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ORIGINAL ARTICLE

Facial aesthetic minimally invasive procedure: More than just vanity, a social-psychological approach

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Abstract

Background: Due to the great importance of the face in social interaction, minimally invasive treatments can—besides their ability to rejuvenate and enhance beauty—also change the way facial impressions of a person are perceived. In recent literature, three main character traits (attractiveness, trustworthiness, and competence) and subdomains essential for facial perception were described.

Objective: To investigate whether minimally invasive procedures truly influence different character traits when evaluated by independent, objective observers.

Methods: Photographs of $n = 34$ female faces before and after treatment with injectable fillers and botulinum toxin were rated by 393 individuals without aesthetic background with regards to different character traits on a 7-point Likert scale. Tests for dimensionality were performed, and composite scores of the impressions underlying each of the three dimensions were created and compared using within-subjects t tests.

Results: Treatments statistically significantly improved the overarching character trait domains attractiveness, trustworthiness, and competence in posttreatment photographs compared with pretreatment. Posttreatment ratings of the respective subdomains also showed a statistically significant difference compared with pretreatment photographs, with the exception of the subdomain dominance which failed to reach statistical significance.

Conclusion: Impressions of facial attractiveness, trustworthiness, and competence can be improved by injectables while the naturalness of the face is left intact. An implication is that the improvement of traits highly relevant to social interaction will accommodate the patient's desires for beautification and rejuvenation.

KEYWORDS

facial anatomy, facial appearance, facial injections, minimally invasive aesthetic treatment, soft-tissue filler

Helga E. van den Elzen and Ard J. Barends contributed equally to this work.

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1 | INTRODUCTION

The annually released statistic report of aesthetic trends and procedures in the US surveyed by The Aesthetic Society revealed that the number of soft tissue filler injections performed in 2021 was 1 857 339 representing an increase of 42% compared with 2020, whereas the number of neuromodulator procedures was 3 651 223, representing an increase by 40% compared with 2020.¹ A recent multicentric prospective observational study investigated the self-reported motivation of 511 aesthetic patients to undergo minimally invasive treatments and found that apart from desiring to look better physically, patients wanted to protect their health, improve their sense of psychological well-being, and increase their comfort and confidence in social situations.² This finding is novel and points to a new understanding of aesthetic treatments which unfortunately for the aesthetic patients are still perceived to be associated with vanity or psychopathology.³⁻⁷ Looking at the WHO definition of health it is stated that "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" implying that health is a multi-dimensional status in which many factors come to play apart from being disease free.⁸

Of those factors, the social aspect is increasingly important in our interconnected society, and research in psychology has produced a wealth of evidence indicating that individuals continuously make social decisions based on facial appearances.⁹⁻¹² It has been shown that people spontaneously and subconsciously receive a wide variety of information about other individuals, such as gender, identity, intentions, emotions, attractiveness, age, or ethnicity just by looking at other people's faces.¹³⁻¹⁵ Such information has been additionally shown to influence daily life matters such as business and employment opportunities and voting and sentencing decisions ultimately affecting social interaction and consequently playing a role in each individual's health.¹⁶⁻²¹

According to research in social psychology, the dimensions in which facial features can be clustered are the following major three: attractiveness, trustworthiness, and competence.²²⁻²⁴ Observed faces differ between these three dimensions which are composed of individually different subdomains: *Attractiveness* captures characteristics such as someone's physical attractiveness, age, and health; *trustworthiness* captures characteristics of someone's warmth, honesty, and approachability; and *competence* captures impressions of someone's intelligence, dominance, and capability.²⁵⁻³⁰

Understanding that the aesthetic medicine influences facial appearances and that facial appearance provides nonverbal, unconscious, immediate information to other people in the respective social group increases the importance and relevance of facial aesthetic treatments performed. Facial aesthetic treatments influence each patient's health by influencing social interactions and social well-being.

The objective of the present study is to investigate whether minimally invasive procedures truly influence the three overarching domains of facial information (attractiveness, trustworthiness,

and competence) and their subdomains when evaluated by independent, objective observers and not through self-reporting of the treated patient. It is hoped that this study will increase the awareness behind minimally invasive facial procedures and enforce that aesthetic treatments are far more than just vanity but actually contribute to each patient's health when defined by the WHO criteria.

2 | MATERIALS AND METHODS

2.1 | Study design

This study was designed as a cross-sectional online survey-based investigation in which 393 volunteers without aesthetic background were tasked to rate standardized pre- and posttreatment images of 34 female patients treated for aesthetic purposes. The rating was based on the attribution of defined character traits to the females displayed in the images. Those traits were classified into three overarching domains (attractiveness, competence, and trustworthiness; [Table 1](#)) and originated from 15 individual subdomains as described previously²⁴: healthy, attractive, young (vs. old), dominant, masculine (vs. feminine), confident, intelligent, competent, knowledgeable, trustworthy, honest, credible, aggressive, approachable, and friendly ([Table 2](#)). Three additional attributes were tasked to identify the outcome of the aesthetic treatment: likeable, natural (vs. fake), and emotionally stable.

2.2 | Image capture

The displayed images were aligned in appearance following a concept termed Evaluation Facial First Impression (EFFI); herein the images of the 34 females were aligned in hairstyle, dress, and background. All images were frontal face captures in neutral facial expressions taken under equal and standardized conditions using a Canon EOS 750D camera (Canon, Tokyo, Japan), at a distance of 1.2 m, and using an Elinchrom B250 monolight soft box (Elinchrom LTD, Renens, Switzerland).

2.3 | Online survey

The participating 393 volunteers rated the images of the 34 females online via a self-created online survey on the Qualtrics^{XM} platform (Seattle, WA, USA; [Figure 1](#)). Access to these data can be requested from the corresponding author.

Image display occurred following randomization and volunteers were not able to rate the pre- and the posttreatment images of the same patient in their rating session to avoid direct comparisons and hypothesis guessing. Volunteers were asked to rate the images based on the predefined 18 characteristics (see [Table 2](#))

TABLE 1 Pre- and postrating of the three overarching character trait domains attractiveness, competence, and trustworthiness in the treated patients. Values are given as mean values with standard deviation.

Domain	Pre M (SD)	Post M (SD)	N	t	g_{av}	d_z
Attractiveness	3.53 (0.64)	3.87 (0.63)	68	7.43	0.53	0.90***
Competence	4.18 (0.79)	4.39 (0.82)	130	5.17	0.26	0.45***
Trustworthiness	3.94 (0.81)	4.45 (0.75)	129	12.24	0.66	1.08***

Note: M = mean; SD = standard deviation; g_{av} = Hedges' g effect size for within subject designs that controls for correlation between measurements and can be interpreted as a between subjects effect size; d_z = Cohen's d effect size for within subjects designs. For an explanation of the effect sizes, see Lakens et al.³¹ *** $p < 0.001$.

TABLE 2 Pre- and postrating of the 15 subdomains and their affiliated overarching character trait in the treated patients. Three exploratory subdomains have been added. Values are given as mean values with standard deviation.

Subdomain	Domain	Pre M (SD)	Post M (SD)	N	t	g_{av}	d_z
Healthy	Attractiveness	4.16 (1.09)	4.56 (1.11)	68	7.36	0.37	0.90**
Attractive	Attractiveness	3.40 (1.10)	3.80 (1.12)	68	6.92	0.35	0.84***
Young (vs. old)	Attractiveness	3.04 (0.91)	3.25 (0.86)	68	3.62	0.23	0.44***
Dominant	Competence	4.26 (0.80)	4.18 (0.76)	62	-1.10	-0.10	-0.14
Masculine (vs. feminine)	Competence	3.30 (0.97)	2.98 (0.90)	62	-6.14	-0.35	-0.78***
Confident	Competence	4.24 (0.86)	4.46 (0.79)	62	3.59	0.27	0.46**
Intelligent	Competence	4.37 (0.88)	4.79 (0.74)	68	8.21	0.51	1.00***
Competent	Competence	4.46 (0.85)	4.94 (0.74)	68	9.02	0.60	1.10***
Knowledgeable	Competence	4.37 (0.86)	4.85 (0.74)	68	9.52	0.60	1.15***
Trustworthy	Trustworthiness	3.91 (0.94)	4.40 (0.86)	64	8.36	0.54	1.05***
Honest	Trustworthiness	3.89 (0.89)	4.38 (0.86)	64	8.61	0.56	1.08***
Credible	Trustworthiness	3.87 (0.91)	4.42 (0.90)	64	8.56	0.61	1.07***
Aggressive (R)	Trustworthiness	4.12 (0.93)	4.51 (0.93)	65	5.64	0.42	0.70***
Approachable	Trustworthiness	3.95 (0.82)	4.56 (0.69)	65	8.87	0.81	1.10***
Friendly	Trustworthiness	3.90 (0.86)	4.46 (0.72)	65	8.23	0.70	1.02***
Natural (vs. fake)	Exploratory	4.99 (0.95)	4.93 (0.86)	66	-0.94	0.07	-0.12
Emotional stability	Exploratory	3.86 (0.87)	4.29 (0.82)	66	6.37	0.50	0.78***
Liking	Exploratory	3.75 (0.87)	4.29 (0.81)	66	8.23	0.65	1.01***

Note: M = mean; SD = standard deviation; (R) = Rating is reverse coded; (sub) is when the overall dimensions are split into two distinct (sub) dimensions that sometimes have been found in the literature, see the text for more information. g_{av} = Hedges' g effect size for within subject designs that controls for correlation between measurements and can be interpreted as a between subjects effect size; d_z = Cohen's d effect size for within subjects designs; ** $p < 0.01$, *** $p < 0.001$.

following a 7-point Likert scale ranging from 1 (= strongly agree) to 7 (= strongly disagree). Answers were exported for further statistical analyses.

2.4 | Aesthetic treatment and patient population

The 34 female patients displayed in the standardized images, were consecutive aesthetic patients treated by the first author (H.E.E.) at her private clinic in Naarden (The Netherlands) Patients were treated for various facial aesthetic indications ranging from volume loss, re-contouring, or facial repositioning using soft tissue fillers and neuromodulators of various rheologic properties, brands, and injection techniques.

All patients were treated following good clinical practice and standard of care at the institution treated. All patients provided

signed informed consent for the use of their personal- and treatment-related data to be used for the purposes of this study.

2.5 | Statistical analysis

Principal component analysis (PCA) with orthogonal (varimax) rotation was calculated and the number of factors was identified based on the screen plot, the Kaiser criterion, and parallel analyses.³² Differences between the ratings of the pre- vs. the posttreatment images following the 18 character traits, a paired Student t test was performed (Table 2). To calculate the difference between the three overarching domains of attractiveness, competence, and trustworthiness, composite scores were calculated (Table 1). Values are presented as mean values with the respective 1x standard deviation and the accompanying probability



FIGURE 1 Exemplary survey question for the rating of the subdomains healthy, attractive and young in an 54-year-old female.

Please give your impression of the person depicted in the photo. This person is...

Not at all healthy	○ ○ ○ ○ ○ ○ ○	Extremely healthy
Not at all attractive	○ ○ ○ ○ ○ ○ ○	Extremely attractive
A young adult	○ ○ ○ ○ ○ ○ ○	An old adult

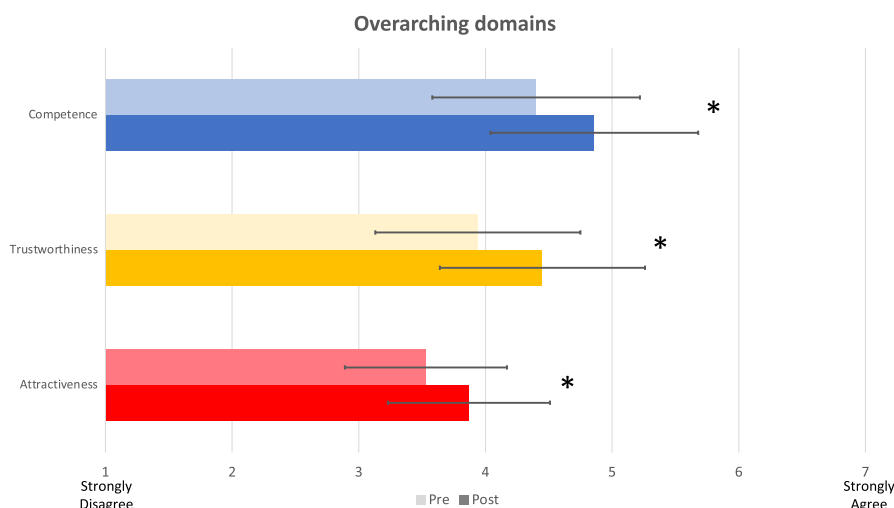


FIGURE 2 Bar graph shows the mean values and standard deviation for the rating of the three overarching character trait domains competence, attractiveness and trustworthiness, both pre- and posttreatment. Asterisks (*) indicate a statistically significant difference.

level (p value). All calculations were computed via SPSS Statistics 26 (IBM, Armonk, NY, USA).

3 | RESULTS

3.1 | Demographic and treatment-related data

The 393 volunteer raters consisted of 228 males and 165 females with a mean age of 42.81 years (12.1) [range: 23–62] whereas the 34 female patients had a mean age of 50.3 years (9.8) [range: 22–70].

The female patients received on average of 5.94 (4.9) treatment sessions [range: 1–25] over a period of 17.4 (17) months [range: 1–73]

administering on average 10.2 (8.5) syringes of product [range: 1–39]. Of all applied treatment sessions, 29 (85.3%) patients received additional neuromodulator injections for various facial indications whereas 5 (14.7%) received soft tissue filler injections only.

3.2 | Attractiveness, trustworthiness, and competence

The independence of the three character traits was confirmed in the run computational model with attractiveness explaining 19.2% of the variance, trustworthiness explaining 63.7% of the variance, and competence explaining 7.1% of the variance.

Despite being rated independently and unpaired in the same session, there was a highly statistically significant difference between pre- and the posttreatment images for attractiveness, trustworthiness, and competence revealing an increase in all three overarching domains independent of the conducted treatment with all p s < 0.001 (Figure 2 and Table 1).

3.3 | The 15 individual subdomains

In all 15 individual subdomains (except one), a statistically significant change was observed with all increasing their rating levels with p < 0.01 (Figures 3–5). The one subdomain failing to reach statistical significance was “dominance” which displayed a decrease following the treatment sessions with 4.26 (0.8) vs. 4.18 (0.8) (pre vs. post) with p > 0.05. This is plausible because aesthetic treatments in females have the major scope to increase femininity which can be perceived as less dominant by independent raters (Table 2).

3.4 | Additional exploratory domains

Emotional stability and Liking increased significantly during the performed treatment with both p 's < 0.001 (Table 2). The domain naturalness (versus fakeness), however, showed similar values for the pretreatment versus the posttreatment rating with 4.99 (1.0) versus 4.93 (0.9) with p > 0.05 indicating that independent of the treatment modality applied and the number of sessions or syringes administered the degree of naturalness did not change over time (Figure 6).

4 | DISCUSSION

This study demonstrates that using injectables in cosmetic surgery significantly alters the perception of a person's facial appearance. Increases were obtained not only in the impressions of facial attractiveness but also in facial impressions of trustworthiness and

competence. These findings, combined with the knowledge that facial impressions matter in all kinds of social interactions—from romantic relationships to the workplace—have important implications for cosmetic medicine. This study also delineates that the much-feared claim that injectables increase the “fakeness” of the face is unfounded.

At this moment there is little awareness in cosmetic medicine of the role that facial impressions play in social interactions. This lack of awareness is exemplified by the absence of a vocabulary to refer to goals other than changes in beautification and rejuvenation after treatment. The mean age of the women in this study was 50 years, which reflects the common age group seeking cosmetic treatment. These women generally appreciate that they cannot look like in their twenties again and many do not aspire so. Yet, beautification and rejuvenation are the most common objective physicians are aiming for at the moment. As cosmetic doctors are unaware of the potential to change impressions beyond beauty that may be more relevant to clients, so are the clients themselves.

This study finds support for the three-dimensional nature of facial impressions.^{22,23} Specifically, the attractiveness dimension covers impressions of perceived youthfulness, health, and attractiveness. The trustworthiness dimension covers impressions of honesty, friendliness, and credibility. Additionally, the competence dimension covers impressions of intelligence, dominance, and competence. Our findings show that the improvements on attractiveness, competence, and trustworthiness dimensions after cosmetic treatment are more or less independent of each other.

An important practical question is whether procedures in cosmetic medicine can target a specific face impression, say trustworthiness, without affecting the other two. Both limitations in human biology and medical techniques will be critical factors here. Although clients and physicians usually address specific anatomical entities, such as eyes, nose, and mouth, faces can only be seen as a single entity in which individual features fuse into unique combinations.^{33–36} A recent study shows that faces can be modeled along different dimensions, but many facial features are correlated. Therefore, it seems virtually impossible to isolate unique effects of any single

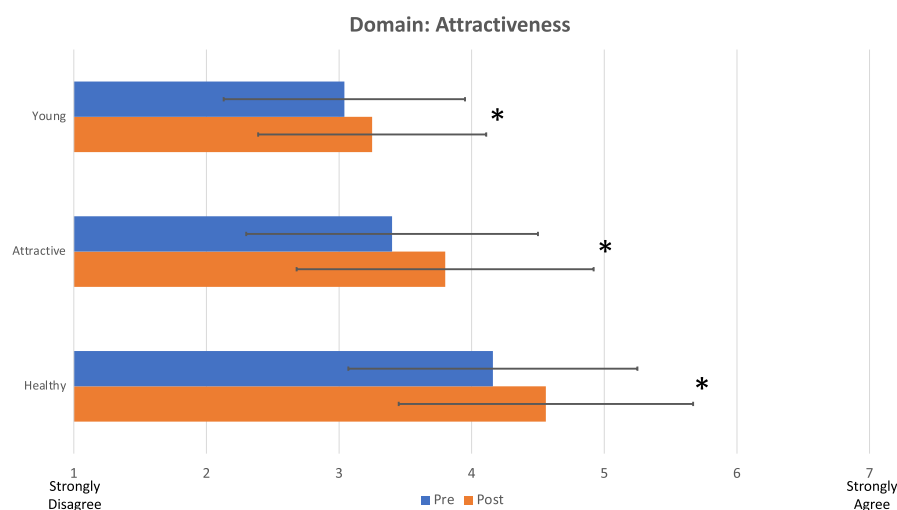


FIGURE 3 Bar graph shows the mean values and standard deviation for the rating of the three subdomains of the overarching character trait domain attractiveness, both pre- and posttreatment. Asterisks (*) indicate a statistically significant difference.

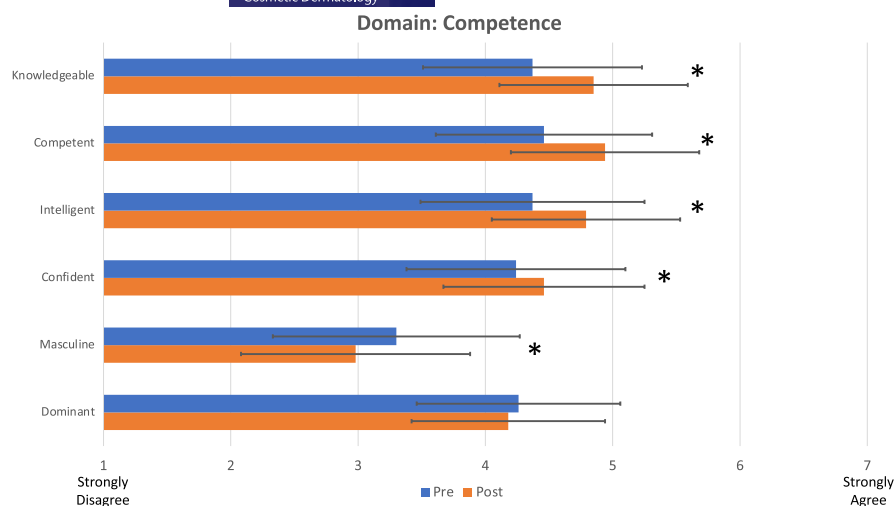


FIGURE 4 Bar graph shows the mean values and standard deviation for the rating of the six subdomains of the overarching character trait domain competence, both pre- and posttreatment. Asterisks (*) indicate a statistically significant difference.

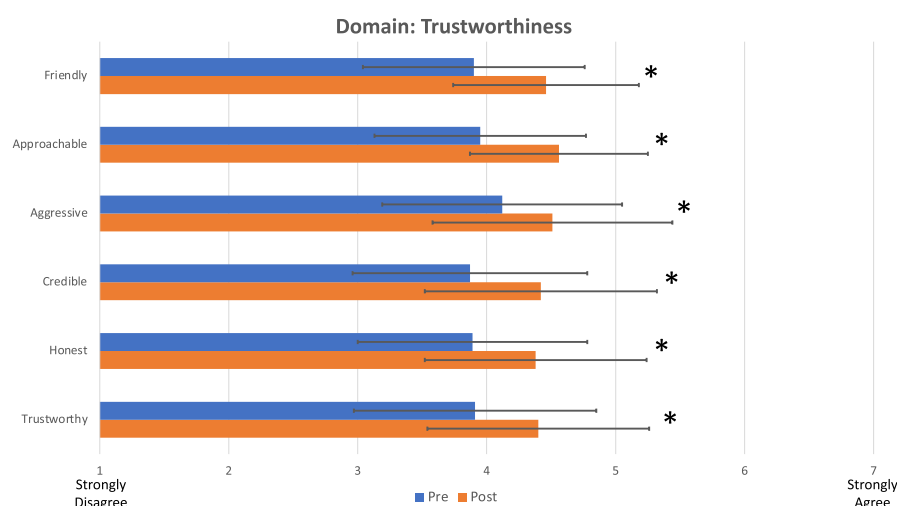


FIGURE 5 Bar graph shows the mean values and standard deviation for the rating of the six subdomains of the overarching character trait domain trustworthiness, both pre- and posttreatment. Asterisks (*) indicate a statistically significant difference.

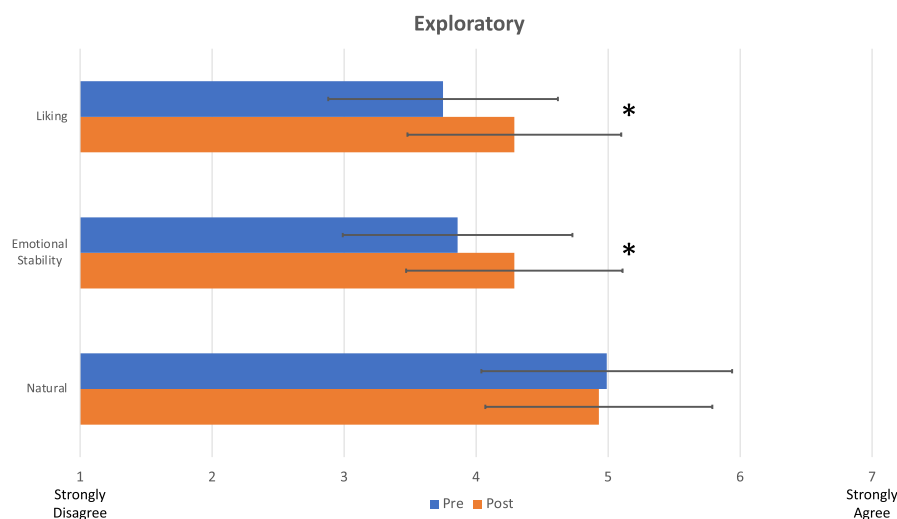


FIGURE 6 Bar graph shows the mean values and standard deviation for the rating of the exploratory domains, both pre- and posttreatment. Asterisks (*) indicate a statistically significant difference.

filler injection strategy.³⁷ Moreover, it seems that the way we infer character traits from faces is not only determined by the physical appearance of a face but also by observer's lay beliefs regarding the personality of others.³⁸ Judgments about faces and character traits are made by the human mind in a holistic manner.³⁹⁻⁴² With so many

factors involved, it will be a challenge to develop treatments that focus on one specific trait dimension.

But the division of appearances into the subdomains attractiveness, trustworthiness, and dominance as we have done in this paper, is new as far as we know.

Our study relies on photographs as a proxy for first impressions made in real life. Even if judgments made from photographs do not directly correspond to a real-life interaction, social judgments from facial photographs can predict surprisingly important real-world outcomes.²³ Furthermore, there is intrinsic value in how people make judgments from facial photographs because people nowadays regularly meet each other online for the first time. Accordingly, first impressions are increasingly based on face photographs, underlining the importance of our research.

The research method of using standardized face photos that we employed in this study is widely used in social psychology and holds promise for basic questions in cosmetic medicine. It should, however, be emphasized that in order to produce reliable results, the methodology should be strictly adhered to. For instance, we know that many factors influence an observer's judgment. Therefore, prior to assessment, photographs have to be standardized in terms of hairstyle, clothing, skin coloration, and other relevant factors.

A limitation of the current study is the exclusive use of pictures of Caucasian-looking women. But given that they make up 90% of the patients who undergo cosmetic facial filler treatment this is not as problematic as it seems.⁴³ It is an open question whether our findings also generalize to women of other ethnicities or men and whether we can find evidence for a more differentiated pattern in the efficacy of the cosmetic filler treatments across both genders and ethnicities. Furthermore, we only showed pictures of faces with a neutral expression; however, research has found that emotional expressions also contribute to the impressions of attractiveness, trustworthiness, and competence.⁴⁴ Because it has been suggested that cosmetic facial filler treatments inhibit emotional expressiveness,⁴⁵ it is a question for future research whether these improvements in social impressions are robust across various emotional expressions.

5 | CONCLUSION

In conclusion, changes in facial features by injectables produce systematic increases in impressions of facial attractiveness, trustworthiness, and competence while leaving the naturalness of the face intact. A shift away from beauty or rejuvenation as exclusive objectives to include other traits highly relevant for social interactions will likely accommodate the desires of clients seeking cosmetic treatment better and may improve treatment satisfaction and personal well-being. Doctors should rethink strategies in consultation and execution of cosmetic medical treatments based on these findings. A paradigm shift in rethinking the value and diversity of face impressions may open up a new era for cosmetic medicine from which both clients and doctors will benefit.

AUTHOR CONTRIBUTIONS

Helga E. van den Elzen designed the study, performed the research, participated in the writing. Ard J. Barends designed the study, performed the research and data analysis, and participated in the

writing. Mark van Vugt initiated and coordinated this study. Brian S. Biesman participated in the writing. Michael Alfertshofer performed data analysis. Sebastian Cotozana performed data analysis and participated in the writing. Peter J. Velthuis initiated the study and participated in the writing.

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CONFLICT OF INTEREST STATEMENT

The authors declared no potential conflict of interest with respect to the research, authorship, and publication of this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request. Data contain photographs that cannot be shared publicly.

ETHICS STATEMENT

The study was approved by the ethics committee of the Vrije Universiteit Amsterdam (VCWE-2020-161) and written and informed consent was obtained from all volunteers prior to the inclusion into this study for the use of their research-related data.

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REFERENCES

1. The Aesthetic Society. Aesthetic plastic surgery National Databank Statistics 2020-2021. Published 2021. Accessed June 21, 2022. <https://cdn.theaestheticsociety.org/media/statistics/2021-TheAestheticSocietyStatistics.pdf>
2. Maisel A, Waldman A, Furlan K, et al. Self-reported patient motivations for seeking cosmetic procedures. *JAMA Dermatol*. 2018;154(10):1167-1174. doi:10.1001/jamadermatol.2018.2357
3. Sarwer DB, Pertschuk MJ, Wadden TA, Whitaker LA. Psychological investigations in cosmetic surgery: a look back and a look ahead. *Plast Reconstr Surg*. 1998;101(4):1136-1142. doi:10.1097/00006534-199804040-00040
4. Higgins S, Wyson A. Cosmetic surgery and body dysmorphic disorder – an update. *Int J Womens Dermatol*. 2017;4(1):43-48. doi:10.1016/j.ijwd.2017.09.007
5. Bouman TK, Mulken S, van der Lei B. Cosmetic professionals' awareness of body dysmorphic disorder. *Plast Reconstr Surg*. 2017;139(2):336-342. doi:10.1097/PRS.0000000000002962
6. Spriggs M, Gillam L. Body dysmorphic disorder: contraindication or ethical justification for female genital cosmetic surgery in adolescents. *Bioethics*. 2016;30(9):706-713. doi:10.1111/bioe.12278
7. de Brito MJA, Nahas FX, Cordás TA, Tavares H, Ferreira LM. Body dysmorphic disorder in patients seeking abdominoplasty, rhinoplasty, and rhytidectomy. *Plast Reconstr Surg*. 2016;137(2):462-471. doi:10.1097/01.prs.0000475753.33215.8f
8. WHO. Constitution of the World Health Organization. Published 1948. Accessed June 21, 2022. http://www.who.int/governance/eb/who_constitution_en.pdf
9. Bruce V, Young A. Understanding Face Recognition. *Br J Psychol*. 1986;77:305-327.

10. Willis J, Todorov A. First impressions: making up your mind after a 100-ms exposure to a face. *Psychol Sci*. 2006;17(7):592-598. doi:10.1111/j.1467-9280.2006.01750.x
11. Oosterhof NN, Todorov A. The functional basis of face evaluation. *Proc Natl Acad Sci U S A*. 2008;105(32):11087-11092. doi:10.1073/pnas.0805664105
12. Todorov A. *Face Value: The Irresistible Influence of First Impressions*. Princeton University Press; 2017.
13. Walker M, Vetter T. Changing the personality of a face: perceived big two and big five personality factors modeled in real photographs. *J Pers Soc Psychol*. 2016;110(4):609-624. doi:10.1037/pspp0000064
14. Little AC, Jones BC, DeBruine LM. Facial attractiveness: evolutionary based research. *Philos Trans R Soc B Biol Sci*. 2011;366(1571):1638-1659. doi:10.1098/rstb.2010.0404
15. Leopold DA, Rhodes G. A comparative view of face perception. *J Comp Psychol*. 2010;124(3):233-251. doi:10.1037/a0019460
16. Van Vugt M, Grabo AE. The many faces of leadership. *Curr Dir Psychol Sci*. 2015;24(6):484-489. doi:10.1177/0963721415601971
17. Olivola CY, Eubanks DL, Lovelace JB. The many (distinctive) faces of leadership: inferring leadership domain from facial appearance. *Leadersh Q*. 2014;25(5):817-834. doi:10.1016/j.leaqua.2014.06.002
18. Pfann GA, Biddle JE, Hamermesh DS, Bosman CM. Business success and businesses' beauty capital. *Econ Lett*. 2000;67(2):201-207. doi:10.1016/S0165-1765(99)00255-4
19. Peng L, Cui G, Chung Y, Zheng W. The faces of success: beauty and ugliness premiums in e-commerce platforms. *J Mark*. 2020;84(4):67-85. doi:10.1177/0022242920914861
20. Ballew CC, Todorov A. Predicting political elections from rapid and unreflective face judgments. *Proc Natl Acad Sci U S A*. 2007;104(46):17948-17953. doi:10.1073/pnas.0705435104
21. Wilson JP, Rule NO. Facial trustworthiness predicts extreme criminal-sentencing outcomes. *Psychol Sci*. 2015;26(8):1325-1331. doi:10.1177/0956797615590992
22. Todorov A, Olivola CY, Dotsch R, Mende-Siedlecki P. Social attributions from faces: determinants, consequences, accuracy, and functional significance. *Annu Rev Psychol*. 2015;66(1):519-545. doi:10.1146/annurev-psych-113011-143831
23. Olivola CY, Funk F, Todorov A. Social attributions from faces bias human choices. *Trends Cogn Sci*. 2014;18(11):566-570. doi:10.1016/j.tics.2014.09.007
24. Todorov A, Said CP, Engell AD, Oosterhof NN. Understanding evaluation of faces on social dimensions. *Trends Cogn Sci*. 2008;12(12):455-460. doi:10.1016/j.tics.2008.10.001
25. Sutherland CAM, Oldmeadow JA, Santos IM, Towler J, Michael Burt D, Young AW. Social inferences from faces: ambient images generate a three-dimensional model. *Cognition*. 2013;127(1):105-118. doi:10.1016/j.cognition.2012.12.001
26. Sutherland CAM, Oldmeadow JA, Young AW. Integrating social and facial models of person perception: converging and diverging dimensions. *Cognition*. 2016;157:257-267. doi:10.1016/j.cognition.2016.09.006
27. Sutherland C, Young A, Rhodes G, Burton N. Do facial first impressions reflect a shared social reality? *Br J Psychol*. 2020;111(2):215-232. doi:10.1111/bjop.12390
28. Sutherland CAM, Liu X, Zhang L, Chu Y, Oldmeadow JA, Young AW. Facial first impressions across culture: data-driven modeling of Chinese and British Perceivers' unconstrained facial impressions. *Pers Soc Psychol Bull*. 2018;44(4):521-537. doi:10.1177/0146167217744194
29. Oliveira M, Garcia-Marques T, Dotsch R. Combining traits into a face: a reverse correlation approach. *Soc Cogn*. 2019;37(5):516-545. doi:10.1521/soco.2019.37.5.516
30. Jones AL, Kramer RSS. Facial cosmetics and attractiveness: comparing the effect sizes of professionally-applied cosmetics and identity. *PLoS One*. 2016;11(10):e0164218. doi:10.1371/journal.pone.0164218
31. Lakens D, Fockenberg DA, Lemmens KP, Ham J, Midden CJ. Brightness differences influence the evaluation of the affective pictures. *Cognition & Emotion*. 2013;27(7):1225-1246.
32. O'Connor BP. SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behav Res Methods Instrum Comput*. 2000;32(3):396-402. doi:10.3758/BF03200807
33. McKone E. Isolating the special component of face recognition: peripheral identification and a Mooney face. *J Exp Psychol Learn Mem Cogn*. 2004;30(1):181-197. doi:10.1037/0278-7393.30.1.181
34. Sergent J. An investigation into component and configural processes underlying face perception. *Br J Psychol*. 1984;75(2):221-242. doi:10.1111/j.2044-8295.1984.tb01895.x
35. Tanaka JW, Farah MJ. Parts and wholes in face recognition. *Q J Exp Psychol A*. 1993;46(2):225-245. doi:10.1080/14640749308401045
36. Young AW, Hellawell D, Hay DC. Configurational information in face perception. *Perception*. 2013;42(11):1166-1178. doi:10.1068/p160747n
37. Jaeger B, Jones AL. Which facial features are central in impression formation? *Soc Psychol Personal Sci*. 2022;13(2):553-561. doi:10.1177/19485506211034979
38. Stoller RM, Hehman E, Keller MD, Walker M, Freeman JB. The conceptual structure of face impressions. *Proc Natl Acad Sci U S A*. 2018;115(37):9210-9215. doi:10.1073/PNAS.1807222115
39. Goffaux V, Rossion B. Faces are "spatial"-holistic face perception is supported by low spatial frequencies. *J Exp Psychol Hum Percept Perform*. 2006;32(4):1023-1039. doi:10.1037/0096-1523.32.4.1023
40. Schiltz C, Rossion B. Faces are represented holistically in the human occipito-temporal cortex. *Neuroimage*. 2006;32(3):1385-1394. doi:10.1016/j.neuroimage.2006.05.037
41. Van Belle G, De Graef P, Verfaillie K, Busigny T, Rossion B. Whole not hole: expert face recognition requires holistic perception. *Neuropsychologia*. 2010;48(9):2620-2629. doi:10.1016/j.neuropsychologia.2010.04.034
42. Quadflieg S, Todorov A, Lagushe R, Rossion B. Normal face-based judgements of social characteristics despite severely impaired holistic face processing. *Vis Cogn*. 2012;20(8):865-882. doi:10.1080/13506285.2012.707155
43. International Society of Aesthetic Plastic Surgery. ISAPS international survey on. Aesthetic/Cosmetic Procedures performed in 2019. <https://isaps.org/media/pubg4jc/global-survey-full-report-2019-english.pdf> (accessed December 22, 2021).
44. Sutherland CAM, Young AW, Rhodes G. Facial first impressions from another angle: how social judgements are influenced by changeable and invariant facial properties. *Br J Psychol*. 2017;108(2):397-415. doi:10.1111/bjop.12206
45. Davis JI, Senghas A, Brandt F, Ochsner KN. The effects of BOTOX injections on emotional experience. *Emotion*. 2010;10(3):433-440. doi:10.1037/a0018690

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