

Unsightly Pictures: Tanning, Attractiveness, and Behavior

A new tool may decrease tanning behavior based on evolutionary and neuroscientific theories of facial attraction.

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In the last 30 years, the incidence of melanoma and non-melanoma skin cancer (NMSC) has increased.¹⁻⁴ In 2013, melanoma will account for 76,690 new cases and 9,480 deaths in America, and NMSC will account for 3.5 million new cases and 2,000 deaths.^{1,2} The most significant environmental risk factor for skin cancer is ultraviolet radiation (UVR), which causes DNA damage.⁴⁻⁶ Sufficient evidence of the link between skin cancer and UVR has led to its classification as a human carcinogen by the Internal Agency for Research on Cancer.^{5,6} Despite knowledge of the harmful effects of UVR on skin health, Americans continue to seek solar UV exposure and use tanning devices.^{6,7}

Research on tanning beliefs and behaviors has demonstrated that tan skin is perceived as attractive. A recent study assessed attractiveness ratings for photographs posted on a public website before and after artificial tan. There was a statistically significant increase in perceived attractiveness of tanned images.⁸ Furthermore, surveys of adolescents and adults have demonstrated that 75-92 percent believe that tan skin is more attractive than untanned skin and 79 percent feel better about themselves when tan.⁹⁻¹²

The perception of tan skin as attractive motivates tanning behavior. Adolescents who prefer tan skin also report

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sporadic use of sunscreen, more frequent sunburns, and increased use of tanning beds.¹¹ Adolescents who report appearance reasons to tan have more frequent intentions to sunbathe in the next year and fewer intentions to sun protect.¹³ College students use tanning beds for desired cosmetic effect, despite knowledge of adverse effects of UV exposure.¹² Finally, users of tanning products are more likely to believe that tan skin is more attractive and to feel better when they are tan compared to nonusers.¹⁰ Together these studies demonstrate that tanning is prompted in part by the belief that tan skin positively impacts appearance.

Given the relationship between tan attraction, increased UV exposure, and skin cancer, a complete understanding of what drives the attraction to tan skin is useful to guide the design of interventions that may decrease tanning behavior. Despite the widely held belief that standards of attraction are determined by cultural norms and learned through experience, there is evidence that some preferences are inherent.¹⁴⁻¹⁶ Cross-cultural agreement on attractiveness has been observed and well documented.¹⁴⁻¹⁶ Additionally, appearance preferences emerge early in development, prior to the opportunity for cultural influence.^{14,16} Within a week of birth, infants look longer at attractive faces.¹⁴ These observations suggest that there are aspects of attraction that are preserved among all people, which may be accounted for by evolutionary and neuroscientific theories of attraction. While the basis of attraction to tan skin is not well studied, significant evolutionary and neuroscientific research exists regarding the basis of facial attraction and may be applied to the perception of tan skin as attractive.

EVOLUTIONARY THEORIES

Evolutionary models characterize attraction as an adaptive function that maximizes mate choice.¹⁵ Preferred traits are thought to denote underlying health and guide humans toward reproductive success.^{15,16} The predominant facial traits studied as sexual selection preferences include symmetry, averageness, and sexual dimorphism. Minor traits that have been studied and apply to tan attraction include familiarity, skin color, and skin color homogeneity.^{15,16}

Averageness and Familiarity. Averageness, or one's resemblance to others in a population, is preferred because it reflects genetic diversity and heterozygosity; therefore it is evolutionarily beneficial.¹⁵ The preference for facial averageness is supported by studies that demonstrate that familiarity, or previous exposure, leads to increased attraction. Exposure to masculine or feminine faces leads to increased attraction to the type of faces previously seen.¹⁷ Exposure to a mildly distorted face leads to a shift toward perception of distorted faces as normal and attractive.¹⁸ These studies suggest that facial exposure adapts preferences to fit the facial characteristics that are commonly seen and may contribute to building an average, attractive face.

Upon exposure to attractive and unattractive faces, preferences shift toward characteristics of more attractive faces.¹⁹ This change in facial preference is directly related to facial exposure time, as participants view attractive faces more often and for longer periods of time. When participants were distracted from attractive faces, the observed change in preferences was eliminated.¹⁹ Facial preferences are also influenced by associated stimuli. When faces were

paired with an aversive or a neutral stimulus, there was a weaker preference for composite faces similar to those previously viewed in association with an aversive stimulus.²⁰ The quality of experiences associated with facial exposure helps determine subsequent preferences.

In summary, these studies demonstrate that facial preferences shift toward what is perceived as average or familiar and are affected by viewing time and associated stimuli. Tan individuals are commonly seen on TV, in movies, and in magazines. Widespread exposure to tan people leads to their perception as familiar and average, which both contribute to increased attraction. Longer exposure times, due to increased frequency and duration of viewing, may reinforce the perceived averageness of tan individuals. Finally, exposure to tan individuals in the context of the media and celebrity may lead to positive associations, which mold subsequent preferences in favor of tan skin.

Skin Color. Coloration is an important component of sexual selection in many species, including fish, birds, and non-human primates.¹⁵ Likewise, in humans, red and yellow facial skin is positively associated with perceived health.¹⁵ A study of male faces found that yellow skin color was a significant predictor of attractiveness.²¹ When allowed to manipulate color calibrated facial photographs along oxygenated and deoxygenated blood color axes to optimize health appearance, study participants increased skin blood color above basal levels.²² In a similar study, participants increased skin yellowness and redness to enhance health appearance in color calibrated Caucasian face photographs.²³ These studies demonstrate that health information is perceived from skin color. Given the link between apparent health and evolutionary based attraction, the improved perceived health associated with the color of tan skin may lead to increased attraction. Specifically, if tan skin is perceived as more yellow or red, and therefore healthier, it is considered attractive.

Skin Color Homogeneity. Skin color homogeneity affects the perception of age, health, and attractiveness of faces.¹⁵ Homogeneity of skin images is directly related to the perception of high health and attractiveness for male and female faces.^{24,25} Faces with even skin color distribution attract more visual attention than those with greater color contrast. Eye tracking technology detects significantly higher dwell time and fixation count for faces with more even skin color distribution.²⁶ Tan skin may be perceived as more homogeneous in color, leading to its perception as healthier and more attractive. Additionally, increased visual attention to tan faces with homogeneous pigmentation can lead to increased perceived familiarity and averageness of tan faces, resulting in greater attraction, as discussed above.

NEUROSCIENTIFIC THEORIES

Functional MRI (fMRI) studies demonstrate that neural activity underlying facial attraction is widely disbursed throughout the brain, includes task specific and automatic activations, and occurs in reward circuits.

In some areas of the brain, neural activity relates directly to facial attractiveness only when beauty is explicitly judged. In other areas, this relationship is maintained regardless of the task in which the person is engaged. Specifically, when explicitly judging facial beauty, neural activity in the ventral occipital, anterior insular, dorsal posterior parietal, inferior dorsolateral, and medial prefrontal cortices is correlated to the degree of facial attractiveness.¹⁴ Each region is thought to have a specific function. Neural activity in the ventral occipito-temporal area mediates visual processing. Parietal, medial, and dorsolateral frontal activations are involved in attention and decision-making. Emotional responses occur in the insular and cingulate areas. Posterior cingulate activity corresponds to negative evaluation of beauty.¹⁴ When tending to a facial processing task other than assessing facial attraction, activation of the ventral occipital region and orbitofrontal cortex still correlates with degree of beauty, indicating that these areas are automatically engaged by attractive faces.^{14,27}

Attractive faces activate areas in the neural reward circuit, including the orbitofrontal cortex, nucleus accumbens, ventral striatum and amygdala.¹⁴ Linear increases in activation of the nucleus accumbens and medial orbitofrontal cortex are seen with increased judgment of attractiveness for faces of the opposite sex.²⁷⁻³⁰ Furthermore, increased activity in the orbitofrontal cortex and the hippocampus, the brain region involved in memory encoding, that occurs in response to attractive faces may account for better memory of attractive faces.³¹ The amygdala demonstrates nonlinear effects, with increased responses to highly attractive and unattractive faces compared to middle ranked faces.^{30,32} Pairing a neutral stimulus with an attractive or unattractive face led to improved rating of the stimuli paired with attractive faces and associated activation in the ventral striatum.³³ Taken together, these studies provide evidence that attractive faces are processed as a visual reward in the same neurological circuitry that is activated by other forms of reward.

In summary, fMRI studies show neural activity that is directly related to the degree of facial attractiveness occurring during explicit judgments of facial beauty—automatically and in reward circuits. These studies demonstrate that facial attraction is based in part on underlying brain activity. If the perception of tan skin as attractive is regarded as a subset of facial attraction, these neuroscientific studies can be used as further explanation of how and why tan skin is perceived as attractive.

INTERVENTIONS TO DECREASE TANNING BEHAVIOR

Evolutionary and neuroscientific theories of facial attraction can be used to explain the basis of tan attraction. According to evolutionary models, attractive traits are those that suggest health and genetic superiority. Facial preferences shift toward what is perceived as average and familiar and are affected by exposure time and associated stimuli. Tan skin may be favored, as it contributes to an individual's appearance as average and familiar, alters skin color to appear healthier and more homogeneous and is associated with positive stimuli. Functional MRI studies reveal that facial attraction results in specific activations in various brain regions, including reward circuitry. Akin to attractive faces, tan skin may be perceived as a reward.

Given this evolutionary and neurological model, two potential interventions may decrease tanning behavior that is motivated by the perception of tan skin as attractive. Limiting exposure to tan individuals in the media will decrease the perception of tan as average and familiar and eliminate a source of positive associated stimuli. This intervention is difficult to implement because celebrities have little incentive to adjust their personal appearance for public health initiatives.

A more practical intervention is to associate tan skin with negative stimuli. According to evolutionary studies of facial attraction, this negative association will shift preferences away from tan skin. Additionally, the association of a reward with a negative stimulus may decrease the rewarding quality of the initial stimulus.

Adverse effects of tanning include skin cancer and photoaging. These negative stimuli may be associated with tan skin with an advertising campaign that pairs pictures of photodamaged skin of elderly individuals or patients with significant cosmetic effects secondary to surgical procedures for skin cancer with images of attractive, tan individuals. In fact, appearance based interventions, including use of UV photographs, information about photoaging and appearance focused booklets, have been effective in decreasing tanning behavior and/or intentions in young people.³⁴⁻³⁶ A campaign of this nature should appeal to people on a logical level and be impactful based on the evolutionary and neuroscientific foundation of tan attraction. Unsightly pictures, therefore, may be useful to decrease tanning attraction and dangerous tanning behavior. ■

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1. Melanoma Skin Cancer. American Cancer Society website. <http://www.cancer.org/cancer/skincancer-melanoma/detailedguide/melanoma-skin-cancer-key-statistics> Published September 20, 2012. Accessed March 30, 2013.
2. Skin Cancer: Basal and Squamous Cell. American Cancer Society website. <http://www.cancer.org/cancer/skincancer-basalandsquamouscell/detailedguide/skin-cancer-basal-and-squamous-cell-key-statistics> Published September 20, 2013. Updated January 17, 2013. Accessed March 30, 2013.
3. Little EG, Eide MJ. Update on the current state of melanoma incidence. *Dermatol Clin*. 2012;30:355-361.
4. Narayanan DL, Saladi RN, Fox JL. Ultraviolet radiation and skin cancer. *Int J Dermatol*. 2010;49:978-986.
5. Gallagher RP, Lee TK. Adverse effects of ultraviolet radiation: A brief review. *Prog Biophys Mol Biol*. 2006;92:119-131.
6. Brady MS. Public health and the tanning bed controversy. *J Clin Oncol*. 2012;30(14):1571-1573.
7. Robinson JK, Rigel DS, Amonette RA. Trends in sun exposure knowledge, attitudes and behaviors: 1986 to 1996. *J Am Acad Dermatol*. 1997;37(2):179-186.
8. Chung VQ, Gordon JS, Veledar E, Chen SC. Hot or not- evaluating the effect of artificial tanning on the public's perception of attractiveness. *Dermatol Surg*. 2010;36:1651-1655.
9. Ashinoff R, Levine VJ, Steuer AB, Sedwick C. Teens and tanning: knowledge and attitudes. *J Clin Aesthetic Dermatol*. 2009; 2:48-50.
10. Sahn RE, McIlwain MJ, Magee KH, Veledar E, Chen SC. A cross-sectional study examining the correlation between sunless tanning product use and tanning beliefs and behaviors. *Arch Dermatol*. 2012;148:448-454.
11. Geller AC, Colditz G, Oliveria S, et al. Use of sunscreen, sunburning rates, and tanning bed use among more than 10,000 US children and adolescents. *Pediatrics*. 2002;109:1009-1014.
12. Knight JM, Kirinich AN, Farmer ER, Hood AF. Awareness of the risks of tanning lamps does not influence behavior among college students. *Arch Dermatol*. 2002;138:1311-1315.
13. Asvat Y, Cafrit G, Thompson JK, Jacobsen PB. Appearance-based tanning motives, sunbathing intentions and sun protection intentions in adolescents. *Arch Dermatol*. 2010;146(4):445-446.
14. Chatterjee A, Thomas A, Smith SE, Aguirre GK. The neural response to facial attractiveness. *Neuropsychology*. 2009;23:135-143.
15. Little AC, Jones BC, DeBruine LM. Facial attractiveness: evolutionary based research. *Philos Trans R Soc Lond B Biol Sci*. 2011;366:1238-1659.
16. Rhodes G. The evolutionary psychology of facial beauty. *Annu Rev Psychol*. 2006;57:199-226.
17. Buckingham G, DeBruine LM, Little AC, et al. Visual adaptation to masculine and feminine faces influences generalized preferences and perceptions of trustworthiness. *Evolution and Human Behavior*. 2006; 27:381-389.
18. Rhodes G, Jeffrey I, Watson TL, Clifford CW, Nakayama K. Fitting the mind to the world: face adaptation and attractiveness aftereffects. *Psychol Sci*. 2003;14:558-566.
19. Jones BC, DeBruine LM, Little AC. Adaptation reinforces preferences for correlates of attractive facial cues. *Vis Cogn*. 2008;16:849-858.
20. Jones BC, DeBruine LM, Little AC, Feinberg DR. The valence of experiences with faces influences generalized preferences. *Journal of Evolutionary Psychology*. 2007;5:119-129.
21. Scott IM, Pound N, Stephen ID, Clark AP, Penton-Voak IS. Does masculinity matter? The contribution of masculine face shape to male attractiveness in humans. *PLoS One*. 2010;5:e13585.
22. Stephen ID, Coetzee V, Smith ML, Perrett DI. Skin blood perfusion and oxygenation colour affect perceived human health. *PLoS One*. 2009;4:e5083.
23. Stephen ID, Smith MJ, Stirrat MR, Perrett DI. Facial skin coloration affects perceived health of human faces. *Int J Primatol*. 2009;30:845-857.
24. Fink B, Mads P, D'Emiliano D, Bunse L, Weege B, Röder S. Colour homogeneity and visual perception of age, health and attractiveness of male facial skin. *J Eur Acad Dermatol Venereol*. 2012;26:1486-1492.
25. Samson N, Fink B, Mads P. Interaction of skin color distribution and skin surface topography cues in the perception of female facial age and health. *J Cosmet Dermatol*. 2010;10:78-84.
26. Fink B, Mads P, Klingenberg H, Kuntze S, Weege B, Grammer K. Visual attention to variation in female facial skin color distribution. *J Cosmet Dermatol*. 2008;7:155-161.
27. O'Doherty J, Winston J, Critchley H, Perrett D, Burt DM, Dolan RJ. Beauty in a smile: the role of medial orbitofrontal cortex in facial attractiveness. *Neuropsychologia*. 2003;41:147-155.
28. Aharon I, Etcoff N, Ariely D, Chabris CF, O'Connor E, Breiter HC. Beautiful faces have variable reward value: fMRI and behavioral evidence. *Neuron*. 2001;32:537-551.
29. Cloutier J, Heatherton TF, Whalen PJ, Kelley WM. Are attractive people rewarding? Sex difference in the neural substrates of facial attractiveness. *J Cogn Neurosci*. 2008;20:941-951.
30. Liang X, Zebrowitz LA, Zhang Y. Neural activation in the 'reward circuit' show a nonlinear response to facial attractiveness. *Soc Neurosci*. 2012;5:332-334.
31. Tsukiura T, Cabeza R. Remembering beauty: roles of orbitofrontal and hippocampal regions in successful memory encoding of attractive faces. *Neuroimage*. 2001;14:653-660.
32. Winston JS, O'Doherty J, Kilner JM, Perrett DI, Dolan RJ. Brain systems for assessing facial attractiveness. *Neuropsychologia*. 2007;45:195-206.
33. Bray S, O'Doherty J. Neural coding of reward-prediction error signals during classical conditioning with attractive faces. *J Neurophysiol*. 2007;97:3036-3045.
34. Hillhouse J, Turrisi R, Stapleton J, Robinson J. A randomized controlled trial of an appearance-focused intervention to prevent skin cancer. *Cancer*. 2008;113:3257-3266.
35. Olson AL, Gaffney CA, Starr P, Dietrich AJ. The impact of an appearance-based educational intervention on adolescent intention to use sunscreen. *Health Educ Res*. 2008; 23(5):763-769.
36. Mahler HIM, Kult JA, Harrell J, Correa A, Gibbons FX, Gerrard M. Effects of UV photographs, photoaging information and use of sunless tanning lotion on sun protection behaviors. *Arch Dermatol*. 2005;141:373-380.