly related to beauty-enhancing behaviors; see Table S8 in the Supplementary Materials).

Furthermore, we found that more time improving one's appearance was spent by individuals who considered themselves as more (vs. less) attractive, less (vs. more) educated, individuals with higher (vs. lower) socioeconomic status, and individuals with more right-wing (vs. left-wing) political views. There was no relationship between time spent improving one's attractiveness and the countries' gross domestic product per capita. When comparing the models derived from each of the perspectives (i.e., mating market perspective, biosocial role theory, pathogen prevalence, cultural media perspective, and individualism-collectivism continuum) against a model that included all predictors, we found that the full model had the best fit to the data (all ΔBIC > 45,258 and ΔAIC > 45,468).

In an exploratory vein, we more closely investigated gender differences with a multilevel model that included interactions with gender and all predictor variables (for detailed results, see Table S7 in the Supplementary Materials). We then followed up with separate analyses for men and women (see Tables S9–S10 in the Supplementary Materials). Results revealed significant interactions between gender (with men as a reference group) and: countries' GDP, historical pathogen prevalence, participants' age, time spent on social media, time spent watching TV, self-assessed physical attractiveness, endorsement of gender roles, attained education, and political beliefs. In contrast, interactions between participant gender and countries' individualism score, gender equality, and participants' relationship status, individualism score, history of transmittable diseases, and socio-economic status were non-significant. After closer inspection, we observed that the effects were larger for women than men in the case of individual endorsement of gender roles and time spent watching TV, but larger for men than women in the case of time spent on social media, self-assessed physical attractiveness, history of transmittable diseases, and SES. In short, men who were wealthier, who more often used social media, perceived themselves as more physically attractive, and had previously contracted transmissible diseases tended to spend more time on appearance enhancement, whereas these patterns were less pronounced among women. Sex-specific effects were also non-significant for men but significant for women in the case of countries' Gross Domestic Product (per capita), age, relationship status, individualism score, attained level of education and political beliefs, and non-significant for women but significant for men in case of countries' gender equality (see Tables S7, S9–S10 and Figs. S10–S19 in the Supplementary Materials).

Furthermore, we closely examined the non-linear relationship between time spent enhancing physical attractiveness and self-assessed physical attractiveness. Results revealed that this relationship was U-shaped. More specifically, the most time on beauty enhancing behaviors was performed by participants who considered themselves as the most physically attractive, followed by those who viewed themselves as the least physically attractive, with those who believed themselves as averagely attractive spending the least amount of time improving their attractiveness (see Table S11 and Fig. S20 in the Supplementary Materials).

Finally, we performed a factor analysis on the eight beauty-enhancing items to test whether distinct factors would emerge. Results of the parallel analysis suggested a 2-factor structure of the measure, which was further confirmed by analyses of Eigenvalues. When analyzing the items' loadings (above the usually recommended cutoff of 0.40; Costello and Osborne, 2019), six items (i.e., cosmetics usage, make-up, body hygiene, exercising, caring for hair and dress) loaded onto the first factor, while the other two items (i.e., caring for diet and "other" types of activities) loaded onto the second factor. We repeated the analyses with these two factors separately, introduced as outcome variables, however, the pattern of results remained similar (for detailed results, see Tables S12-S13 in the Supplementary Materials).

4. General discussion

Many scholars have called for a large-scale study on primarily non-Western samples to comprehensively examine predictors of activities aimed at improving physical attractiveness in humans (see, e.g., Bradshaw and DelPriore, 2021; Davis and Arnocky, 2020; Wagstaff, 2018). The present multi-national investigation addressed this core need by testing evolutionarily-driven hypotheses, alongside several other influential hypotheses regarding beauty-enhancing behaviors that have not been jointly and empirically verified in a large-scale global investigation.

4.1. Mating market perspective

We observed that globally, while both sexes spent approximately an average of 4 h a day on behaviors specifically aimed at improving their attractiveness, women reported spending an average of 23 more minutes a day enhancing their beauty than did men. The effect size of this gender difference was moderate compared to other predictors and in general, corroborates the results of previous studies (see, e.g., Biesterbos et al.,

Theoretical background	Who will spend more time enhancing beauty?			Evidence?	Effect size
Mating Market Perspective	Women	>	Men	✓	●
	Of reproductive age	>	Not of reproductive age	✓ / U-shape	●
	Single	>	Non-single	✗ (dating > rest)	•
Pathogen Prevalence	High pathogen stress (countries)	>	Low pathogen stress (countries)	✗ (no differences)	–
	High pathogen stress (individuals)	>	Low pathogen stress (individuals)	✓	●
Biosocial Role Theory	Gender-unequal countries	>	Gender-equal countries	✓	●
	Women conforming to traditional gender roles	>	Women not conforming to traditional gender roles	✓	●
Cultural Media Perspective	More time on social media	>	Less time on social media	✓	●
	More time watching TV	>	Less time watching TV	✓	●
Individualism-collectivism continuum	Individualistic (countries)	>	Collectivistic (countries)	✗ (no differences)	–
	Individualistic (individuals)	>	Collectivistic (individuals)	✓	•
Other variables	High SES	>	Low SES	✓	•
	High attractiveness	>	Low attractiveness	✓	●
	Less educated	>	More educated	✓	•
	Right-wing political beliefs	>	Left-wing political beliefs	✓	•

Fig. 4. A summary of the hypotheses and results with effect sizes (standardized coefficients; Lorah, 2018), ordered from the largest effect sizes (largest dots; standardized coefficients from 0.100 up), through to moderate effect sizes (medium-sized dots; standardized coefficients from 0.050 to 0.099), to the smallest effect sizes (smallest dots; standardized coefficients from 0.049 or less; dashes represent non-significant associations).

2013; Corson, 1972; Ficheux et al., 2016; Gunn, 1973). For instance, cosmetics generally increase women's attractiveness as rated by themselves (Anchieta et al., 2021) and by others (e.g., Tagai, Ohtaka, and Nittono, 2016). Future studies are still needed to disentangle whether the main motive to increase one's attractiveness for women is to attract other mates, retain a current mate (Davis and Arnocky, 2020), increase one's social status (Bradshaw and DelPriore, 2021), or a combination of these and other factors.

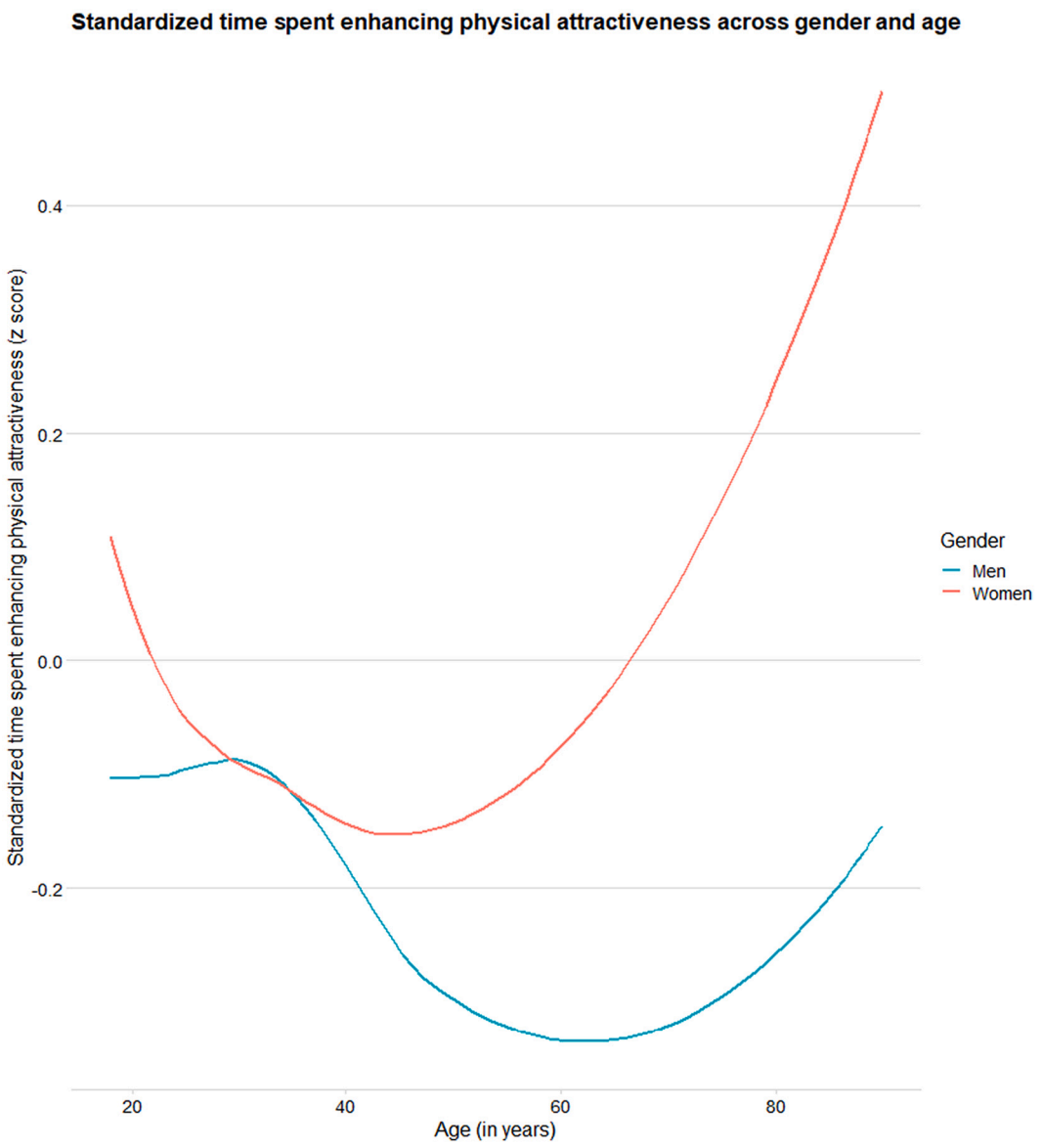

Fig. 5. Standardized time spent enhancing beauty across ages and gender (i.e., women and men).

Apart from cosmetics usage, we show that many other activities are undertaken across cultures to increase physical attractiveness (Davis and Arnocky, 2020). One such activity is physical exercise. Previous studies found that men exercise more than women do (Deaner and Smith, 2013; Hsu and Valentova, 2020; Mafra, Castro, and Lopes, 2016; Sallis, Zakarian, Hovell, and Hofstetter, 1996), and that men's motivation to exercise, at least in part, stems from their desire to increase their attractiveness (Antonova and Merenkov, 2020). We observed the same pattern of results in our study. The mating market perspective provides a plausible explanation for this phenomenon: physical training increases male formidability and strength, which, in ancestral times, were related both directly and indirectly to ancestral males' and their partners' fitness (Sell et al., 2009; von Rueden et al., 2008). Strength is often closely connected to men's bodily attractiveness (Lidborg, Cross, & Boothroyd, 2022; Sell, Lukazsweski, and Townsley, 2017), as is muscularity (Frederick and Haselton, 2007). Fat-free muscle mass has been linked to having more sex partners (Lassek and Gaulin, 2009). However, when all types of activities aimed at increasing one's beauty were considered here, it was still women who spent more time daily enhancing their appearance compared to men, which confirms the first hypothesis.

The current study partly corroborated our second hypothesis. The results showed a U-shaped relationship between the intensity of beauty-enhancing behaviors and age, but only among women. This implies that middle-aged women spent the least amount of time improving their attractiveness (see Fig. 3). To put this into perspective, 18-year-old women spent 63 more minutes a day enhancing their appearance than did 44-year old women, whereas 60-year-old women spent 30 more minutes than did 44-year old women, on average. This effect size was large compared to other predictors. According to the mate preferences perspective, younger individuals of reproductive age should be more interested in attracting potential mates because their own reproductive potential is relatively high (Fitzgerald et al., 1998; World Health Organization, 2006). Once reaching a certain age, an individual may realize the footprint of time on their face and body (e.g., wrinkles, graying hair, weight gain; Winterich, 2007). Ficheux et al. (2016) found that older French people used more cosmetics than their younger counterparts. Women aged 40 years or older who wear make-up appear younger than same-aged women who do not wear make-up (Russell et al., 2019), though this effect is not present among women aged 30 years or less. Notably, the perceived adverse effects of time on appearance are often more severe in the case of women than men (Gerbner, Gross, Signorielli,

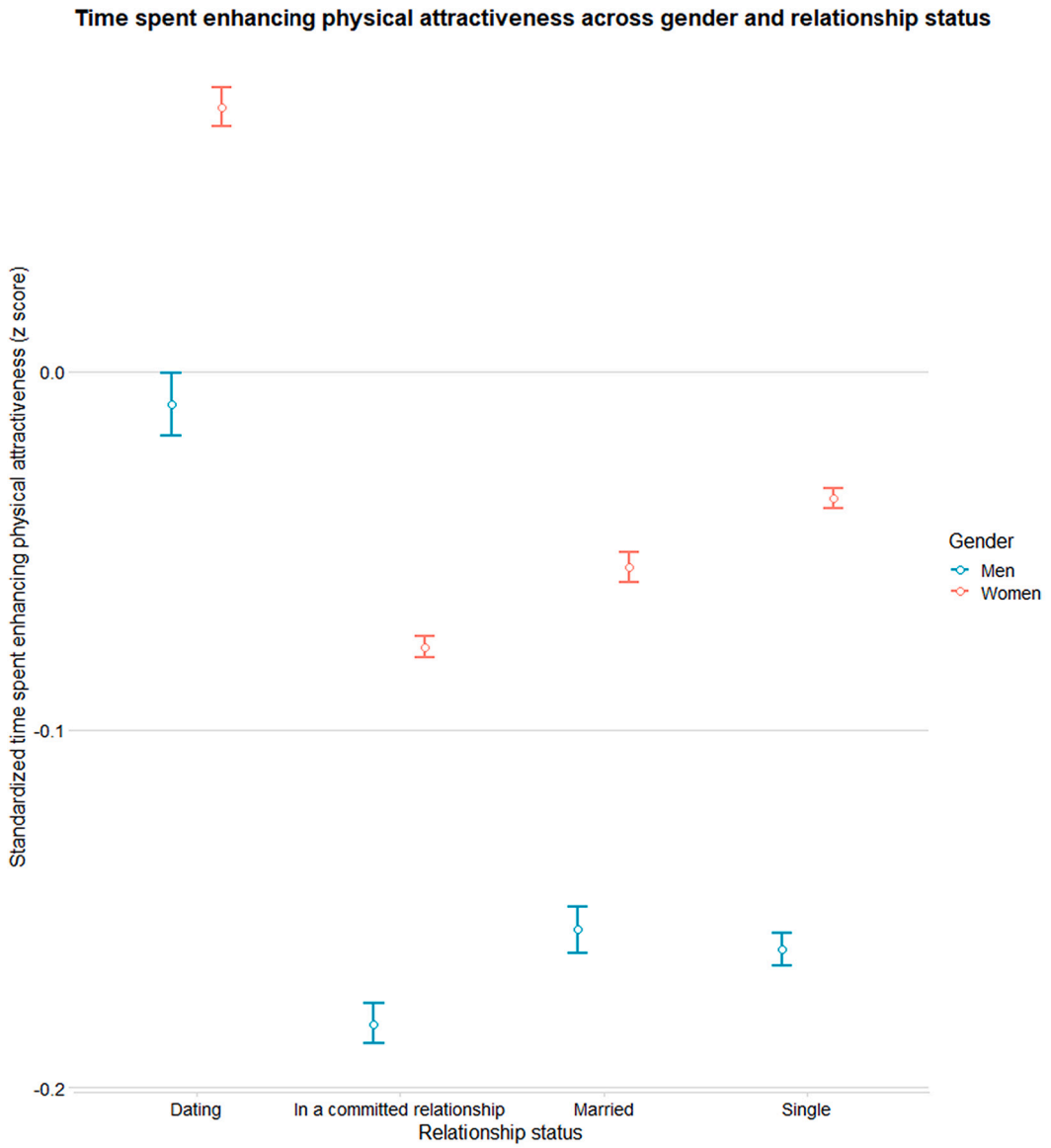

Fig. 6. Standardized time spent enhancing beauty across relationship status (i.e., single, dating, in a committed relationship, and married) and gender (i.e., women and men). *Note. Error bars represent standard errors.*

and Morgan, 1980; Lauzen and Dozier, 2005), which is in line with the results of the present study, as age was unrelated to time spent enhancing attractiveness by men.

Surprisingly, we found evidence against the third hypothesis: being in a relationship was linked to more, not less, intense beauty-enhancing behaviors. However, after a closer inspection, we observed that dating individuals spent more time improving their appearance than did single people (on average 24 min more a day), married people (26 min more), and individuals in committed relationships (29 min more). This result is especially interesting, as it may explain the inconsistent findings of past research (see, e.g., Fisher et al., 2009; Mafra et al., 2020; Miguel and Buss, 2011; Perilloux and Buss, 2008). The mating market perspective surmises that individuals who are not pair-bonded are highly interested in finding a potential mate (Buss, 2015). Hence, dating individuals may fall into this category, as they are actively pursuing a potential partner. Conversely, individuals in committed relationships including marriage are already pair-bonded, and thus, are typically less interested in finding a new mate. At the same time, single individuals may opt not to pursue a mate and conscientiously decline using any strategies (including self-modification) to acquire one. The present results do question previous hypotheses on improving one's appearance as a tactic to retain current partners (Davis and Arnocky, 2020). It seems that such a motive, among many others previously identified in the literature, such as intrasexual competition (Mafra et al., 2020; Varella, Valentova, and Fernández, 2017), social prestige (Mileva, 2016), and status-seeking (Blake, 2021), might be less pronounced compared to the motive of attracting a potential partner. Thus, to disentangle the influence of relationship status on beauty enhancing behaviors, researchers should control the type of relationship more specifically–not only controlling whether individuals are in a relationship, but also whether they are currently courting.

4.2. *Pathogen prevalence*

We found evidence for the fifth hypothesis and less consistent evidence for the fourth. Individuals with a more severe history of transmittable diseases spent relatively more time improving their appearance, but the relationship between country-level pathogen prevalence and beauty-enhancing behaviors only emerged when using the pathogen prevalence index from Fincher et al. (2008), but not from Murray and Schaller (2010). The effect size for the individual level

pathogen history was moderate compared to other predictors. Interestingly, the link between time spent enhancing one's attractiveness and individual history of transmittable diseases was more pronounced for men than women. It is noteworthy that the immunosuppressive effects of circulating testosterone, that are higher in men than women, may make men more vulnerable to pathogens than women (Furman et al., 2014; Giefing-Kröll, Berger, Lepperdinger, and Grubeck-Loebenstein, 2015).

The pathogen prevalence index (Murray and Schaller, 2010), which was introduced as a country-level predictor variable, was drawn from historical data on the severity of transmittable diseases in given countries. It may be that the effects of modernization and globalization are slowly leveling traditional inequalities in access to health care. Thus, countries that struggled with severe diseases in the past (e.g., Burkina Faso, Burundi, and the Central African Republic; Bhargava, Jamison, Lau, and Murray, 2001) may now provide better healthcare for their citizens (WHO, 2000). We conclude that it might be preferred to consider more contemporary approaches to computing pathogen prevalence (Fincher et al., 2008) when analyzing phenomena that are strongly affected by the current socio-environmental conditions more than those of the distant past (i.e., behaviors aimed at increasing one's physical attractiveness; Blake, 2022; Mafra et al., 2020).

When considering an individual's history of pathogen stress, we observed that those who suffered from more transmittable diseases in their lifetimes also spent more time enhancing their beauty than did those who reported a more favorable health history. On average, those who suffered from one or more diseases spent as much as 1.5 h more improving their appearance compared to those who did not encounter any severe infections in their lifetimes. Physical attractiveness can indicate the absence of underlying diseases (Tybur and Gangestad, 2011; but see Jones, Holzleitner, and Shiramizu, 2021), and it may be that people are aware of this link (Gray and Boothroyd, 2012; Henderson and Anglin, 2003). Indeed, Fink et al. (2017) showed that ratings of facial healthiness correlate with ratings of facial attractiveness. On the other hand, individuals who are perceived as unhealthy and less attractive might evoke negative psychological and physiological responses (e.g., disgust; Principe and Langlois, 2011; Schein and Langlois, 2015). Individuals who have undergone severe diseases may have more visible perceived imperfections (e.g., asymmetries or flawed skin condition; Samson, Fink, and Matts, 2010). As evidenced by Wakeda, Okamura, Kawahara, and Heike (2020), such individuals might be more motivated to cover these imperfections to present themselves as healthier (and more attractive) than they actually are. An alternative but not mutually exclusive explanation would be that performing beauty-enhancing behaviors by individuals who suffered from infectious diseases might simply take more time than performing those same behavior by their counterparts who did not suffer from health and body devastating diseases. While using make-up is a relatively simple behavior for women, men might have to go to greater lengths to achieve the same level of attractiveness enhancement, hence the observed larger effect sizes for men than women with a history of pathogen stress. However, one needs to keep in mind that relatively few individuals have suffered from any of the nine transmittable diseases tested here, and thus, this result needs to be cautiously interpreted.

4.3. Biosocial role theory

We found support for both the sixth and seventh hypotheses: women from countries with lower (vs. higher) gender equality and women conforming (vs. not conforming) to traditional gender roles spent more time enhancing their attractiveness. Interestingly, the effect size for gender role equality on an individual-level was large, while moderate on a country-level. Our results align with early studies demonstrating a link between attitudes toward gender roles and attitudes toward one's body (Freedman, 1984; Striegel-Moore, Silberstein, and Rodin, 1986). Jackson, Sullivan, and Rostker (1988) observed that cultural standards about beauty affect women who adhere to stereotypical gender roles more than they affect those who have less favorable attitudes toward stereotypical gender roles. Furthermore, Shipley, O'donnell, and Bader (1977) provided evidence that women who decided to augment their breasts through an invasive surgery were more prone to comply with traditional gender roles than were women in the control group.

Women from more gender-equal countries and with more gender-equal personal attitudes may be less pressured to comply with the belief that beauty is a prerequisite of the feminine gender role (Buote et al., 2011; Fredrickson and Roberts, 1997). Instead, they may fulfill themselves differently, going beyond the traditional feminine stereotype (Jameson, 2012). The role of gender equality on beauty ideals is an active and important avenue of research that must now aim to include women from a broader range of cultures. Our results show similar relationships are also found among men. The more gender-equal the country and the higher men's individual levels of endorsement of gender equal roles, the less time men spent enhancing their physical attractiveness. This result is especially interesting when considering that, stereotypically and traditionally, men are thought to be less interested in their appearance relative to women (IIsser, 2020). However, other factors may come into play for such men. For instance, because upper body strength has been hypothesized to serve an important role in our evolutionary past (Puts, 2010), and still today, more muscularized men are considered more masculine (McCreary, Saucier, and Courtenay, 2005). Hence, men who wish to be perceived as masculine may be particularly interested in performing physical exercises (Galli, Petrie, Reel, Chatterton, and Baghurst, 2014; Yeung, Massar, and Jonas, 2021). Attaining a muscular body might be less important for men who do not conform to stereotypical gender roles (Readdy, Cardinal, and Watkins, 2011).

Considering all men and women in our study, those from the least gender-equal countries devoted on average one and a half hours more improving their attractiveness compared to those from the most gender-equal countries. This gap was even larger for individual-level endorsement of gender roles. Participants who had the lowest scores on the gender equality scale (that is, those who supported gender roles) devoted on average two hours more per day enhancing their physical attractiveness compared to those who had the highest scores on the gender equality scale (that is, those who did not support traditional gender roles).

4.4. Cultural media perspective

Results of the current study support both the eighth and nineth hypotheses: individuals who spent more time on social media and watching TV also spent more time enhancing their attractiveness. Most researchers agree that the media often conveys unrealistic physical ideals (Barlett, Vowels, and Saucier, 2008; Levine and Murnen, 2009; Thompson and Stice, 2001), that are also often unattainable for the average person (Grogan, 2016). Confronting one's body with the photo-retouched silhouettes of models may trigger many negative feelings and behaviors, including anxiety, depressive symptoms, body dissatisfaction, and eating disorders (Fardouly and Vartanian, 2015; Mills, Musto, Williams, and Tiggemann, 2018). Apart from evoking affective responses, watching idealized media images may also expose one to more advertisements aimed at appearance-enhancing products and may in turn increase a willingness to comply with the widespread canon of beauty (de Vries, Peter, Nikken, and de Graaf, 2014; Gambla, Fernandez, Gassman, Tan, and Daniel, 2017), that, presumably, may help to explain the strong link between media exposure and time spent improving one's attractiveness in the current research. However, given the correlational nature of this research, we cannot rule out the possibility that the direction of causality may be reversed, such that people who choose to invest more time improving their appearance are thus more prone to use social media, or the possibility that a third unknown factor may explain the link between beauty-enhancing behaviors and social media usage.

Interestingly, we observed that spending time on social media was more strongly related to enhancing one's beauty than was watching TV. In fact, social media usage was the strongest predictor of beauty-enhancing behaviors among all predictors. Furthermore, watching TV was more strongly related to physical attractiveness enhancing behaviors among women than men, while social media usage explained more variance in these behaviors among men than women. These results are in line with those of previous studies (see e.g., Sampasa-Kanyinga, Colman, Goldfield, Hamilton, and Chaput, 2020; Sorokowski et al., 2016). We also found that participants who spent the most time watching TV spent 1 h more time daily enhancing their attractiveness than did those who spent the least amount of time watching TV, on average. In comparison, those who spent the most time on social media spent 2 h more per day improving their looks than did those who spent the least amount of time on social media, on average.

Our results seem to corroborate those of previous studies highlighting an exceptionally strong negative link between social media usage and well-being, that is particularly worrisome given the stark rise in social media usage in the past decade. For instance, engaging in social media activity is linked to negative mood (Mills et al., 2018), poor academic performance (Abdulahi, Jalil, Lumpur, Samadi, and Gharleghi, 2014), chronic sleep deprivation (Abi-Jaoude, Naylor, and Pignatiello, 2020), and the possible emergence of depression, anxiety, and other mental disorders (Cataldo, Lepri, Neoh, and Esposito, 2021). Although some studies focus on counteracting these adverse effects (see, e.g., Fardouly and Holland, 2018; Tiggemann and Anderberg, 2020), more actions, especially from policymakers, are needed to protect the mental health of social media users.

4.5. Individualism-collectivism continuum

We found support for the eleventh but not tenth hypotheses: personal individualistic attitudes were positively related to the amount of time spent enhancing one's beauty, but country-level individualism scores were not. However, the effect size for individual-level attitudes toward individualism and collectivism was negligible compared to other predictors. Moreover, this effect was mainly driven by women, as the individualism score was not related to time spent enhancing attractiveness among men. The most individualistically oriented women spent half an hour more time improving their attractiveness than the most collectivistically-oriented women, on average.

Interestingly, our results contradict some previous findings. For instance, recent statistics revealed that people in Asia, where collectivism is, on average, more common than individualism, vigorously pursue beauty standards and spend the most money on skincare (Euromonitor, 2021), even compared with the leading Western economies that are more individualistic (e.g., USA or UK). Furthermore, one-third of women between the ages of 19 and 29 from South Korea (a collectivistic country) report undergoing aesthetic surgery (Gallup Korea, 2015; Hu, 2018). On the other hand, although individuals adhering to more individualistic values may be less prone to undergoing plastic surgeries (Frederick and Gan, 2015), as it is less of a cultural norm compared to some more collectivistic Asian countries (Heidekrueger et al., 2017), people with individualistic attitudes might nevertheless be more willing to perform other types of activities explored in the current study (e.g., body hygiene, caring for diet, exercising, hair grooming, clothing style).

4.6. Other factors

We observed a positive link between time spent enhancing beauty and higher socioeconomic status (stronger effect for men), lower education (but only among women), right-wing political beliefs (but only among women), and a U-shaped relationship for self-assessed attractiveness (stronger effect for men). Notably, only self-assessed attractiveness was moderately linked to self-modification, while the remaining predictors (socioeconomic status, attained level of education, and political beliefs) had small effect sizes.

Previous research has produced conflicting results about the relationship between self-assessed attractiveness and beauty-enhancing behaviors. On one hand, individuals with higher self-esteem (which is a predictor of higher self-assessed attractiveness; Bale, 2010) reported using fewer cosmetics (Fares et al., 2019). On the other hand, individuals who considered themselves more attractive spent more time improving their looks (Antonova and Merenkov, 2020). Our results shed more light on this matter by providing evidence that those who believe in their very high attractiveness care the most for their appearance, followed by those who consider themselves as very unattractive, with those who believe they look average spending the least amount of time improving their attractiveness. As we cannot infer causation from correlation, future studies could experimentally investigate whether enhancing one's beauty increases self-assessed attractiveness or rather that more beautiful individuals are more willing to increase (or maintain) their attractiveness (for some preliminary evidence on the first prediction, see Anchieta et al., 2021).

As for the explanation of other predictors, we hypothesize that individuals of a relatively higher socioeconomic status may have more time and money to improve their appearance, whereas higher education may work as a buffer against focusing excessively on one's appearance, while instead focusing on other traits and skills. Nevertheless, high education is usually linked to higher socioeconomic status (Boshara, Emmons, and Noeth, 2015), so the opposite results for these two variables require investigation in further studies. Finally, regarding political views, is it possible that physical attractiveness might be more important for relatively more conservative individuals. For instance, some researchers have found that right-wing politicians appear more attractive than left-wing politicians (Berggren, Jordahl, and Poutvaara, 2010) and right-wing political beliefs tend to be conservative (Karwowski et al., 2020). This hypothesis likewise requires further investigation.

4.7. Summary, limitations, and future directions

Several decades ago, a preoccupation with one's body image was thought to be a typically female issue (van Lennep, 1957). However, more recent studies provide converging evidence that men also care for their looks (Antonova and Merenkov, 2020; Kowal and Sorokowski, 2022; Mafra et al., 2016). Indeed, we show that only 0.003% of women or men indicate not doing anything to improve their appearance, and only 1% (among whom half were men) report spending <10 min a day enhancing their beauty. In comparison, 99% of the nearly one-hundred thousand people in our cross-cultural sample report spending >10 min a day enhancing their physical appearance, and on average around 4 h daily. Thus, we conclude that beauty-enhancing behavior is a universal phenomenon.

This may not come as a surprise, as previous studies provide abundant evidence that attractiveness can be beneficial in manifold ways and that humans are concerned with physical attractiveness, largely because of the social and reproductive benefits it can confer. For instance, more attractive individuals are often treated more positively (Langlois et al., 2000), are preferred as potential partners (Walter et al., 2020) and friends (Vannatta, Gartstein, Zeller, and Noll, 2009; Zakin, 1983), are perceived as healthier (Fink et al., 2017) and as more competent (Etcoff, Stock, Haley, Vickery, and House, 2011), are more likely to be hired for jobs (Cash and Kilcullen, 1985), earn higher tips as servers (Parrett, 2015), earn higher salaries both at the early stage of the career (Dossinger, Wanberg, Choi, and Leslie, 2019) and from a lifetime perspective (Scholz and Sicinski, 2015), are more popular as athletes (Mutz and Meier, 2016), receive a higher endorsement in politics (Berggren et al., 2010), and report higher psychological well-being and lower levels of distress and depression (Gupta, Etcoff, and Jaeger, 2016).

However, when it comes to factors linked to the intensity of beauty-enhancing behaviors, the matter becomes more complex, as many

aspects come into play. Apart from evolutionary theory, here we provide support for several other perspectives that have attempted to describe and explain who devotes more energy to enhancing one's appearance, and why. Importantly, these theories are not mutually exclusive. Instead, when considering them jointly, they offer a valuable and extensive (but not exhaustive) theoretical framework for analyzing activities aimed at increasing one's looks. Each perspective adds another piece to the puzzle by suggesting a distinctive (and as our results show, a significant) explanation for why a given social or demographic group should be particularly interested in improving their beauty. The mate preference perspective appeals to the human evolutionary past and sexual selection pressures that have shaped different mating strategies between the sexes (Buss, 2015; Tooby, 2018; Tooby and Cosmides, 1990; Walter et al., 2020). The pathogen prevalence approach suggests that humans have an evolved ability to detect cues of transmittable diseases, especially in pathogen-rich environments (Murray and Schaller, 2010), and one way to advertise one's health (i.e., a lack of pathogens) is through improving one's physical appearance (Tybur and Gangestad, 2011). The biosocial role theory concerns the influence of physiological differences and gender constructs on forming the propensity of women to comply with the pursuit of feminine beauty (Eagly and Wood, 1999; Wood and Eagly, 2012). The cultural media approach relates to the influence of mass media in pressuring people to conform to the westernized canon of beauty (Murnen and Seabrook, 2012; Stephens et al., 1994; Xu et al., 2010). The individualism-collectivism continuum refers to how an individual relies on others, either caring more for the welfare of their group or caring more for their personal aspirations and goals (Markus and Kitayama, 1991), which may be consequential when devoting time and energy to one's appearance.

Although the current study sheds new light on beauty-enhancing behaviors, it is not free of limitations. First, the research was conducted mostly with the use of virtual survey tools, rather than in person. Many researchers highlight the importance of advanced methods for screening and filtering careless responses in online surveys (see, e.g., DeSimone, Harms, and DeSimone, 2015; Wood, Harms, Lowman, and DeSimone, 2017) and thus, we excluded responses from participants who failed the attention check. Second, while our sample included a large number of countries (i.e., 93), it is not exhaustively representative of all human cultures. Moreover, even less representative are samples from less modernized countries, where access to Internet is relatively more limited than in more industrialized countries, in turn limiting the probability of participants from such samples being invited to participate in the study (Batres and Perrett, 2014). Third, our participants were primarily well-educated (65% obtained a bachelor's degree or higher), and most of them were women (67%). Fourth, our data are not experimental and thus, no causal conclusions can be made. Further studies could include a longitudinal design to explore intra-individual variability of self-modification practices. Fifth, most of our participants were cis-gender and heterosexual. It is important to replicate the present study on a more sexually diverse sample. Future studies could also provide some interesting insight on self-modification in dyadic relationships, depending on the partners' mate value: does a larger gap between the mate values of partners predict more intense beauty-investments? Sixth, although we emphasized to participants in written instructions to indicate time spent on a given beauty-enhancing activity *only* if it is performed for appearance-enhancing reasons (and not, for example, for health reasons), we cannot exclude the possibility that some participants miscounted time spent on various activities. Indeed, our study's greatest limitation is self-reported data, which is susceptible to biases and errors.

Our open-access dataset provides an excellent opportunity to further test a manifold of interesting hypotheses. Therefore, we encourage scholars to analyze it (the dataset is publicly available under the link https://osf.io/sh3an/) to shed even more light on attractiveness enhancing behaviors. One could, for instance, focus on the relationship between activities aimed at increasing one's appearance and country-level variables, such as income inequality (Blake and Brooks, 2019) or the modernization index (Zhang and He, 2015), and individual-level variables pertaining to, for instance, partners' relationships, such as durability of marriages (Parker, Durante, Hill, and Haselton, 2022) and marital satisfaction (Kowal, Groyecka-Bernard, Kochan-Wójcik, and Sorokowski, 2021). Finally, it is important to emphasize that the established boundaries among the theoretical perspectives examined in this study are in fact blurry, as the theories share many similarities in their rationale for beauty-enhancing behaviors. The theories thus provide a framework for hypothesis testing and should not necessarily be considered as opposing one another, but rather, as complementary.

4.8. Conclusions

Despite its limitations, the current research represents the largest investigation of predictors of self-enhancing physical attractiveness, testing hypotheses drawn from five non-mutually exclusive theoretical frameworks, based on data from 93,158 participants across 93 countries. As such, it takes an important step toward understanding the consistency and variability in attractiveness enhancing behaviors across cultures or demographic groups, alongside factors operating at the individual level. The main strength of this research is its cross-cultural nature and large sample size, which allows for weighing claims of different theories and examining factors that explain the most variance in activities aimed at improving one's appearance. We believe that a more nuanced understanding of the phenomenon of beauty enhancement may translate into developing more effective ways to counteract the negative influence of the uncontrolled pursuit of beauty.

Data availability statement

All data and Supplementary Materials have been made publicly available at the Open Science Framework (OSF) and can be accessed at https://osf.io/sh3an/.

Declaration of Competing interest

None.

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Appendix A. Supplementary data

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