Chapter

Perceptual Attributes of Human-Like Animal Stickers as Nonverbal Cues Encoding Social Expressions in Virtual Communication

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Abstract

Communicative expression is a cross-species phenomenon. We investigated the perceptual attributes of social expressions encoded in human-like animal stickers commonly used as nonverbal communicative tools on social media (e.g. WeChat). One hundred and twenty animal stickers which varied in 12 categories of social expressions (serving pragmatic or emotional functions), 5 animal kinds (cats, dogs, ducks, rabbits, pigs) and 2 presented forms (real animal vs. cartoon animal) were presented to social media users, who were asked to rate on the human likeness, the cuteness, the expressiveness and the matchness of each intended expression against the given label. The data shows that the kind of animal that is expected to best encode a certain expression is modulated by its presented forms. The "cuteness" stereotype towards a certain kind of animal is sometimes violated as a function of the presented forms. Moreover, user's gender, interpersonal sensitivity and attitudes towards the ethic use of animals modulated various perceptual attributes. These findings highlight the factors underlying the decoding of social meanings in human-like *animal* stickers as nonverbal cues in virtual communication.

Keywords: Nonverbal communication, Virtual communication, Animal, Anthropomorphism, Stickers, Interpersonal reactivity index, Animal Attitude Scale

1. Introduction

Nonverbal communication is essential in online social interaction. Many interpersonal communications are carried out in virtual scenarios on the internet in the digital age. The understanding and expression of subtle variations in communicative meanings are significant for the users of online social media. WeChat is one of the most commonly used social software in China and has been prevalent among many digital chatting platforms all over the world. One salient benefit for the Wechat user is that people can communicate quickly and conveniently with a large variety of nonverbal expressions, in particular, through virtual symbols such as stickers. Stickers are complex images that have typically a larger size than emoticon and emoji, often with an animated virtual character, and has also considered

equivalent to "biaoqing" (the Chinese words for indicators of social expressions) [1]. One can use stickers to express our thoughts, emotions, intentions and stances on WeChat. Using stickers can complement the lack of human nonverbal cues (e.g. human facial and vocal expressions) in communications under virtual environments such as online social media [2].

The character of the sticker can be a person, but is often a non-human character with anthropomorphic (or human-like) features (which can be animals or other human-created cartoon characters). It is intriguing how communicators evaluate interpersonal meanings delivered by the sticker users and the associated personal characteristics through the anthropomorphic animal stickers.

As a typical way to create a virtual character, anthropomorphism is a process of assigning human identity and human personality to non-human objects [3] and has extended from religious divine targets to animals, naturally occuring objects, and robots [4]. Anthropomorphism makes the target more vivid, affective and human like, which is an effective communication tool [5]. The anthropomorphic image is more attractive because we are familiar with human-like animals or other targets [6]. Therefore, anthropomorphic stickers are well seen in social media and is often embedded in a verbal message or used on its own.

Evidence has already shown that stickers can ease interpersonal interactions in virtual environments, complement textual information exchange, and facilitate the expression of emotions and communicative meanings [2]. Adding anthropomorphic features to stickers can further enhance their ability to represent the speaker's emotions, attitudes and thoughts, and serve as an effective cue for the perceivers to understand the speaker's message, given that humans have the tendency to understand the non-human character with their knowledge of how to communicate to humans [7].

In addition to the inclusion of anthropomorphism, categories of non-human objects may impact the human perception of stickers. In the WeChat sticker store, most stickers are animals or animal cartoons. Psychological studies have revealed the emotional bondings between the human and the animals, and showed that humans displayed empathy and attitudes towards animals [8, 9]. The relationship between human perceivers and stickers with animal characters is therefore worthy of attention. Humans hold different stereotypical opinions towards different kinds of animals which is often culturally-specific [10, 11]. For example, dogs and pigs are typically associated with a positive stereotype of commitment and faithfulness and rabbits are typically associated with a negative stereotype of timidness in the Chinese culture. Dogs were perceived cuter than cats and humans and attracted different frequency and length of lookings than humans [12]. In WeChat, stickers have different representations of animal characters and can be categorized in cartoons or in real forms. It is shown that the contextual reality of a picture in different presented forms affected the perceptual outcome and its neural responses that were related with empathy, with the pictures showing a stronger activity than the cartoon ones [13]. The facial expressions of different presented forms altered the perceiver's neural responses, with the real expression eliciting a response in the relatively late stage of evaluating the emotional value of the stimuli whereas the cartoon expression eliciting a stronger response indexing the face recognition [14]. These findings are not sufficient in informing us about how a cartoon or a real form of animal could modulate the associated evaluative outcomes when they are the targets of the stickers.

Moreover, the expressions encoded by the characters may affect human perception of stickers. Studies on Weibo have documented the capacity of encoding emotional and social expressions in stickers and online tools to perform sentiment analysis such as MoodLens to decode emotions conveyed in the emoji [15]. The perceived cuteness of anthropomorphic animal stickers can be affected by different

expressions which may in turn affecting the human likeness [16]. Increased tendency to decode higher-level cognitive states has been found in animals perceived to be closer to humans (e.g. pets such as cats and dogs) [17]. The universal mechanism underlying the encoding of expression across species suggests an ability for animal stickers to express different social meanings [18].

The present study aims to investigate the factors that affect the human perception of various attributes (i.e. human likeness, expressiveness, cuteness and matchness of the stickers towards the intended expressions) of social expressions of anthropomorphic animal stickers. We assessed the impact of different types of anthropomorphism on human perception of different attributes towards the animal stickers, by presenting stickers with cartoons or real animals as the characters. We are also interested in how different targets of anthropomorphism (cartoon vs. real animals) interact with the categories of social expressions and animal kinds in attribute perception, and whether these perceptions are sensitive to the individual differences. Based on previous literatures on real-world communication, we predict that individual attitudes towards animals [19] and their reactivity towards social contexts [20] may also affect how they evaluated anthropomorphic animal stickers.

2. Methods

2.1 Participants

Twenty-one students who aged 18-35 years old were recruited via WeChat advertisements and the campus forum from Tongji University in China (Gender: 11 females; Age: 21.3 ± 2.12 years). They comprise a wide variety of academic majors and none reported to have suffered from any psychotic or neurological disorders. All participants were given informed consent before the study and each was compensated 30 RMB for their participation. The study was approved by the Ethics Committee of Tongji University.

2.2 Material

One hundred and twenty animal stickers were selected from the "Store of Expression" on the WeChat which provides many sticker packages for people to use in chat. A sticker package normally consists in stickers of different expressions and features of one animal character. Typically, the intended expression of each sticker was labeled a key word in each package. For example, the sticker package called *mitaomao* by *bujuexiaoxiao* has 24 stickers with different expression, and its character is a cat. The expression types were the most commonly used on WeChat and twelve expressions were pre-selected by the authors after they screened 59 animal sticker packages. These social expressions represented typical communicative meanings in interpersonal interaction each of which served a certain pragmatic function (i.e. agreement, commitment, refusal, having fun, greeting, gratitude), or emotional function (i.e. shyness, fear, happiness, sadness, anger, and grievance). These expressions were either labeled by the creator of the sticker and validated by the authors. Each expression was further represented by five animal kinds (cat, dog, pig, duck, rabbit) in two forms (cartoon, real). These five animal kinds were selected as the most common kinds in stickers. All stickers were adjusted into the same size (250 × 250 pixels). All was in static form and contained verbal messages on the stickers (see **Figure 1** for the demonstration of a set of stickers to express agreement). Verbal messages were all Chinese words except for the stickers of a greeting expression.

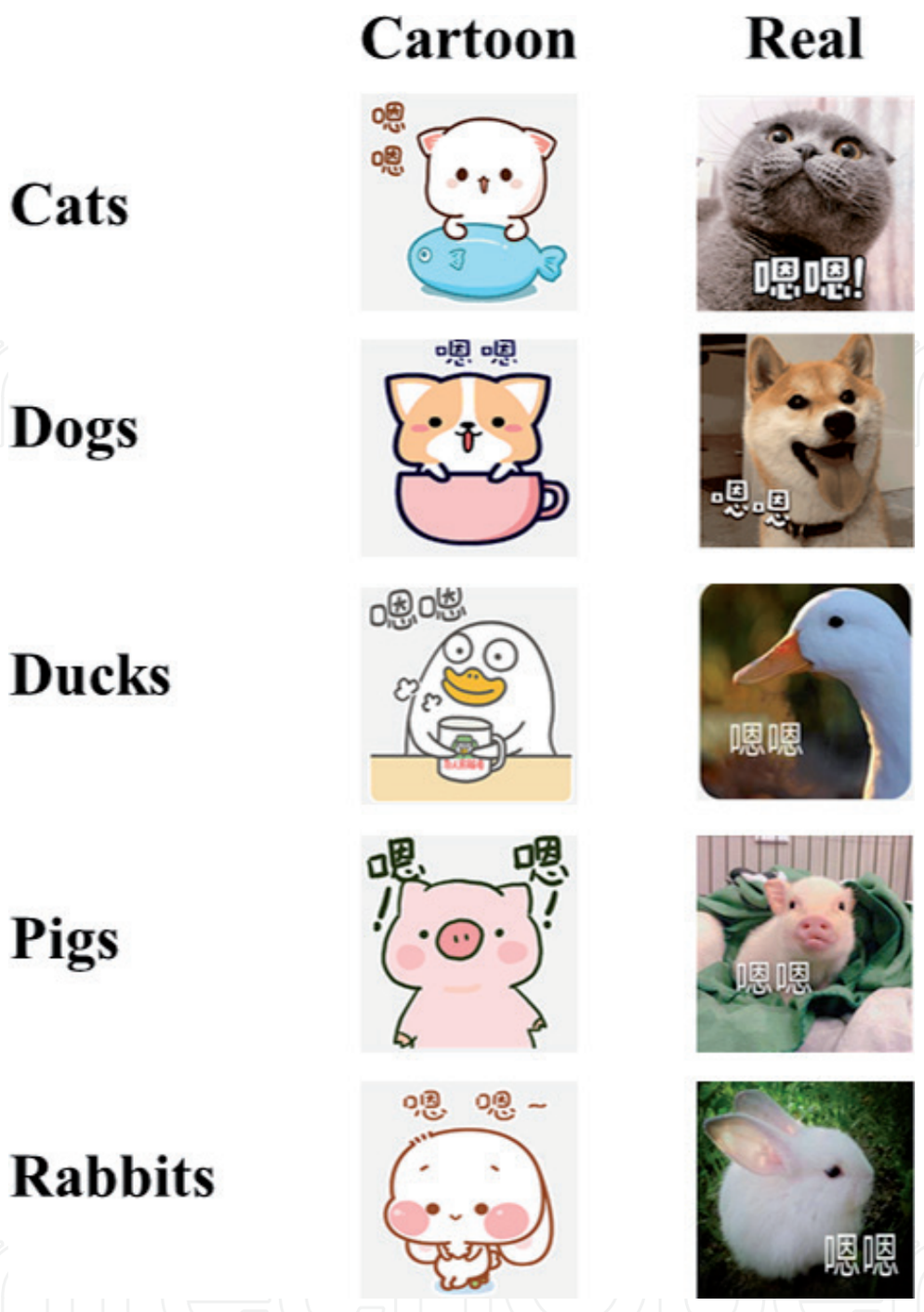

Figure 1.
Exemplar stickers that express intended agreement by five kinds of animals in both cartoon and real forms.

2.3 Procedure

All participants completed the attribute evaluation questionnaire, followed by two psychological scales, in a sequential order. All tests were completed online via the platform of the Chinese Wenjuanxing (https://www.wjx.cn/) in a quiet computer room in Tongji University. Before they started to rate stickers, they were asked to report the length of using social media per day, the frequency of using WeChat per day, the frequency of using emotive stickers per day and whether they used animal stickers.

2.3.1 Evaluating attributes of animal stickers

Participants evaluated four attributes on each of the 120 animal stickers on 7-point Likert scales. For each sticker, they were firstly given the sticker image

together with the label of its intended expression, and were asked the degree to which the label matched what is shown in the sticker from "1- to the least degree" to "7-to the most degree". This rating was followed by three sequential ratings on how human-like the animal character is on the sticker, how cute the animal character is on the sticker, and how expressive the sticker is. The stickers were randomized and the four evaluation questions were presented in the same order per sticker. At the end of the evaluation, all stickers of cats and dogs in the cartoon forms were presented to participants who were asked to identify which animal category the character belonged to. The identification task aimed to ensure the participants can recognize the correct animal category without ambiguity. Overall, average hit rates were 97.62% ± 6.53% (for dogs) and 96.83% ± 12.77% (for cats), suggesting that the accuracy of disambiguating between dogs and cats displayed in cartoon forms was high.

2.3.2 Evaluating individual differences

At a subsequent session, each participant received two scales which aimed to evaluate their attitudes towards animals and sensitivity towards the interpersonal relationships: the Animal Attitude Scale (AAS-10; [19]) and the Interpersonal Reactivity Index (IRI; [21, 22]). The AAS aims to measure the attitudes towards the ethic use of nonhuman species and consists in 10 items. Participants had to choose an answer on a 5 point scale from strongly agree to strongly disagree. The IRI consists in four subscales, each measuring a distinct component of empathy: (1) Fantasy (FS), which measures the tendency to imagine oneself to be the characters in books, film etc.; (2) Perspective Taking (PT), which assesses the tendency to cognitively take the perspective of another; (3) Empathic Concern (EC) which indicates the feeling of emotional concern for others; (4) Personal Distress (PD), which quantifies negative feelings in response to the distress of others [21]. The IRI has 28 items and the participants had to choose an option whether the statement is consistent with their opinion on a 5-point scale. Six scores were obtained for each participant, including the total scores for the AAS and the IRI and the scores for the sub-scales of IRI. The internal consistencies were calculated for each scale through the cronbach's alpha. The consistency was high for the AAS (=.73) and for the IRI (=.70). The consistency were from medium to high for the subscales of IRI (.59 for FS, .76 for PT, 42 for EC, and .56 for PD).

2.4 Data analysis

2.4.1 Perceptual attributes judgments

The repeated measures ANOVAs were performed on each of the judgments (Degree of Match, Human likeness, Cuteness, Expressiveness). The models treated these measures as dependent variables each for one model, and included Expression, Animal Kind and Form as fixed factors. Follow-up analyses were planned whenever an interaction was significant. Statistic values from pairwise comparisons were corrected for multiple comparisons using the Bonferonni method.

2.4.2 Individual differences: correlations and impacts on perceptual attributes judgments

To assess the relations between individual difference measures, Pearson correlations were conducted on participants' age, the score of AAS, IRI and its sub-scales.

To assess the relations between measures on one's social media usage, different categorical measures were first transformed into the ranking scale *from short to long duration* (4 levels) for the Length of Using Social Media Per Day (Length), *from less to more frequent* (4 levels) for the Frequency of Using WeChat Per Day (Frequency of Wechat Usage) and for the Frequency of Using Emotive Stickers Per Day (Frequency of Sticker Usage). Spearman correlations were applied to these ranking scores.

To assess the impacts of individual differences on social attribute judgments, new ANOVAs based on what was described in 2.4.1 were performed with one individual difference measure included as an additional fixed factor and all other individual difference measures included as controlling factors. Besides measures of AAS and IRI, participant sex was also considered as the fixed factor. Follow-up analysis was planned whenever a significant interaction between these measures and Expression/Form/Kind was shown. Linear regression models were built to assess the effects of scale measures on each expression. The effects of categorical measures were analyzed with ANOVA. The analyses were performed in R 3.6.0 within the R studio 1.2.1335.

3. Result

3.1 Self-reports on social media usage

All reported to be the user of WeChat. On the length of social media use, 13 reported to use WeChat for 1-3 hours per day, 4 reported 3-6 hours per day, 3 reported 6 hours or more per day and 1 reported less than 1 hour per day. On the frequency of social media use, 6 reported to use WeChat every ten minutes, 10 reported every half an hour, 3 reported every hour and 2 reported every two to three hours.

All reported to have used emotive stickers, among whom 18 reported to have used animal stickers. On the frequency of using stickers, 4 reported to use stickers highly frequently, 9 reported often, and 8 reported occasionally.

3.2 Social attribute ratings

3.2.1 Match-ness

The ANOVAs revealed significant interactions (Expression x Animal: $F(44, 880) = 2.95$, $p < .0001$; Expression x Form: $F(11, 220) = 3.58$, $p < .0001$; Animal x Form: $F(4, 80) = 6.58$, $p < .0001$; Expression x Animal x Form: $F(44, 880) = 2.15$, $p < .0001$).

The stickers of real animals showed a higher matchness in dogs to express refusal[1] relative to cartoon animals. The stickers of cartoon animals showed higher matchness than real ones in dogs for fear, commitment, gratitude, and shyness[2]; in cats for happiness, fear, commitment and greeting[3]; in ducks for happiness, agreement, commitment, grievance, gratitude, greeting, shyness, fun and anger[4]; in

[1] refusal: $t = 2.21$, $p = .03$

[2] fear: $t = 3.47$, $p = .001$; commitment: $t = 3.77$, $p = .0005$; gratitude: $t = 3.22$, $p = .003$; shyness: $t = 2.12$, $p = .04$

[3] happiness: $t = 5.89$, $p < .0001$; fear: $t = 2.27$, $p = .03$; commitment: $t = 4.85$, $p < .0001$; greeting: $t = 2.83$, $p = .007$

[4] happiness: $t = 3.28$, $p = .002$; agreement: $t = 2.52$, $p = .02$; commitment: $t = 2.36$, $p = .02$; grievance: $t = 2.97$, $p = .005$; gratitude: $t = 2.18$, $p = .04$; greeting: $t = 2.90$, $p = .006$; shyness: $t = 2.80$, $p = .008$; fun: $t = 2.84$, $p = .007$; anger: $t = 2.77$, $p = .008$

rabbits for happiness, fear, agreement, commitment, grievance, gratitude, greeting, shyness, sadness, fun, and anger[5], and in pigs for commitment and anger[6].

For stickers with real animals, the matchness of the intended expression was highest for dogs than other animals to express refusal[7], happiness[8] and agreement[9]. The matchness was higher for cats than other animals to express grievance[10], fun[11], and anger[12]. The matchness was higher for ducks than rabbits when expressing fear[13]. Moreover, the matchness was highest for anger and grievance and was lowest for happiness in cats[14]. The matchness was highest for refusal and lowest for gratitude in dogs[15]. The matchness was higher for sadness than greeting and grievance in ducks[16].

For stickers with cartoon animals, the matchness was lower for rabbits than other animals to express refusal[17], higher for rabbits than pigs to express grievance[18], and lower for dogs than other animals to express sadness[19]. The matchness was higher for commitment than sadness in dogs[20], and was lowest to express refusal for rabbits[21].

3.2.2 Human likeness

The interactions of Expression x Form ($F(11, 220) = 1.97$, $p = .03$) and Animal x Form ($F(4, 80) = 4.15$, $p = .002$) were significant. Stickers with cartoon animals were judged as more human-like than those of cartoon animals for happiness, fear,

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[5] happiness: $t = 5.40$, $p < .0001$; fear: $t = 2.56$, $p = .01$; agreement: $t = 4.49$, $p < .0001$); commitment: $t = 3.6$, $p = .001$); grievance: $t = 3.89$, $p = .0004$; gratitude: $t = 2.45$; $p = .02$; greeting: $t = 2.47$, $p = .02$; shyness: $t = 3.60$, $p = .0009$; sadness: $t = 2.57$, $p = .01$; fun: $t = 3.78$, $p = .0005$; anger: $t = 2.33$, $p = .02$

[6] commitment: $t = 2.69$, $p = .01$; anger: $t = 4.47$, $p < .0001$

[7] dog>cat: $t = 3.91$, $p = .002$; dog>duck: $t = 3.24$, $p = .01$; dog>pig: $t = 3.24$, $p = .01$; dog>rabbit: $t = 3.66$, $p = .004$.

[8] dog>cat: $t = 4.18$, $p = .001$; pig>cat: $t = 4.09$, $p = .001$; dog>duck: $t = 2.93$, $p = .03$; dog>rabbit: $t = 3.64$, $p = .004$; pig>duck: $t = 2.84$, $p = .04$; pig>rabbit: $t = 3.55$, $p = .01$.

[9] dog>rabbit: $t = 4.02$, $p = .001$.

[10] cat>duck: $t = 4.30$, $p = .001$; cat>pig: $t = 2.89$, $p = .04$; dog>duck: $t = 3.27$, $p = .013$

[11] cat>rabbit: $t = 2.94$, $p = .03$.

[12] cat>pig: $t = 4.67$, $p < .0001$; cat>rabbit: $t = 4.12$, $p = .001$; dog>pig: $t = 2.93$, $p = .03$

[13] duck>rabbit: $t = 3.21$, $p = .02$

[14] anger>agreement: $t = 3.86$, $p = .01$; grievance>agreement: $t = 3.57$, $p = .02$; anger>commitment: $t = 4.42$, $p = .01$; anger>fear: $t = 3.67$, $p = .02$; anger>happiness: $t = 5.74$, $p = .01$; anger>refusal: $t = 3.95$, $p = .01$; grievance>commitment: $t = 4.14$, $p = .01$; shyness>commitment: $t = 3.57$, $p = .02$; grievance>fear: $t = 3.39$, $p = .04$; fun>happiness: $t = 4.51$, $p = .01$; gratitude>happiness: $t = 3.48$, $p = .03$; greeting>happiness: $t = 3.39$, $p = .04$; grievance>happiness: $t = 5.45$, $p = .01$; grievance>refusal: $t = 3.67$, $p = .02$; sadness>happiness: $t = 4.42$, $p = .01$; shyness>happiness: $t = 4.90$, $p = .01$.

[15] refusal>commitment: $t = 3.56$, $p = .02$; refusal>fear: $t = 4.05$, $p = .01$; fun>gratitude: $t = 3.50$, $p = .03$; grievance>gratitude: $t = 3.68$, $p = .01$; happiness>gratitude: $t = 3.68$, $p = .01$; refusal>gratitude: $t = 5.43$, $p = .01$; sadness>gratitude: $t = 3.31$, $p = .05$; refusal>shyness: $t = 3.59$, $p = .02$.

[16] sadness>greeting: $t = 3.43$, $p = .03$; sadness>grievance: $t = 3.34$, $p = .05$

[17] dog > rabbit: $t = 3.44$, $p = .007$; duck > rabbit: $t = 3.90$, $p = .002$

[18] rabbit > pig: $t = 2.90$, $p = .04$

[19] duck>dog: $t = 2.92$, $p = .034$; rabbit > dog: $t = 2.92$, $p = 03$

[20] commitment>sadness: $t = 3.58$, $p = .02$

[21] agreement>refusal: $t = 3.90$, $p = .01$; anger>refusal: $t = 3.59$, $p = .02$; commitment>refusal: $t = 5.38$, $p = .01$; grievance>fear: $t = 3.69$, $p = .01$; fun>refusal: $t = 4.64$, $p = .01$; gratitude>refusal: $t = 4.43$, $p = .01$; grievance>greeting: $t = 3.38$, $p = .04$; grievance>refusal: $t = 6.43$, $p = .01$; happiness>refusal: $t = 5.59$, $p = .01$; sadness>refusal: $t = 5.38$, $p = .01$; shyness>refusal: $t = 5.70$, $p = .01$.

and commitment[22]. The increased human-like judgment of cartoon animals was also revealed for dogs, ducks and rabbits[23].

3.2.3 Cuteness

The ANOVAs revealed a significant effect of Animal ($F(4, 80) = 30.25$, $p < .001$), with stickers of dog being judged of higher cuteness than those of pig ($t = 2.90$, $p = .03$). The interactions were significant (Expression x Animal: $F(44, 880) = 2.56$, $p < .0001$; Expression x Animal x Form: $F(44, 880) = 1.41$, $p = .04$).

Stickers of cartoon animals were judged as cuter than those of real animals in cats[24], ducks[25] and rabbits[26].

For stickers of real animals, ducks were judged as cuter than other animals to express happiness[27], and commitment[28]. Cats were judged as cuter than other animals to express gratitude[29], greeting[30], and shyness[31]. Fear and refusal were judged as less cute than expressions of gratitude and shyness in cat[32].

For stickers of cartoon animals, cats were judged as cuter than other animals to express happiness[33], and sadness[34]. Pigs and ducks were judged as less cuter than other animals to express agreement[35], commitment[36], grievance[37], fun[38]. Refusal was judged as less cute than gratitude and happiness in cats[39]. Sadness was rated less cuter than other expressions in dog[40]. Commitment was judged as cuter than anger and refusal for rabbit[41].

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[22] happiness: $t = 2.62$, $p = .009$; fear: $t = 2.32$, $p = .02$; commitment: $t = 2.39$, $p = .02$

[23] dog: $t = 2.62$, $p = .009$; duck: $t = 3.18$, $p = .002$; rabbit: $t = 3.47$, $p = .0006$

[24] happiness: $t = 2.59$, $p = .01$; commitment: $t = 2.29$, $p = .03$

[25] happiness: $t = 2.09$, $p = .04$; shyness: $t = 2.06$, $p = .05$

[26] agreement: $t = 3.30$, $p = .002$; commitment: $t = 5.84$, $p < .0001$; grievance: $t = 3.07$, $p = .004$; gratitude: $t = 2.39$, $p = .02$; fun: $t = 2.16$, $p = .04$

[27] cat>duck: $t = 2.91$, $p = .03$; dog>duck: $t = 3.18$, $p = .02$; pig>duck: $t = 4.24$, $p = .001$; rabbit>duck: $t = 3.27$, $p = .01$

[28] dog>duck: $t = 3.12$, $p = .02$

[29] cat>dog: $t = 4.37$, $p = .0003$; cat>duck: $t = 4.37$, $p = .0003$; cat>pig: $t = 2.86$, $p = .04$; cat>rabbit: $t = 3.12$, $p = .02$

[30] cat>duck: $t = 3.43$, $p = .008$; cat>pig: $t = 3.26$, $p = .01$

[31] cat>dog: $t = 3.69$, $p = .003$; cat>duck: $t = 3.85$, $p = .002$; cat>pig: $t = 4.36$, $p = .0003$

[32] gratitude>fear: $t = 3.58$, $p = .02$; shyness>fear: $t = 3.76$, $p = .01$; gratitude>refusal: $t = 4.68$, $p = .01$; greeting>refusal: $t = 3.39$, $p = .04$; shyness>refusal: $t = 4.86$, $p = .01$.

[33] cat>duck: $t = 2.90$, $p = .04$; cat>pig: $t = 2.90$, $p = .04$, gratitude: cat>dog: $t = 2.96$, $p = .02$; cat>duck: $t = 4.54$, $p = .001$; cat>pig: $t = 2.96$, $p = .03$; rabbit>duck: $t = 3.16$, $p = .02$

[34] cat>dog: $t = 3.70$, $p = .003$; cat>duck: $t = 2.96$, $p = .03$

[35] dog>pig: $t = 3.31$, $p = .01$; rabbit>pig: $t = 3.01$, $p = .03$

[36] cat>duck: $t = 3.91$, $p = .002$; dog>duck: $t = 3.62$, $p = .004$; pig>duck: $t = 2.84$, $p = .04$; rabbit>duck: $t = 5.47$, $p = .001$

[37] cat>duck: $t = 2.91$, $p = .04$; dog>duck: $t = 3.64$, $p = .004$; dog>pig: $t = 3.00$, $p = .03$; rabbit>duck: $t = 4.46$, $p = .0002$; rabbit>pig: $t = 3.82$, $p = .002$

[38] cat>duck: $t = 2.94$, $p = .03$; dog>duck: $t = 2.94$, $p = .03$

[39] gratitude>refusal: $t = 3.42$, $p = .03$; happiness>refusal: $t = 3.32$, $p = .05$

[40] agreement>sadness: $t = 4.69$, $p = .01$; commitment>sadness: $t = 3.37$, $p = .04$; fun>sadness: $t = 3.78$, $p = .01$; grievance>sadness: $t = 3.88$, $p = .01$

[41] commitment>anger: $t = 3.43$, $p = .03$; commitment>refusal: $t = 3.63$, $p = .02$

3.2.4 Expressiveness

The ANOVAs revealed significant interactions (Expression and Animal: $F(44, 880) = 1.89$, $p = .0004$; Animal x Form: $F(4, 80) = 7.83$, $p < .0001$; Expression x Animal x Form: $F(44, 880) = 1.53$, $p = .01$).

Stickers of real animals were judged as more expressive than those of cartoon animals in cats[42] and dogs[43]. Stickers of cartoon animals were judged as more expressive than those of real animals for rabbit[44], duck[45] and pig[46].

For stickers of real animals, dogs were judged as more expressive than other animals to express refusal[47] and happiness[48]. Cats were judged as more expressive than ducks to express grievance[49] and anger[50]. Moreover, anger and fun were judged as more expressive than other expressions in cats[51]. Refusal was judged more expressive than gratitude in dogs[52]. Shyness was judged more expressive than agreement in rabbits[53].

For stickers of cartoon animals, cats were judged as less expressive than other animals for happiness[54], dogs were judged as less expressive for sadness[55], and ducks were judged as less for greeting[56]. Grievance was judged as less expressive than other expressions in pigs[57].

3.3 Individual differences in social attributes ratings

3.3.1 Associations between individual difference measures

The Pearson correlation revealed significant positive associations between AAS and IRI total scores ($r = 0.47$, $p = 0.03$), between the scores of IRI and the subscales[58] and between the scores for FS and PD ($r = 0.63$, $p = 0.002$). Neither significant effects between Length, Frequency of WeChat Usage and Frequency of Sticker Usage, nor significant effects between these usage-related measures and ASS or IRI scores were shown ($ps > .1$).

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[42] grievance: $t = 2.06$, $p = .05$

[43] refusal: $t = 3.36$, $p = .002$

[44] happiness: $t = 2.44$, $p = .02$; shyness: $t = 3.93$, $p = .0003$; sadness: $t = 2.34$, $p = .02$

[45] agreement: $t = 2.79$, $p = .008$; commitment: $t = 2.03$, $p = .05$; grievance: $t = 2.25$, $p = .03$; greeting: $t = 3.56$, $p = .001$); fun: $t = 2.55$, $p = .01$

[46] anger: $t = 2.37$, $p = .02$

[47] dog>cat: $t = 3.53$, $p = .006$; dog>pig: $t = 2.97$, $p = .03$; dog>rabbit: $t = 3.05$, $p = .02$

[48] dog>cat: $t = 2.84$, $p = .04$; dog>rabbit: $t = 3.19$, $p = .02$

[49] cat>duck: $t = 3.63$, $p = .004$

[50] cat>pig: $t = 3.35$, $p = .01$; cat>rabbit: $t = 3.44$, $p = .007$

[51] anger>gratitude: $t = 3.74$, $p = .01$; anger>happiness: $t = 3.74$, $p = .01$; anger>refusal: $t = 3.56$, $p = .02$; fun>gratitude: $t = 3.65$, $p = .02$; fun>happiness: $t = 3.65$, $p = .02$; fun>refusal: $t = 3.48$, $p = .03$

[52] refusal > gratitude: $t = 3.94$, $p = .01$

[53] shyness > agreement: $t = 3.43$, $p = .03$

[54] dog>cat: $t = 3.26$, $p = .01$; duck>cat: $t = 3.17$, $p = .02$

[55] duck>dog: $t = 3.07$, $p = .02$; pig>dog: $t = 2.98$, $p = .03$

[56] duck>dog: $t = 3.36$, $p = .01$; duck>rabbit: $t = 3.18$, $p = .02$

[57] fear>grievance: $t = 3.38$, $p = .04$; sadness>grievance: $t = 3.56$, $p = .02$

[58] IRI-FS: $r = 0.73$, $p = 0.0001$; IRI-PD: $r = 0.71$, $p = 0.0003$; IRI-EC: $r = 0.59$, $p = 0.005$; IRI-PT: $r = 0.43$, $p = 0.05$

3.3.2 Matchness

The interactions of Sex x Animal ($F(4, 80) = 3.01$, $p = .02$) and Sex x Form ($F(1, 20) = 69.31$, $p < .01$) were significant. The matchness score was higher for women than men and such gender difference was more pronounced in pigs than ducks[59], and was more pronounced in in stickers of real relative to cartoon animals[60].

The interaction of Length x Form ($F(3, 60) = 12.29$, $p < .01$) was significant. The matchness score was higher for individuals who used social media 3-6 hours than those who used 1-3 hours in stickers of cartoon animals ($t = 2.70$, $p = .03$).

The interactions Frequency of WeChat Use x Animal ($F(20, 400) = 2.78$, $p = .0009$) and Frequency of WeChat Use x Form ($F(5, 100) = 23.98$, $p < .01$) were significant. For dogs, the matchness was higher for individuals who used WeChat every 30 minutes than those who used that every 10 minutes ($t = 3.14$, $p = .009$). For cats and rabbits, the matchness was higher for those who used WeChat every 30 minutes than those who used that every 10 minutes and those who used WeChat every 1 hour[61]. For pigs, the score was higher for individuals who used WeChat every 30 minutes than those who used WeChat every 1 hour ($t = 2.79$, $p = .03$).

For stickers of real animals, the matchness was higher for those who used that every 1 hour than those who used WeChat every 30 minutes and those who used WeChat every 2-3 hours[62]. For stickers of cartoon animals, the matchness was higher for individuals who used WeChat every 30 minutes than those who used WeChat every 1 hour ($t = 2.61$, $p = .04$).

The interactions of Frequency of Stickers x Animal ($F(12, 240) = 1.97$, $p = .05$) and Frequency of Stickers x Form ($F(3, 60) = 26.04$, $p < .01$) were significant. For cats, the matchness score was higher for individuals who used stickers very frequently than those using stickers often ($t = 2.65$, $p = .02$). For pigs, the matchness was higher for those who used stickers very frequently than those who used stickers often and those who used stickers occasionally[63]. For stickers of cartoon animals, the matchness was higher for those who used stickers frequently than those using stickers often ($t = 3.08$, $p = .006$).

The interaction AAS x Animal was significant ($F(52, 1040) = 3.80$, $p = .004$). Individuals with higher AAS produced lower matchness for dogs and rabbits[64]. The interaction IRI x Expression was significant ($F(132, 2640) = 2.27$, $p = .009$). Individuals with higher IRI produced lower matchness for the expression of agreement, greeting and refusal[65]. The two-way interaction EC x Expression was significant ($F(99, 1980) = 2.36$, $p = .007$). Individuals with higher EC produced higher matchness for the expression of anger, agreement, commitment, gratitude, greeting, fun, fear, shyness and refusal[66].

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[59] ducks: $t = 2.35$, $p = .02$; pigs $t = 2.99$, $p = .003$

[60] real: $t = 3.36$, $p = .0008$; cartoon animals: $t = 2.52$, $p = .01$

[61] every 30 minutes > every 10 minutes: cats: $t = 2.76$, $p = .03$; dogs: $t = 2.83$, $p = .02$; every 30 minutes > every 1 hour: cats: $t = 2.97$, $p = .02$; dogs: $t = 3.06$, $p = .01$

[62] every 1 hour > every 2-3 hours: $t = 2.81$, $p = .02$; every 1 hour > every 30 minutes: $t = 3.11$, $p = .01$

[63] very frequently > often: $t = 3.06$, $p = .007$; very frequently > occasionally: $t = 3.00$, $p = .008$

[64] dogs: $b = -0.16$, $t = -2.32$, $p = .02$; rabbits: $b = -0.28$, $t = -3.74$, $p = .0002$

[65] agreement: $b = -0.16$, $t = -2.91$, $p = .004$; greeting: $b = -0.15$, $t = -2.73$, $p = .007$; refusal: $b = -0.17$, $t = -2.82$, $p = .005$

[66] anger: $b = 0.30$, $t = 2.46$, $p = .01$, agreement: $b = 0.35$, $t = 2.83$, $p = .005$, commitment: $b = 0.41$, $t = 3.19$, $p = .002$; gratitude: $b = 0.38$, $t = 3.25$, $p = .001$, greeting: $b = 0.38$, $t = 3.11$, $p = .002$, fun $b = 0.30$, $t = 2.54$, $p = .01$; fear: $b = 0.28$, $t = 2.16$, $p = .03$; shyness: $b = 0.26$, $t = 2.26$, $p = .03$; refusal $b = 0.52$, $t = 3.85$, $p = .0002$

3.3.3 Human likeness

The interaction between Sex x Animal was significant ($F(4, 80) = 7.66$, $p < .01$). Men judged stickers more human like than women and such effect was more pronounced in cats than dogs[67].

The interactions Length x Animal ($F(12, 240) = 2.08$, $p = .002$) and Length x Form ($F(3, 60) = 5.80$, $p = .0006$) were significant. For cats, ducks and pigs[68], those who used social media for 3-6 hours produced a higher rating than those who used that for 1-3 hours. For stickers with real animals, those who used social media for 1 hour per day rated higher than those who used that for 1-3 hours ($t = 3.00$, $p = .01$). For stickers with cartoon animals, those who used social media for 3-6 hours rated higher than individuals who used it for 1-3 hours and those who used it for 6 hours[69].

The interactions of Frequency of Stickers Use x Animal ($F(12, 240) = 2.23$, $p = .02$) and Frequency of Stickers Use x Form ($F(3, 60) = 20.58$, $p < .01$) were significant. For pigs, those who used stickers highly frequently rated higher than those who used stickers often ($t = 2.55$, $p = .03$). For stickers of cartoon animals, those who used stickers often rated higher than those who used stickers highly frequently and those who used stickers occasionally[70].

The interaction IRI x Form was significant ($F(12, 240) = 4.05$, $p = .04$). For stickers of real animals, those who displayed higher IRI score produced lower human-likeness scores ($b = -0.11$, $t = -2.68$, $p = .007$). The interactions Form x FS ($F(10, 200) = 12.69$, $p = .0004$) and Animal x FS ($F(40, 800) = 3.26$, $p = .01$) were significant. For stickers of cartoon animals, those with higher FS score judged less human-like ($b = -0.16$, $t = -2.31$, $p = .02$). Those showing higher FS score judged less human-like on rabbits ($b = -0.19$, $t = -2.34$, $p = .02$). The interaction PT x Expression was significant ($F(154, 3080) = 1.83$, $p = .04$). Those with higher PT score judged the agreement expression to be less human like ($b = -0.30$, $t = -2.74$, $p = .007$).

3.3.4 Cuteness

The interaction of Sex x Form was significant ($F(1, 20) = 101.47$, $p < .01$). Women judged stickers of real animals to be cuter than men ($F(1, 20) = 78.95$, $p < .01$; $t = 2.09$, $p = .04$).

The interactions of Length x Animal ($F(12, 240) = 3.99$, $p < .01$) and Length x Form ($F(3, 60) = 8.04$, $p < .01$) were significant. For cats, individuals who used social media 3-6 hours rated cuter than those who used that 1-3 hours ($t = 2.64$, $p = .04$). For ducks, the cuteness was lower for those who used that for 1-3 hours than those who used it for 1 hour and those for 6 hours[71]. For pigs, the cuteness was higher for those who used social media for 6 hours than those using that for 1-3 hours ($t = 3.47$, $p = .003$). For stickers of real animals, the cuteness was higher for those who used social media for 1 hour than those for 1-3 hours ($t = 2.76$, $p = .03$). For stickers with cartoon animals, the cuteness was higher for those who used social media 6 hours than those who used that for 1-3 hours ($t = 3.08$, $p = .01$).

The interactions Frequency of Stickers Use x Animal ($F(12, 240) = 2.61$, $p = .008$) and Frequency of Stickers Use x Form ($F(3, 60) = 39.44$, $p < .01$) were

[67] cats: $t = 2.62$, $p = .009$; dogs: $t = 1.97$, $p = .05$

[68] cats: $t = 4.04$, $p < .001$; ducks: $t = 2.96$, $p = .02$; pigs: $t = 3.05$, $p = .01$

[69] 1-3 hours: $t = 6.11$, $p < .001$; 6 hours: $t = 2.70$, $p = .03$

[70] highly frequently: $t = 3.08$, $p = .006$; occasionally: $t = 2.95$, $p = .009$

[71] 1 hour per day: $t = 3.01$, $p = .01$; 6 hours: $t = 2.72$, $p = .03$

significant. For cats, the cuteness was higher for individuals who used stickers very frequently than those who used stickers often (t = 2.55, p = .03). For stickers of cartoon animals, the cuteness was higher for those who used stickers very frequently than those using them often (t = 2.43, p = .04).

The interaction of AAS x Animal was significant (F(52, 1040) = 3.17, p = .01). Those who showed a higher AAS judged dogs and rabbits[72] less cuter.

The interaction of IRI x Animal was significant (F(48, 960) = 5.10, p = .0004). Those with higher IRI judged ducks (b = −0.16, t = −2.91, p = .004) and pigs (b = −0.13, t = −2.80, p = .005) less cute than those with lower IRI. The interaction Animal x PD (F(36,720) = 15.86, p < .01) was significant. Those who showed higher PD produced a higher rating of cats, dogs, rabbits and pigs[73] than those with lower PD.

3.3.5 Expressiveness

The interaction Sex x Form was significant (F(1, 20) = 34.20, p < .01). Females produced higher expressiveness score as compared with males and such difference was more pronounced for stickers of cartoon animals than for those of real animals[74].

The interaction of Length x Animal (F(12, 240) = 1.87, p = .03) was significant. The expressiveness of cats was higher for those who used social media 6 hours than those who used 1 hour, 1-3 hours and 3-6 hours[75]. The expressiveness of dogs, ducks and rabbits[76] was higher for those who used social media 6 hours per day than those who used 1-3 hours. The expressiveness of pigs was higher for those who used social media 6 hours than those who used 1 hour and 1-3 hours, and was higher for those who used social media 3-6 hours than those who used 1-3 hours[77].

The interaction AAS x Animal was significant (F(52, 1040) = 3.75, p = .005). Those who demonstrated higher AAS revealed lower expressiveness for dogs, ducks and rabbits[78].

The interactions FS x Expression (F(110,2 200) = 1.90, p = .04), FS x Animal (F(40, 800) = 3.19, p = .01) and FS x Form (F(10, 200) = 6.24, p = .01) were significant. Individuals with higher FS produced higher expressiveness ratings for anger, agreement, commitment, greeting, grievance, fun, shyness and refusal[79]. Those with higher FS produced higher expressiveness for cats, ducks and pigs[80]. Those with higher FS produced higher expressiveness and such effects were stronger for stickers of cartoon than for those of real animals[81]. The interaction of PD x Form (F(9, 180) = 5.03, p = .03) was significant. Individuals with higher PD produced lower expressiveness rating when cartoon and real animals were presented in stickers[82].

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[72] dogs: b = −0.17, t = −2.28, p = .02; rabbits: b = −0.15, t = −2.15, p = .03

[73] cats: b = 0.22, t = 2.22, p = .03); dogs b = 0.41, t = 4.00, p < .01; rabbits: b = .21, t = 2.10, p = .04; pigs: b = 0.26, t = 2.39, p = .02

[74] cartoon animals: t = 2.65, p = .008; real animals: t = 2.35, p = .02

[75] 1 hour: t = 3.51, p = .003, 1-3 hours: t = 5.40, p < .001; 3-6 hours: t = 3.45, p = .003

[76] dogs: t = 2.70, p = .03; ducks: t = 3.66, p = .001; rabbits: t = 3.71, p = .001

[77] 1 hour: t = 3.54, p = .002; 1-3 hours: t = 4.79, p < .001; 1-3 hours: t = 3.01, p = .01

[78] dogs: b = −0.29, t = −4.06, p < .01; ducks: b = −0.19, t = −2.61, p = .009; rabbits: b = −0.39, t = −5.39, p < .01

[79] anger: b = 0.24, t = 2.44, p = .02; agreement: b = 0.33, t = 3.42, p = .0008; commitment: b = 0.23, t = 2.15, p = .03; greeting: b = 0.26, t = 2.59, p = .01; grievance: b = 0.21, t = 2.22, p = .03; fun: b = 0.32, t = 3.60, p = .0004; shyness: b = 0.35, t = 3.60, p = .0004; refusal: b = 0.36, t = 3.58, p = .0005

[80] cats: b = 0.30, t = 3.85, p = .0001; ducks: b = 0.38, t = 4.29, p < .01; pigs: b = 0.28, t = 3.42, p = .0007

[81] cartoon: b = 0.25, t = 3.33, p = .0009; real animals: b = 0.32, t = 4.09, p < .01

[82] cartoon: b = 0.27, t = 3.04, p = .002; real animals: b = 0.49, t = 5.36, p < .01

4. Discussion

The study mainly investigated the role of human-like animal stickers in encoding social expression. Four perceptual attributes (the matchness between the intended and the perceived expression, the human likeness, the cuteness and the expressiveness) were demonstrated to be modulated by the discrete expression types, by which animal served as the virtual target of the sticker, and by whether the animal was a real or a cartoon character.

4.1 Perceptual attributes of animal stickers

Animal kinds interplayed with forms of presentation in affecting the perceptual attributes of animal stickers. Rabbits, ducks and pigs are generally judged more expressive, more human like and cuter than others in cartoon forms. Cats and dogs are perceived more expressive in real forms. These exploratory findings based on a group of social media users suggest the expected expression stereotypically associated with certain animal kinds maybe affected by whether the animal is perceived as a real or a virtual character. The matchness rating reflects the degree a given label fits the intended expression and maybe associated with the most expected communicative expression encoded by an animal. The expressiveness rating reflects the perceived amounts of cues that are associated with the expression, and may be associated with the expected easiness of encoding certain expression by an animal. As is shown in the matchness and expressiveness, the cats are more expected to convey anger and grievance; the dogs are expected to convey refusal; and ducks are expected to convey sadness when they are presented in real animal forms. However, when they are presented in cartoon forms, dogs are expected to convey commitment and rabbits are expected to convey refusal. Besides, the expected "cuteness stereotype" is sometime violated as a function of forms of presentation. Rabbits are considered cuter when expressing anger and refusal in the cartoon forms. Cats are considered cuter in real animal forms when expressing shyness and in cartoon forms when expressing gratitude. Although not directly tested in the present study, it is possible the amount of anthropomorphic features (e.g. the perceived similarity to human based on physical likeness, familiarity, cultural stereotype as human like) may explain different expectations towards different kinds of animals presented in different forms [23]. Pending further research, these data draws a first sketch on how animals encode social expressions that serve different communicative functions in stickers.

4.2 Individual characteristics and evaluation of animal stickers

The second aim of the study was to explore the individual differences in the judging the perceptual attributes of the animal sticker. Consistent with previous studies showing a female advantage in recognizing social signals and inferring meanings from these signals [24–26], our data showed females perceived the intended expression of the animal stickers to match to a greater extent with the labels and cuter relative to males for real animals, but perceived stickers to be more expressive relative to males for cartoon animals. One exception is in human likeliness which demonstrated a male advantage. Despite a higher frequency of using Stickers to communicate (Female: 18% - occasionally; 55% - often; 27% - highly frequently; Male: 60% - occasionally; 30% - often; 10% - highly frequently), the female did not consider certain animals (cats and dogs) to be more human like. It is assumed that a certain motivation may underlie the use of less human-like animal stickers as a communicative strategy; nevertheless, this assumption needs to be

evaluated in future studies, given that this study did not include a set of person stickers to serve as a baseline.

Interestingly, showing a higher level of concern towards animals was associated with a reduced perception of matchness, cuteness, and expressiveness but not human likeness in animal stickers. The stickers showing such individual differences were mainly featured by dogs, rabbits and ducks. Increased cuteness perception was seen in animals bearing more baby features [12]. More inference of cognitive states is demanded on animals sharing more human characteristics [17]. However, neither these cognitive processes seem to well explain the current pattern given an opposite pattern would have be shown. However, this finding maybe associated with the emotional or empathic response triggered by those who showed higher sensitivity towards the ethic use of animals, given an increased intention of protection may lower the users' emotional responses (and their ability to recognize expressions from these stickers) but increase their empathic response [27].

Higher interpersonal sensitivity was associated with a reduced perception of matchness of certain types of intended expressions with the actual labels regardless of real or cartoon animals. The IRI was shown to modulate one's sensitivity towards nonverbal cues such as face [28], voice [29, 30] and body awareness [31], and the mechanisms underlying constructing pragmatic representations beyond literal expressions [32, 33]. These affected expressions marked certain pragmatic functions in human communication (e.g. agreement, refusal, greeting) and may reflect a mismatch between the expected and the actual nonverbal cues in the animal stickers, for example, an expression of greeting between two interlocutors is not commonly seen in animals. The unexpected use of pragmatic expressions can be generally observed in real animals which typically do not display human characteristics, and lead to a lower perceptual rating in human-likeness by those demonstrating higher sensitivity. On a similar note, the unexpected use of social expressions by certain animals less familiar to humans (e.g. pigs, ducks, rabbits) is often given a lower cuteness rating by those showing higher sensitivity.

Fantasy, the tendency to transpose oneself imaginatively to the feelings and actions of fictitious characters in books and movies was shown to be associated with the expressiveness of the nonverbals cues in the sticker. Increased fantasizing ability was shown to modulate the behavioral acceptability of an underspecified sentence which can make sense after one engages a pragmatic inference (e.g. Sentence: *even such a person*$_{\text{[underspecified]}}$ *can afford an expensive house.* Inference: That person is poor). The extent to which an inference is engaged can be systematically involved in the medial prefrontal cortex [33], a region critical to decoding nonverbal meaning in social communication [34]. Consistent with previous literature, our data shows the social expressions that mark pragmatic functions were modulated by fantasy; moreover, the more imaginative to the cartoon animals, the more expressive the stickers were perceived [34].

Empathic concern has been defined to assess one's other-oriented feelings of sympathy and concern for unfortunate others. Evidence suggests the sensitivity of such tendency with the perceptual accuracy of emotional cues in nonverbal communication, and we demonstrated the modulation of EC on the expression of anger, fear and shyness. Furthermore, the matchness of the expected pragmatic function to the actual label was also modulated by such individual difference. Emotional concern has been considered an essential part when interactants encode speech acts (here agreement, commitment, greeting and refusal; and also see [35]) and complex social emotions (Apology: [36]; Gratitude; [37]; Guilt: [38]). The decoding of certain nonverbal cues of emotional consequences in animal stickers may also require higher EC.

4.3 Experience in using social media and evaluation of animal stickers

The heavier use of social media per day and the more frequent use of emotive stickers generally enhanced the ratings of the perceptual attributes of animal stickers, such as human-likeness, cuteness and expressiveness, although different kinds of animals appeared to benefit from different amounts of social media use.

Importantly, a clearer dissociative pattern can be seen between stickers of real and cartoon animals. For the cartoon animals, the longer time the social media is used (and the more frequently emotive stickers is used), to a larger extent was the intended expression judged to match the actual label, more human like and cuter was the sticker. However, an opposite pattern was shown in the expression of real animals, with the heavier use of social media producing lower ratings. The added experience of using social media does not exert a unified impact on the perceptual attributes of the social expression in animal stickers. On one hand, such experience may enhance the general acceptability of imaginary characters (cartoon animals) to encode human expressions which results in positive evaluations towards these animals. On the other hand, the perceived unexpected use of human expression by a real animal gets more salient and may cognitively result in a conflict which requires monitoring and resolution (for example, to reason why a real-animal expresses a human-like expression; to think of a conversational context when such use can be accommodated). Further studies could be developed to see whether the experience of using social media is associated with the motivation of using an animal sticker [39].

5. Conclusion

We reported the perceptual attributes of a set of *animal* stickers varying in social expressions (of pragmatic and emotional communicative functions), animal kinds (of different levels of familiarity to humans) and presented forms (real vs. virtual). We also correlated the individual characteristics (interpersonal sensitivity and attitudes towards animals) and the experience in social media use with the attributes. Our data shows the expression that is expected to be best encoded by certain animals is modulated by its presented forms. The cuteness stereotype towards an animal is sometimes violated as a function of presented forms. Moreover, gender, dispositional empathy towards humans and concerns towards animals modulated the perceptual attributes of nonverbal cues in the social expression of animal stickers. These findings highlight the role of anthropomorphism for animal stickers to encode social meanings in nonverbal cues; and put forward a novel avenue of research on the effectiveness and the mechanisms of human-like *animal* stickers and the related forms in virtual communication.

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