

**Dog-owners show experience-based viewing behavior in judging dog
face approachability**

Carla Jade Gavin, Sarah Houghton, Kun Guo
School of Psychology, University of Lincoln, Lincoln LN6 7TS, UK

Corresponding author:

Dr. Kun Guo

School of Psychology, University of Lincoln, Brayford Pool, Lincoln LN6 7TS, UK

e-mail: kguo@lincoln.ac.uk

Tel: +44-1522-886294

Fax: +44-1522-886026

Running head: Differential gaze allocation in face viewing between dog-owners and non-owners

ABSTRACT

Our prior visual experience plays a critical role in face perception. We show superior perceptual performance for differentiating conspecific (vs non-conspecific), own-race (vs other-race) and familiar (vs unfamiliar) faces. However, it remains unclear whether our experience with faces of other species would influence our gaze allocation for extracting salient facial information. In this eye-tracking study, we asked both dog-owners and non-owners to judge the approachability of human, monkey and dog faces, and systematically compared their behavioral performance and gaze pattern associated with the task. Compared to non-owners, dog-owners assessed dog faces with shorter time and fewer fixations, but gave higher approachability ratings. The gaze allocation within local facial features was also modulated by the ownership. The averaged proportion of the fixations and viewing time directed at the dog mouth region were significantly less for the dog-owners, and more experienced dog-owners tended to look more at the dog eyes, suggesting the adoption of a prior experience-based viewing behavior for assessing dog approachability. No differences in behavioral performance and gaze pattern were observed between dog-owners and non-owners when judging human and monkey faces, implying the dog-owner's experience-based gaze strategy for viewing dog faces was not transferable across faces of other species.

Keywords: visual attention; gaze pattern; faces; species; visual experience

Introduction

Human faces are probably the most important visual stimuli in our social environment. With a single glance, we can extract abundant facial information about a person such as their gender, age, race, identity and expression. This highly efficient cognitive processing for faces seems to be correlated with our prior experience of face encountering, as clearly demonstrated by psychological studies such as own-race bias (e.g., O'Toole, Deffenbacher, Valentin, & Abdi, 1994). That is, in comparison with faces of people from our own race, processing less experienced faces from other races often results in frequent misidentification, poorer performance in recognition, memory and perceptual discrimination, and less accurate judgement of age and gender (Dehon & Brédart, 2001; Levin, 2000; Meissner & Brigham, 2001). Interestingly, our prior experience with a face could also affect early stage of face recognition process, such as gaze allocation in extracting diagnostic facial cues from local facial regions (i.e. eyes, nose and mouth). A few eye-tracking studies have revealed that, in comparison with unfamiliar faces, viewing of familiar (famous, familiarized or personally familiar) faces is associated with fewer fixations and a shorter scanning duration (Barton, Radcliffe, Cherkasova, Edelman, & Intriligator, 2006; Heisz & Shore, 2008), or is accompanied by directing sequential fixations to different local facial regions (van Belle, Ramon, Lefèvre, & Rossion, 2010).

Considering that in natural surroundings we often meet animals with faces sharing human-like spatial configurations (i.e. two front eyes above a nose and a mouth), it seems plausible that our experience-related face processing strategy can be extended to processing non-human faces. Indeed, previous studies from human observers have reported clear differences in perceptual and neural processing of faces of different species. At perceptual level, humans were more sensitive in detecting subtle differences between a pair of human rather than monkey faces (Pascalis & Bachevalier, 1998); the holistic or configural processing of faces (perceiving relations among facial features and integrating all features into a single representation of the whole face; Young, Hellawell, & Hay, 1987) was more evident with human faces than with monkey or dog faces (McKone, Kanwisher, & Duchaine, 2006). At neural processing level, the 'face-sensitive' N170 event-related potential (ERP) component elicited by human faces peaked 10 ms

earlier than that elicited by monkey faces (e.g., Carmel & Bentin, 2002; Rousselet, Mace, & Fabre-Thorpe, 2004). Furthermore, one recent eye-tracking study further compared non-pet-owners' spontaneous gaze distribution in the viewing of human, monkey, dog and cat faces, and observed that the proportion of fixations directed at the mouth region was species-dependent (fewer fixations at the dog or cat mouth) and could be differentiated at the earliest stage of face viewing (Guo, Tunnicliffe, & Roebuck, 2010).

The above-mentioned studies have implied that our limited experience with non-conspecific faces could affect the processing of relevant facial information at different stages, from extracting local facial information (i.e. eye-tracking studies), to neural encoding of facial structures (i.e. ERP studies) and recognizing facial identities (i.e. behavioral studies). These studies, however, often use a free-viewing task, which lacks a specific task context, to test non-pet-owners. Given that our gaze allocation in face exploration is subject to a modulatory role of task-based top-down guidance (Buchan, Pare, & Munhall, 2000; Malcolm, Lanyon, Fugard, & Barton, 2008), it remains unclear whether our enhanced experience with non-conspecific faces (e.g., pet owners) would influence our gaze allocation for extracting salient facial cues and/or facilitate the subsequent processing of specific facial information.

It is well established that expertise in a particular area would promote an expert cognitive strategy in sampling and processing visual information. Specifically, expertise can affect various aspects of the ocular exploratory behaviour, such as the number, duration, and especially the spatial distribution of fixations. Such expertise-modulated gaze pattern differences have been observed between expert and novice observers when they look at pictures or art pieces (Zangemeister, Sherman, & Stark, 1995; Vogt & Magnussen, 2007; Humphrey & Underwood, 2009; Pihko et al., 2011), watch sports videos (Crespi, Robino, Silva, & de'Sperati, 2012), read music (Waters, Underwood, & Findlay, 1997), interpret medical images (Nodine, Kundel, Lauver, & Toto, 1996; Donovan & Manning, 2007; Kundel, Nodine, Krupinski, & Mello-Thomas, 2008; Matsumoto et al., 2011; Wood, Batt, Appelboam, Harris, & Wilson, 2014), drive (Underwood, 1998; Nabatilan, Aghazadeh, Nimbarte, Harvey, & Chowdhury, 2012), or play chess (Reingold, Charness, Pomplun, & Stampe, 2001). For instance, in comparison with laypersons, experienced radiologists tend to adopt a more global gaze strategy to

examine mammography images in detecting breast cancer (Kundel et al., 2008), art-trained viewers often scan a larger surface of representational paintings and give higher aesthetic rating when evaluating abstract paintings (Pihko et al., 2011), and the experienced drivers fixate more on the front and centre view, and make fewer driving errors when facing visual distraction (Nabatiyan et al., 2012). Based on these earlier studies, it is reasonable to assume that for a given task, the pet owners are likely to adopt an experienced-based viewing behaviour to extract informative facial information from familiar non-conspecific faces.

In this study, we adopted a naturalistic task of judging face approachability to systemically compare dog-owners' and non-dog-owners' gaze behaviour, in examining images of human, monkey and dog faces. Approachability is one of the facial trait judgements people often made (sometimes automatically) to form first impressions (Vernon, Sutherland, Young, & Hartley, 2014), and is probably more relevant when encountering non-human animals in comparison with other facial traits, such as attractiveness, trustworthiness and dominance. For human faces, the judgement of approachability corresponds closely to trustworthiness/valence rating (Vernon et al., 2014), and the perceived facial expression is crucial for forming an impression of approachability (Willis, Palermo, & Burke, 2011; Vernon et al., 2014). Considering that humans would name familiar faces faster than unfamiliar ones (Bar & Bierderman, 1998) and demonstrate proficient gaze pattern in the viewing of more-experienced familiar faces (Barton et al., 2006; Heisz & Shore, 2008), we hypothesized that dog-owners may use less viewing time and adopt a more 'efficient' gaze strategy (e.g., fewer number of fixations and fixation allocation at task-relevant informative facial regions) to judge the approachability of dog faces.

Materials and Methods

Seventy-six participants (28 male, 48 female), age ranging from 18 to 38 years old with the mean of 22.16 ± 5.02 (Mean \pm SD), volunteered to participate in the study. All participants had normal or corrected-to-normal visual acuity, and did not have frequent contact with monkeys or cynophobia. Thirty-eight participants (13 male, 25 female, mean age 22.34 ± 5.02) were currently dog-owners with between 1 and 26 years' experience of

dog ownership (mean years of experience 10.79 ± 6.95). The other 38 (15 male, 23 female, mean age 21.97 ± 5.02) were non-dog-owners. The Ethical Committee in School of Psychology, University of Lincoln approved this study. Written informed consent was obtained from each participant prior to the testing, and all procedures complied with the British Psychological Society “Code of Ethics and Conduct”, and with the World Medical Association Helsinki Declaration as revised in October 2008.

Digitized grey scale face images were presented through a ViSaGe graphics system (Cambridge Research Systems, UK) and displayed on a high frequency non-interlaced gamma-corrected color monitor (30 cd/m^2 background luminance, 100 Hz frame rate, Mitsubishi Diamond Pro 2070SB) with the resolution of 1024×768 pixels. At a viewing distance of 57 cm the monitor subtended a visual angle of $40 \times 30^\circ$.

Three different categories of unfamiliar face images with closed mouth and neutral facial expressions in full frontal view were used as stimuli (see examples in Fig.1): 12 human (Western Caucasian) faces, 12 monkey (Rhesus macaque) faces and 12 dog (*Canis familiaris*) faces. The faces of adult dogs were obtained from common dog breeds (Poodle, miniature Dachshund, Spaniel, Labradors, and Border Terrier). All images shared similar spatial facial configurations, were gamma-corrected to ensure a natural shades appearance as seen by human eyes, and displayed once in a random order at the centre of the screen with a resolution of 600×600 pixels ($22 \times 22^\circ$).

A self-paced task was used to mimic natural viewing condition. During the experiments the participants sat in a chair with their head restrained by a chin-rest, and viewed the display binocularly. To calibrate eye movement signals, a small red fixation point (FP, 0.3° diameter, 15 cd/m^2 luminance) was displayed randomly at one of 9 positions (3×3 matrix) across the monitor. The distance between adjacent FP positions was 10° . The participant was instructed to follow the FP and maintain fixation for 1 s. After the calibration procedure, the participant pressed the response box to initiate a trial. The trial was started with a FP displayed on the centre of the monitor. If the participant maintained fixation for 1 s, the FP disappeared and a face image was presented. During the self-paced presentation, the participant was instructed to “rate the perceived face approachability as accurately and as quickly as possible”, and to respond by pressing a button on the response box (for stopping face presentation and collecting reaction time

data) with the dominant hand followed by a verbal report of the perceived face approachability on a 5-point scale (1=least approachable, 5=most approachable). No reinforcement was given during this procedure. The faces of different species were displayed once in a randomised order for each participant.

Horizontal and vertical eye positions from the self-reported dominant eye (determined through the Hole-in-Card test or the Dolman method if necessary) were measured using a Video Eyetracker Toolbox with 250 Hz sampling frequency and up to 0.25° accuracy (Cambridge Research Systems, UK). The software developed in Matlab computed horizontal and vertical eye displacement signals as a function of time to determine eye velocity and position. Fixation locations were then extracted from the raw eye-tracking data using velocity (less than 0.2° eye displacement at a velocity of less than 20°/s) and duration (greater than 50 ms) criteria (Guo, Mahmoodi, Robertson, & Young, 2006).

Whilst determining fixation allocation within key internal facial features (i.e. eyes, nose, and mouth), a consistent criterion was adopted to define boundaries between local facial features for different faces (for details see Guo, Tunncliffe, & Roebuck, 2010). Specifically, the 'eye' region included the eyes, eyelids, and eyebrows; the 'nose' or 'mouth' region consisted of the main body of the nose (glabella, nasion, tip-defining points, alar-sidewall, and supra-alar crease) or the 'mouth' and immediate surrounding area (up to 1°). The division line between the mouth and nose regions was the midline between the upper lip and the bottom of the nose. Each fixation was then characterized by its location among feature regions and its time of onset relative to the start of the trial.

Given each face could attract different number of fixations or different length of viewing time in the self-paced presentation, the number of fixations or viewing time directed at each facial feature was normalized as a proportion to the total number of fixations or viewing time sampled in that trial. Furthermore, as the same facial feature across faces of different species often vary in size (e.g., dogs usually have larger noses than humans), the proportion of the area of a particular facial feature relative to the whole image was subtracted from the proportion of fixations directed at that feature in a given trial. Any difference in fixation distribution from zero means that this particular facial

region attracted more or less fixations than predicted by a uniform looking strategy (Guo, Tunnicliffe, & Roebuck, 2010).

Results

As the initial analysis did not reveal any significant gender difference in all of the behavioural measurements (i.e. approachability rating, reaction time, fixation number, and fixation distribution) from either dog-owners or non-owners, the data from both male and female participants were collapsed together for the below reported analysis. We first examined how dog-ownership would affect participants' behavioural responses in judging face approachability. After checking data distribution for normality with a Shapiro-Wilk test ($p > .05$), we conducted a series of 2 (ownership: dog-owners vs non-owners) \times 3 (face species: human, monkey and dog faces) repeated-measures analyses of variance (ANOVAs) with approachability rating, reaction time and number of fixations per image as the dependent variables. For each ANOVA, Greenhouse–Geisser corrections were applied where sphericity was violated.

The analysis of approachability rating showed significant interaction between ownership and face species ($F(2,74)=3.67$, $p=.03$, $\eta_p^2=.09$; Fig. 2), revealing that dog-owners gave significantly higher approachability ratings to the dog faces than non-dog-owners (2-tailed t-test, $t(37)=2.97$, $p=.004$; Table 1). The human and monkey faces, on the other hand, attracted the same approachability ratings from both dog-owners and non-owners ($t<.28$, $p>.78$ for all comparisons). The significant main effect of face species ($F(2,74)=42.98$, $p<.001$, $\eta_p^2=.54$) further suggested that across all the participants irrespective of dog ownership, the dog faces attracted the highest approachability ratings (3.67 ± 0.08) followed by the human faces (3.24 ± 0.07) and then the monkey faces (2.78 ± 0.08) ($t>4.39$, $p<.001$ for all comparisons; Table 1).

The analysis of both reaction time and fixation numbers also showed significant interaction between ownership and face species (reaction time: $F(2,74)=6.37$, $p=.003$, $\eta_p^2=.15$; fixation numbers: $F(2,74)=6.83$, $p=.003$, $\eta_p^2=.16$). In comparison with non-dog-owners, dog-owners used similar amount of time and number of fixations to rate human and monkey faces ($t<.79$, $p>.43$ for all comparisons; Fig. 2), but were quicker and allocated a significantly less number of fixations when judging dog faces (reaction time:

$t(37)=2.36, p=.02$; fixation numbers: $t(37)=2.04, p=.04$; Table 1). No other significant main effect was observed.

Taken together, it seems that dog-owners needed less time and fewer fixations to view dog faces, but gave higher approachability ratings (Table 1, Fig. 2). Could these behavioural differences between dog and non-dog owners be manifested in their gaze strategies associate with face-viewing? To address this question, we performed 2 (ownership) \times 3 (face species) \times 3 (facial regions: eyes, nose and mouth) ANOVAs with normalised proportion of viewing time and fixation directed at each facial region as the dependent variables (Fig. 3). Although we did not find significant main effect of ownership or interaction between ownership and face species on the gaze distribution, in comparison with non-owners, dog-owners tended to allocate less proportion of viewing time and fixation at the mouth region in dog faces (viewing time: $t(37)=2.71, p=.01$; fixation: $t(37)=2.71, p=.009$; Table 2). No significant difference in gaze distribution between dog-owners and non-owners was observed for other local facial regions ($t<.65, p>.51$ for all comparisons). It seems that as a population, dog-owners needed fewer fixations to judge dog face approachability (Fig. 2) and fixated less at the dog mouth (Fig. 3).

Considering that the dog-owners in our study had between 1 and 26 years of dog ownership experience, to examine to what extent the length of ownership could affect dog face approachability assessment and associated gaze behaviour, we conducted a series of correlation analysis (one-tailed Pearson correlation) between years of dog ownership and approachability rating, the proportion of fixations allocated at the eyes, nose and mouth regions in dog faces. Although the length of ownership was not related to the dog face approachability rating ($r=.12, p=.23$), more experienced dog-owners clearly allocated more fixations at the dog eyes ($r=.29, p=.04$; Fig. 4) and showed a tendency to direct less fixations at the nose ($r=-.2, p=.11$) and mouth regions ($r=-.2, p=.11$). No such tendency was observed when dog-owners were in viewing of human and monkey faces (Fig. 4).

Furthermore, the ANOVA analysis of gaze distribution showed significant main effect of facial region (view time: $F(1.24,45.77)=109.9, p<.001, \eta_p^2=.75$; fixation: $F(1.2,44.28)=125.83, p<.001, \eta_p^2=.77$) and face species (view time: $F(2,74)=62.75,$

$p < .001$, $\eta_p^2 = .63$; fixation: $F(2,74) = 71.71$, $p < .001$, $\eta_p^2 = .66$), and significant interaction between face region and face species (view time: $F(3.28, 121.41) = 22.4$, $p < .001$, $\eta_p^2 = .38$; fixation: $F(3.08, 113.86) = 19.45$, $p < .001$, $\eta_p^2 = .35$). Specifically, faces of different species elicited qualitatively similar patterns of viewing time and fixation distribution across local features. Regardless of face species, the eyes always attracted the highest proportion of viewing time and fixations, followed by the nose and then the mouth ($t > 2.89$, $p < .004$ for all comparisons; Fig. 3). However, the amount of viewing time and fixation directed at individual facial feature was species-dependent. In comparison with the same facial region in human and dog faces, the eyes in monkey faces attracted longer viewing time and more fixations, whereas the nose region in monkey faces attracted less viewing ($t > 2.24$, $p < .03$ for all comparisons; Table 2). Furthermore, the mouth region in monkey and dog faces attracted significantly fewer fixations and shorter viewing time than the mouth in human faces ($t > 4.18$, $p < .001$ for all comparisons; Table 2).

Discussion

Previous studies have suggested that expertise in a particular area would promote an expert cognitive strategy in sampling and processing visual information, such as modifying gaze distribution in viewing paintings, watching sports videos and interpreting medical images (e.g., Kundel et al., 2008; Pihko et al., 2011; Crespi et al., 2012; Wood et al., 2014). In this study, we extended this expertise- or experienced-modified viewing behaviour to the processing of non-conspecific faces by systematically comparing dog-owners' and non-dog-owners' behavioral performance and gaze distribution in judging face approachability. Unsurprisingly we found that in comparison with non-owners, dog-owners needed a shorter viewing time and fewer fixations to assess dog faces, and gave higher approachability ratings to them (Fig. 2). It is plausible that dog-owners might use an experienced-based gaze strategy for extracting and/or analyzing facial information regarding approachability, such as valence or expressive facial cues (Willis et al., 2011; Vernon et al., 2014). This ability may develop through necessity as it would be beneficial for dog-owners to be able to quickly perceive the mood of their dogs. For example, it would be imprudent to approach a dog whose facial expressions

conveyed aggression, as you may get bitten. Indeed, when asked to label dog emotion using facial and bodily cues, previous studies have observed that experienced dog-owners were more accurate in recognising some dog emotions, such as fear, than inexperienced and non-dog-owners (Wan, Bolger, & Champagne, 2012).

Alternatively given that people normally have a higher preference for familiar compared to unfamiliar faces (Bruce, 1982), it could be argued that dog-owners were biased to give higher approachability ratings to the dog faces. Such bias (rather than the experienced-based gaze strategy) may also account for the reduced response time and fixation numbers when rating the dog faces. If this was the case, the comparison of gaze distribution between dog-owners and non-owners would observe dog-owners showing an equal reduction of fixations across all dog facial features (eyes, nose and mouth). However, in comparison with non-owners, dog-owners allocated indistinguishable proportion of fixations at the dog eyes and nose, but fewer fixations at the dog mouth (Fig. 3), suggesting they might use feature-specific facial cues to assess face approachability.

Further correlation analysis between gaze distribution and the length of ownership suggested that this experience-modulated processing in dog face among dog-owners was associated with the increased viewing at the eye region and reduced viewing at the mouth region (Fig. 4). This is probably due to their prior experience that the image of dog eyes rather than mouth offers more reliable information about approachability. In contrast non-owners directed more fixations towards the mouth region, probably because they are aware that the human mouth is important for determining a range of subtle facial expressions (Schyns, Petro, & Smith, 2007) and they generalised this knowledge to the dog face. Indeed, when asked to label facial expressions of emotion, human adults tended to direct a substantial amount of fixations at the human mouth regardless of expression category and intensity (Guo, 2012), viewing distance (Guo, 2013) and viewpoints (Guo & Shaw, 2015). This exaggeration in the importance of the mouth region is even more evident in younger children, who are more likely to rely on a single facial feature (e.g., mouth) to categorize facial expressions, such as happiness (Kestenbaum, 1992).

Interestingly, when assessing human and monkey faces, dog-owners and non-dog-owners had the same approachability ratings and showed indistinguishable viewing

behavior (viewing time, number of fixations, fixation and viewing time allocation at local facial regions), further suggesting that dog-owners' gaze behavior for viewing dog faces was experience-dependent and was not transferrable across faces of other species. Such viewing bias towards dog faces in dog-owners seems to fit well with the multi-dimensional face space model, which suggests that as we become more familiar with a type of faces, we develop dimensions to code those faces (Valentine, 1991). This model has been used to explain some experience-based face perception bias, such as own-race bias (Valentine & Endo, 1992; Hills & Lewis, 2011). It is plausible that the same theoretical model can be extended to account for the observed dog face processing advantage (shorter viewing time, higher approachability rating, and experienced-modulated gaze allocation) in dog-owners. Furthermore, this observed relation between experience-based viewing behaviour and dog-owners' assessment of dog face approachability could support the view of embodied cognition which argues bodily action (motor system) can directly affect cognition and related cognitive process (e.g., Borghi & Cimatti, 2010). It would be interesting to explicitly examine to what extent this task-specific experience-based gaze behaviour leads to expert assessment of dog facial traits in the future research.

In comparison with dog and human faces, the monkey faces were rated as less approachable by both dog-owners and non-owners. This can be partly explained by previous findings that people have a higher preference for familiar compared to unfamiliar faces (Bruce, 1982). The conceptual knowledge about individual species (e.g., monkeys may bite but humans don't normally bite) may also contribute to these approachability rating differences between faces of different species. Interestingly, probably due to the similarity in facial configurations, rating human and monkey faces needed a similar amount of viewing time and number of fixations from dog-owners or non-owners, but the quantitative gaze allocation at individual facial features was slightly different between human and monkey faces. The participants directed proportionally fewer fixations and shorter viewing time at the monkey mouth than at the human mouth. Given the relevance and importance of the human mouth in transforming a range of diagnostic cues for fast detection of some facial expressions (Schyns, Petro, & Smith, 2007), it is quite possible that in order to evaluate approachability from neutral faces, our

participants directed a substantial amount of attention to the mouth region to assess subtle expression or emotion cues. On the other hand, the lack of perceptual experience in processing subtle emotion cues from the monkey mouth may lead to the reduced gaze allocation at this region. Instead, our participants tended to examine the monkey eyes more frequently for rating its approachability (Fig. 2).

Taken together our findings suggest that previous experience with dogs may allow dog-owners to adopt an experience-based viewing strategy, requiring shorter viewing time, fewer fixations and slightly different gaze allocation to local facial features, to give higher approachability ratings for dog faces. This task-specific experience-based viewing behaviour was not transferable for assessing face approachability of other species, such as humans and monkey faces. Considering that facial communication plays a crucial role in human-animal (e.g., human-dog) interactions and eye-tracking technology has been developed for a variety of non-human animal species, it would be interesting to examine whether this experience-based viewing behaviour for non-conspecific faces can be extended to other animals, such as pet dogs.

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FIGURE LEGENDS

Figure 1. Examples of human, monkey and dog face images used in this study.

Figure 2. Average approachability rating, reaction time and number of fixations per image sampled from both dog-owners and non-owners in the self-paced task of judging approachability of human, monkey and dogs faces. Error bars indicate standard error of mean. * Significant difference between dog-owners and non-owners (2-tailed t-test, * $p < 0.05$, ** $p < 0.01$).

Figure 3. Normalised distribution of viewing time and fixations in eyes, nose and mouth regions sampled from both dog-owners and non-owners in the self-paced task of judging approachability of human, monkey and dogs faces. Error bars indicate standard error of mean. * Significant difference between dog-owners and non-owners (2-tailed t-test, * $p < 0.05$).

Figure 4. Correlation between years of dog ownership experience and the proportion of fixations directed at the eyes, nose and mouth regions in human, monkey and dog faces.

Figure 1



Figure 2

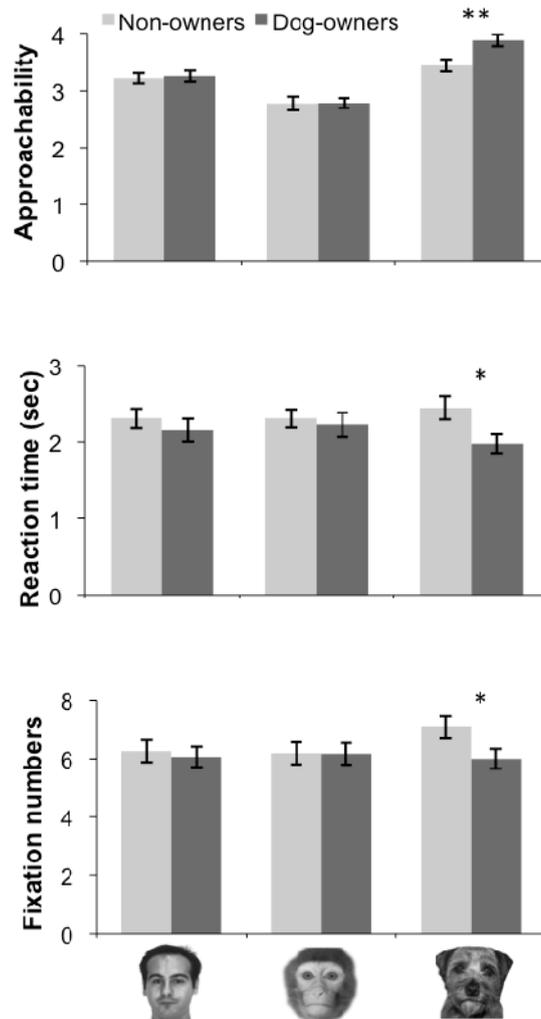


Figure 3

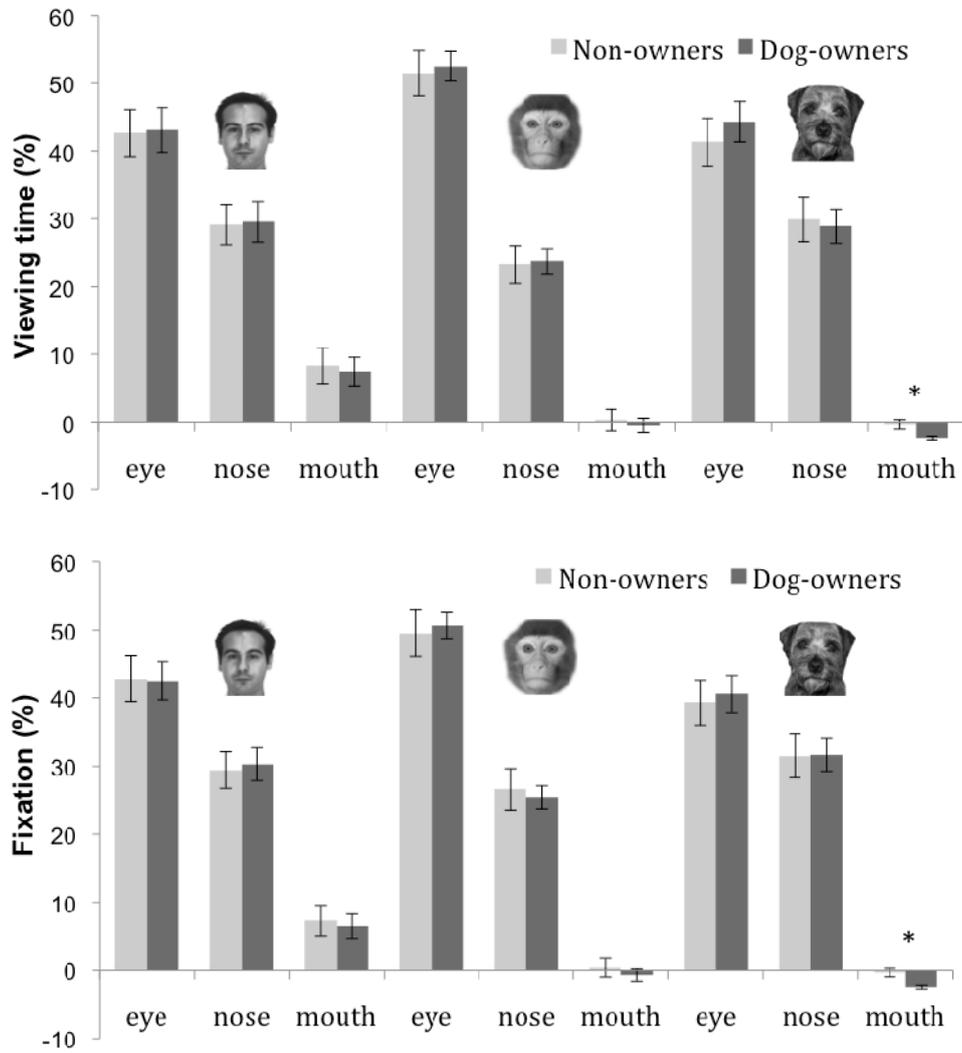


Figure 4

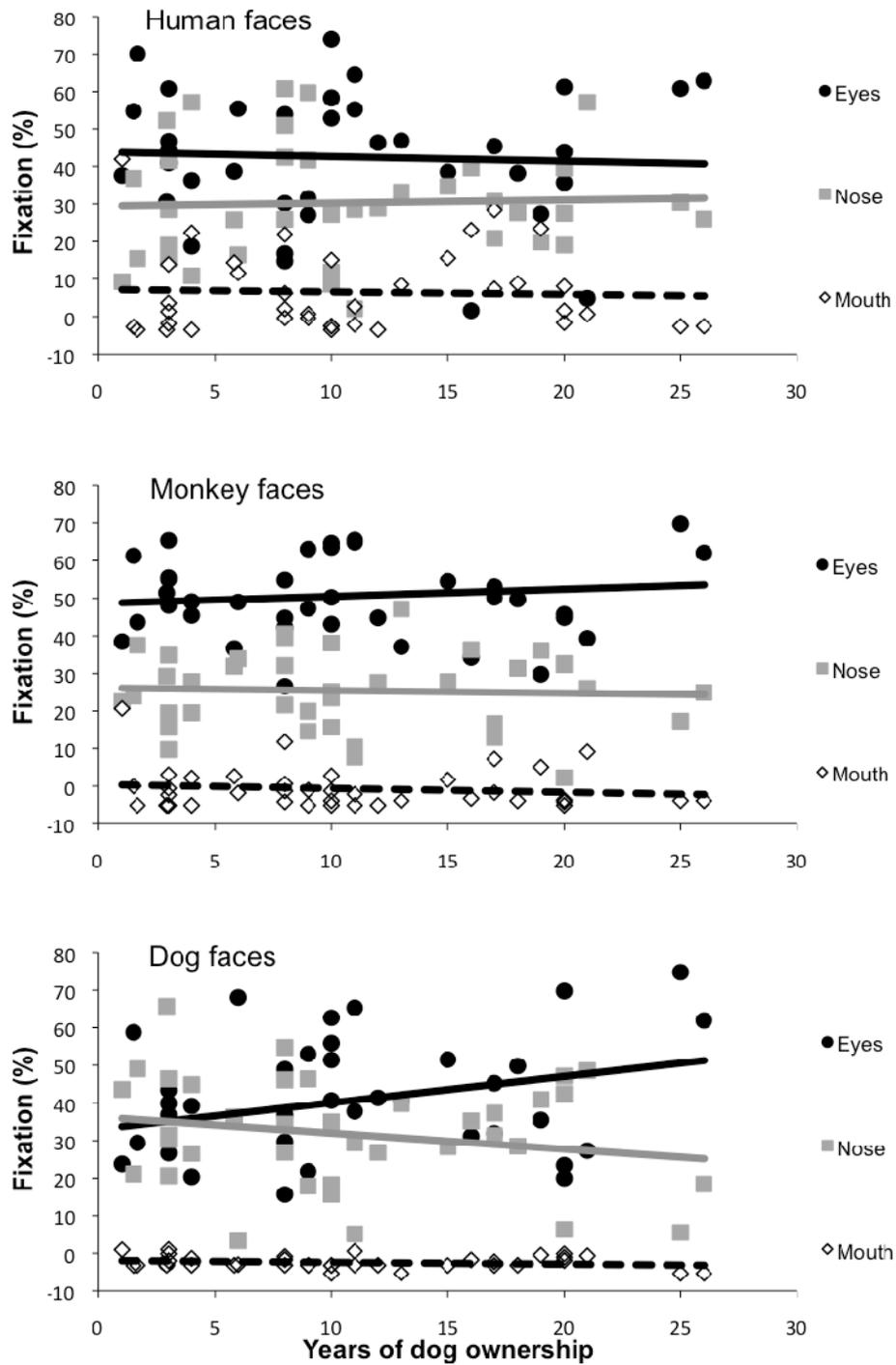


Table 1. Behavioural performance (mean±SE) and difference (p-value from 2-tailed t-test) between dog-owners and non-owners when judging approachability of human, monkey and dogs faces.

	Approachability rating			Reaction time (sec)			Fixation numbers		
	Human-F	Monkey-F	Dog-F	Human-F	Monkey-F	Dog-F	Human-F	Monkey-F	Dog-F
Dog-owners	3.25±0.1	2.79±0.09	3.44±0.11	2.15±0.15	2.22±0.16	1.98±0.12	6.06±0.35	6.17±0.37	6±0.34
Non-owners	3.22±0.09	2.78±0.12	3.89±0.11	2.31±0.13	2.3±0.12	2.44±0.15	6.26±0.38	6.19±0.38	7.06±0.39
P-value	0.78	0.97	0.004	0.43	0.68	0.02	0.7	0.97	0.04

Table 2. Gaze distribution (mean±SE) and difference (p-value from 2-tailed t-test) between dog-owners and non-owners when judging approachability of human, monkey and dogs faces.

Proportion of fixations (%) in local facial regions									
	Human Face			Monkey Face			Dog Face		
	Eyes	Nose	Mouth	Eyes	Nose	Mouth	Eyes	Nose	Mouth
Dog-owners	43±3	30±2	6±2	51±2	25±2	-0.7±0.9	41±3	32±2	-2.4±0.3
Non-owners	43±3	29±3	7±2	50±3	27±3	0.4±1.4	39±3	31±3	-0.3±0.6
P-value	0.95	0.81	0.77	0.76	0.73	0.51	0.77	0.96	0.003

Proportion of viewing time (%) in local facial regions									
	Human Face			Monkey Face			Dog Face		
	Eyes	Nose	Mouth	Eyes	Nose	Mouth	Eyes	Nose	Mouth
Dog-owners	43±3	30±3	8±2	53±2	24±2	-0.5±1	44±3	29±3	-2.5±0.3
Non-owners	43±3	29±3	8±3	51±3	23±3	0.3±1.5	41±4	30±3	-0.3±0.7
P-value	0.93	0.92	0.8	0.8	0.89	0.68	0.52	0.81	0.004