Detection of wind turbines' rotary motion by birds: A matter of speed and contrast

Constance Blary[1,2], Francesco Bonadonna[1], Élise Dussauze[1], Simon Potier[3,4], Aurélien Besnard[5] and Olivier Duriez [1]

Context:

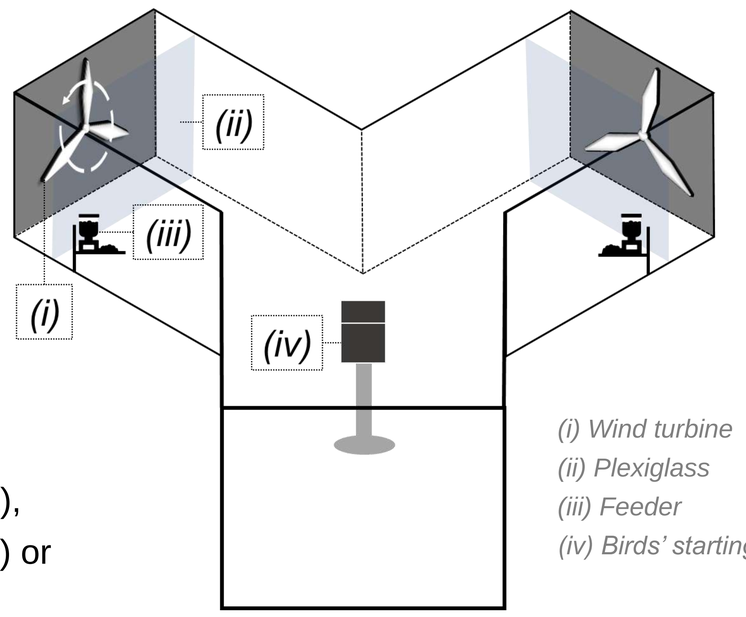
To reduce bird collisions on wind turbines, Automatic Detection Systems (ADS) have been developed to detect approaching birds and trigger turbines to slow down blades to 3-5 rotations per minute (rpm). However, it is not known whether birds can detect this reduced speed and avoid the turbine. In this study, we evaluated the detection of rotary motion by birds.

Species studied:

- 5 domestic doves (*Streptopelia roseogrisea risoria*)
- 3 Harris's hawks (*Parabuteo unicinctus*)

Method:

- Operant conditioning with miniatures wind turbines (2m diameter)
- Positive stimulus (rewarded): stationary wind turbine
- Negative stimulus (unrewarded): wind turbine in rotation
- 6 rotation speeds tested: 3, 5, 8, 16, 21 and 286 rpm
- White wind turbine on a black background (high achromatic contrast), dark-grey background (mid-range achromatic contrast, for dove only) or light-grey background (low achromatic contrast, for dove only)
- 32 trials per speed and bird – binomial tests

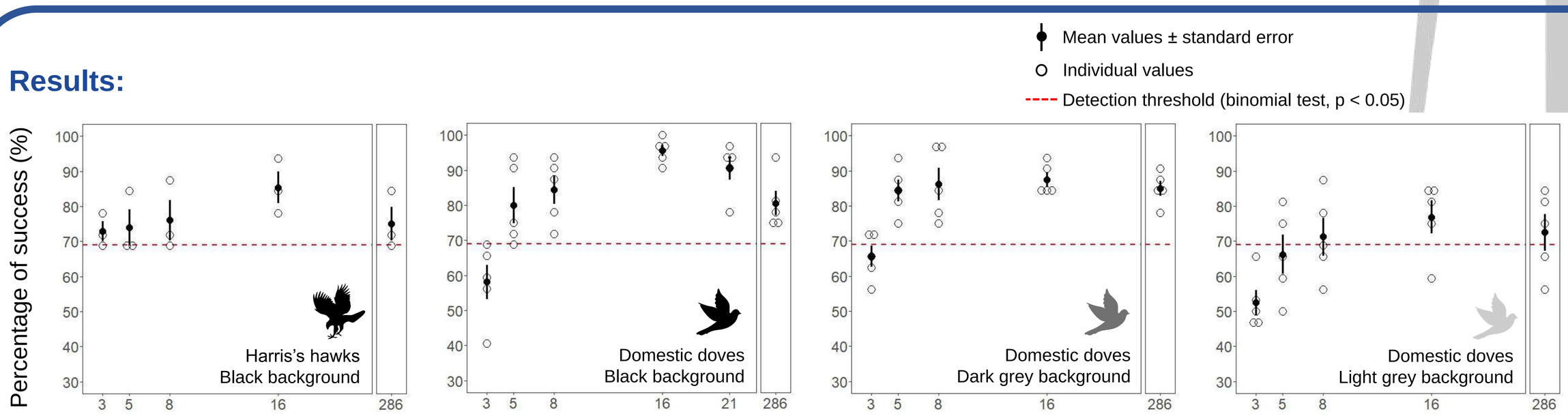


(i) Wind turbine
(ii) Plexiglass
(iii) Feeder
(iv) Birds' starting box

Experimental aviary

Sites: Centre for Functional and Evolutionary Ecology and Les Ailes de l'Urga (France)

Results:



Harris's hawks

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Domestic doves – High and mid-range contrasts

3 RPM = > 3 RPM ≠

Domestic doves – Low contrast

3 – 8 RPM = > 8 RPM ~/ ≠

Conclusion:

Doves perceive blades as stationary at low rotation speeds and low contrast conditions, which could influence their decision to enter the rotor-swept zone.

The action to slow down the blade speed might encourage the bird to fly through the rotor-swept zone despite the risk.

The speed reduction to 3-5 rpm triggered by ADS may be counterproductive for some bird species.

➔ **As a precaution, to limit avian mortality ADS should trigger a true stop of the blades.**

[1] CEFE, Univ Montpellier, CNRS, EPHE, IRD, Montpellier, France
[2] Agence de l'environnement et de la Maîtrise de l'Energie 20, avenue du Grésillé- BP 49004, Angers Cedex 01, France
[3] Department of Biology, Lund University, Sölvegatan 35, Lund S-22362, Sweden
[4] Les Ailes de l'Urga, 72 rue de la vieille route, 27320 Marcilly-la-campagne, France
[5] CEFE, Univ Montpellier, CNRS, EPHE PSL University, IRD, Montpellier, France

UMR 5175 Centre d'Ecologie Fonctionnelle & Evolutive
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