Pigeons discriminate between human feeders

Article *in* Animal Cognition · June 2011

DOI: 10.1007/s10071-011-0420-7 · Source: PubMed

7 authors, including:

Ahmed Belguermi

10 PUBLICATIONS **44** CITATIONS

SEE PROFILE

Dalila Bovet

University Paris Nanterre

81 PUBLICATIONS **1,096** CITATIONS

SEE PROFILE

Anne-Caroline Prevot

CNRS - Muséum National d'Histoire Naturelle

110 PUBLICATIONS **2,364** CITATIONS

SEE PROFILE

Michel Saint Jalme

Muséum National d'Histoire Naturelle

81 PUBLICATIONS **2,262** CITATIONS

SEE PROFILE

Pigeons discriminate between human feeders

Ahmed Belguermi, Dalila Bovet, Anouck Pascal, Anne-Caroline Prévot-Julliard, Michel Saint Jalme, Lauriane Rat-Fischer & Gérard Leboucher

Animal Cognition

ISSN 1435-9448

Anim Cogn
DOI 10.1007/
s10071-011-0420-7

Springer

Anim Cogn
DOI 10.1007/s10071-011-0420-7

SHORT COMMUNICATION

Pigeons discriminate between human feeders

Ahmed Belguermi · Dalila Bovet · Anouck Pascal · Anne-Caroline Prévot-Julliard · Michel Saint Jalme · Lauriane Rat-Fischer · Gérard Leboucher

Received: 28 October 2010 / Revised: 12 May 2011 / Accepted: 19 May 2011

Abstract Considered as plague in many cities, pigeons in urban areas live close to human activities and exploit this proximity to find food which is often directly delivered by people. In this study, we explored the capacity of feral pigeons to take advantage of this human-based food resource and discriminate between friendly and hostile people. Our study was conducted in an urban park. Pigeons were fed by two experimenters of approximately the same age and skin colour but wearing coats of different colours. During the training sessions, the two human feeders displayed different attitudes: one of the feeders was neutral and the second was hostile and chased away the pigeons. During the two test phases subsequent to the training phase, both feeders became neutral. Two experiments were conducted, one with one male and one female feeder and the second with two female feeders. In both experiments, the pigeons learned to quickly (six to nine sessions) discriminate between the feeders and maintained this discrimination during the test phases. The pigeons avoided the hostile feeder even when the two feeders exchanged their coats, suggesting that they used stable individual characteristics to differentiate between the experimenter feeders. Thus, pigeons are able to learn quickly from their interactions with human feeders and use this knowledge to maximize the profitability of the urban environment. This study provides the first experimental evidence in feral pigeons for this level of human discrimination.

Keywords Feral pigeons · Foraging behaviour · Inter-specific recognition

A. Belguermi · D. Bovet · A. Pascal · G. Leboucher
Laboratoire d'Ethologie et Cognition Comparées, Université Paris Ouest Nanterre La Défense, 200 Avenue de la République, 92001 Nanterre Cedex, France

A.-C. Prévot-Julliard · M. Saint Jalme
Laboratoire Conservation des Espèces, Restauration et Suivi des Populations (CERSP), UMR 7204 CNRS Museum National d'Histoire Naturelle, CP 51, 55 Rue Buffon, 75005 Paris, France

A.-C. Prévot-Julliard
Institut des Sciences de la Communication du CNRS (ISCC), 20 Rue Berbier du Mets, 75013 Paris, France

L. Rat-Fischer
Laboratoire Psychologie de la Perception, Université René Descartes, CNRS, UMR 8158, 45 Rue des Saints-Pères, 75006 Paris, France

A. Belguermi (✉)
Laboratoire d'Ethologie et Cognition Comparées, EA 3456, Université Paris Ouest Nanterre La Défense, Nanterre, 200 Avenue de la République, Bâtiment BSL, 92000 Nanterre, France
e-mail: ahmed.belguermi@gmail.com

Introduction

The feral pigeon (*Columba livia*) is one of the most studied avian species in the behavioural sciences, especially in cognitive tests, but much less work has focused on the ecology of this species. Present in most European and American cities, often in high densities (Jokimaki and Suhonen 1998), urban feral pigeons are descendants of domesticated rock doves (*Columba livia*) (Jonston and Janiga 1995). The demographic success of feral pigeons in cities can be attributed to the low level of predation (Sol et al. 1998) and the year-round availability of food resources and breeding sites (Jokimaki and Suhonen 1998; Sol et al. 1998).

The majority of city dwellers are hostile to pigeons, regarding them as 'flying rats' and chasing them away (Jerolmack 2008). Many cities try to control pigeon

Published online: 07 June 2011

populations through periodic capture and euthanasia. However, city dwellers are also potential active food providers for pigeons; many people cast out pieces of bread when eating in parks and, despite public bans, some people regularly provide food for pigeons, notably in urban parks. Many feral pigeons are almost completely dependent on human activity to find food (Miklósi and Soproni 2006). Following these human practices, pigeons have progressively adopted new foraging habits based on spilled food or feeding by humans (Johnston and Janiga 1995). The majority of pigeons feed in the streets and squares (e.g. Gompertz 1956; Sol and Senar 1995).

Pigeons have been shown to be capable of remarkable feats of perception, memory, and mental processing (Cook 2001). Among many studies on categorization and discrimination by pigeons, several researchers have investigated the ability of pigeons to recognize human stimuli like pictures of human, faces and bodies (Herrnstein and Loveland 1964; Huber 2001; Aust and Huber 2003). But only a few studies have shown this in real entities and fewer studied interspecies individual recognition in pigeons (e.g. Dittrich et al. 2010). Further, these abilities of discrimination and recognition have never been demonstrated in urban pigeons who have never been specifically trained beforehand (this contrasts with laboratory pigeons who receive extended training in various tasks throughout their life) and are tested in their 'natural' environment (urban zones).

Animals' social life often requires the ability to discriminate among individuals, based on the recognition of individually distinctive characteristics. Many animals use acoustic, olfactory and visual cues for intra-species individual recognition (Wilson 1975), for example recognition between parents and offspring in the colonial birds (Halpin 1991). Animals are also able to use cues from other species, for example the use of alarm calls of other species to detect predators (Burger 1984; Goodale and Kotagama 2005). These abilities can expand on inter-species individual recognition. Heterospecific individual recognition, although not much studied in animals, could be useful for any animal living in proximity with another species in which individuals differ in their behaviour. A few studies have shown this ability in domestic or captive animals: for example, dogs have been shown to be able to recognize the voice and the face of their owner (Adachi et al. 2007) and captive rhesus macaques discriminate familiar from non-familiar people (Sliwa et al. 2011). Even some nondomestic animals appear to be able to interpret heterospecific signals of particular individuals, for example changes in human behaviour, and respond to these changes by adjusting their behaviour: Levey et al. (2009) found that urban mockingbirds quickly learn to identify individual humans approaching at different distances to their nest. In Marzluff et al. (2010), American crows are able to recognize human wearing dangerous masks (i.e. masks that had been worn by experimenters when trapping the birds); crows typically ignored the neutral mask and followed and scolded the person wearing the dangerous mask.

Feral pigeons in urban environments probably use their memory and categorization abilities in their daily foraging activities. They may also use perception and cue learning. The ability to rapidly detect a human feeder could be an important factor in decreasing the total time spent foraging and increasing the rate of food ingestion. Therefore, urban pigeons should be able to recognize and discriminate rapidly between neutral (e.g. feeders) and hostile humans. Estimating their ability to recognize and respond appropriately to different types of heterospecific signals, especially in a new foraging situation, may help to explain why some species (nondomesticated species) are better at prospering in environments modified by humans.

In the present study, we tested the hypothesis that feral pigeons can quickly learn to recognize individual humans who feed them and can adjust their behaviour according to whether feeders appear to be friendly or hostile. Importantly, we did not use masks or hats to standardize the appearance of feeders, which better mimics natural conditions and also allowed us to study the pigeons' recognition of general characteristics such as general shape, facial traits and the colour of clothes.

Methods

Subjects and study area

Free-ranging feral pigeons (*Columba livia*) were studied in an urban park 'Ménagerie du Jardin des Plantes' located in the centre of Paris, France, from April to May 2008. Experiments were conducted in a private section of the park with restricted access. This area was located near a preferred roosting site where 80–100 pigeons perched daily. A concrete floor in the area made the seeds cast by experimenter feeders highly visible. Two sections were delimited with a coloured chalk and were 2.5 m apart. The total feeding area was 2.5 × 2.5 m, and 1,300 g of a seed mixture (wheat, pea, and maize) was spread homogeneously over the entire surface by the feeders. This quantity of seeds was chosen because it was enough to last until the end of an observation session.

Procedure

We carried out two experiments, the first with two human feeders male and female and the second also with two human feeders but of the same sex (female). All

experimenter feeders were approximately of the same age, body size and skin colour. The second experiment began 10 days after the end of the first one. Each experiment started with a training period during which pigeons were attracted by the new foraging opportunities and learned to distinguish between the two feeders. During the training period, one of the feeders systematically disturbed the pigeons that she fed (hostile feeder) whereas the other one did not (neutral feeder). The training period lasted 9 days during the first experiment. Because the results from the first experiment indicated that a 6-day stage was sufficient to induce a clear discrimination between the hostile and the neutral feeder (see 'Results' section), the second training period was limited to 6 days. The placement of the feeding patches was randomly exchanged between feeders, ensuring that each location was rendered 'secure' or 'insecure' depending only on the presence of the feeder. At the end of the training period, two test sessions, during which the two feeders both behaved neutrally, were carried out.

Each training session and test session lasted 30 min. Each experimenter feeder made 16 scan samples: one scan every 2 min (Altmann 1974), with a digital camera (Casio Exilim EX—Z80 8.1 mega pixels) in order to measure the number of pigeons feeding in the patch. In the end of each session (training and testing sessions), both experimenter feeders cleaned up their patch if seeds were left on the floor, which was mostly the case in the hostile observer's patch.

Training sessions

At the beginning of each training session, the two feeders put out identical quantities of seeds (see above) within the marked area. The neutral feeder remained stationary, while the hostile feeder systematically disturbed the pigeons once a minute by vigorous arm waving. During the first experiment, the hostile feeder wore a red coat and the neutral feeder wore a white coat in all training sessions. In the second experiment, the hostile feeder wore an orange coat and the neutral feeder wore a yellow coat. All coats covered about 90% of the body.

Testing

In order to determine what criteria the pigeons used to recognize the feeders, tests were conducted at the end of the training session for each experiment (one test per day). During the 'Same-coats test', the feeders wore the same coats as they did during the training session. In contrast, during the 'Exchanged-coats test', the formerly hostile feeder wore a white or a yellow coat, whereas the formerly neutral people wore a red or an orange coat. During each test, both feeders were neutral and remained motionless for 30 min. Moreover, the feeders exchanged places between the two tests.

Data analysis

The number of pigeons per patch for each sampling was scored from images collected during the experiment. In order to evaluate the efficiency of the training, we considered that the learning was acquired when animals completely avoided the hostile observer's patch for two consecutive days while continuing to visit the neutral observer's patch.

We used generalized linear models (GLM; McCullagh and Nelder 1983) as implemented in the GLM function of R Software Version 2.9.2 for Mac Os.X; package stat. We analysed the whole data set with a Poisson distribution, taking the number of pigeons as the dependent variable, and testing for the effect of (1) the feeder ('hostile' vs. 'neutral'), (2) the experiment ('same-sex experimenter feeders' vs. 'different-sex experimenter feeders'), and (3) the coat ('the same coat between training and test' vs. 'coat exchanged with the other feeder for the test session'). Explanatory variables and their interactions were fitted to the data by performing a stepwise procedure.

Results

Training sessions

Pigeons avoided for two consecutive days the hostile observer's patch in the first experiment after 3 days, while continuing to visit the neutral one. In the second experiment, pigeons learned to avoid the hostile observer's patch after 4 days, a maximum number of pigeons were observed in the last 2 days in the neutral observer's patch.

Testing sessions

GLM

The final model selected by the stepwise procedure only included two factors: experimenter feeders (neutral vs. hostile) and gender-effect (same- vs. different-sex-experimenter feeders). No interaction was significant. The number of pigeons differed significantly between experimenters feeders; there were significantly more pigeons in the neutral observer's patch than in the hostile observer's patch. (GLM, $t = 3.11$, $P = 0.002$,). The factor gender-effect was not significant (GLM, $t = 1.77$, $P = 0.077$) Table 1; Fig. 1. The same data were found when the GLM was conducted without the first five outliers (Table 2).

Table 1 Results of the final GLM analyses that explain the number of pigeons on the feeding area

	Estimate	SE	*t* value	Pr(>|*t*|)
Intercept	0.582	1.079	0.540	0.58998
Experimenter (neutral)	3.883	1.246	3.117	0.00204**
Experiment (same sex)	2.211	1.246	1.775	0.07710

Variables were selected by the stepwise procedure

** $P < 0.01$

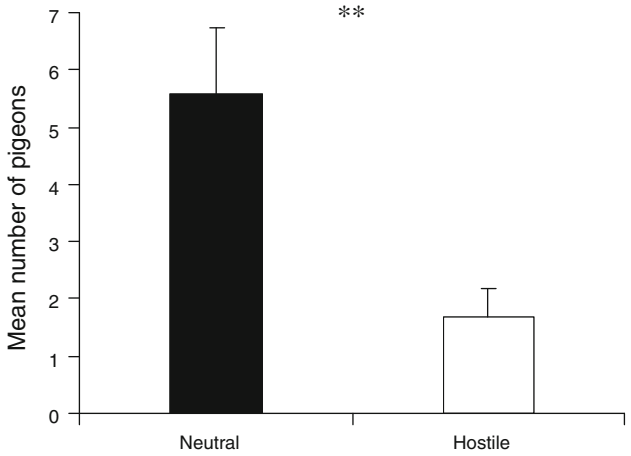

Fig. 1 Mean number of pigeons (±SE) during the test sessions with a hostile or a neutral experimenter. The *asterisks* mean that the two *bars* are significantly different from one another (GLM, $P < 0.01$)

Discussion

In this study, we highlighted the capacity of pigeons living in an urban area to distinguish between human feeders that differed in their shapes, face traits, sex and especially in their behaviour. Feral pigeons were able to discriminate between two types of human feeders: neutral and hostile feeders. Using an experimental approach, such as ours helps to elucidate the real-life abilities of pigeons in a recognition and discrimination task in their 'natural' environment.

The results of the training sessions indicate that pigeons learned to discriminate between the neutral and the hostile feeders after three or four sessions only. The number of pigeons in the hostile area diminished until no pigeon was present on this patch during training sessions. Pigeons never became habituated to the hostile feeder waving his arms and discerned the physical traits of the feeders and associated physical traits with behavioural traits in only three to four sessions of 30 min. Feeders wore coats of different colours, which could have facilitated the discrimination during training sessions. Several studies (Cook et al. 1997; Aust and Huber 2001) have emphasized the importance of colour in stimuli discrimination and recognition. Dittrich et al. (2010) have shown that captive pigeons in a laboratory setting were able to identify individual, real-life humans, this discrimination depended primarily on visual cues from the heads of the persons. During the test phases, the hostile feeder became neutral and no longer disturbed the pigeons. Despite this shift in behaviour, pigeons persisted in avoiding the previously hostile feeder.

In the analysis, the 'gender-effect' was not significant. Pigeons were able to recognize human feeders of the same sex and feeder of different sexes, probably using general body shape, face traits or other individual stable characteristics as unchanging criteria. The 'experimenter feeders' effect was highly significant: the number of pigeons was higher in the neutral observer's patch than in the hostile one, all other factors confounded.

We tried to use a far more challenging task by exchanging feeder's coats test, despite this the discrimination was maintained even when the feeders exchanged their coats; therefore, birds were able to recognize the person and in our experiment spontaneously used this criterion instead of the more conspicuous colour of her/his coat. The coats covered about 90% of the feeder's bodies, leaving only the head, hands and shoes of the feeder visible, so we can suppose that pigeons discriminated facial or other body or movement characteristics and used them to recognize and avoid the hostile feeder. We can also suppose that feral pigeon in cities have learned to discriminate between human individuals and that they also learned that

Table 2 GLM analysis when the first 5 outliers were removed

	Estimate	SE	*t* value	Pr(>|*t*|)
Intercept	1.4684	0.8315	1.766	0.0786
Experimenter (neutral)	2.1100	0.9667	2.183	0.0300*
Experiment (same sex)	0.4381	0.9667	0.453	0.6508

* $P < 0.05$

humans often change their clothes, whereas some individual characteristics are reliable criterions to predict their behaviour; this could explain the ability of our individuals to use these criterions instead of the coats' colour to discriminate the two feeders during the test. It is also possible that this ability is not specific to feral pigeons in cities and was shaped earlier in pigeons' evolution, maybe during their domestication. We do not know yet precisely which characteristics are used. It could have been general body shape, or face traits; although both feeders were instructed in the test phase not to move (except to take pictures) it is also possible, as pigeons are able to discriminate subtle movements (Dittrich and Lea 2001), which they used some movement cues. More tests would be needed to determine the cues used by the pigeons.

In everyday life, the information about the presence or absence of a feeder is not the only input that individuals may get; the quality of the feeder may also be used for the best exploitation of the urban environment and may enhance the daily rate of food consumption.

Despite the continual presence of large quantities of seeds in the patch of the hostile feeder during the test period, the pigeons did not redirect their foraging behaviour away from the neutral observer's patch, even when the seeds availability was drastically diminished by the pigeons' consumption.

In risky environments, animals are confronted with situations where it is important to make quick decisions: leaving, defending or hiding. Levey et al. (2009) showed that Northern Mockingbirds (*Mimus polyglottos*) nesting on the campus of a large university quickly learned to assess the level of threat posed by different human individuals and to respond accordingly. In another recent study, Marzluff et al. (2010) found that American crows (*Corvus brachyrhynchos*) quickly and accurately learned to recognize the face of a dangerous person and continued to do so for at least 2.7 years. Taken together, these data indicate that pigeons, like other 'urban' species quickly recognize and discriminate human feeders in urban areas.

In cities, most of the food found by pigeons is either directly provided by benevolent people or indirectly from human activities (wasted food) (Sol et al. 1998). In both cases, the food source is related to humans; therefore in urban zones, pigeons are dependent on humans to find food and each human individual can be a potential feeder. Pigeons are advantaged if they recognize the best human feeder. In our study, this human feeder discrimination can be ecologically relevant for pigeons because it implies a faster recognition of the safe human feeder, and thus a gain in energy and time to obtain food.

Acknowledgments A.B. was supported by the French Ministry of National Education. We thank Dr J. Rigoulet, who allowed us free access to the Ménagerie, and the students who helped us to carry out this experiment: Betty Hebert, Justine Philippon, Marie Mercier, Hanifa Challab. This study is part of a larger research program on urban pigeons supported by grants from the ANRJC (ANR-05-JCJC-0098-01), the Region Ile-de-France (no. 06-1064 MN 07) and the Seine-Saint-Denis department.

References

Adachi I, Kuwahata H, Fujita K (2007) Dogs recall their owner's face upon hearing the owner's voice. Anim Cogn 10:17–21

Altmann J (1974) Observational study of behaviour: sampling methods. Behaviour 49:227–267

Aust U, Huber L (2001) The role of item- and category-specific information in the discrimination of people versus non-people images by pigeons. Anim Learn Behav 29:107–119

Aust U, Huber L (2003) Elemental versus configural perception in a people-present/people-absent discrimination task by pigeons. Learn Behav 31:213–224

Burger B (1984) Grebes nesting in gull colonies: protective associations and early warning. Am Nat 123:327–337

Cook RG (Ed) (2001) Avian visual cognition. Available via: www.pigeon.psy.tufts.edu/avc/

Cook RG, Cavoto BR, Katz JS, Cavoto KK (1997) Pigeon perception and discrimination of rapidly changing texture stimuli. J Exp Psychol Anim Behav Process 23:390–400

Dittrich WH, Lea SEG (2001) Motion discrimination and recognition. In: Cook RG (ed) Avian visual cognition. Available via: http://pigeon.psy.tufts.edu/avc/dittrich/ default.htm

Dittrich L, Adam R, Ünver E, Güntürkün O (2010) Pigeons identify individual humans but show no sign of recognizing them in photographs. Behav Process 83:82–89

Gompertz T (1956) Some observation on the feral pigeon in London. Bird Study 4:2–13

Goodale E, Kotagama SW (2005) Alarm calling in Sri Lankan mixed species bird flocks. Auk 122:108–120

Halpin ZT (1991) Kin recognition cues of vertebrates. In: Hepper PG (ed) Kin recognition. Cambridge University Press, Cambridge, pp 220–258

Herrnstein RJ, Loveland DH (1964) Complex visual concept in the pigeon. Science 146:549–551

Huber L (2001) Visual categorization in pigeons. In: Cook RG (ed) Avian visual cognition. Available via: http://www.pigeon.psy.tufts.edu/avc/huber/default.htm

Jerolmack C (2008) How pigeons became rats: the cultural-spatial logic of problem animals. Soc Probl 55:72–74

Johnston RF, Janiga M (1995) Feral pigeons. Oxford University Press, Oxford

Jokimaki J, Suhonen J (1998) Distribution and habitat selection of wintering birds in urban environments. Landsc Urban Plan 39:253–263

Levey DJ, Londono GA, Ungvari-Martin J, Hiersoux MR, Jankowski JE, Poulsen JR, Stracey CM, Robinson SK (2009) Urban mockingbirds quickly learn to identify individual humans. PNAS 106:8959–8962

Marzluff JM, Walls J, Cornell HN, Withey JC, Craig DP (2010) Lasting recognition of threatening people by wild American crows. Anim Behav 79:699–707

McCullagh P, Nelder JA (1983) Generalised linear modelling. Chapman & Hall, London

Miklósi Á, Soproni K (2006) A comparative analysis of animals' understanding of the human pointing gesture. Anim Cogn 9:81–93

Sliwa J, Duhamel JR, Pascalis O, Wirth S (2011) Spontaneous voice–face identity matching by rhesus monkeys for familiar conspecifics and humans. PNAS 108:1735–1740

Sol D, Senar JC (1995) Urban pigeon population: stability, home range, and the effect of removing individuals. Can J Zool 73:1154–1160

Sol D, Santos DM, Garcia J, Cuadrado M (1998) Competition for food in urban pigeons: the cost of being juvenile. Cooper Ornithol Soc 100:298–304

Wilson EO (1975) Sociobiology: the new synthesis. Belknap Press, Cambridge