

Letter to the Editor

Facial expression recognition in golden snub-nosed monkeys

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For socialized animals, such as primates, emotions are the expression of internal states, which may be recognized by others to adjust an individual's potential actions (Girard and Bellone 2020). Facial expressions are therefore important signals in communication (e.g., happy or in pain) and can help individuals understand potential meanings between each other (Dolensek et al. 2020). Facial expressions can be expressed and processed freely and are useful in social interactions and bonding (Waller et al. 2016). Many classic studies have suggested that facial expressions are rich sources of information, and thus the ability to recognize and interpret facial expressions is critical in managing social relationships and maintaining population stability, particularly for human and nonhuman primates (Waller and Micheletta 2013). For example, crested macaques *Macaca nigra* can interpret facial expressions and predict social outcomes depending on others facial expressions (Waller et al. 2016); rhesus monkeys *M. mulatta* use facial expressions as formal signals of dominance, which can reliably indicate dominance rank within a group (Parr 2009); chimpanzees *Pan troglodytes* use facial expressions in social communication, which can reduce the likelihood of social conflict or allow safe approach (Frank 2001). Therefore, rapid and accurate recognition of facial expressions is crucial in regulating social interactions and increasing group cohesion. However, the adaptive functions of facial expression recognition in animals remain largely unknown.

Here, we used photographs displaying different facial expressions to investigate individual recognition in a wild troop of golden snub-nosed monkeys *Rhinopithecus roxellana* (for information

about the species and study methods, see [Supplementary Materials](#)). After 84 days of repeated observation, we collected a total of 1,260 facial expression samples from 22 adults and 25 nonadults in total, resulting in an average of 27 samples per individual. The behavioral responses to the 3 facial expression stimuli were analyzed (Table 1, mean \pm SE). Results showed that monkeys preferred to look at the bared-teeth affiliative display than at the opened-mouth agonistic display ($Z = -3.109$; $P = 0.002$). We also found a significant difference between looking at neutral and opened-mouth displays ($Z = -2.230$; $P = 0.026$), but not between the bared-teeth and neutral displays ($Z = -1.620$; $P = 0.105$). Monkeys approached the bared-teeth image significantly more often than the opened-mouth agonistic image ($Z = -5.616$; $P = 0.000$). A significant differentiation was also found between neutral and opened-mouth displays, that is, monkeys approached the neutral image more often ($Z = -4.564$; $P = 0.000$). This significant difference was not found between the bared-teeth and neutral displays ($Z = -1.444$; $P = 0.149$). Furthermore, monkeys showed a preference for touching the bared-teeth image than the opened-mouth image ($Z = -6.076$; $P = 0.000$); and the neutral display was significantly more often than the opened-mouth display ($Z = -5.493$; $P = 0.000$). However, the differences between the bared-teeth and neutral displays did not reach a significant level ($Z = -1.062$; $P = 0.288$). When the target adults and nonadults were compared, we found that nonadults spent significantly more time looking at the photographs ($Z = -10.507$; $P = 0.000$), but there were no significant differences in looking the 3 different facial expression images by nonadults ($\chi^2 = 2.167$; $df = 2$;

Table 1. Behavioral responses of adult and nonadult golden snub-nosed monkeys to 3 different facial expression stimuli

Facial expression stimulus	Adult individual (mean ± SE)			Nonadult individual (mean ± SE)		
	Looking time (s)	Approach frequency	Touch frequency	Looking time (s)	Approach frequency	Touch frequency
Bared-teeth affiliative display	2.97 ± 0.18	1.38 ± 0.08	0.76 ± 0.06	5.27 ± 0.34	1.68 ± 0.11	1.00 ± 0.10
Neutral display	2.78 ± 0.20	1.23 ± 0.08	0.67 ± 0.06	5.24 ± 0.29	1.61 ± 0.13	0.94 ± 0.10
Open-mouth agonistic display	2.42 ± 0.12	0.54 ± 0.07	0.13 ± 0.04	5.30 ± 0.33	1.40 ± 0.12	0.93 ± 0.10

$P = 0.338$). There were also no significant differences in touching or approaching the different facial expression images by nonadults ($\chi^2 = 0.306$, $df = 2$, $P = 0.858$; $\chi^2 = 4.076$, $df = 2$, $P = 0.130$). This suggests that effective recognition of facial expressions and understanding of the association between expression and possible consequences is not fully established in nonadult golden snub-nosed monkeys, resulting in an inability to interpret facial cues accurately and adjust their corresponding actions accordingly.

The results found in this study suggest that identifying and understanding facial expressions are important factors in social interactions and communication for *R. roxellana*. Changes in facial expression are not reflex-like reactions but echo many hinted properties of emotions, for example, valence (negative and positive). Our findings also suggest that adult individuals gain important information from facial expressions to adjust their potential actions, indicating that, like humans, they understand the implications of facial expressions. Thus, research on facial expressions is important for understanding information interpretation, which should be further studied on animals that live within highly-socialized groups. The responses to facial expressions via alternative behavioral patterns found in *R. roxellana* are important strategies for guiding their social lives, for example, reducing conflicts and improving social cohesion. Evolutionary psychologists argue that emotional recognition of facial expressions may have led to increased fitness for social animals (Öhman et al. 2001). Indeed, *R. roxellana* individuals face considerable challenges in the wild, which has resulted in their endangered status (Li et al. 2002, 2020). Thus, they need to quickly recognize and avoid danger through alternative means, including via facial expressions that can convey important information about affiliative and agonistic affairs (Waller et al. 2016; Zhao et al. 2016). For example, an opened-mouth expression might signal forthcoming danger, whereas a bared-teeth expression may indicate communication or reconciliation (Yang et al. 2013). The above 2 studies indicate that although monkeys can discriminate between affiliative and agonistic facial expression stimuli, they do not show clear behavioral discrimination corresponding to affiliative and neutral faces, similar to that reported in chimpanzees (Parr 2009) and crested macaques (Waller et al. 2016). Therefore, we argue that there may be no significant differences in functional values between affiliative and neutral facial expressions. Nonadult individuals spending more time with the photographs may imply a lack of experience at facial expression identification, implying they need time and experience to evaluate affiliative or agonistic contexts from facial expressions accurately. This also indicates that facial expression recognition and appraisal of related social cues are dependent on social learning and experience, as reported in humans and other animals (Wathan et al. 2016). Based on previous reports, we propose that the studied species may have the ability to discriminate between images of familiar and unfamiliar conspecifics within the species and distinguish

closely-related individuals from distant relatives. Thus, it would be interesting to further study these issues. It should be noted, however, that other factors may also play the role in influencing such recognition, for example, sex. In conclusion, our research confirms that *R. roxellana* can identify different facial expression stimuli and adjust their behavioral patterns accordingly.

Ethics Approval

Our research adhered to all regulatory requirements of Guanyinshan National Nature Reserve, China. All applicable institutional, national, and international guidelines for animal care and use were followed.

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Supplementary Material

Supplementary material can be found at <https://academic.oup.com/cz>.

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