GENERAL ARTICLE

Toward Interspecies Art and Design

Prosthetic Habitat-Structures in Human-Owl Cultures

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ABSTRACT

Urbanization severely reduces opportunities for nonhuman habitation and undermines nonhuman subjectivities, aesthetic experiences, behaviors, traditions, and cultures. In response, humans need to reimagine cities as places for interspecies cohabitation. In this article, a team of architects and ecologists demonstrates that such reimagination depends on the cultural behaviors of multiple species. The authors illustrate the implications of this dependence by designing and discussing nesting structures for the powerful owl (*Ninox strenua*). The project shows that prosthetic habitats can serve as useful provocation for thinking about interspecies cultures. The authors use this work to propose productive avenues for further research.

THE INTERSPECIES ART HYPOTHESIS

Interspecies Cohabitation

Disturbances caused by people, buildings, and traffic make cities inhospitable to many nonhuman species. Yet even the densest megalopolises provide habitats for nonhuman organisms as well as for humans [1]. Such urban cohabitation can cause conflict between human and nonhuman dwellers. For example, human activities can disrupt nonhuman animals' behavior, breeding, and foraging. Conversely, nonhuman animals can damage property, attack humans, spread disease, and increase dirtiness or noise [2]. Despite such challenges, it is important to enhance cultural diversities in urbanized environments. This diversification is important because nonhuman lifeforms can benefit from acculturation to human-modified habitats, just as humans can benefit from accommodating behaviors and traditions of other organisms.

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Interspecies Culture

In this article, we propose the notion of *interspecies culture*. Interspecies cultures emerge when cultures of more than one species become codependent. This notion presumes a definition of "culture" that includes nonhumans. Traditional humanist positions (cf. Charles Ellwood, Edward Tylor, Franz Boas, Clark Wissler, Robert Lowie, or Alfred Kroeber) understand culture as a uniquely human achievement. However, recent research demonstrates that nonhuman lifeforms also engage in forms of culture that are important for their well-being and survival [3]. Such cultures obtain, for example, in foraging tactics, predator avoidance, vocal communication, habitat use, breeding-site choices, and play [4]. Nonhuman cultures emerge through socially transmitted information that includes behaviors, traditions, beliefs, knowledges, skills, and practices [5]. We suggest that curated interactions between such cultures can foster solidarity and understanding among all urban dwellers [6].

Interspecies Art and Design

How can cities support interspecies cultures and shape them to encourage mutually beneficial cohabitation? Cultures can have multiple expressions via shared behaviors, rituals, customs, ethics, objects, and art. This article focuses on the aesthetic dimensions of culture. We introduce the idea of *interspecies art* to describe one type of activity that promotes interspecies cultures. Production of such art depends on an understanding of aesthetics that acknowledges nonhumans' ability to make aesthetic judgments. Female bowerbirds or peahens make such judgments, for example, when selecting mates [7]. This expansion of aesthetics includes judgments made by nonhuman species, inviting humans to rethink familiar concepts, practices, and sites in ways that highlight the presence and roles of nonhumans. We frame such reconceptualizations as art. In its attention to evidence, participation, and orientation toward practical outcomes, such art is similar to approaches that include "public art," "social art," and "useful art" as well as "speculative design," "transition

 https://doi.org/10.1162/leon_a_02224

design," and "design as activism." To provide a working definition: *Interspecies art consists of aesthetic practices that are (1) produced and also (2) used by more than one species.* An explicit recognition that nonhuman lifeforms can make and experience art distinguishes our understanding from existing artistic practices that take inspiration from, describe, or use nonhumans for human aesthetic purposes. Such existing practices commonly presume that outcomes of art will make sense only in human cultures and do not consider engagements with art by nonhuman beings [8].

This article extends current approaches by exploring and highlighting cultural implications of art for more than one species. It hypothesizes that interspecies approaches to culture, art, and design can usefully inform practices of urban cohabitation. We aim to illustrate the feasibility of such approaches by providing examples of interspecies participation and listing directions for further research.

One way to produce interspecies art is via design experiments. Such experiments can combine scientific knowledge with iterative approaches toward creative production. We illustrate this approach through a consideration of prosthetic habitat-structures. The term "prosthetic habitat-structures" refers to artifacts that aim to reinstate absent habitat opportunities by grafting remedial elements onto existing structures. The process of specifying proposals for such habitats can benefit from the enrollment of all stakeholders, human and nonhuman. We call this practice *interspecies design*. The development of effective methods for such design is an open challenge. For example, design collaboration with nonhuman lifeforms is nontrivial because they cannot describe their needs in human languages.

Our methods contribute to the construction of theory and the advancement of practice by exploring the issues highlighted by a design provocation. This approach depends on the selection of an appropriate case. Here, we choose to focus on the challenge of providing compensatory surrogates in areas where humans have severely diminished the availability of naturally occurring habitat structures. Lives of many species in all biomes depend on such structures, making our case representative of widespread phenomena.

Our case study provides technical recipes for the construction of prosthetic habitat-structures and a comparative assessment of habitat designs [9]. However, these aspects of the project are beyond the scope of this article. Instead, we focus on overlapping cultural concerns to (1) outline owls' culture in relationship to humans; (2) outline human cultures in relation to owls; and (3) illustrate relevant human-owl cultural issues in application to interspecies design.

THE CASE OF POWERFUL OWLS

To explore how prosthetic habitat-structures can encourage interspecies cultures, we focus on one species, the powerful owl (*Ninox strenua*) [10]. Powerful owls live in eastern and southeastern Australia. They are threatened in the southern parts of their range [11], where humans have significantly reduced the number of large old trees that owls use for nesting.

In response, our project analyzes owl biology, ecology, and behavior to propose innovative interventions that can convert existing urban structures into owl homes. To date, this ongoing long-term project has involved the installation and monitoring of several prosthetic nests (Fig. 1). We continue to assess ecological outcomes, but these aspects are beyond the scope of this article, which focuses on culture and design.

Fig. 1. A prosthetic-nest prototype installed in a living tree. (© Dan Parker and Stanislav Roudavski)

Human Cultures

Human-owl cultures have a long and varied history. Humans fear and admire owls, associating them with wisdom, power, clairvoyance, good (or bad) omens, mystery, death, and medical cures [12]. Humans use owls as subjects of art, architecture, literature, films, toys, banknotes, and institutional logos. A typical human learns some owl-related facts through such cultural objects but knows little about specific owls in specific places. Humans might sometimes experience urban owls as exciting curiosities but otherwise have few occasions to consider their lives. This detachment is problematic, as urbanization continues to force more owls into cities, increasing potential for interspecies conflict. For instance, owls do not clean their nests and they leave dismembered animal carcasses under nest sites (Fig. 2, left). In dense cities, humans might find the resulting smells and sights repulsive.

Human ignorance about owls' needs can lead to harmful practices. For example, urban managers routinely remove understory vegetation. Owl chicks that fledge in the areas without such vegetation to protect them from hard landings can suffer injuries and perish. Further harm results from noise and other disturbances. Powerful owls are charismatic and reported sightings can attract many observers (Fig. 2, right). Human presence can force owls to abandon their nests and exhibit other abnormal behaviors, possibly including infanticide [13]. Such examples demonstrate that owls will not succeed in urban areas without a shift in human cultures. Better familiarity with owls' life histories is likely to result in greater empathy, solidarity, and practical support.

Owl Cultures

Owls also must adapt their behaviors to prosper in urban conditions. Their ability to engage with new objects and develop new habits indicates that this is feasible. Environmental change, including introduction of human-made structures, can lead to the emergence of new cultures in many species, including cetaceans, birds, and primates [14].

Fig. 2. Potential conflicts between humans and owls. (left) A powerful owl roosting with dismembered prey. (© Dan Parker and Stanislav Roudavski. Photo: Nick Bradsworth.) (right) Crowds gather to watch a powerful owl in an inner-urban context (Carlton, Melbourne). (© Dan Parker and Stanislav Roudavski. Photo: Lian Hingee.)

Fig. 3. Atypical nesting sites. (left) A powerful owl chick nesting in a termite nest. (© Dan Parker and Stanislav Roudavski. Photo: Ofer Levy.) (right) An arboreal termite mound. (© Dan Parker and Stanislav Roudavski. Photo: Blantyre.)

With owls, evidence suggests that juveniles learn from adults through mimicking. Examples of young owls copying their parents' hunting strategies include snatching at branches to capture insects, ferrying bark strips, chasing aerial fauna, and swooping upon animals on the ground [15]. Birds adhering to distinct musical trends in different regions provide an example of cultural variation within one species [16]. Urban owls show similar capabilities when they learn to be more tolerant of humans compared to their bush-dwelling conspecifics [17].

Owls can also be inventive as individuals. They use arboreal termite mounds (Fig. 3) and non-native trees for nesting. Their roosting choices can include tennis-court fences and power lines. They exhibit atypical behaviors such as catching fish [18] and practice hunting techniques on clothing, cooler bags, and towels (Fig. 4). This plasticity can be dangerous, and owls in human-altered places suffer from car-strikes, disease, electrocution, entanglement, and fluctuating prey populations [19]. By contrast, their flexibility suggests the potential for cultural adaptation to novel ecosystems.

INTERSPECIES-DESIGN EXPERIMENT

Following this glimpse into human-owl interactions, we continue with the introduction to our design provocation and the discussion of its cultural implications. Existing provisions for owls include nest boxes, hollows from felled trees, and even repurposed waste bins (Fig. 5). To date, there is only one observation of a successful powerful-owl breeding in a nest box—and only one of the two chicks survived [20]. The rectilinear forms of plywood nest boxes do not match the material and geometric complexity of the natural structures they aim to replicate. Current techniques could benefit from functional and cultural improvements. For humans,

Fig. 4. Powerful owls exhibiting novel behavior with human-made items. (left) A powerful owl with a cooler bag. (right) A powerful owl pair with a tea towel. (© Dan Parker and Stanislav Roudavski. Photos: Choosypix.)

Fig. 5. Existing nest designs for the powerful owl. (left) A repurposed wheelie-bin nest. (© Dan Parker and Stanislav Roudavski. Photo: Gio Fitzpatrick.) (right) A nest box. (© Dan Parker and Stanislav Roudavski. Photo: Ed McNabb.)

log hollows can be heavy and difficult to install (Fig. 6). For owls, nest boxes can be functionally inadequate or appear too unfamiliar for consideration during nest-site selection.

Our project uses algorithmic modeling to generate forms informed by arboreal termite mounds. Such mounds can self-organize to fit existing living, dead, or human-made structures. The project also generates forms that can fit these locations (Fig. 7, left). These forms aim to support owls' nesting habits. For example, designs provide rounded edges that suit the owls' large talons during landing. Inside, there are platforms for feeding the chicks and roughened interior surfaces for scratching and climbing (Fig. 7, right). For further details on the generative techniques, refer to the supplemental materials associated with this article and to Roudavski and Parker [21].

DISCUSSION AND FUTURE WORK

How can such interspecies approaches to culture, art, and design inform urban cohabitation? We respond to this question by highlighting cultural implications of prosthetic habitats. First, we position prosthetic habitat-structures as art and identify future practical work. Second, we introduce issues for future research into human–powerful owl cultures in the context of such design. Last, we raise important questions for future cohabitation that emerge whenever prosthetic habitat-structures attract new tenants.

Prosthetic Habitat-Structures as Interspecies Art and Design

We propose to recognize designs of prosthetic nests as artistic expressions that can be meaningful to the cultural needs of owls. Owls must recognize and approve the resulting artifacts before they attempt to use them and must find them agreeable in practice. Successful design will have to consider pragmatics and aesthetics of both human and owl cultures. Further, prosthetic habitat-structures will need to refer to the subjective preferences of owls and not only to generic bodily requirements or species-wide considerations. In turn, owls might learn to recognize, accept, and use locations and forms that are increasingly different from ancestral templates, extending their capacity to inhabit novel ecosystems.

Future work should make improvements to prosthetic nests' geometry, material, and construction in ways that extend engagement with the subjective preferences of humans and owls. For instance, owls may benefit from the intelligent distribution of material properties such as soft, porous and self-repairing surfaces. Such features are common in natural hollows with decomposing floors that are safe for the eggs and regrowing edges that resist scratching. Simultaneously, humans may want to participate in the design and making of prosthetic nests that benefit local ecologies while adhering to human cultural values.

Prosthetic Habitat-Structures in Interspecies Cultures

Such improvements to design and management will rely on further research into human attitudes toward owls and owl cultures. Better knowledge of existing and possible interspecies cultures can help to address the challenges of cohabitation. For instance, should prosthetic habitat-structures for owls be visible to humans or placed in secretive locations? On one hand, future management can aim to capitalize on owls' cryptic lifestyles and keep their behaviors hidden from

Fig. 6. Installation of log hollows. (left) An arborist installing the log into place at a tree crotch. (right) Arborists hoist a heavy log up the host-tree. (© Dan Parker and Stanislav Roudavski)

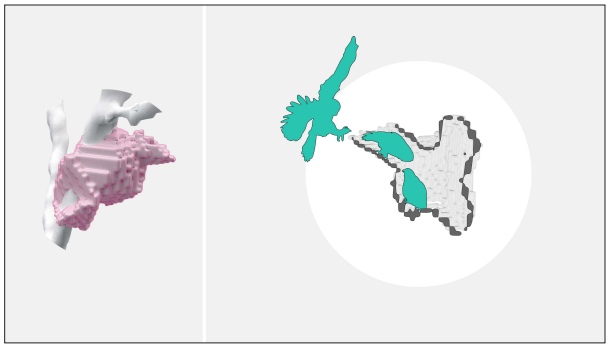

Fig. 7. Computational design of prosthetic nests for the powerful owl. (left) A model wrapped around the unique form of a dead tree. (right) Functional features, including a rounded entrance for landing, an entrance pad for feeding, and a roughened interior for scratching. (© Dan Parker and Stanislav Roudavski)

humans. However, if owls remain hidden, the "extinction of experience" [22], where humans have no contact with nonhuman lifeforms, will only increase. This type of extinction is unhealthy for humans and can lead to the loss of support for nonhuman lives. Complete isolation of the nests, as desired by some activists, will likely be unfeasible for many species that cannot escape or that choose to live in cities. A compromise approach might be one that makes owls visible but prevents them being disturbed—acculturated to urban life but not tamed.

Any future management should take cultural implications of such options into account. Further investigations on foraging patterns, home-range areas, and dispersal of young adults can inform these choices. Such research ought to engage with multiple knowledge bases, including community experiences and anecdotal observations, scientific evidence, indigenous expertise, and fictional narratives.

Prosthetic Habitat-Structures and Interspecies Cohabitation

Regarding future cohabitation, our case study shows that design provocations can generate useful challenges for further exploration of interspecies relationships. Cohabitation of humans and nonhumans produces novel cultural attitudes. Such attitudes are a subject of ongoing contestation because they depend on moral and political preferences as well as on bodily or cognitive capabilities. Management of such tensions will determine whether human-made habitat structures will be built, last, or prove successful.

Should owls become like pigeons and sparrows or even like pets? On one hand, urban adaptation of species such as pigeons can cause over-habituation, overabundance, and frequent human-wildlife encounters. A significant repercussion of such encounters is popular disdain toward common species and consequent efforts to remove them from cities [23]. Conversely, keeping owls as pets will prevent them from expressing such capabilities as choosing partners or deciding on roosting sites. For example, after the release of the Harry Potter films in Indonesia, owls became popular as pets. This coincided with the proliferation of illicit capturing, trading, and subsequent abandonment [24]. Large-scale human help can also lead to problems. For example, globally, birds already rely on human-made structures [25]. This is potentially problematic because humans can favor some species, leading to the demise of others, or create dependence on human-made structures without guarantees of continuing support. Future decision-making on human-owl relationships may benefit from design that tests possible future states at various temporal and physical scales.

CONCLUSION

This article demonstrates that design of prosthetic habitat-structures can highlight issues of interspecies cultures and indicate directions for further research. To inhabit human cities, owls need to become more tolerant of disturbance and human-made objects. At the same time, humans must learn more about the habits of owls and in some cases adjust their attitudes. Such mutual shifts are necessary in many other situations and for many other species. As in other intercultural engagements, best practices are likely to emerge when stakeholders influence decisions as active agents and not only as passive recipients of care.

Acknowledgments

This project is supported by the Australian Research Council Discovery Project DP170104010.

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Manuscript received 23 April 2021.

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