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Social facilitation in short-tailed fruit bats, *Carollia perspicillata* (Linnaeus)

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Abstract

Group-living animals can potentially enhance their foraging performance and efficiency by obtaining information from others. Using PIT-tag data to study foraging behaviour in individual bats, we tested short-tailed fruit bats, *Carollia perspicillata* (Linnaeus), for evidence of local enhancement or social facilitation. To discriminate between these phenomena, we manipulated the presence of conspecifics while individuals searched for food. We quantified the time to find food and the order and sex of bats accessing the food, and any consistent associations between bats. Presence of conspecifics decreased the time needed to find food. We found no evidence that pairs of individuals consistently fed together; however, bats of the same sex tended to feed closer in time with one another. The same individuals consistently accessed the food first, and males found food more quickly than females. Our results provide evidence of social facilitation, with bats finding food more quickly in a group than alone.

Keywords

foraging behaviour, individual variation, sex differences, social learning.

1. Introduction

The influence of conspecifics on foraging behaviour has been the subject of considerable theoretical and empirical study (Giraldeau & Caraco, 2000; Galef & Giraldeau, 2001; Shettleworth, 2010). Depending on the situation, the presence of conspecifics can facilitate or hinder foraging efforts (e.g.,

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Lefebvre & Giraldeau, 1994). In addition, while there are many examples of animals using social information to learn about food location and feeding methods, at least one individual must make the initial discovery of a food source or foraging technique via individual exploration and learning. Furthermore, consistent associations with specific individuals could be useful in a foraging context to reduce aggression or to share information, or even food (Wilkinson, 1985). Foraging behaviour of individuals can also be characterized with regard to variation in exploration and learning among animals of the same species; for example, some individuals may ‘lead’ others to resources, while other individuals tend to follow (e.g., Fisher & Hinde, 1949; Giraldeau & Lefebvre, 1986; Gadjon et al., 2006).

Distinguishing between various forms of social influence on foraging can prove challenging. Social facilitation, wherein the presence or action of conspecifics results in increased occurrence or rate of specific behaviours, such as foraging or other food-related activities, has been studied in a wide variety of taxa, including red-winged blackbirds (Mason & Reidinger, 1981), rooks (Dally et al., 2008), crows (Miller et al., 2014), lizards (Greenberg, 1976), hermit crabs (Hazlett & Bossert, 1965), sea slugs (Trowbridge, 1991), fish (Webster & Laland, 2012), macaques (Harlow & Yudin, 1933), capuchins (Dindo et al., 2009), humans (reviewed in Herman, 2015), and insectivorous bats (Barak & Yom-Tov, 1989). Social facilitation may be the result of competition over food or predator risk avoidance. While social facilitation is commonly inferred, many published studies reporting this behaviour are observational and/or did not track the behaviour of known individuals both alone and in groups, making it difficult to exclude other types of social influence, such as information transfer.

The term information transfer encompasses a range of behaviours, including observation of others to determine the quality of a food patch (Templeton & Giraldeau, 1995), exchange of information about diet composition (e.g., Galef, 1988), or attraction to a feeding site based on the presence of conspecifics at the site, i.e. local enhancement. Evidence of information transfer by local enhancement has been obtained for a wide range of species. For example, vultures (Buckley, 1996), wasps (D’Adamo et al., 2000), mollusks (Hurst, 1965; Hughes & Dunkin, 1984), guppies (Reader et al., 2003), insectivorous bats (e.g., Barclay, 1982; Gaudet & Fenton, 1984) and nectarivorous bats (Rose et al., 2015) have been shown to learn about locations related to food or foraging from conspecifics. Social facilitation and information transfer by local enhancement can, however, operate simultaneously, and be difficult to differentiate using observational studies, because both processes can result in an increase in the rate at which food is obtained.

The short-tailed fruit bat, *Carollia perspicillata* (Linnaeus), is a neotropical frugivore that roosts in large groups (Fleming, 1988). *C. perspicillata* display short-term fidelity to a few feeding areas nightly (Fleming & Heithaus, 1986), feed only on ripe fruit which may be present at low densities, change diet components frequently based on seasonal availability, and conduct prolonged searches for food (Fleming, 1982). In addition, captive adult *C. perspicillata* were shown to prefer a novel diet flavour previously eaten by conspecifics to which they were exposed, after detecting the odour of the flavour from the other bats' fur or breath (Ratcliffe & ter Hofstede, 2005). Considering these factors, this species is well-suited for examining the relative importance of social facilitation and local enhancement on foraging performance (defined herein as how well an animal finds food, including success rate and speed in food-finding). By studying a captive colony of individually-marked bats in group and solitary situations, we tested the following predictions about foraging behaviour.

First, we examined the possible influence of others on individual foraging performance. We postulated that if the presence of other individuals is disadvantageous due to competition, distraction, aggression, or confusion, poorer foraging performance would be expected when a bat feeds with conspecifics. Conversely, if the presence of conspecifics is beneficial (e.g., because of social facilitation or local enhancement), better foraging performance would be expected when individuals forage with others.

Second, to determine whether any change in foraging performance in the company of conspecifics is related solely to social facilitation, as opposed to or in addition to use of local enhancement (Heyes, 1994; Shettleworth, 2010), we compared the time that individual bats took to find food when alone and in the presence of others. We predicted that if social facilitation was responsible for an increase in the speed at which food is discovered, time to find food, even for the fastest bat, would be shorter in a group. If local enhancement was occurring, we expected the interval between the first and second fastest bat to find food to be smaller in a group setting, when bats could presumably follow or copy one another's feeding behaviour.

Third, if animals gain an advantage from the presence of conspecifics when foraging, consistent associations between pairs of individuals (e.g., related bats or members of the same harem) could provide at least one member of the pair with a reliable individual(s) from which to acquire or with which to exchange information. Indeed, *C. perspicillata* form relatively stable roosting associations, at least seasonally (Porter, 1978; Fleming, 1988). If these bats also maintain stable associations while foraging, we would expect to see instances of the same pairs of bats feeding close together in time more often than expected by chance. If consistent social associations while foraging are not advantageous, we would not expect to find stable foraging pairs.

Finally, we examined potential differences in foraging performance related to sex and individual behaviour. If males exhibit more competition or aggression than females, or are more successful at fending off others attempting to feed, or if females seek to avoid aggressive interactions, as has been suggested (Porter, 1978; Fleming, 1988), we expect better foraging performance among males. Males defending roost sites might also be expected to be among the first to access the food before returning to their roosting sites (Fleming, 1988). However, which bats are 'leaders' may depend on individual behavioural differences or strategies not necessarily related to sex or social status (e.g., Barnard & Sibly, 1981; Vickery et al., 1991; Sih et al., 2004). If the same bats consistently find food first, this could have implications for information transfer, with information necessarily flowing from leaders to others.

To test these predictions, we studied the foraging performance of bats alone and in groups of 25. Using a passive-integrated transponder (PIT) tag reader and video cameras, we recorded foraging speed (time to find food), time elapsed between two individuals finding food, and behavioural interactions at the feeding site, and compared foraging speed and foraging success (whether the bat ever accessed the food during the allotted time) under different conditions. We also looked for instances of consistent associations or feeding order among individuals and tested for differences between males and females in foraging speed and success.

2. Methods

2.1. Study subjects

In total, we collected data from 16 male and nine female captive-born *C. perspicillata* marked with unique passive integrative transponder (PIT) tags.

All bats were housed and tested in a (2.6 (l) × 1.6 (w) × 2.7 (h) m) flight cage, which also contained eight to 12 untagged *Glossophaga soricina* and up to seven untagged *C. perspicillata*. Untagged bats included new pups, some of which were beginning to fly, and, occasionally, adults whose PIT-tag had fallen out. Bats were fed fruit and nectar daily, had ad libitum access to water, and were kept on a reverse 12 h day-night cycle. When individuals were being tested alone, all remaining tagged and untagged *C. perspicillata* were removed to a separate cage. All testing occurred in the home flight cage with *G. soricina* present. Because these nectar-feeding bats were present for all *C. perspicillata* trials and rarely ate from the feeders, they are unlikely to impact our findings. Similarly, while the few untagged *C. perspicillata* may have eaten from the feeder, repeated measures of individual foraging performance in different social settings should not be influenced by their presence. References to group size and bats being tested ‘alone’ refer only to the number of *C. perspicillata* present in a given experiment. This research was approved by the University of Maryland Institutional Animal Care and Use Committee (Protocol R-08-08).

2.2. *Experimental design*

To find evidence of social facilitation, we tested five males both with and without mixed-sex conspecifics present. These five males were tested in 15 sessions in a group setting (one session per day with all tagged bats present) and in 10 sessions each with no other *C. perspicillata* present (June 2009). To account for potential changes in performance over time, seven group sessions occurred from May–June 2009 (before lone sessions), while the remaining eight group sessions were conducted in July 2009, after lone sessions were completed. The accessible feeder changed location in each session.

Data were collected for the first 90 min after food was placed in the target feeder. In group trials, we recorded a total of 375 times to food discovery from 25 bats (21 of which found the food on at least one day). For the five focal bats also tested alone, we collected data from 25 test sessions (15 in a group and 10 alone per bat), and the number of times each of these bats accessed the food within the allotted time was 21, 17, 17, 16, and 14. We compared the time to find food and foraging success in a group versus alone for the five individuals tested under both conditions. This allowed us to determine the effect of a group on the foraging performance of the same individuals. All analyses comparing the foraging performance of bats alone versus in a group refer to the bats we tested in both conditions.

Figure 1. Schematic (left) and photo (right) of the experimental set-up in the flight cage. In the schematic, each circle represents the approximate location of a mesh feeder on the flight cage wall. The darkened circle represents the PIT-tag reader antenna at the target feeder. The photo shows a close-up view of a bat approaching the target feeder. The location of the artificial vegetation, as well as which feeder contained accessible food, changed daily.

2.3. Experimental set-up

In all trials, bats were presented with 15 feeders (mesh cylinders on a flight cage wall; Figure 1) and given the opportunity to discover the one that contained accessible food on a given day. Mesh cylinders (and the circular PIT-tag reader antenna) had an interior diameter of 10 cm, which was large enough to hold multiple bats but small enough that bats needed to crawl (vs. fly) into the cylinders. Banana, a highly palatable food, was used as a food reward in the experiments, and bats were only offered this fruit during the experimental data collection period. The antenna for the PIT-tag reader was placed around the accessible food to record the time and identity of a bat entering to get food. Previous testing, including recordings made with false antenna and cables, indicated that the bats did not use the antenna as a spatial cue.

To create a more complex foraging environment, artificial vegetation was affixed to the flight cage wall to cover at least five or six feeders each day, including the feeder with the accessible food (Figure 1). The exact location of plants varied from day to day but was similar throughout the experiments. A different feeder had accessible food during each test session, but all feeders had inaccessible banana behind them so that bats could not rely on olfactory cues (this species' primary method of initially locating food; Laska, 1990;

Thies et al., 1998) to locate the feeder with accessible food. Attempts to food-deprive bats resulted in low activity levels; therefore, bats were fed non-banana food each day following data collection. Any fruit remaining in the cage the following day was removed at least two hours prior to the start of an experimental trial. All trials were conducted in the afternoon.

To avoid artificially inflating records of bat feeder visits, the reader was programmed not to record the same bat until 3 s had elapsed. The reader could read more than one PIT-tag (individual) within one second. A spare PIT-tag was scanned to denote start and end of each trial. The start coincided with banana being placed in the target feeder and the experimenter leaving the room. To avoid giving bats cues about food location, the experimenter also pretended to place banana in and scan the PIT-tag at other feeders during this process. An infrared-sensitive video camera recorded the trials, and infrared light was used to illuminate the feeder with accessible food and the surrounding area.

2.4. *Time to discover food*

Using data from the five bats tested in both group and lone trials, we compared the time for the first bat to access the food on group and on lone trial days (i.e., day 1 of testing for each lone bat was treated as trial day 1, even if every bat was not tested on the same calendar day). If social facilitation contributed to the bats' foraging behaviour, we expected a smaller latency to find food for group vs. lone trials. In addition, we compared the interval between the first and second bat to find the food (using the same five bats) on a given day between group and lone days. For lone trials, we calculated this interval using the times to find food by the fastest and second fastest bats on a given trial day. If information transfer by local enhancement was occurring, we expected shorter intervals in the group vs. lone setting.

2.5. *Feeding order and sex*

To look for consistent foraging patterns within individuals, we used all of the group trials and evaluated which bat was first to find food on a given day (including all 25 bats). To determine if some bats were 'leaders' (the first to find food) more often than expected by chance, we calculated how many times each bat would be expected to lead by chance (25 bats flying in 15 trials = 0.6 times), and then compared expected to observed values for bats feeding first on more than one day.

We used the group trials to test whether sex was related to feeding order, time to find food, or foraging success. We used the number of males and females present (16 M, nine F) to determine if the leading bat was male or female more often than expected by chance. In addition, we compared time to find food and foraging success between males and females.

2.6. Statistical analyses

We recorded time elapsed to find food and used the maximum time allowed within a trial for bats that did not feed to provide a conservative estimate of time to find food. Because time to find food tended toward an exponential distribution, we applied a natural log (ln) transformation to the raw times. We then fit a linear model using Ordinary Least Squares (OLS) to test for differences in times to find food depending on bat sex, bat ID, and whether bats foraged in a group or alone. Where appropriate, we included bat ID as a nested effect in the models. We also fit linear models to compare feeding times for the bat that found food at the shortest latency and the interval between the first and second bat feeding when bats foraged alone versus in a group. Additionally, we tested success or failure to find food within a given session using a contingency test and feeding order or sex bias in the first bat to feed using Chi square goodness-of-fit tests. We used SAS and JMP statistical software.

2.7. Inter-individual associations

In addition to comparing food discovery patterns, we examined whether pairs of individuals associated with one another while feeding more often than expected by chance, i.e. visited the target feeder within 10 s of one another. To eliminate data from bats sitting by the feeder for lengthy periods during the same visit, we only counted a second ‘pairing’ if it occurred at least 30 s after the previous pairing of the same two individuals (i.e., 30+ s from the time bat 2 was recorded in the first pairing to the time bat 1 was recorded in the second pairing).

We then quantified associations using the symmetrical index of Fager (1957), which is computationally the same as the half-weight index (Cairns & Schwager, 1987), for each pair of bats. We used Socprog (Whitehead, 2017) to determine if the coefficient of variation in associations differed from random expectation and if associations depended on sex. We used a Mantel test with 1000 permutations to test for differences in associations within and between the sexes.

3. Results

Once each experimental session had commenced, bats flew around the room, often visiting multiple feeders as they searched for the accessible food. Some bats attempted (unsuccessfully) to access the inaccessible banana located outside the cage at non-target feeders, while others moved on more quickly. At times, one bat would land on the accessible feeder when another bat was already feeding there. In some cases, multiple bats fed together inside the feeder simultaneously. At other times, the first bat quickly left when a new bat landed, or appeared to 'defend' the food via physical interactions with other individuals.

3.1. Presence of conspecifics

Male bats found food faster when foraging with conspecifics. When considering the same individuals tested both with and without conspecifics (using a nested analysis to account for bat ID), these bats accessed the food significantly faster (on average, 17.5 minutes faster) when flying in a group vs. alone ($F_{1,115} = 9.88$, $p = 0.002$; Figure 2). Among those five bats tested in both conditions, the effect of bat nested within condition (group/alone) was not significant ($F_{8,115} = 1.30$, $p = 0.25$), indicating that social context — and not individual variation among bats — was responsible for the observed variation in foraging speed. We also found a difference in foraging success between bats searching for food by themselves versus in a group, with bats finding the food in 74.7% of group trials but only 58% of trials when flying alone ($\chi^2_1 = 6.39$, $p = 0.011$; Figure 2). When comparing the fastest time to find food for these five bats within a given group or lone trial day, we found that the fastest time was significantly shorter (on average 9.3 minutes shorter) when these bats flew in a group vs. alone ($F_{1,23} = 6.99$, $p = 0.015$; Figure 2). However, when comparing the interval between the first and second bat (of the 5 focal bats) to find food in each trial we found no significant difference between group and lone trials ($F_{1,23} = 0.06$, $p = 0.805$; Figure 2; the interval was, on average, 2.9 minutes smaller for group trials).

3.2. Sex and individual differences

Within group trials, both time to find food and foraging success depended on bat sex (time: $F_{1,23} = 35.09$, $p < 0.0001$; Figure 3; success: $\chi^2_1 = 27.63$; $p < 0.0001$). Males found food, on average, 19.5 minutes more quickly than females and displayed a higher success rate, finding food 58.3% of the time

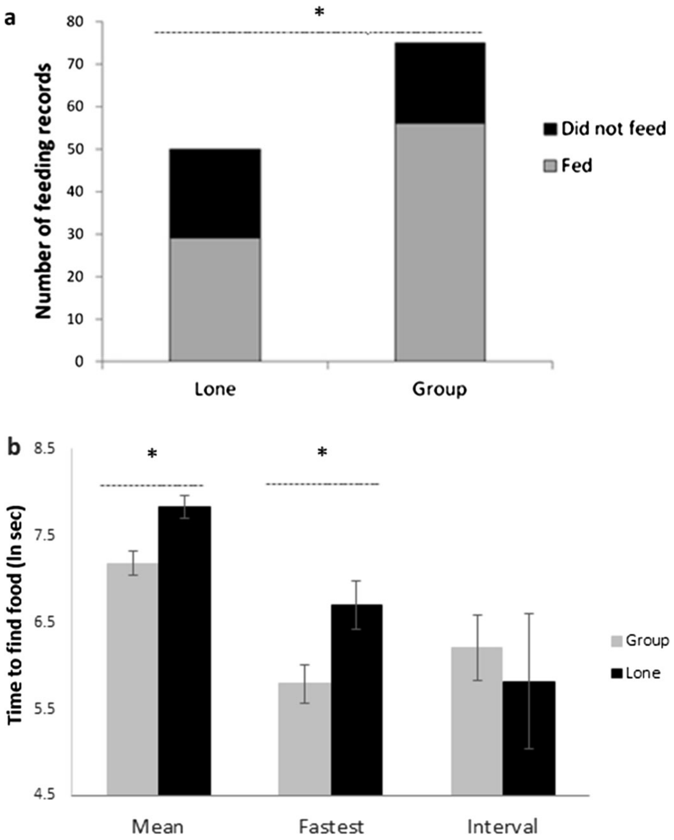

Figure 2. Comparisons between group and lone trials regarding (a) foraging success and (b) mean time to find food, minimum time to find food (fastest bat), and interval between the fastest and second fastest bat within a trial (±SE for each). $*p < 0.05$ ‘Feeding record’ refers to a trial, wherein a bat had the opportunity to locate food. $N = 125$ trials (75 group and 50 individual) from 5 bats.

compared to 30.4% for females. We also found significant differences among individuals in both time to find food and foraging success (individual nested within sex; time: $F_{23,350} = 5.42$, $p < 0.0001$; success: $\chi^2_{23} = 151.23$, $p < 0.0001$).

3.3. Feeding order

Within group trials ($N = 15$), seven (of 25) bats were the first to find food at least once, including one bat that was first in five sessions. Including this bat, four individuals were first to find food in 80% of sessions. Two bats were

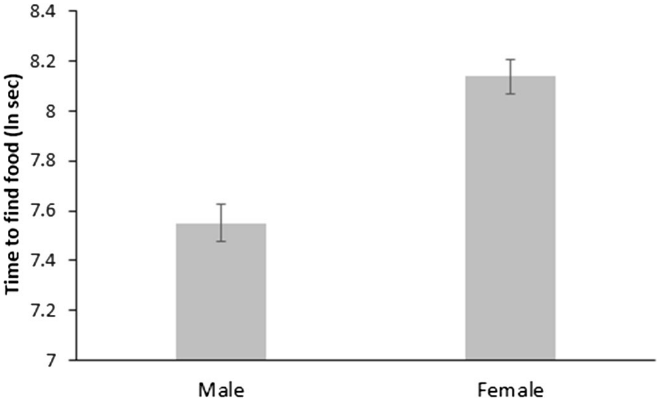

Figure 3. Mean (± SE) time to find food by sex ($N = 240$ records from males and 135 from females). Males found food significantly faster than females.

leaders more often than expected by chance ($\chi_1^2 = 33.61$, $p < 0.0001$ for the bat finding food first most often and $\chi_1^2 = 10.00$, $p = 0.002$ for the other bat). The first bat to find food was male more often than expected ($\chi_1^2 = 8.44$, $p = 0.004$).

3.4. Inter-individual associations

We found no evidence of consistent inter-individual foraging associations among pairs or subgroups of individuals. Out of 4029 feeding records, we recorded two bats (involving 15 individuals) feeding within 10 s of each other 54 times, with an average of 1.4 pairings per bat (SD = 0.76). Most (68%) pairs occurred once. Mean ± SD association was 0.0297 ± 0.047 (range: 0.004 to 0.062) and the coefficient of variation in association (1.587) did not differ from random expectation (1.563, $P = 0.38$). There was a trend for same sex pairs to have more associations than between sex pairs (mean association ± SD: within sex 0.035 ± 0.022, between sex 0.021 ± 0.017; Mantel test, $p = 0.062$).

4. Discussion

The bats in our study foraged in a much smaller area than wild, free-ranging bats would use. However, placing fruit behind the inaccessible feeders increased the complexity of the foraging environment by preventing bats from relying on olfaction to locate food, as they would typically do in the wild (Thies et al. 1998). Despite the differences between our captive setting and a wild environment, in both cases, bats must actively search for food and contend with the effects of other bats on their foraging strategy and performance. For example, whether in our flight cage or in a forest, bats could potentially follow conspecifics to a food source, or compete with other individuals for food.

Our results show that presence of conspecifics, individual differences, and sex all influence foraging behaviour in *Carollia perspicillata*. Male bats found food more quickly than females when conspecifics were present in this study. In addition, our findings indicate that *C. perspicillata* did not form consistent pairwise associations while foraging. Furthermore, specific 'leaders', and males in general, were more likely to find food first than expected by chance.

4.1. Presence of conspecifics

We found evidence of social facilitation, i.e. animals obtained food more readily when conspecifics were present. Data from five males tested with and without conspecifics revealed that the bats accessed food more quickly in the presence of other *C. perspicillata* and that the time to find food for the fastest bat within a trial was smaller in a group vs. lone setting. In his discussion of social facilitation, Zajonc (1965) describes both 'audience effects', when the mere presence of other individuals facilitates a behaviour, and 'co-action effects', when the specific behaviour of one individual facilitates the same behaviour in others. Our results are consistent with the former effect, given that even the first bat to find the food did so more quickly when others were present (i.e., when no other bat was yet feeding on the banana). This could be due to perceived competition or an increase in exploratory and searching behaviour when conspecifics are present.

While we found strong evidence of social facilitation, we found no direct evidence of information transfer by local enhancement, considering that there was no difference between inter-bat feeding intervals across trial types. However, bats that had already found the food in the group setting may have provided information to other individuals. In addition, even the first bat to find food on a given day could have gained information from other individuals if it detected others unsuccessfully searching for food at other feeders. Such information could have helped the 'leader' bat find food more quickly, because it did not need to explore feeders already discovered to be inaccessible by other individuals. Therefore, we cannot rule out that information transfer, along with social facilitation, contributed to the observed differences in times to find food between bats by themselves versus in a group.

4.2. Feeding order

When Porter (1978) observed a captive colony of *C. perspicillata* (identified by individually-distinct bleach marks), she reported no consistent patterns of feeding behaviour among individuals. However, our findings indicate that the first bat to access food on a given day is non-random, and a relatively small number of bats were the first to feed on most days. Some individuals may be more likely to feed first either because they are dominant within the group or because they feed quickly and then return to defend their roosting territory. Fleming (1988) reported that territorial male *C. perspicillata* tend to forage closer to their day roost than other individuals. While we do not have information about the social status of the bats used in this study, exploring how the social status of individuals affects foraging time would be of interest for future study.

It is also possible that certain individuals are predisposed to exhibit bold or exploratory behaviour independent of their social status or sex. Leading bats could represent a ‘bold’ behavioural type, making them more prone to risk-taking and exploration (Sih et al., 2004) and leading them to locate and/or access the food ahead of other individuals. Although socially-obtained information should be advantageous, at least one individual must find the food via individual exploration before others can obtain information from it. If a habitat changes over time, multiple behavioural types can be advantageous and maintained within a population (Sih et al., 2004). Our findings suggest an example of different individuals within a population specializing in different ‘skills’ related to finding food (Giraldeau, 1984).

Indeed, we observed what appear to be individual differences in social behaviour among the bats we tested. Video recordings revealed that in some cases, individuals appeared to ‘defend’ the food by physically interacting with other bats attempting to access the food, while at other times, feeding bats passively allowed others to join them inside the feeder. The absence of visible markings prevented us from systematic analysis of these recordings.

4.3. Inter-individual associations

If foraging bats consistently exchange information with the same individuals, we would expect stable foraging associations. However, we found that *C.*

perspicillata did not often feed in pairs or in quick succession (<10 s) with the same individual when accessing a food source. When considering how often pairs of bats fed together, the highest level of association we found was one pair feeding together 6.2% of the number of times they were paired with any bat, which was not more than expected by chance. Therefore, while this species is known to form relatively stable roosting associations in captivity (e.g., Porter, 1978), bats did not form consistent foraging associations in our study. Considering that the area in which bats flew in our experiment is significantly smaller than the area wild bats would cover during a night of foraging, it is possible that bats could form pairwise associations while still remaining further apart than we measured in our study. We did find a trend of bats more likely to forage close in time with members of the same sex. Differences in nightly foraging patterns between females and males have been observed in wild *C. perspicillata* (Thies et al., 2006).

While Ratcliffe and ter Hofstede (2005) found that *C. perspicillata* can exchange information about diet preference, their study demonstrated this behaviour in a roosting setting with no food present during inter-bat interactions. They concluded that bats in the roost might gain information about novel or currently available food without conspecifics recruiting them to actual feeding sites. This, along with our results, is consistent with the finding that female roost-mates of this species do not forage near each other (Fleming, 1988). Based on our findings, if pairs of bats are gaining social information about food from one another on a regular basis, this occurs during roosting rather than foraging, and there is no evidence that information exchanged would include food location. Instead, actively foraging bats are likely to obtain information opportunistically or from those bats that typically feed first. Despite the lack of stable pairs, we found that males fed in quick succession with one another more often than with females. The higher instance of males finding food close together in time may be due to faster food-finding times for males in general, or could reflect competition among males in a foraging context.

4.4. *Individual and sex differences*

Aggressive or more competitive behaviours of males in a foraging setting, as is seen in some bird species (e.g., Gill & Wolf, 1975; Cadieu et al., 2010), could be responsible for the sex-related differences in foraging behaviour we observed. Increased aggression by males could make females hesitate to approach the food until males have left. While interactions between individuals of this species are not typically aggressive (Fleming, 1988), males do engage in ‘boxing’ fights, and it has been postulated that females have left roosting areas to avoid aggressive interactions between males (Porter, 1978). Given that we did observe some defence of the food source, but that aggressive interactions between feeding bats were not prevalent, avoidance of perceived competition seems more likely than outright aggression.

With regard to females, we observed a trend of lactating females accessing the food more quickly than non-reproductive females. A study of wild *C. perspicillata* found that reproductive females exhibit less exploratory food-finding behaviour compared with non-reproductive females and some males (Charles-Dominique, 1991), but exploring in a laboratory flight cage is much less energetically demanding than in the wild, and a larger sample size of females in varying reproductive states would be needed to fully address this question. Considering the above factors, that males in our study exhibited superior foraging performance, and that we did not test females in both group and lone settings, it is possible that females would not exhibit the same increase in foraging performance in the presence of conspecifics, that we observed in males.

In conclusion, we found that social facilitation decreased feeding latencies in *C. perspicillata*. We did not find evidence of information transfer by local enhancement. The same few males were the first to access the food in a majority of trials, perhaps due to dominance or individual differences in foraging strategy. In addition, males accessed feeding sites faster than females, possibly due to competition for the food. These findings offer revealing information about the role of social facilitation in a group-living bat species.

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