City centre seagulls could help plan drone flight paths

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Credit: AI-generated image (disclaimer)

Seagulls are the bane of many city dwellers' lives. From snatching sandwiches, to tearing up rubbish bags, for many they are far worse than traditionally unpopular pigeons or rats. The issue of gulls in cities is an interesting one, as populations of herring gulls and lesser black-backed gulls are declining in many rural areas, while increasing in many urban

locations.

The reasons are likely multiple, among them easy access to nesting sites and food, and a learned tolerance of humans. However, in our recently published study, we raised the possibility that ease of flight might also make city centres an attractive option for these birds.

Turbulant skies

As terrestrial animals, it can be difficult for humans to imagine what it is like to travel in a medium that is also moving. If you swim in a pool alone, it feels easier to slip through the water because it hasn't been churned up by another swimmer. This is just small-scale turbulence: add on top of this how it feels to swim in the sea, where the tide can pull you back as you try to return to the shore, and you will begin to understand what it is like to be a bird.

Now imagine that you have to swim through the sea to get to work every day. Sometimes the currents would be with you, sometimes they would be against you, this and the choppiness of the water will have a huge effect on how hard you have to work. If you had to do this every day, you would get pretty good at predicting the sea state and current direction. Flying animals face this all the time: the air is hardly ever still and this has a profound effect on flight behaviour.

In our study, we looked at how gulls use the rising air generated by buildings to fly without flapping. Using the seaside city of Swansea as our research location, we found that gulls actually alter their flight paths in certain wind conditions, to take advantage of updraughts occurring around a line of hotels bordering the bay.

Such energy-saving strategies are already well-recognised in birds that are undertaking their vast annual migrations, but are less well-studied for

birds moving around on a daily basis.

Tracking gulls

To learn more about the gulls' flight paths, we used laser range-finding binoculars to capture the trajectory of the birds soaring on rising air generated by the hotel buildings. We combined this with a simplified computer model of how the air moved around the seafront hotels and the flight characteristics of the gulls themselves. What we found suggested that gulls may be adopting a strategy that provides increased flight control in the face of cross-wind gusts.

This shows that man-made structures – even those as small as hotels a couple of stories high – can change bird flight paths by altering airflows. In fact urban areas are likely to be associated with cheap flight costs in a general sense, as buildings provide ample updraughts under a range of weather conditions.

Nonetheless, gaining cheap rides from urban airflows is not without its risks. Environments with complex substrates, such as those in urban spaces, produce very complex airflows. In order to account for this, we mapped the precise positions of gulls in relation to the airflows over the hotels to identify whether this changed as the wind strength increased.

Flying ahead

This interesting flight strategy doesn't only help us understand the lives of gulls, it could also prove useful when planning flight paths for unmanned aerial vehicles (UAVs), or drones, in urban landscapes.

Our results show that airflows around even small-scale features can have profound implications for energy use and flight control in birds and drones. We were very much aware that here, and in much research to

come, biological and engineering researchers stand to gain a lot from each other.

Small-scale UAVs with fixed wings – like conventional aircraft – are much more strongly affected by gusts and turbulence than larger aircraft, as the wind speed is comparable to their airspeed. Flying at low altitudes in the highly complex flow field of urban environments, and in close proximity to terrain and buildings, is a significant challenge that most autonomous flight control systems have not been developed to cope with. As such, examining how birds of a similar size and weight overcome these challenges could help to inform UAV flight path planning and the development of flight control systems for flight in the same environments.

So next time you are feeling ill-disposed towards gulls soaring in city spaces, possibly shielding your ice-creams as you stroll along the seafront, stop a moment to appreciate the complex decisions that these feathered pilots are making, second by second, as they respond to their continually changing aerial environment, in ways that engineers can, for now, only dream of.

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