Bird-safe glass as a step toward species-inclusive design

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To design ecocentrically, we must see our built environment through the eyes of non-human species. In this article, I briefly consider one example of how anthropocentric thinking has made our cities into killing fields for members of other species: the fatal hazard of glass to our avian brethren. The hazard can be greatly reduced if we incorporate a literal bird's eye perspective into architecture and urban planning. Thus, I present bird-safe glass as a case study in moving beyond anthropocentrism in built environments.

Collisions with windows and other glass surfaces are estimated to kill over one billion birds each year in the US alone (Kornreich *et al.*, 2024). Glass-caused fatalities have been documented in 90 countries, affecting hundreds of bird species worldwide (Klem, 2025). Moreover, contrary to common belief, birds who collide with windows might still be fatally harmed even if they fly away or are 'merely' stunned. Although some do go on to lead long lives, others soon perish due to injuries that they have sustained. Collision research pioneer Daniel Klem documented birds who appeared to recover from window collisions only to die later from intracranial haemorrhaging (1990). One recent study tracked the outcomes of more than 3,000 window collision victims admitted to wildlife rehabilitation clinics. Even with the most technologically advanced expert care, 60 per cent of these patients succumbed to their injuries in hospital (Kornreich *et al.*, 2024).

These painful deaths and injuries can be greatly reduced with appropriate design or treatment of glass panes. Before proceeding, however, it is useful to draw a contrast between genuinely *ecocentric* design – which incorporates the needs and interests of non-human species and ecosystems – and *biophilic* design. In its origins, biophilic design was an anthropocentric movement that focused on creating built environments that appeal to *humans'* attraction to nature for the sake of *human* health and well-being. Natural light, greenery,

and views of nature are all fundamental to biophilic design (*e.g.* Kellert and Calabrese, 2015). A stereotypical 'biophilic' building is likely to feature large glass windows, indoor plants, and views into exterior gardens. While it might be appealing to human sensibilities, such design can create death traps for birds.

Birds cannot see transparent glass. In that respect alone, they are not so different from us. (Don't we all know someone who has walked straight into a glass door or wall at some point?) Unlike us, however, birds do not learn where to expect glass by growing up in buildings in which glass windows are standard architectural features. Depending on lighting conditions and the properties of the glass, a window can appear either transparent or reflective from the outside. Under transparency conditions, birds perceive glass panes simply as open space through which they can fly to reach whatever they see on the other side. Under reflectivity conditions, birds perceive the scene reflected on glass – leaves and branches of nearby trees, for example – as habitat they can fly into. In either case, untreated glass is deadly, and all the more when surrounded by attractive greenery (*e.g.* Rössler *et al.*, 2023).

If we are truly 'biophilic', it seems the least we can do is to protect other creatures from painful premature death. Fortunately, urban planners like Timothy Beatley have been instrumental in shifting the meaning of 'biophilic' to a less human-centric perspective. The Biophilic City Network, which he founded, promotes the "ethical responsibility that cities have to conserve global nature as shared habitat for non-human life and people". Beatley is also the author of *The Bird-Friendly City* (2020), in which he specifically encourages planners to try "to put ourselves in the position of birds" and ask "What are the dangers, and what are the obstacles to flight and movement? Where are the stopover points, where is the habitat, where are the places of respite and nourishment [...]?" (p. 181).

Of course, a more holistic *ecocentric* perspective consists of more than birds. Certainly, however, one aspect of ecocentric design is to recognize that human perception is not the only vantage point from which to view a shared planet. In the case of bird-safe glass, the question we must ask is, "How can we get birds to recognize glass panes as obstacles?" We don't know how to give them a crash course (no pun intended) on human architecture, but we *do* have sufficient understanding of how birds see and react to obstacles. The general strategy, therefore, is to mark glass so that birds will interpret it as an impermeable obstacle.

Extensive testing has shown that most birds will not attempt to fly between vertical barriers spaced closer than four inches (10 cm) or horizontal barriers spaced closer than two inches (5 cm). The deterrent effect can be achieved by marking the exterior of glass with vertical or horizontal stripes, a matrix of dots, or any other pattern that follows the "2×4 rule" (Klem, 2019). In addition to the spacing, it is crucial that stripes, dots, or other pattern elements are large enough to be discerned by a bird's eye, at a great enough distance to avert their flight trajectory in time to avoid a collision. Testing shows that horizontal stripes should be at least 3 mm wide, vertical stripes at least 5 mm wide, and

dots at least 9 mm in diameter, and that high contrast is more important than any particular colour (Rössler *et al.*, 2023). When such solutions are implemented, numerous avian lives are saved. In 2023, Chicago's McCormick Place gained international notoriety when more than 1,000 birds were killed in a single night during the peak of autumn migration. This mass mortality event was a call to action: building managers were subsequently able to reduce collisions by 95 per cent by retrofitting its windows with dot-patterned film (Cosier, 2024).

We might think of bird-friendly design as an extension of two traditionally anthropocentric concerns: safety and accessibility. When developers and politicians baulk at bird-safe legislation, the overriding concern is almost invariably *cost*. But consider other safety codes that architects and builders must follow, such as those intended to prevent structural collapse or the spread of fires. These are not optional; they are legally mandatory *because they save lives*, and any architect or engineer who willfully disregards them to cut costs would rightfully lose their license. Likewise, most countries have laws mandating that businesses are accessible to persons with disabilities. The desire to save money provides no excuse for a building owner to refuse to provide a ramp for wheelchair users, for example.

The inclusive design movement decentres norms like (for example) able-bodied persons as standards for design. *Ecocentric* design should extend the spirit of inclusive design even further to decentre the norm of the *human* user. We must consider how non-human species could be affected by anything that we design and build. Birds are only one part of the more-than-human world, of course, but I submit that requirements for bird-safe glass could provide one first step in the direction of ecocentric standards for architecture and urban planning, and one easily within our reach.

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