

Getting Anxious while Retouching Photos? Exploring the Relationships between Affordances of Photo Retouching Applications and Appearance Anxiety

Dongyuan Zhu
Dr. Stephen Hui Research Centre for Physical
Recreation and Wellness
Hong Kong Baptist University
Hong Kong, China
zdy036@163.com

Vincent Huang
Department of Interactive Media
School of Communication
Hong Kong Baptist University
Hong Kong, China
vincenthuanglei@gmail.com

Abstract

Appearance anxiety, or people's fear of negative evaluation of their body shape or physique by others, has become an increasing concern. The development of mobile devices and photo retouching applications have made it easier to create flattering photos. However, little research explores how they contribute to appearance anxiety. Drawing on the agency model of customization, this study explores how the affordances of photo retouch applications affect appearance anxiety. Using Meitu, a popular photo retouch application in China, as an example and drawing on results from an online survey among its users (N=136), this study showed that the interactivity, modality, and navigability affordances of Meitu were positively correlated with the feeling of self as source, which contributed to people's negative emotions about appearance. These findings add to understanding the mechanisms underlying the potential effects of photo retouching software use on appearance anxiety.

Keywords: appearance anxiety, interactivity, modality, navigability, self as source

1. Introduction

Appearance anxiety, or social-physical anxiety, refers to individuals' feelings of being afraid of negative evaluations of their body shape or physique by others or a lack of confidence in appearances (Hart et al., 1989; Hart et al., 2008). This form of anxiety is particularly prominent among young Chinese women, especially after "internet celebrity face" became the most discussed buzzword in 2016 (Gan, 2021; Dippner, 2018). Wanghong refers to internet celebrities who have gone viral on the internet (Han, 2020). They often attract consumers' attention through their beauty, like

"internet celebrity face (wanghong face)", to position and market themselves. This new occupation indicates a trend of identity division under neoliberal discourse and is a typical example of aesthetic vigilance in neoliberal subjectification. Through the calculative and self-governmental labor of risk-managing one's attachments to beauty and its technologies (Dosekun, 2017), people have a highly vigilant and critical gaze on their bodies.

The emergence of internet celebrities and internet celebrity faces has contributed to the rise of digital technologies that help people enhance their self-presentation online, such as photo retouching tools. These tools allow users to reframe their faces, such as changing the structure of their face, lightening their skin and enlarging their eyes, to enhance their appearance (Varagur, 2016; Nguyen, 2017).

The global success of neoliberal economic reforms has resulted in several institutional collapses, and people increasingly perceive the environment as uncertain and insecure. A new entry point for neoliberal discourse emerges, which advocates that everyone must accept that it is impossible to resist or protect themselves from the various difficulties but must learn how to adapt to their advantages by embracing insecurity (Salecl, 2005; Chandler & Reid, 2016). The fear of being abandoned by social norms creates enormous pressure to conform to narrowly defined norms, such as beautiful, homogeneous looks (Dippner, 2018).

Research in the field of body image has shown that people who are chronically exposed to idealized depictions of beauty can distort perceptions of their own bodies and lead to dissatisfaction to their appearances (Shaw & Waller, 1995). After seeing idealized images, there is a significant interaction between levels of self-objectification and body idealization, with participants experiencing increased

body shame (Monro & Huon, 2005). As a result, the ability of these retouching applications to create idealized images can enhance the doubts about the authenticity of online self-presentation and appearance anxiety.

Existing research has focused much on the negative impacts of internet celebrity, such as increased social comparison and inauthentic self-presentation. However, there is limited research on the design of photo retouching tools and its negative impact. This study fills the gap by taking Meitu, a popular photo retouching software in China, as an example to study the impact of digital technology on people's self-comparison to their appearance.

2. Literature review

2.1. Meitu as a leading photo retouching software and application in China

Photo retouching software and mobile phone applications provide a convenient tool to create flattering photos. Founded in October 2008, Meitu is a Chinese technology company that offers products for photo retouching and enhancement using artificial intelligence. Since its launch, it has helped countless users beautify their photos in an all-around way. The company's products include Meitu, BeautyCam, and MakeupPlus. Among them, Meitu is the benchmark software in the industry, with more than 1 billion users worldwide. According to the data of QuestMobile (2020, 2021 & 2022), which is China's professional mobile internet business intelligence service provider, Meitu has maintained the largest number of users in the photo retouching track for a long time.

The rise of photo retouching products such as Meitu has indeed empowered people to beautify photos. However, it has received criticisms and worrisome that the excessive use of photo retouching might lead to a large gap between people's images in real life and those on the internet. The original purpose of photo retouching software is to make adjustments and modifications of photos; however, many would argue that the excessive use might result in authenticity issues.

Studies in recent years have focused on the relationships between appearance anxiety and the rise of internet celebrities. Exploratory studies concerning the mechanism and influence of internet celebrities' body representation through social media have emerged (Wen, 2021; Han, 2020; Dippner, 2018; Schreiber, 2017). The impact of photo retouching software on the relationship between appearance anxiety and affordances has also been explored

(Moreno & Uhls, 2019; Bue, 2020; Zhang, 2023). Unfortunately, in the existing studies, scholars pay more attention to the social comparison generated when people use social media or photo retouching software, that is, the comparison between self and others. However, these studies often ignore how self-comparison occurs. In this study, we use the agency model of customization (Sundar et al., 2015; Sundar, 2008) to explain how using photo retouching applications affects people's self-comparison. Following the model, we argue that the affordances of photo retouching applications could induce a sense of self as a source. Subsequently, the sense of self could trigger users' emotions. When there is a contrast between people's actual selves and their digitally enhanced self-images (in our case, the resultant beautified photos), they may develop feelings of anxiety.

2.2. Affordances in the agency model of customization

People interact with an artifact after the perception of their action possibilities. Such properties of artifacts that are identified and contribute to the interaction that takes place between the actor and the artifact are called affordances (Gibson, 2014). The concept of affordance has been used in the design of many digital technologies (Treem & Leonardi, 2013). The internet removes the barriers of physical, spatial, and temporal distance, making it possible for users to feel synchronized when communicating with information sources, and users can enjoy a better interactive experience on the internet (Wang et al., 2002). Breaking down media into specific technological variables, such as interaction, can help us understand how technology engages users. It can also help us understand what the salient aspects of interaction are, whether they affect user psychology, and what kind of changes have occurred in users' perceptions and attitudes toward content (Sundar et al., 2015).

The agency model of customization (Sundar et al., 2015) argues that when users think of themselves as a source of customization, this leads to greater user involvement in customizing the interface. When users are empowered to customize, the feeling of self as source may increase their interest and engagement with the interface. Their interactive engagement can also be transformed into a cognitive engagement. Acting as a source of information and exerting their influence, users could maintain their identities during the interaction with the interface (Sundar, 2008). The ability to consciously project one's own identity is especially evident when the self is the source, and a

focus on one's personal identity is more likely to have an impact on one's feelings and attitudes during and after the interaction.

In the agency model of customization, interactivity, modality, and navigability are conceptualized as affordances that are likely to trigger the sense of self as source. Interactivity allows users to go beyond being mere receivers of messages to become gatekeepers, referees, and even sources of information. It enables users to communicate with and control the interface based on their needs. Modality can enrich users' perception of the environment through sensory experience. Users can choose a variety of forms of content. Empowered by multi-modalities, users' sense of presence is enhanced. When customized interfaces allow users to present and represent themselves to different degrees, users are more likely to feel that they are the source. Similarly, the navigability of the interface promotes the concept of self as source, allowing users to move through different areas of the interface, creating immersive experiences (Balakrishnan & Sundar, 2011).

Informed by the definitions of the three affordances, we argue that certain features of Meitu provide experiences of interactivity, modality, and navigability, which are likely to trigger the heuristic of self as source. Table 1 provides a summary of features related to the three affordances, respectively.

Table 1. Affordances and features of Meitu

Affordances	Definition based on Sundar (2008)	Related Features of Meitu
Interactivity	People interact or participate in activities through digital devices, and the medium responds to user needs.	Meitu provides creative and fast interactive buttons like one-click generation of retouch photos.
Modality	Digital devices present carefully designed content to people in some form or a combination of forms to inspire users.	Meitu provides a large number of text descriptions, image examples and dynamic effects for users to refer to retouching effects.
Navigability	Digital devices use different navigations to motivate people	Meitu provides different navigation keys to direct users to

Affordances	Definition based on Sundar (2008)	Related Features of Meitu
	to jump from one place to another.	other pages to use more other services.

Based on the agency model of customization, we propose that the three affordances of photo retouching applications would bring appearance anxiety through the perception of self as source. Figure 1 illustrates our model. The following hypothesis is proposed.

H1: The uses of affordances of interactivity, modality, and navigability of Meitu are positively related to appearance anxiety through the enhanced perception of self as source.

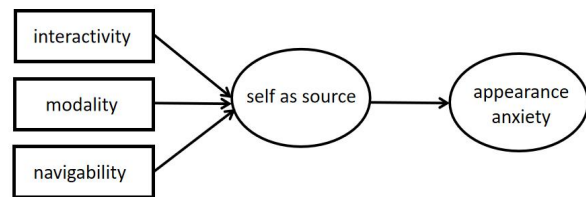


Figure 1. Research models for affordance and appearance anxiety.

3. Methodology

The photo retouching software selected for this study is Meitu, and the module involved in the retouching operation is portrait beautification and the portrait part of photo retouching. An online survey among Meitu users was conducted. Upon obtaining the research ethics clearance from the authors' university, convenience sampling was conducted by distributing a questionnaire on popular social media platforms in China, such as WeChat, QQ, Weibo, Zhihu, and Xiaohongshu.

3.1. Participants and procedure

The participants should be users of Meitu and have used it to edit photos and post them on their moments in the past year. An informed consent statement was provided at the beginning of the survey. Upon agreeing to participate in the study, the participants were given a scenario that the participants had an original photo of their whole body without retouching or any editing. They were instructed to think about how they would use Meitu to retouch the photo according to their previous experience.

Of the 320 people who agreed to participate in the study, 136 completed the survey and had valid responses. Specifically, there were 115 women (84.56%) and 21 men (15.44%). According to Meitu's 2021 report, a majority of users (81.6%) are female. Thus, our data can be assumed to be representative of Meitu users. In the context of the neoliberal era, the financial rewards of beauty are now almost equal to the advantages of having qualifications, as plenty of young women now believe that being physically attractive is as important as education, meaning that their hopes of generating income and improving their social status are contingent on the body politics (Dippner, 2018; Hakim, 2011). Studies have shown that women are more concerned about their appearances, and have more negative feelings about their bodies (Eckler, 2017; Trekels & Eggermont, 2017; Phares et al., 2004). When women base their self-worth on their appearance, failure to meet their expected aesthetic norms can lead to severe psychological distress and lower self-evaluation (Patrick et al., 2004). Therefore, women are more likely to fall into aesthetic vigilance and will be more dependent technologies that could enhance their beauty and presentations of self-images. This further indicates that the distribution of women in the survey group is very reasonable, which is in line with the user group distribution of Meitu.

All of the participants were over 18 years old, among which the largest number of participants were from 21 to 31 (55.88%, N = 79), and a few were over 51 (5.16%, N = 7). In terms of their education levels, more than half of the participants had a bachelor's degree (55.88%, N = 76), followed by master's degree (17.65%, N = 24), bachelor's degree (11.03%, N = 15), senior high school (11.03%, N = 15), junior high school (2.94%, N = 4) and doctor's degree (1.47%, N = 2). Most participants are students (66.18%, N = 90), followed by employees of an organization (27.94%, N = 38), and neither students nor employees (5.88%, N = 8).

3.2. Measures

The study measured the frequency of the use of Meitu affordances, the perception of the self as source, and assessments of appearance-related anxiety. As the frequency of using different functions related to the three affordances is related to personal habits, the items associated with respective affordances are not assumed to be internally consistent.

Other self-report scales with multiple items were reliable as their Cronbach's alphas were higher than 0.8 (see Table 2). Moreover, KMO and Bartlett's test showed that KMO values of the two constructs were

both greater than 0.8, which means that the questionnaire data is suitable for factor analysis. The p-values of Bartlett test results are all less than 0.001, so the questionnaire is considered valid (see Table 3).

3.2.1. Meitu activity. We measured three types of Meitu activities according to the agency model of customization: interactivity, modality, and navigability. For the interactivity affordance, we asked the participants to indicate the frequency of using one-click generation, photo refinements, and degree adjustments. In measuring the modality affordance, we investigated forms of content the participants were exposed on Meitu, including texts, picture instances, and dynamic changes. As for the navigability affordance, we surveyed the frequency of navigating experience on Meitu, including using "More" to explore additional functions, switching between before and after beautification, switching between the automatic mode and the manual mode, and switching between different layers.

Table 2. Cronbach's alphas of scales

Construct	Cronbach's alpha	Number of items	M	SD
Self as source	.807	7	2.576	0.668
Appearance anxiety	.903	16	1.846	0.904

Table 3. KMO and Bartlett's test

Dimensionality	KMO	Approx. Chi-Square	df	p-value
Self as source	.831	250.066	21	<.001
Appearance anxiety	.916	846.468	120	<.001

3.2.2. Self as source. The measurement of the self as source consists of two dimensions, namely perceived control and self-expression (Oh et al., 2021). Perceived control measured the extent to which people believed that they were responsible for the outcome of a particular situation (DeCharmes, 1968). Users may feel an increased level of control when they can choose to

personalize their actions rather than having an app that offer a pre-set setting (Sundar & Marathe, 2010). Self-expression assessed the extent to which Meitu users actively controlling the choice of features to create a sense of agency (Sundar et al, 2012). The four items of perceived control were adapted into a 5-point Likert scale based on the sense of control scales of Liu (2003) and Marathe and Sundar (2011). The three items of self-expression were measured on a 5-point Likert scale by Stavrositu and Sundar (2012) items.

3.2.3. Appearance anxiety. We chose the Social Appearance Anxiety Scale (SAAS) on a 5-point Likert scale to measure the anxiety of being negatively evaluated by others due to the overall appearance including body shape. The scale provided valid psychometrical indicators to measure the social anxiety of a person's overall appearance. The SAAS includes 16 items, assessing social anxiety, body image dissatisfaction, and body deformation disorder (Hart et al., 2008).

4. Results

Pearson correlation analysis was used in this study to conduct an exploratory preliminary analysis of the correlation between study variables. In general, as shown in Table 4, at a 95% significance level, all correlation coefficients are no more than .80, and p-values are less than .01. This indicates that there is no high correlation between the variables, suggesting that multicollinearity is not an issue in our data.

Table 4. Simple correlations among the study variables

	I	M	N	SAS	AA
I	-				
M	.555**	-			
N	.456**	.446**	-		
SAS	.493**	.580**	.646**	-	
AA	0.144	.293**	.243**	.370**	-

Note: *p <.05; **p <.01; ***p <.001. I = Interactivity, M = Modality, N = Navigability, SAS = Self as source, AA = Appearance anxiety.

The hypothetical model was tested using structural equation modeling (SEM) in SPSS AMOS, which included the relationships specified in the hypothesis (see Figure 2). SEM was used to estimate the maximum likelihood of the hypothetical model. Since the Chi-square statistical critical value of one degree of freedom ($\alpha=0.05$) is 3.84, MI value greater than 3.84 is considered to be large enough, and if there is sufficient theoretical support for the causality of this parameter, it can be released and reestimated (Fu et al., 2013). In this study, variables less than 3.84 as shown in Modification Indices (Mis) were released from large to small until the fitting index reached the target. According to the following fitting indexes, the fitting degree of the model is in the acceptable range: $\chi^2/df=1.568$, $p<.001$, $RMSEA=.065$, $IFI=.823$, $TLI=.801$, $CFI=.818$.

Table 5. Standardized regression weights of the final model

	Estimate	S.E.	C.R.	p
SAS \leftarrow I	.204	0.141	1.913	0.056
SAS \leftarrow M	.562	0.102	4.036	***
SAS \leftarrow N	.726	0.191	3.989	***
AA \leftarrow SAS	.336	0.098	1.914	0.056

Note: *p <.05; **p <.01; ***p <.001. SAS = Self as source, I = Interactivity, M = Modality, N = Navigability, AA = Appearance anxiety.

Then, based on the final model, this study conducted a chain mediation effect analysis for each path. See Table 6 for the results. The path through which interactivity influences appearance anxiety through the mediation variable self as source is named M1. The path through which modality affects appearance anxiety through the intermediary variable self as source is named M2. The path that navigability influences appearance anxiety through the mediation variable self as source is named M3. The overall mediation effect is named M4. The results suggested that only modality and interactivity were positively related to appearance anxiety through the perception of self as source.

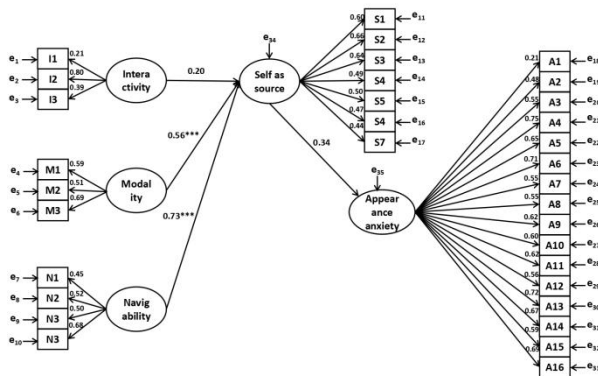


Figure 2. Structural regression model.

Table 6. Indirect effects in the final model

Parameter	Estimate	Lower	Upper	p-value
M1	.051	-.021	.349	.153
M2	.077	.011	.238	.004
M3	.143	.020	.472	.003
M4	.271	.031	.820	.005

Note: Path coefficients are standardized regression weights.

5. Discussion

5.1. Affordances of photo retouching applications and the perception of self as source

Our findings suggest that interactivity, modality, and navigability enable people to have a stronger perception of self as source when using Meitu. TIME models view affordances as a source interactivity (SI) because they can induce a sense of self as source in users (Sundar et al., 2015). When faced with highly controversial issues, such as appearance anxiety, which is often debated on the internet today, SI shifts the focus from other sources to its own. When SI is present, users are very eager to choose self-expression, this kind of self-expression is associated with the reinforcement of attitudes, and users' attitudes become clearer and more determined, even if they themselves

do not understand the information provided on these interfaces. Therefore, the use of SI reduces users' participation in the understanding of the information content itself but leads to users' increased attention to themselves (Sude et al., 2021).

Modality can enhance users' attitudes toward the interface by increasing the sense of presence during browsing (Hartmann et.al, 2015). It reduces people's systematic processing of various messages on the interface and enables users to focus on the interaction with the website through interactive functions. They spend less time integrating prior knowledge to understand the information on the interface. Since individuals' concentration and awareness assigned to the interface are different, modality can guide users to pay more attention to the interactive task itself rather than the information on the interface, encouraging them to actively deal with visual changes on the interface and increasing the allocation of their own cognitive resources in terms of hand-eye coordination (Oh et al., 2020).

Navigability aligns with spatial metaphors such as "site" and "cyberspace" applied to digital media, suggesting that interface features from one location to another are more important than other functions. It has the dual ability to use different navigation aids on the interface to directly trigger the user's deeper experience and to transmit information for prompting through the generated content. Navigability implies a variety of heuristics that operate on different levels, leading users to view navigation structures in their own dominant way, from the perspective of psychological immersion that seeks variety and pleasure and to take a stronger cognitive stance towards digital media (Sundar, 2008).

5.2. Self as source and appearance anxiety

Our study extends the applicability of the agency model of customization to a new context. We found that, in the context of using photo retouching applications, the stronger the feeling of self as source, the higher the feeling of appearance anxiety.

In social cognitive theory (Bandura, 1986), self-efficacy to control potentially threatening events plays a central role in the arousal of anxiety. The threat is not a fixed attribute of situational events, but rather a relational attribute involving a match between a person's perceived ability to cope and potentially harmful aspects of the environment. People's evaluation and response to external threats largely determine people's subjective risk in the face of the external environment (Bandura, 1988). Therefore, when beautifying images is a personal and private activity, people will feel confident and satisfied by the

positive signals provided by the Meitu interface. Even if they impose prejudices on their actual abilities in the process of repainting, they often do not realize these biases, but maintain a relatively stable and less prone to self-doubt (Mobius et al., 2014). Customization is favored over personalization in this case, because it provides users with a higher sense of self-ownership, and users have more power in operating the interface and deciding the final content (Sundar, 2015). When people operate the interface to customize their favorite image, they are full of pleasure and positivity and are longing for success, so they have a certain degree of emotional self-regulation and resilience (Marsh et al., 2017).

However, it also means that users need to take more responsibility for their power. Once this activity is exposed to the external environment and becomes a public activity, people will immediately perceive that the external environment may bring harm to them, such as attacks on their appearance, or attacks on the level of their beauty. Therefore, it is necessary to bear any damage caused by the content they have created. In the environment of the internet under the neoliberal context, it is almost impossible for people to fully resist risks and protect themselves. When people have a high awareness of self as source, they tend to think that these external attacks will definitely act on them, and when they think that they cannot deal with potential threats, they will fall into a high level of anxiety.

5.3. Modality and navigability indirectly lead to appearance anxiety through self as source

The mediation analyses showed that modality and navigability were indirectly related to appearance anxiety, while the related functions of interactivity had little influence on people's negative emotions. A system can be more or less interactive, depending on how people use it. Users exchange messages with the interface in a special way as they navigate in different orders using the features provided by these interfaces and decide which parts of the content to participate in and which to ignore based on the representation of the features. Therefore, people decide the information they receive according to the different characteristics of interactivity, modality and navigability, which will have distinctive impacts on people's emotions.

Modality and navigability are more about providing users with messages and guiding them to engage in longer and deeper interactions with the interface. These interactions with high message volumes are very helpful to enhance users' understanding of the message (Sundar, 2015). The photo effects and texts provided

by Meitu, as well as the templates of beautiful pictures, all reflect mainstream aesthetics in society. Users can capture more information from the outside world through the description of the filter style or the visual impact of picture examples. Interacting with Meitu will strengthen users' cognition of the current social aesthetic norms, which can lead to low self-esteem if they deem themselves below the standards. In the neoliberal era, when people are exposed to appearance-related information that reinforces the link between self-image and social rewards, they become more aware of beauty norms, hold themselves to higher standards, and experience greater anxiety (Turel et al., 2018; Trekels & Eggermont, 2017; Glazzard & Stones, 2019).

Interactivity is the most influential factor for instilling self-awareness (Sundar, 2015). The functions of interactivity in Meitu do not set up too much reference and guidance for users. When people use relevant functions, they will be highly subjective and put more self-aesthetic consciousness into the interactive behavior. This might lead to higher levels of social anxiety when users compare their self-images with the indicated beauty standards during interactions.

6. Limitations and further research

It should be noted that this study has several limitations. First of all, this study adopted a cross-sectional design. Therefore, we could only test the correlations among our study variables. We were unable to assess whether the uses of different affordances of Meitu caused the appearance anxiety. Future research could design experiments or adopt a longitudinal design to test the causes and effects of photo retouching application usage. Second, in this study, we only measured interactivity, modality, and navigability by asking the frequencies of using relevant functions. However, it might be problematic as users might link affordances with other functions. Future research could adopt a qualitative design to dig into people's experience of using Meitu, constructing more valid measures of affordances. Finally, this study only focused on one type of photo retouching application. Future research could compare how different application designs could bring distinctive experiences and impacts on appearance anxiety.

7. Conclusion

This study takes Meitu as an example and draws on the agency model to explore the impact of affordances of the photo retouching software on people's

appearance anxiety. It was found that interactivity, modality, and navigability had a significant impact on people's feelings of self as source. The enhancement of self as source was associated with people's increased appearance anxiety. What's more, modality and navigability contributed to people's appearance anxiety through self as source. Appearance anxiety has become a prevalent issue in today's society. If the affordances of photo retouching applications could bring appearance anxiety, designers who wish to alleviate such feelings from users and prefer more inclusive interfaces could start reconsidering and redesigning these affordances.

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