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Research Note

Bicycles evoke longer flight-initiation distances and higher intensity escape behaviour of some birds in parks compared with pedestrians

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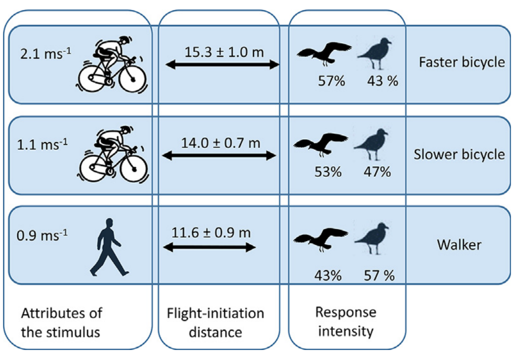
GRAPHICAL ABSTRACT



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ABSTRACT

Wildlife discriminate between potential threats they encounter and may modulate their escape responses accordingly. Flight-initiation distances (FIDs), the distance at which an animal initiates escape to an approaching threat, can inform separation distances which minimise disturbance. However, FID data are currently lacking for many common human-related stimuli encountered by wildlife. Our aim was to elucidate avian responses to a common human stimulus, bicycles being ridden in parks. We compare FIDs in response to a fast bicycle, slow bicycle and a single walker for a range of Australian birds commonly found in parks. When all 57 species were pooled, bicycles did not evoke longer FIDs than walkers. Single species models revealed that bicycles evoked longer FIDs for four of 12 well-sampled species. The response towards bicycles was more intense (i.e., more likely to involve flying) than to walkers for two of ten species.

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1. Introduction

Parks provide important services to people such as enhanced well-being and health through contact with nature (Chiesura, 2004; Maller, Townsend, Pryor, Brown, & St Leger, 2006). Parks can also play a major role in urban wildlife conservation but can also act as ecological traps (Rudd, Vala, & Schaefer, 2002; Lepczyk et al., 2017). Conservation and recreation in parks may not always be compatible and, depending on management objectives, many managers have to balance the costs and benefits of human-wildlife interactions to improve conservation measures without over-regulating human activities (Aronson et al., 2017).

Human activities ('stimuli', e.g. a walker) can evoke responses among wildlife which result in disturbance i.e. the disruption of normal activity or physiology (Weston, McLeod, Blumstein, & Guay, 2012). Disturbance can detrimentally affect wildlife, such as birds, depending on the nature, frequency and intensity of stimuli (Weston et al., 2012). For example, modelling of a Common Ringed Plover *Charadrius hiaticula* population, in England, revealed that the numbers of people were to double, the plover population was predicted to decrease by 23%, if people were excluded, the plover population was predicted to increase by 85% (Liley & Sutherland, 2007). Responses differ between species (Blumstein, Fernández-Juricic, Zollner, & Garity, 2005). Disturbance incurs important fitness costs to birds (e.g., reduced survival or reproductive success; West et al., 2002), is associated with population declines (Fernández-Juricic, 2000; Møller, Samia, Weston, Guay, & Blumstein, 2014) and in some circumstances is considered a conservation issue (Møller, 2008; Møller et al., 2014).

Animals respond to stimuli based on the perceived risk associated with the stimulus (Frid & Dill, 2002). Understanding bird fear of various human-related activities (e.g. walkers with or without dogs, motorised vehicles) is important when formulating appropriate strategies to minimise human disturbance in natural areas (McLeod, Guay, Taysom, Robinson, & Weston, 2013). The distance at which birds initiate escape responses to approaching potential threats (i.e. the flight-initiation distance, FID) can be used to determine appropriate separation distances that minimise disturbance (Guay, van Dongen, Robinson, Blumstein, & Weston, 2016). The characteristics of a stimulus can affect how threatening it is to a bird (Lethlean, van Dongen, Kostoglou, Guay, & Weston, 2017; McLeod et al., 2013; Weston et al., 2012) and birds might discriminate between different human activities. To formulate effective disturbance management strategies, FID data are required from a variety of species and stimuli. To determine whether simple modifications to stimulus behaviour may reduce responses of wildlife (Schlacher, Weston, Lynn, & Connolly, 2013), it is also prudent to test stimulus attributes (such as speed).

Most studies (82%) on avian FIDs have focused on walkers (McLeod et al., 2013), even though bicycles are a prevalent feature of parks (Weston, Antos, & Glover, 2009), can cover longer distances and thus may have more extensive impacts. Only 0.3% of currently available FIDs relate to bicycles (Livezey, Fernández-Juricic, & Blumstein, 2016). We measure the responses of birds to bicycles and walkers to elucidate whether FIDs and mode of escape (e.g. walking or flying away) differ between the two stimuli. These data will provide a basis for constructing ecologically meaningful separation distances where bicycle-riding occurs around sensitive areas or species (Fernández-Juricic, 2000; Richardson & Miller, 1997; Rodgers & Schwikert, 2002; Rodgers & Smith, 1995).

Our aim is to explicitly test whether bicycles cause different responses to walkers, to aid land use and other planning for the benefit of coexistence between recreationists and biodiversity. We do this at two scales: 1) all species, to examine whether a general pattern exists, and 2) individual species, to examine whether species differ in their response to bicycles (managers may manage for specific species of particular value or sensitivity; Marcot, Wisdom, Li, & Castillo, 1994). Specifically, we compare avian responses to bicycles travelling relatively fast and slowly, with responses to walkers. We: 1) pool data across species and compare response distances to fast and slow bicycles and walkers; 2) examine whether response distances differ between stimuli within species; and 3) examine whether escape modality (i.e. run/walk versus fly) exhibited by different species differs between stimuli. Our sampling does not support an analysis of what ecological or taxonomic factors explain observed responses, however we include body mass in our cross-species analysis as it is a major determinant of response distances (Blumstein, 2006; Weston et al., 2012).

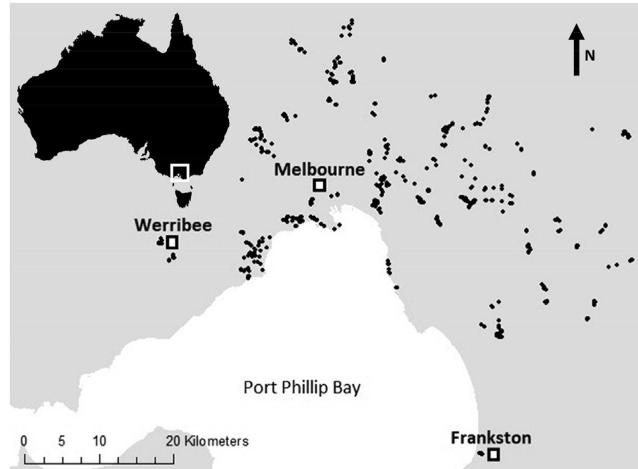

Fig. 1. Map of sampling locations (dots).

2. Methods

2.1. Study sites

We collected data in 112 urban parks throughout Melbourne, Victoria, Australia (Fig. 1). The FIDs of 57 species were collected February–July 2015 (the post and non-breeding season for almost all birds included in this study), between 0900 and 1600 (AEST). Data were collected in dry, low-wind conditions in the absence of any disturbance.

2.2. Data collection

The standard protocol used to estimate FIDs of birds involves a slow continuous approach towards the target bird/s and the recording of the escape distance (Weston et al., 2012). Approaches were direct and only performed in the absence of visual obstructions (e.g. trees, shrubs). We avoided birds in groups > 2, and recorded the response of the nearest bird. Markers were dropped during the approach and distances were later measured using a Bushnell® Pro1600 rangefinder.

We also measured Starting Distance (SD), the distance at which an observer begins an approach and which is routinely used to control for an almost universal positive relationship between FID and SD (Blumstein, 2003; Dumont, Pasquaretta, Réale, Bogliani, & von Hardenberg, 2012). We also timed each approach to measure stimulus speed.

Birds were presented with three stimulus types: a single walker stimulus (with an intended approach speed of 1 ms^{-1}), a single slow bicycle stimulus (1 ms^{-1}) and the single fast bicycle stimulus (2 ms^{-1}). Although bicycles in parks often travel faster than 2 ms^{-1}, reliable behavioural data could not be collected at higher speeds. For reasons of practicality, we only conducted approaches using one stimulus type per day. No area was visited more than once. The first three days of data collection were randomly allocated to one of the three treatments and the sequence was subsequently repeated in a systematic fashion. Parks were then visited in a random order.

All approaches were made by GB who wore standard clothing (black long-sleeved top and grey shorts), remained silent and avoided sudden