

Algorithmic Beauty: The New Beauty Standard

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ABSTRACT

Background: Algorithms on various social media platforms feed users what it considers “beautiful,” impacting the aesthetic desires of patients as well as beauty ideals.

Objective: To discuss how algorithms on social media platforms personalize feeds and influence a patient’s preference for procedures. Methods: YouTube, Instagram, and TikTok’s websites were searched for how their algorithms function. A narrative review of the literature pertaining to social media and cosmetic procedures was also conducted using PubMed.

Results/Discussion: Social media platforms personalize feeds for their users. Identifying exactly what a patient is exposed to on social media and how that influences their preference for cosmetic procedures presents a challenge at various levels. Social media usage appears to at least influence cosmetic procedure consideration. The desired appearance may be impacted by location, repeated exposure, and familiarity.

Conclusion: While impossible to predict the next beauty trend, it is important to understand how algorithms and artificial intelligence may play an increasing role in a patient’s visual diet and how their aesthetic goals are thereby affected. Using social media platforms and understanding market trends can guide dermatologists to provide evidence-based education, dispel misinformation, and anchor patients in reality while understanding the cosmetic procedures that patients seek.

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INTRODUCTION

Beauty has always captured the interest of our society. From an evolutionary perspective, beauty signals higher mate quality and competence.¹ From a social and psychological perspective, being beautiful is associated with higher self-esteem, improved well-being, and the perception of intelligence and success in both professional and personal life.² The golden ratio dates back to ancient Greece and is said to be aesthetically pleasing due to its recurring theme throughout nature, including its relevance to facial proportions. While this ratio is widely considered “ideal,” anthropomorphic studies in non-Europeans were not concordant with these proportions.³ Though some canons of beauty that we subscribe to are widespread, beauty standards of facial features are dynamic, varying by region, and evolving over time, especially as innovations in technology bring us closer and promote cultural interactivity.

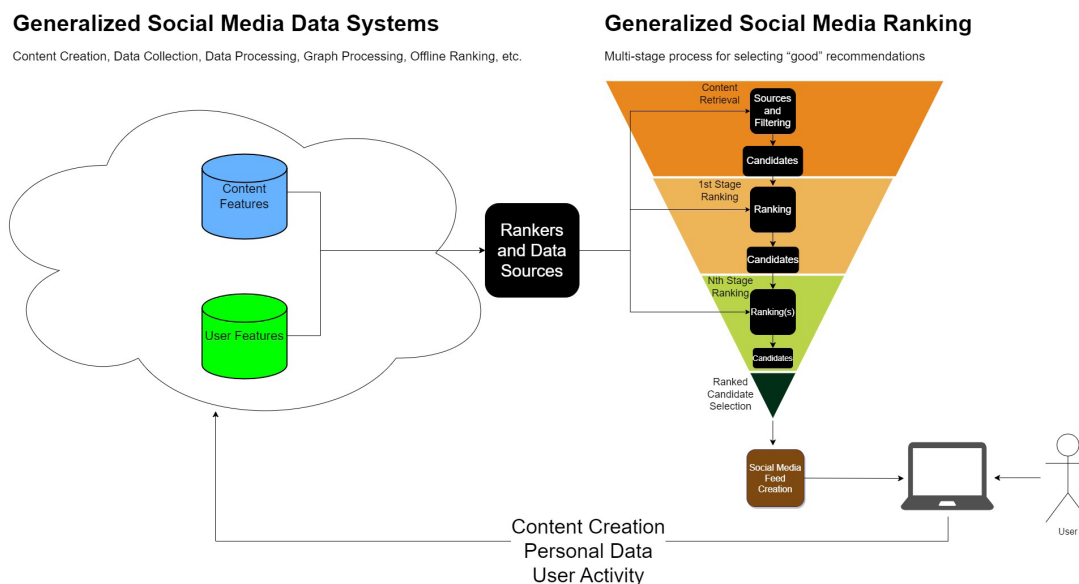
Unsurprisingly, our fascination with beauty has not only spilled over into social media but has become a significant part of it as these platforms have grown exponentially. From 2019 to 2021 the number of users on social media platforms such as YouTube, Instagram, and TikTok increased by 50% to 300%, with the most having one to two billion users.⁴⁻⁶ The visual appeal of primarily photo and video content on these platforms are ideal for the beauty world and the audience engagement, immediate

feedback, influencer partnerships, and user-generated content enhance the experience to the point of addiction in some users.⁷

Influencers are those on social media considered to have purchasing decisions of their audiences. Influencers in the beauty, cosmetics, and personal care fields have some of the largest followings on social media and it was estimated that beauty companies spent \$2.6 billion on digital advertising in 2022.⁸ While there is no direct link between the popularity of beauty topics on social media and the number of cosmetic procedures being done, parallel trends have been observed.

In 2019, the American Society for Dermatologic Surgery (ASDS) reported 4 million total injectable procedures wherein wrinkle-relaxers increased by 60% and fillers by 78% since 2012; 4.1 million total procedures for laser/light/energy-based treatment, which increased by 106% since 2012; and over 1 million body sculpting procedures, which increased by over 500% since 2011.⁹ While newer data have not been published yet and the effects of the COVID-19 pandemic on dermatologic cosmetic procedures is unclear, the American Academy of Facial Plastic and Reconstructive Surgery reported increases in both surgical and non-surgical procedures of the face from 2020 to 2021, citing improved appearance on video conferencing as a patient motivator.¹⁰ Herein, we aim to discuss how the algorithms on

FIGURE 1. Features (eg, content, user) feed into all levels of social media ranking. Social media ranking uses several rounds of candidate selection, ranking, and filtering. This creates a final ranked selection that is shown to users in their feed. The user views the feeds, resulting in more activity and potential content creation. Then based on the user's platform interactions (eg, content created, engagement), this feedback influences the subsequent feeds.



popular social media platforms YouTube, Instagram, and TikTok function to personalize feeds, influencing one's visual diet; and ultimately how social media affects patient preference for procedures.

MATERIALS AND METHODS

The top social media platforms with significant photo and/or video posts based on numbers of users were selected and their methods of recommendations were searched on their respective websites. A review of the literature pertaining to social media and cosmetic procedures was conducted using PubMed. The goal of this search was to evaluate the literature for the assessment of social media usage and cosmetic procedure preferences and influences. Article titles containing the term "social media" or one of the top social media platforms and "cosmetic" were reviewed, and relevant articles were included.

Understanding the Algorithm: YouTube, Instagram, and TikTok

The most popular social media platforms using visual content are YouTube, Instagram, and TikTok. Figure 1 demonstrates an overview of how recommendation systems work, and additional details of each social media platform are further discussed below.

YouTube

YouTube's algorithm considers viewer personalization and video performance when recommending videos to a user. Viewer personalization analyzes information collected from

the user, termed "signals." Signals include watch history, watch time, search history, channel subscriptions, clicks, shares, likes, and dislikes. Video performance includes qualities of the video itself such as longer watch time, video shares, likes, comments, and subscriptions.

These signals are not always reliable for determining the quality of a video. One study from 2021 examined the quality and accuracy of YouTube videos regarding genioplasty and found that most of the 70 videos studied contained bad information context.¹¹ In those videos, the number of likes, dislikes, and interaction index was significantly higher ($P=0.037$, $P=0.037$, and $P=0.026$, respectively) than other videos. Later in 2021, YouTube announced that while the dislike button would remain, the dislike count would be private in an attempt to decrease dislike-attacking behavior.¹²

YouTube works to limit low-quality content and boost quality content by training evaluators to determine video quality using a set of public guidelines. Borderline content is not recommended unless a user is subscribed to that channel, whereas authoritative content, influenced by factors such as speaker expertise and video topic, is more likely to be promoted in the recommender systems.¹³ These human decisions are then used as a model to train artificial intelligence (AI) systems, an ever-evolving process. Since the publication of the genioplasty study and as a direct consequence of the COVID-19 pandemic, YouTube has taken steps to combat misinformation.¹⁴ YouTube

TABLE 1.**Summarized Table of Studies Evaluating Social Media Usage and Influence on Cosmetic Procedures**

Author	Number of Participants	Participant Characteristics	Findings
Seekis et al. ²²	399	Age 17-25 y/o, avg 19.36 Women	A direct link exists between beauty social media engagement and cosmetic surgery consideration Internalization of attractiveness and dysmorphic appearance were not mediators in this link
Arab et al. ²³	816	Age 18-30 y/o, avg 21.15 Women Saudi Arabia	Spending more time on social media and viewing cosmetic-surgery related material was associated with an increased likelihood of considering future cosmetic treatment
Wang et al. ²⁴	884	Age 14-19 y/o, avg 16.8 Women and men China	Viewing selfies of others was associated with facial dissatisfaction and cosmetic surgery consideration in both men and women

implemented a health content shelf for medically-related searches with videos from eligible sources such as accredited health organizations, physicians, and nurses.¹⁵ When scrolling through the search results, a shelf labeled “Shorts” and vertically oriented thumbnails appear. The purpose of videos labeled from health sources are meant to be educational and the Shorts are intended for users to see or hear about personal experiences from the community.

Instagram

Instagram has a variety of features, such as Feed, Stories, Explore, and Reels, each using its own algorithm based on the intended purpose. We focus on Explore, which is used by hundreds of millions of people to discover new content and creators each day.¹⁶

Explore is comprised of photo and video content from accounts that the user does not yet follow. Utilizing machine learning, the team at Instagram uses a multi-stage ranking approach that involves retrieval, first-stage ranking, second-stage ranking, and final reranking. Simply put, retrieval approximates what content is higher, taking various signals into account, such as the user’s past activity on similar posts liked, saved, shared, and commented on.¹⁶ The following ranking stages then rank potential content by value, filter out incompatible content, and may shuffle in outside content for diversity.¹⁶

For Reels, signals include how likely the user is to reshare a reel, watch a reel completely, and like and go to the audio page. The most important signals are users’ activity, information about the reel, and information about the person who posted the reel. Information on the person who posted and how popular the post itself is plays a role as well. Instagram has also published a set of Recommendation Guidelines to help avoid making recommendations that are low-quality or sensitive.¹⁷ In a health context, sensitive or low-quality content includes content that promotes or depicts cosmetic procedures, content with exaggerated health claims, and content attempting to sell products or services based on health-related claims.¹⁷ Content

that falls into these categories can still be posted to Instagram; however, they are not eligible to be recommended. Users also have the option to control sensitive content and mark posts “not interested” to influence what shows up in their future feeds. This allows users to further personalize their recommendations; however, this may homogenize the content on a user’s feed, narrowing the definition of beauty with material impacts on the already problematic self-esteem and body dysmorphia concerns surrounding social media. Ways to improve biased content promotion could be to improve algorithm transparency.

TikTok

TikTok’s For You feed is curated for users based on their interests. Factors that play a role in what is recommended are user interactions (eg, comments), which accounts are followed, videos liked or shared, video information (eg, captions, sounds, and hashtags), and device and account settings, which include language preference and device type.¹⁸ Actions such as following new accounts, exploring hashtags, and sounds provide signals to alter the feed. They also avoid repetitive patterns by not showing 2 back-to-back videos from the same creator or with the same sound. There is also a function that aims to diversify recommendations by featuring content that appears to be relevant to the user’s expressed interests. It is unclear which videos are selected and how often they arise.

A study of 340 TikTok videos on non-surgical facial injectable treatments found that 37% of videos were uploaded by non-physician healthcare providers with the most common category being patient experience.¹⁹ Uploads from physician and non-physician provider teams had significantly lower median views, likes, comments, shares, and engagement compared with non-healthcare team content ($P<0.001$), even though the content quality was significantly higher in physician-created videos compared with non-physician and non-physician healthcare provider created videos ($P<0.001$ and $P=0.001$, respectively).¹⁹ Content quality was measured using DISCERN scores, a validated measure of health information quality.²⁰ Similarly, when analyzing the “slugging” TikTok trend, which entails

applying a petrolatum-based ointment on the skin as the final step in the evening skincare routine, the authors found that using DISCERN scores, healthcare providers provided more high-quality, educational content on slugging compared with influencers (87.5% vs 30%, respectively, $P=0.009$).²¹ In contrast, influencers created more patient experience videos.²¹ It should be considered that users may not be looking for educational content when searching cosmetic topics, but rather, anecdotes of personal experiences.

Influence on Patient Preferences of Procedures

While YouTube, Instagram, and TikTok have published how they come up with search results and recommendations, details of their algorithms are unavailable to the public and would likely be difficult to obtain as it is part of the core business. This is a major barrier to conducting studies examining user feeds and personalized recommendations. Determining what exactly a person sees and how that has influenced their perception of beauty, beauty ideals, and preference for a cosmetic procedure presents a challenge. Nevertheless, social media usage appears to influence cosmetic procedure consideration, and appearance preferences are impacted by location, repeated exposure, and familiarity.

Several studies have suggested that social media usage is associated with cosmetic procedure consideration. A summary of the study features and conclusions are presented in Table 1.²²⁻²⁴

Beauty is subjective and an individual's definition may be fluid, affected by psychological mechanisms, complicating our understanding of patient preferences. A study of 48 women were first exposed to a set of either under- or exaggerated lip fullness and then tested with the same set of photos in part two.²⁵ The authors found that an individual's aesthetic preference skewed towards the extreme they had been initially exposed to.²⁵ Depending on the visual diet we are being fed by social media's algorithms, our preferences may adapt and perpetuate particular traits, launching into a positive feedback loop with progressively exaggerated appearances selected by the algorithms and subsequent recalibration of what beauty means to the individual. Knowing the long-term effect of such exposure is needed. It may be possible to reorient towards a "more normal" look by exposure to the opposite extreme; however, on social media, it is unclear if "normal" is added to the feeds and at what frequency.

Historically, beauty definitions vary by race and ethnicity; and even with the internet bringing us closer together than ever before, the ideal appearance may be influenced by region. One study examining 257 YouTube advertisements from 18 different countries found no statistically significant difference in symmetry, youthfulness, and health in different regions.²⁶ Differences noted included a preference for fuller lips in Latin America, the USA, and Australia, whereas milky white skin

and a small mouth were preferred in Asia. Additionally, Arab and Southeast Asian women had more intense eyebrows and artificial eyelashes. The authors concluded that differences reflect cultural influences on beauty perception. With the population diversity of the US, cultural trends may play a role in what cosmetic goals a patient would like to achieve. Given the ability of the internet to bring together the far corners of the world and its increasing access, monitoring the changes in trends from different regions may provide insight into what patients are seeking.

Role of Algorithms and Artificial Intelligence

Bias in image recognition and processing partially stems from inherent bias in representation. This is present in images of women and in people of color. For example, when asked for images of occupations, results reproduced gendered stereotypes.²⁷ Bias introduced in facial detection and analysis is complex and ties into historic sexism and racism roots.²⁸ Further bias is introduced inherently in the datasets of the model design that AI is trained on.²⁸ In the end we have a product that has compounded bias at all levels. For example, one Asian woman asked AI to make her headshot "more professional;" in return, she received a photo that turned her skin tone lighter and changed her eye color to blue.²⁹ One study found that when asked to generate positions of authority such as "CEO" or "director," 97% of AI generations were "white" and "man" even though women comprise 29.1% and 39.6% of those positions, respectively.³⁰ Sometimes, the bias introduced and where it entered the system cannot be identified. Similar to how the methodology of clinical trials is a factor in the quality of results, the methodology of how AI systems are built is a factor in the quality of tools, underscoring the importance of understanding how AI systems are generated.

Google Trends has been used as a resource to determine market trends over time and may be filtered by location. One study found an increase in fillers after Kylie Jenner announced that she had received lip fillers.³¹ Another study found an increase in searches related to dermatology, which may be due to the rising interest in non-invasive cosmetic procedures. Terms relating to neuromodulators, fillers, and body contouring were associated with the number of Instagram and Facebook users.³² With the rise of social media and the rapid spread of information, awareness of who or what is controlling our visual diet is important. As mentioned earlier, what is popular among the public may not be of the highest quality information nor evidence-based. Recognizing and acting upon the need for reputable sources on social media is crucial to combat misinformation.

In 2021, the ASDS conducted a survey and reported that almost 70% of responders were considering a cosmetic procedure, the most popular being laser, light, ultrasound, or radiofrequency for skin tightening or wrinkles.³³ Dermatologists were the top influencers (28%) for cosmetic procedures, followed by a tie

of 23% between social media and friends.³³ On social media, 78% of patients follow their current or potential provider, and over half (52%) of consumers were influenced to schedule an appointment based on a provider's social media preference. It may be important to not only keep up with current social media trends but also to maintain a social media account for patients and future patients to view.

DISCUSSION AND FUTURE DIRECTIONS

The specifics on how recommendation systems work on social media platforms are not entirely clear, although various social media platforms have taken initiative to increase algorithm transparency. These models for personalization are dynamic and increase in complexity the more that they are tested and learned. It should be considered that health educational content, which is more likely uploaded by physicians, while being objectively more accurate does not necessarily align with the goals of social media companies. Social media is oftentimes used by the common user as a means of entertainment or networking. Social media companies balance the algorithm to achieve their own goals (eg, growth, revenue, engagement, etc). Considering this, educational content may not rank as highly because it does not achieve desirable outcomes for the users or the business. In addition, because social media allows anyone to create a free account and post content, the credentials of the poster and the validity of the posted content will vary significantly. Even though not directly measurable, perhaps valuing educational content and combating misinformation should be considered part of the ethical responsibility of social media companies. Moving forward, it may be valuable to see what type of content such as educational material, patient experiences, or advertisements are most influential regarding preferences.

CONCLUSION

One's definition of beauty is malleable, likely altered by the visual diet fed by social media content. To prevent homogenization of content, increasing diversity at all levels, including software developers working on algorithms, content creators, and the social media users, may lead to exposure to diversity and widening of our definitions of beauty.

Beauty is a popular interest on social media with an ever-growing consumer base and large market capital. Canons of beauty have historically followed mathematical formulas, but perhaps this will shift to algorithms on social media platforms feeding users what it considers "beautiful," impacting beauty ideals in the future, and with it, aesthetic treatment pursuits. As social media usage continues to expand, it may be valuable for dermatologists to be aware of trends to better understand the patient perspective and to better educate and counsel patients.

DISCLOSURES

The authors have no conflicts of interest to disclose.

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