Likely to be Liked? A Study of Facebook Images

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***Abstract*—This paper investigates how aesthetic properties of images posted on Facebook are related to the number of Likes they attract. Aesthetic properties are conceptualized in terms of technical perspectives such as brightness, colorfulness and clarity as well as non-technical perspectives such as artistry, liveliness and ingenuity. The images collected for this paper were coded in terms of the aesthetic properties by two coders. Data analysis was done using Tobit hierarchical regression. Brightness, clarity, liveliness and ingenuity of images turned out to be positively associated with the number of Likes. The significance of the findings is discussed.**

Keywords-Facebook, image, Like, social media

I. INTRODUCTION

Social networking sites (SNS) such as Facebook make it easy for the online community to contribute and share content. They also allow users to easily browse and evaluate content posted by others. These social media platforms have become popular by enabling users to present themselves, their thoughts, emotions, likes and dislikes to their online peers. Their growing popularity is unlikely to plateau out any time soon [1,2].

SNS spawn an ever growing volume of user-generated content that not only includes text but also multimedia such as images. On an average, more than 300 million images are uploaded daily on Facebook [3]. The website serves as an essential avenue for users to exhibit their photography skills. Interested users may also choose to express their appreciation by clicking on the Like button. In fact, by 2012, the SNS had garnered over 1.13 trillion Likes from users across some 219 billion uploaded images [4]. Hence, images constitute a pivotal part of the SNS experience for Facebook users.

While Facebook is replete with multimedia content that are often liked, not much scholarly attention has delved into the ways in which aesthetic properties of images posted by users could predict the number of Likes. Nonetheless, scholars have already ventured into allied areas such as the relationship between message properties of Facebook posts and the number of Likes [5] as well as the association between aesthetic properties of web pages and users' preferences [6].

Inspired by these works, the objective of the paper is to investigate the extent to which aesthetic properties of images are related to the appreciation they receive from users on Facebook, one of the most popular SNS [2]. Aesthetic properties are conceptualized in terms of technical perspectives such as brightness, colorfulness and clarity as well as non-technical perspectives such as artistry, liveliness and ingenuity [7-13]. Users' perception of appreciation toward a given image is calculated as the number of Likes the image has attracted.

The rest of the paper is organized as follows. The next section describes the conceptualization of images' aesthetic properties based on the literature. This is followed by a description of the methods for data collection, coding and analysis. The results are presented next. Finally, the paper discusses the results, and concludes by highlighting a few directions for future research.

II. LITERATURE REVIEW

This paper conceptualizes aesthetic properties of images in terms of technical perspectives and non-technical perspectives. Technical perspectives are generally dependent on the camera that has been used to capture a given image, particularly its electronic and optical components [7]. For the purpose of this paper, three technical perspectives are considered, namely, brightness, colorfulness, and clarity.

First, brightness refers to physiological sensations and perception of light as provided by images [8]. While lack of brightness in a given image blurs its parts [9], bright images are generally eye-catching.

Second, colorfulness refers to the overall ambience created in images through the use of colors. Colorful images are known to be stimulating and could attract the attention of users [10].

Third, clarity is a measure of the extent to which images are free from distortions. It refers to the level of depth and granularity in images that can help users distinguish the contents [9].

Non-technical perspectives are generally dependent on the skill of the photographer, and are often based on viewers' interpretation of images [7]. For the purpose of this paper, three non-technical perspectives are considered, namely, artistry, liveliness, and ingenuity.

First, artistry refers to the ability of images to attract and hold attention of their viewers [11]. It is a measure of the extent to which images are pleasing to the eye, providing them an aesthetic appeal.

Second, liveliness is a measure of images' originality and naturalness. It is a reflection of the extent to which images convey optimism and positive energy [9].

Third, ingenuity of images is a property that arouses curiosity and acts as a key precursor to attention [12]. It is often attributed to photographers' novelty, and is reflected by the extent to which the presentation of the image gives it an inventive appeal [13].

Till date, not much scholarly attention has been trained on how these aesthetic properties of images posted on Facebook are able to predict the number of Likes they are likely to garner. Therefore, this paper can enrich the understanding of Facebook users' image liking behavior as a function of images' aesthetic appeal.

III. METHODS

Facebook was chosen as the SNS for data collection given its unparalleled popularity [14,15]. Since its debut in 2004, it has achieved remarkable growth as one of the world's leading SNS with more than some 2 billion monthly active users [16]. In addition, Facebook offers ample opportunities for its users to exhibit their photography skills and engage in self-presentation through photo album management [17]. Images posted on Facebook are accompanied by the number of Likes they have attracted. This makes the platform particularly suitable for the context of the paper. Furthermore, Facebook has been widely chosen as a suitable platform for analysis in numerous recent studies on SNS [18].

Two research assistants helped with the data collection and coding procedures. For data collection, it was not possible to meaningfully identify a well-defined pool of images. Therefore, the research assistants selected 500 images posted on Facebook randomly based on the following three criteria: One, every image should be posted by a unique user. This ensured data points from a wide range of users. Two, the images must not show any human figure. This meant that the number of Likes was not influenced by the popularity of the person in the image. Three, the images must have been posted about a year ago from the period of data collection. Thus, all the images had a comparable time to attract Likes.

To select images based on these criteria, Facebook was searched iteratively with keywords such as "photography" and "photo album". The retrieved results were filtered to include publicly available images posted a year earlier by any user. The tagged location was changed to draw images posted by users from diverse geographical regions such as America, Asia-Pacific, Europe and Middle-East [19]. This was necessary to maximize the representativeness of the dataset as much as possible. Admittedly, the scope of the dataset is bounded by Facebook users who had disclosed their hometowns, and made their uploaded images publicly available.

Of the selected 500 images, 182 had to be deleted. In particular, 17 images were excluded because they had attracted about a million Likes. They mostly showed iconic buildings such as the Eiffel Tower and the Burj Khalifa. Including such images might have skewed the dataset. Another 104 images were eliminated because they were blurry. They would not have allowed a fair comparison across images. Yet another 61 images were removed because they were either black-and-white or grayscale images. Hence, their colorfulness, one of the aesthetic properties studied in this paper, could not be meaningfully ascertained.

The remaining 318 images (500 - 182) were archived and assigned unique identification numbers. The number of likes attracted by the images was also recorded.

For data coding, this paper called for evaluating the images based on the technical (brightness, colorfulness and clarity) and the non-technical perspectives (artistry, liveliness and ingenuity). The coding was performed by the research assistants. They were provided a briefing on the six aesthetic properties. Then, they independently rated the images using the Mean Opinion Score (MOS) scale of image properties. The MOS scale represents a 5-point Likert type scale, ranging from 1 (worst) to 5 (best), to indicate the extent to which a given image property could be observed in each image. The scale has been widely used to rate the quality of digital media such as videos [20].

The coding was done independently by the two coders in the same experiment room at the same time. They viewed the images in two computers that had similar specifications and settings. These ensured uniform illumination conditions for both while coding [21]. The inter-coder reliability between the two coders in terms of Cohen's Kappa was found to be 0.78, indicating a level of agreement beyond chance [22].

The data were analyzed using multiple linear regression. Number of Likes was the dependent variable. The independent variables included the three technical perspectives, namely, brightness, colorfulness, and clarity along with the three non-technical perspectives, namely, artistry, liveliness, and ingenuity. These were included in the regression model in a hierarchical fashion.

Instead of the ordinary least square estimate, Tobit estimate was employed for the analysis. The latter is suitable to negate potential selection bias inherent in the dataset. For example, Facebook indicates the number of Likes for a posted image. However, it is conceivable that all users who view an image may not express their opinions. Furthermore, users do not have the liberty to express their dislikes for images. Under such a circumstance that gives rise to selection bias, ordinary least square estimate tends to be biased and should be replaced by Tobit estimate [23].

IV. RESULTS

The descriptive statistics of the dataset is shown in Table I. Interestingly, the mean score for the technical perspectives ($M = 3.44$, $SD = 1.26$) was similar to that for the non-technical perspectives ($M = 3.44$, $SD = 1.00$). In terms of the technical perspectives of the selected images, clarity had the highest mean while brightness lagged behind in the rear. With respect to the non-technical perspectives, liveliness had the highest mean while artistry was found to lie at the other end of the spectrum. The dependent variable, number of Likes, ranged from 1 to 50 with mean and standard deviation of 4.41 and 6.02 respectively.

TABLE I. DESCRIPTIVE STATISTICS

	Mean	SD	Min	Max
Brightness	3.32	1.42	1	5
Colorfulness	3.37	1.44	1	5
Clarity	3.63	0.91	1	5
Artistry	3.40	1.31	1	5
Liveliness	3.51	0.85	1	5
Ingenuity	3.42	0.85	1	5
Likes	4.41	6.02	1	50

As indicated earlier, multiple regression was conducted with Tobit estimate for making inferences. The independent variables were entered hierarchically according to their assumed causal order. It is conceivable that if images do not qualify certain minimum criterion with respect to their technical perspectives (brightness, colorfulness and clarity) in the first place, they may not attract much attention from Facebook users. If images do not grab the eyeballs, users may not bother to appreciate the non-technical perspectives (artistry, liveliness and ingenuity). Hence, the three technical perspectives were entered in the first block followed by the three non-technical perspectives in block 2, thereby resulting in two regression models.

The inferential statistics are presented in Table II. With respect to the technical perspectives, the positive relations of brightness and clarity with the number of Likes were statistically significant. With respect to the non-technical perspectives, the positive relations of liveliness and ingenuity with the number of Likes were statistically significant. To sum up, brightness ($\beta = 0.63$, $p < 0.01$), clarity ($\beta = 0.79$, $p < 0.001$), liveliness ($\beta = 0.65$, $p < 0.05$), and ingenuity ($\beta = 1.46$, $p < 0.05$) of images turned out to be positively associated with the number of Likes (final $R^2 = 19.24\%$).

TABLE II. INFERENTIAL STATISTICS

	Model 1		Model 2	
	Coeff	Std Err	Coeff	Std Err
Brightness	0.95***	0.28	0.63**	0.30
Colorfulness	-0.19	0.41	-0.47	0.46
Clarity	1.01***	0.26	0.79***	0.27
Artistry			-0.70	0.54
Liveliness			0.65*	0.32
Ingenuity			1.46*	0.49
Log Likelihood	-995.19 (df: 3)		-987.58 (df: 6)	
Incremental R^2	15.46%		3.78%	
Total R^2	15.46%		19.24%	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

V. DISCUSSION AND CONCLUSION

This paper investigated the extent to which the aesthetic properties of images could predict the number of Likes they attract on Facebook. Results indicated that among the technical perspectives, the positive relationship of brightness and clarity with the number of likes was statistically significant. On the other hand, among the non-technical perspectives, the positive association of artistry and ingenuity with the number of likes was statistically significant.

Consistent with prior research [7,9], brightness and clarity emerged as crucial predictors of the number of Likes. These image properties have long been known to determine individuals' ability to distinguish the contents of an image. Moreover, in line with the literature that has shown that perception of images could be related to their inherent liveliness or naturalness [9,21], such a phenomenon was also observed in the context of images in Facebook. Interestingly, users of Facebook seem to have proclivity for images with high levels of ingenuity irrespective of colorfulness and artistry.

Furthermore, it is interesting to note that mean values of the six image properties were generally on the higher end. This suggests that users generally tend to upload only good quality images in Facebook, perhaps with the hope of receiving appreciation from the online community. Such tendency of self-presentation among users in SNS is perhaps expected [24].

This paper is significant for two reasons. First, on the research front, it represents a relatively new attempt to study how image properties are related to the number of Likes on Facebook. For this purpose, it drew from two disparate strands of research, namely, evaluation of user-generated content, and assessment of images. This paper sheds light on the ways users perceive images contributed by their online peers on Facebook. Given that scholarly investigation into the analysis of images has thus far been confined to selected test images without venturing into SNS such as Facebook, this paper represents a modest attempt to expand the boundaries of research in social media and serves as a call for scholars to delve into the quality of user generated content beyond text. It also suggests that users in SNS are largely driven by desires for self-presentation, and hence tend to upload only good quality images.

Second, this paper is valuable on the practical front as it demonstrates users' liking behavior in Facebook. It is expected that high quality images should be liked more by Facebook users. However for images in Facebook, even though brightness, clarity, liveliness and ingenuity had significant positive relationship with the number of Likes, the effects of colorfulness and artistry were not statistically significant. Voracious users of SNS may lean on the findings of the paper to upload images that have the potential to attract widespread appreciation. This can also inform the kind of images that brands should post on their Facebook Fan Pages as a way to promote brand loyalty. The findings also offer insights into some of the key issues in developing visual applications that are aimed to improve quality as

perceived by social media users. Furthermore, the presence of high quality images in Facebook suggests that content contributed by individual users are increasingly becoming professional. Hence, platforms such as SNS can be leveraged for crowd-sourcing in various image-related domains.

That said, the findings of this paper should be viewed in light of two constraints. First, users' appreciation of images was operationalized as the number of Likes without taking into account the comments garnered by the images. Qualitative analysis of comments received by images might have offered richer insights. Second, the findings of this paper are limited by the window of the data collection period as well as data that were publicly available. Caution is advocated in generalizing the results.

Nonetheless, this paper unravels a few directions for potential future research. One direction of investigation could involve analysis of users' perception towards image quality in Facebook using mixed methods, taking into account not only the number of Likes but also the textual comments. Another approach could be to replicate the study for other types of digital media such as videos. More scholarly inquiries along these themes could help verify and refine the findings gleaned from this paper.

REFERENCES

[1] B. Kalsnes, A. O. Larsson, and G. S. Enli, "The social media logic of political interaction: Exploring citizens' and politicians' relationship on Facebook and Twitter," First Monday, vol. 22, 2017, http://ojphi.org/ojs/index.php/fm/article/view/6348/5916

[2] B. Bodroža, and T. Jovanović, "Validation of the new scale for measuring behaviors of Facebook users: Psycho-Social Aspects of Facebook Use (PSAFU)," Computers in Human Behavior, vol. 54, pp. 425-435, 2016.

[3] R. Armbrust, "Capturing growth: Photo apps and open graph," 2012, https://developers.facebook.com/blog/post/2012/07/17/capturing-growth--photo-apps-and-open-graph/

[4] M. Prigg, "Facebook has a billion users, reveals a 'humbled' Mark Zuckerberg," 2012, http://www.dailymail.co.uk/sciencetech/article-2212747/Facebook-reaches-BILLION-users-just-dont-mention-share-price.html

[5] F. Sabate, J. Berbegal-Mirabent, A. Cañabate, and P. R. Lebherz, "Factors influencing popularity of branded content in Facebook fan pages," European Management Journal, vol. 32, pp. 1001-1011, 2014.

[6] L. Deng, and M. S. Poole, "Aesthetic design of e-commerce web pages – Webpage complexity, order and preference," Electronic Commerce Research and Applications, vol. 11, pp. 420-440, 2012.

[7] G. Nyman, T. Leisti, P. Lindroos, et al., "Measuring multivariate subjective image quality for still and video cameras and image processing system components," Proc. International Society for Optics and Photonics - Electronic Imaging, Image Quality and System Performance V, 68080N, Jan. 2008, pp. 1-9, doi:10.1117/12.766186

[8] FS-1037C, "US Federal glossary of telecommunication terms," 1996, http://www.its.bldrdoc.gov/fs-1037/dir-005/_0719.htm

[9] J. Radun, T. Leisti, T. Virtanen, J. Häkkinen, T. Vuori, and G. Nyman, "Evaluating the multivariate visual quality performance of image-processing components," ACM Transactions on Applied Perception, vol. 7, article 16, 2010.

[10] S. Baloglu, and M. Mangaloglu, "Tourism destination images of Turkey, Egypt, Greece, and Italy as perceived by US-based tour operators and travel agents," Tourism Management, vol. 22, pp. 1-9, 2001.

[11] K. Vaiapury, and M. S. Kankanhalli, "Finding interesting images in albums using attention," Journal of Multimedia, vol. 3, pp. 2-13, 2008.

[12] H. Katti, K. Y. Bin, T. S. Chua, and M. Kankanhalli, "Pre-attentive discrimination of interestingness in images," Proc. IEEE International Conference on Multimedia and Expo, IEEE, Jun. 2008, pp. 1433-1436, doi:10.1109/ICME.2008.4607714

[13] M. Cao, Q. Zhang, and J. Seydel, "B2C e-commerce web site quality: An empirical examination," Industrial Management & Data Systems, vol. 105, pp. 645-661, 2005.

[14] C. Jacques, D. Fortin-Guichard, P. Y. Bergeron, C. Boudreault, D. Lévesque, and I. Giroux, "Gambling content in Facebook games: A common phenomenon?," Computers in Human Behavior, vol. 57, pp. 48-53, 2016.

[15] T. Kaya, and H. Bicen, "The effects of social media on students' behaviors; Facebook as a case study," Computers in Human Behavior, vol. 59, pp. 374-379, 2016.

[16] Statista, "Number of Facebook users worldwide 2008-2017," 2017, https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/

[17] M. M. Strano, "User descriptions and interpretations of self-presentation through Facebook profile images," CyberPsychology: Journal of Psychosocial Research on Cyberspace, vol. 2, article 1, 2008.

[18] A. Pal, A. Chua, and S. Lim, "Analysis of Facebook comments in response to counter rumors," Proc. AIS Pacific Asia Conference on Information Systems, AIS, Jul. 2017, http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1155&context=pacis2017

[19] S. Banerjee, and A. Chua, "Authentic versus fictitious online reviews: A textual analysis across luxury, budget, and mid-range hotels," Journal of Information Science, vol. 43, pp. 122-134, 2017.

[20] ITU-R Recommendation BT.500-11, "Methodology for the subjective assessment of the quality of television pictures," International Telecommunication Union, Geneva, Switzerland, 2002.

[21] R. Halonen, S. Westman, and P. Oittinen, "Naturalness and interestingness of test images for visual quality evaluation," Proc. International Society for Optics and Photonics – Electronic Imaging, 2011.

[22] W. D. Perreault, and L. E. Leigh, "Reliability of nominal data based on qualitative judgments," Journal of Marketing Research, vol. 26, pp. 135-148, 1989.

[23] P. Kennedy, A Guide to Econometrics. Oxford, England: Blackwell Publishers, 1994.

[24] J. B. Walther, "Selective self-presentation in computer-mediated communication: Hyperpersonal dimensions of technology, language, and cognition," Computers in Human Behavior, vol. 23, pp. 2538-2557, 2007.