Urban geese discriminate between predators of different sizes

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Abstract

Compared to rural areas, the density of predators such as domestic Dogs *Canis lupus familiaris* is high in urban areas. Greylag Geese *Anser anser* recently colonised the city of Stuttgart, southwestern Germany where they frequent large public parks that offer rich grazing for these herbivores. People regularly walk their dogs within the parks, which often disturb the geese and provides an opportunity to study the anti-predator behaviour of Greylag Geese to these potential predators. Goose response distances and strength increased with dog size. Small dogs, people without dogs and vehicles resulted in much shorter response distances. Since large dogs can easily kill geese, it may be adaptive for the geese to fine-tune their behaviour to the real danger from domestic predators.

Key words: dogs, flight, response distance, vigilance.

In wild geese, anti-predator behaviour can be difficult to study, and many accounts of predator-prey interactions are anecdotal rather than systematic with actual predation rarely observed (Ebbinge & Spaans 2002). Although cities are often considered as predator-free safe havens (Møller 2012), the density of domestic predators such as the domestic Cat *Felis catus* and Dog *Canis lupus familiaris* can be high (Sorace 2002). The prey of cats has been studied in detail (Baker *et al.* 2008; Møller *et al.* 2010), for instance in demonstrating that the average weight of predated songbirds was lower than the population average (Baker *et al.* 2008). Cats' prey are usually dead or near-dead when found, so this does not allow any deduction about the birds' behaviour prior to the predation event. Whereas cats are unlikely to harm geese, dogs can kill them. We therefore would predict that urban geese would show appropriate adaptive behaviours on encountering dogs. Adaptation to predation risk is important in an evolutionary sense: caution could be beneficial in reducing the risk of injury and mortality, whilst on the other hand responding too early and too often can cause stress, cost energy, reduce feeding time and may ultimately reduce survival (Rebolo-Ifran *et al.* 2015). Cities offer the possibility of observing closely not only geese and dogs, but also their interactions. In this study, we hypothesise that in an urban setting

Greylag Geese will show: (a) longer response distances to large dogs in comparison with their responses to medium-sized or small dogs, and (b) a stronger response towards larger dogs. Larger dogs may have the potential to severely harm or even kill geese, whereas smaller dogs may be less of a threat to them.

Methods

Observations were made in the city of Stuttgart, southwest Germany, between 9 May and 12 July 2010 during the Greylag Goose breeding season (see Hohmann & Woog 2021 for detailed descriptions of the study flock and site). During all-day behaviour scans of urban Greylag Geese made for a different study (Woog *et al.* 2012), the number of people and, if applicable, dogs in the birds' immediate vicinity were recorded directly after each 10 min scan by the same observer (K.S.). The observer remained at the same point throughout the all-day observations made of the geese. In the event of a disturbance (*e.g.* caused by a dog), the exact time, flock size, cause of the disturbance, distance of the source of the disturbance to the geese and their response were all recorded. Codes were used to identify the source of the disturbance and responses by the geese, to describe the type and strength of response. Dog types were recorded in much detail including their size, colour, behaviour (*i.e.* barking) and whether or not they were on a lead. Dog sizes were estimated according to their shoulder level: a dog was considered small when up to 35 cm (*e.g.* Chihuahua, Yorkshire Terrier, Dachshund), large dogs were over 50 cm (German Shepherd, Golden Retriever, Labrador), and

medium sized dogs were in-between. In a preliminary test, dog colour did not play a role in influencing goose behaviour (F. Woog, unpubl. data) and there were insufficient data on the dogs' behaviour for analysis because the dogs were usually on a lead (which is a legal requirement) in the city. Data therefore were pooled according to dog sizes, regardless of the other parameters. Interference sources were classified as: (1) small dog, (2) medium-sized dog, (3) large dog, (4) human without a dog and (5) traffic, including cars and lawnmowers. Response strength was defined as: (1) no goose reacts, (2) < 50% of the geese present react, (3) ≥ 50% of the geese react and (4) all geese react. The following behavioural responses were used: (1) vigilance, (2) running/walking towards water, (3) running without direction, (4) escape by flight, (5) hissing and (6) attack. The last two categories were too rarely observed to merit inclusion in the analysis and are therefore only described anecdotally.

Data analysis

After removing a few abnormally long response distances to helicopters (at > 100 m), which rarely came over the park, continuous distance data were normally distributed. One-way ANOVAs therefore were used to test whether response distance was influenced by the type of disturbance, using Minitab 16.1.0 (Ryan *et al.* 2005). Chi-square tests were used to test the number of occurrences of the different behaviours in relation to dog size.

Results

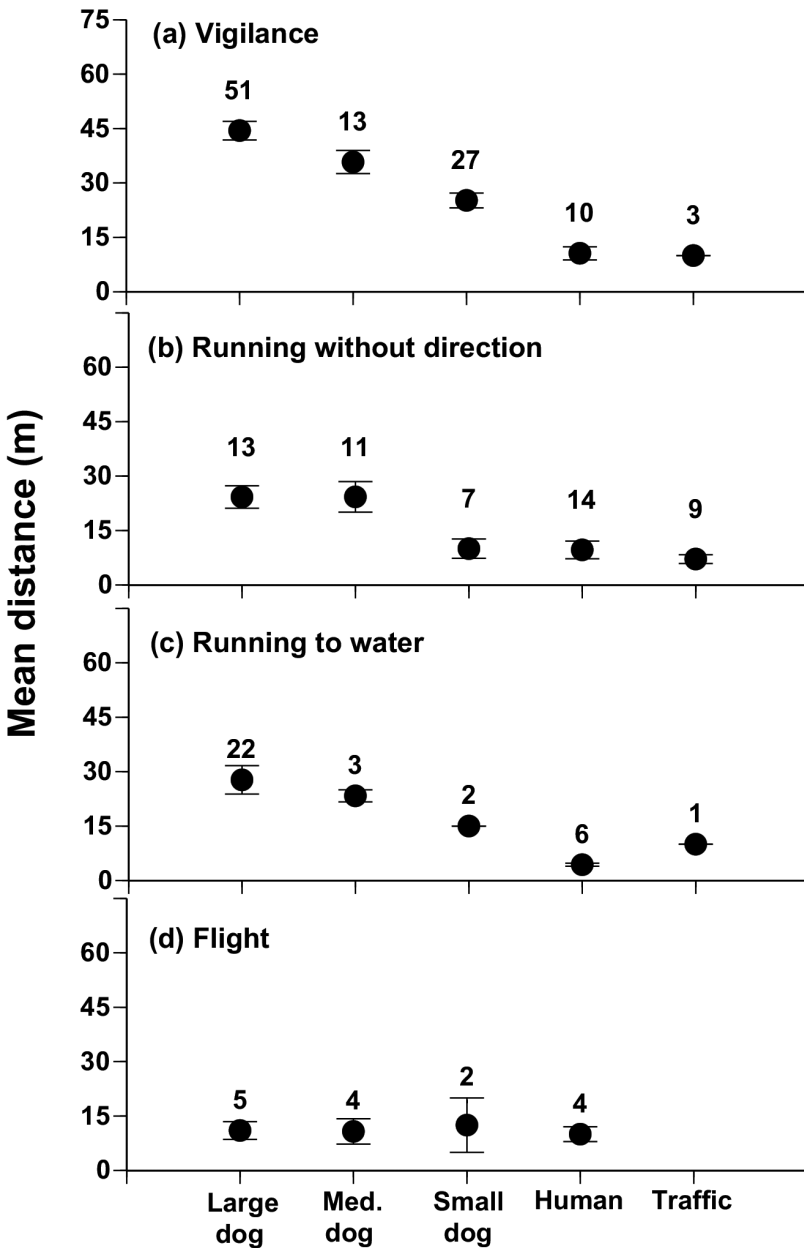Urban Greylag Geese distinguished between dogs of different sizes (Fig. 1), reacting at

Figure 1. Mean (± s.e. bars) response distances (m) of geese to different sources of disturbance and behavioural response types. Data were only analysed for geese that were able to fly; observations on moulting birds were excluded. Distances of > 100 m were also omitted. Values above the means represent sample sizes for each event.

longer distances to larger dogs. Humans without dogs and vehicles were tolerated at much shorter distances (ANOVA: vigilance $F_{1,4} = 16.47$, $P < 0.001$; running without direction $F_{1,4} = 7.18$, $P < 0.001$; running/walking towards water $F_{1,4} = 7.41$, $P = 0.001$; escape by flight $F_{1,4} = 12.78$, $P < 0.001$; Fig. 1). For all behavioural responses, the response distances were longest for large dogs and decreased with dog size. The response distance was lowest for humans. The geese reacted to vehicles at distances similar to those recorded for small dogs.

When encountering large dogs, birds extended their necks upwards in vigilance and started to walk or run, often towards the water body at varying speeds depending on the proximity of the dog, its size and whether or not it was on a lead. Rare responses of geese towards dogs or people included hissing, and these were mostly in situations where the birds had goslings and were unable to escape quickly. Very rarely geese were observed attacking people or small dogs with direct physical contact (Schwarz 2010; F. Woog, pers. obs.). Geese always hissed before an attack. Flight onto the lake in response to large or medium-sized dogs was also rarely observed.

In general, vigilance to any of the disturbance sources, with or without dogs, occurred at distances (mean ± s.d.) of 46.31 ± 4.23 m, but escape by flight was relatively rarely observed, at an average of 16.18 ± 6.54 m from the source of the disturbance. The strength of the individual response types to the presence of dogs (*i.e.* whether < 50%, > 50% or all the geese responded) varied with the size of an approaching dog only for vigilance behaviour,

with the geese reacting more strongly to large dogs than to medium-sized and small dogs ($\chi^2_4 = 13.54$, $P = 0.009$). Data on occurrence of the other response types – "running towards water", "running without direction" and "escape by flight" – were pooled to obtain sufficient sample sizes by category but, in contrast to the vigilance data, there were no differences in response strengths in relation to different dog sizes ($\chi^2_4 = 0.39$, $P = 0.53$, n.s.).

Discussion

The results suggest that Greylag Geese were able to categorise different sources of disturbance according to their potential danger. Whereas lawnmowers and people without dogs could approach quite closely without eliciting a response (vigilant at < 15 m; Fig. 1), geese reacted to dogs of all sizes at longer distances. Moreover, the larger the dog, the earlier and stronger the geese reacted. Other urban-living geese, such as the Egyptian Goose *Alopochen aegyptiacus* and feral domestic Swan Geese *Anser cygnoides* also react to dogs as well as humans (Randler 2003; Hohmann & Woog 2021), with the Egyptian Geese responding even more strongly than Greylag Geese when approached by dogs (Hohmann & Woog 2021), but whether these species fine-tune their response to the size of the dog has not yet been tested. The physiological effect on the birds has however been demonstrated, with elevated heart rates measured in semi-tame Greylag Geese exposed to dogs (Wascher *et al.* 2011).

The geese were apparently habituated to the frequent mowing of the Stuttgart meadows, and did not consider mowing

activity to be sufficiently threatening that they needed to flee to a lake. Conversely, when a dog came very close, the geese often reacted by running in different directions. This may perhaps have been a feature of the landscape at the study site, with many trees that could obscure not only potential sources of disturbance but also escape sightlines, depending on the birds' location within the park. Unfortunately, we did not study the birds' behaviour in relation to habitat structure, which may alter response distances, as found for geese in other studies. For example, wild Greylag Geese in Danish wetlands at Skjern Enge flew at shorter distances (at 171 m) when the source of the disturbance (a human) was obscured from view by vegetation, than when they were not obscured (230 m; Bregnballe *et al.* 2009). These escape distances, which did not involve dogs, were much longer than in our study and were also further than recorded for other smaller waterbirds at Skjern Enge. Greylag Geese are hunted on Danish wetlands, however, which may have contributed to the longer flight distances in a rural setting. In Stuttgart, no hunting is allowed in the public parks.

The decision to take flight is probably based on each bird's perception of the threat level, considering the behaviour of other individuals in the vicinity, and influenced also by the benefits of remaining *in situ*. Greylag Geese in Denmark ceased feeding for an average of 19 mins following flight to open water triggered by a disturbance (Kahlert 2006). Moreover, flight is the most energetically costly predator-response behaviour shown by geese (Mooij 1992). To minimise such unnecessary energy expenditure and loss of feeding time, it is therefore important that the geese interpret the threat from a given stimulus correctly, in order to avoid flight when not directly threatened. Under ideal conditions, the costs of flight can be compensated for by an increased food intake rate, on moving to a site with good food resources combined with lower disturbance levels (Bregnballe *et al.* 2009), but these are not always available.

Urban geese did not leave the city in response to their encounters with dogs, *e.g.* by flying to the surrounding countryside, but escaped mostly to nearby open water or grassland within the park landscape. In general, the geese adapted their response distance and behaviour to the disturbance stimulus (notably the size of the dog) and, in the case of vigilance behaviour, there was an association between the type of disturbance and strength of the response, measured as the proportion of birds responding. Often, not all individuals in a flock reacted to a disturbance. The fact that more geese became vigilant, and at longer distances, in response to large dogs than to medium-sized and small dogs therefore again shows that the geese fine-tune their response depending on the potential danger encountered.

Acknowledgements

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Photograph: Greylag Geese in Stuttgart, by Gabriele Rohde.