Life on Wings: Relating to a Bird's Life in a City through a Board Game

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This paper presents a novel board game called Life on Wings, designed to create an experience and awareness about the life of birds in an urban landscape. The game lets users experience the life of six tropical urban birds across three seasons of a year. By performing different activities of birds, players learn about the challenges that an ever-changing urban environment creates for bird species. We reflect on our design process and describe the key design decisions that led to the development of our game. We also present insights of a playtesting session that was conducted with 11 participants to evaluate the design aspects of the game. Based on the study insights we present three implications on collaboration over competition, local game movement and longitudinal first-person perspective. Through this work, we aim to inspire more playful explorations on human-wildlife cohabitation.

CCS Concepts: • Human-centered computing → Human computer interaction (HCI)

KEYWORDS: Board games; Bird ecology; Designing for cohabitation

ACM Reference format:
Prasad Sandbhor, Priti Bangal, Deepti Aggarwal, and Rohit Ashok Khot. 2021. *Life on Wings*: Relating to a Bird's Life in a city through a Board Game. In *Proceedings of the ACM on Human-Computer Interaction,* Vol. 5, CHI PLAY, Article 232 (September 2021), 26 pages, https://doi.org/10.1145/3474659

1 INTRODUCTION

Urbanization is an unavoidable reality of the modern age as large human populations across the world live in cities [45,46,64]. It follows a wide array of drastic environmental changes like the depletion and fragmentation of vegetation, and increase in anthropogenic disturbances and pollution through sound, light, and chemicals to make way for roads, buildings, and other infrastructure. These changes have affected the urban ecosystems and caused shrinking of urban habitats suitable for non-domesticated animals. Birds, among other wildlife have faced negative impacts of urbanization, observed through population declines in urban areas. [26,46]. Birds face several challenges in urban areas, some of them include loss of habitat nest sites and food. Besides, noise and light pollution can directly affect survival and reproduction [46].

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2573-0142/2021/September 2021 - 232 $15.00
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https://doi.org/10.1145/3474659

Figure 1: "Life on Wings" is a board game in which players play as birds in a cityscape and perform everyday activities of a bird while tackling various situations that an ever-changing environment like a city might offer.

In response, humans have created several interventions to create spaces for coexistence with birds in urban areas [18,20]. While structured approaches like creating protected areas in the form of sanctuaries, parks, and green patches offer interesting opportunities for birds to thrive in cities, simple interventions like placement of nest boxes, green corridors, bird feeders, and birdbaths in gardens, parks and backyards have also been successful [18]. Studies suggest that several bird species gradually adapt to survive in the urban environment [18,26,50]. For instance, birds have changed their mating behavior with changing noise and light conditions in cities; and have also taken to nesting in several urban habitats (Figure 2).

Figure 2: Birds close to human habitation, and seen using the man-made structures. Left to right: Bird on a nest in the doorway of a house (Photo: "Nesting Birds in the Doorway" by Dave Schumaker is licensed under CC BY-NC-ND 2.0), a parakeet feeding on a bird feeder (Photo: "Ring-necked parakeet" by Marie Hale is licensed under CC BY 2.0), Dove perched on an electric wire pole (Photo: "The bird is sitting on the ugly wires" by shyb is licensed under CC BY-NC 2.0), Flocks of pigeons thriving in a city environment (Photo by Vikas Sawant from Pexels).

While the challenges for birds and other wildlife in urban environments are not new, city dwellers often do not engage with these issues. Mainstream media helps create awareness about the plight of urban wildlife through articles, documentaries, and social media [32,75]. However, these resources offer one-way interactions and fail to engage the target audience. Clarke and team noted [14] that we need to move away from a perspective where urban environments are for human inhabitants alone and focus on making the experiences of non-human others noticeable. With the decline in wildlife in close to human habitation [45,46,64], it is important to create opportunities for nurturing stronger relationships between humans and wildlife.

As a contribution to nurturing these relationships, this paper presents the design of a novel board game, Life on Wings that aims to create awareness on the challenges and opportunities that animals face in everyday life to survive in an urban environment. The game is about experiencing the life of non-human animals while empathizing with the way their life changes with predictable and unpredictable events in the city. In the game, players play as birds and perform their everyday activities while tackling various situations that an ever-changing environment like a city might offer. We chose birds as central characters in the game for many reasons - they are the most visible, and encountered by people in everyday life.; people often have emotional connection and empathetic relationship with birds – people put out bird feeders and water bowls in hot summers, as birds generally (barring a few exceptions e.g. pigeons, seagulls, etc) are not seen in conflict with humans like other animals like rats, mice, and monkeys [15]. Additionally, the negative effects of urbanization are easily noticeable on birds and many of us have noticed the birds colliding with windmills, reflective surfaces like glass doors, and getting electrocuted on electric wires [42,55].

We decided to develop a board game because board games have been used previously as a starting point to design a social play [31,76]. Board games are usually simpler in mechanics than digital games, hence researchers can easily evaluate the player experience and social interactions of a new game [7,76]. On the other hand, digital games require complex simulations, real-time rule based engines and the ability to save the state of the game, which may not be easier to iterate based on game evaluation [44]. For instance, Zagal et al. [76] utilised the design lessons learnt from designing collaborative board games for developing a digital version and commented that the process was fruitful as computer games can follow complicated mechanics that are difficult to begin with. Several games therefore, started as a board game and then were digitised partially or completely [68]. For instance, the commercially available tabletop augmented reality game, The Eye of Judgment, inherits much of its structure from the card game, Magic: The Gathering [23]. The award-winning board game Pandemic [40] was adapted digitally for Android devices in 2019 [5], where the digital card faces look exactly as the physical cards but the plastic tokens and pawns are replaced by the 2D sprites. Game scholars [12,52,65,72] also note that games are procedural systems regardless of their material basis, and many design issues, insights and solutions do transfer across material bases that carry and execute a similar rule system. Inspired by these works, we designed Life on Wings as a starting point to create empathy for urban birds.

Our work makes the following contributions: (1) To the best of our understanding, Life on Wings is the first game that helps users to understand the struggles of urban birds through a first person perspective. The game is grounded in the literature on ornithology [15,18,20] and game design [11,17]. Our work introduces CHI PLAY researchers to a new design opportunity of how to design playful systems that can sensitize players to the wildlife struggles and endangerments. (2) Secondly, this work also contributes to HCI and design research by offering

a descriptive account of the design and the making of our game, which addresses the call of design documentation [2,13,17]. We employed the Research through Design (RtD) [78] methodology to develop the game. We present the key design decisions that guided the game design through different iterations. (3) Finally, we also present the insights gained from a preliminary lab study. The lab study highlights the importance of collaborative play, and the use of local context and natural situations to connect to the game. Drawing on the study insights, we discuss the implications of our work around three themes: collaboration over competition, local food movement and first-person perspective. By reflecting on our design journey across these three themes, this research contributes ideas and practical strategies for supporting playful human-animal cohabitation.

2 BACKGROUND & RELATED WORK

Empathy refers to the ability to understand and share the feelings of others. It incorporates three distinct yet related abilities – affective empathy, cognitive empathy, and empathic concern [16]. In this work, we focus on cognitive empathy, which is the ability to understand the experiences of others by recognizing and imagining their reality (ibid). Literature in social sciences suggests that empathy improves people's attitudes and behaviors towards other individuals or groups, while a lack of empathy is associated with more negative attitudes and behaviors [10,54,67]. According to Berenguer [10], inducing empathy towards animals and plants could increase pro-environmental behaviors. Participants in the high empathy condition displayed stronger feelings of moral obligation to help animals, plants, and nature as a whole.

Researchers have been studying what it means to have humans and animals as equal partners of a common ecosystem [41,66,70]. There has been an interest in peeking into the day-to-day lives of other living beings [24,33] as well as to understand how human activities affect the lives of non-humans [80]. For instance, My Naturewatch Camera project [24] introduces individuals to wildlife in their local area by capturing photographs with a non-intrusive camera. The camera captured images of the animals in personal spaces like backyard, authors argue that these photographs are more valuable for individuals than any generic photos of wildlife. These efforts are helping in spreading fundamental awareness about the need for decentering humans when thinking of cohabitation and city planning. However, most of these experiences are quite solitary in nature and do not offer opportunities to learn through collaboration or role playing, which are defined as important elements to practice empathy.

Using games to foster empathy is not new. Games can effectively foster empathy by allowing players to inhabit the roles of other people in an engaging and immersive way [30]. Farber and Schrier [21] highlighted five aspects of digital games or games in general, that may lead to empathy-related behaviors and actions. First, there is the chance of promoting immersive experiences. The second factor is the feeling that the actions and choices made by the player during the gameplay result in significant changes in the game world. The third factor is perspective-taking and identity, which refers to the act of taking a different point of view of another person, making it possible to understand him/her better, despite differences in point of views or disagreements. The fourth aspect is the possibility of connecting with non-playable characters, which is a kind of independent relationship that may result in empathic emotions similar to those established with actors or characters from a book. Finally, the last aspects are connection, communication, and reflection resulting from real people interactions. These can collectively support several aspects that are relevant to the practice of empathy, such as

perspective-taking, role-playing, reflection, agency, identity formation, and relationship building.

Existing literature in the CHI PLAY and HCI community showcases a variety of playful embodied experiences to help humans connect with and empathize with humans as well as "other than humans" by living under their skin [1,38,58]. For example, Participatory Chinatown is a 3D multiplayer game that examines how role-play can affect the way people understand local issues and engage with their community. It also points to the challenges of extending player empathy from the magic circle of gameplay to the larger context of a community meeting [25]. Breathtaking Journey is an embodied and multisensory mixed-reality game providing a first-person perspective of a refugee's journey [36] whereas Permanent is a virtual reality game designed to foster empathy towards evacuees from the 2011 Fukushima Daiichi nuclear disaster [37]. Krekhov and colleagues [38] created and studied an illusion of virtual body ownership (IVBO) using the examples of a scorpion, a rhino, and a bird to explore possible avatar controls and game mechanics based on specific animal abilities. Finally, existing research has also looked into immersive technologies such as AR and VR to foster empathy towards cyclists [71], chronic pain patients [69] and gender stereotypes [51].

Moreover, Animal Superpowers [81] is an immersive exploration of animal senses through physical artefacts that mimic the vision of ants, simulate birds' detection of geomagnetic fields and the visual perspective of giraffes. Reassembling the experience of avatars, Animal Superpowers allows children to play the role of being inhabitants of animal bodies. Kau's Animal Diplomacy Bureau's Bird Games [58] is also a step towards this direction where players put on a bird hat and possess special Bird Sense. As birds, players will navigate through the city by listening and deciphering bird songs. However, besides mentioning the technical difficulties in replicating the sensory richness associated with coming face to face with a wild animal, Pimentel [59] also cautions that in creating such technology led AR and VR experiences, there are chances that it may negatively affect humans and the survivability of the very species seeking to benefit from them. Melson argues, "one cannot rule out the possibility that increasing exposure to mediated interactions with animals, through robotics, virtual reality and other media, may come at the expense of direct engagement with living animals" [48]. We draw inspiration from all these works, and instead of using digital technologies such as AR or VR to support our research endeavour, we turned our attention to the oldest interactive technology - board games [29].

In recent years, board games have gathered significant popularity [29]. Board games support "make-believe" or "as-if" aspects of play [47] which allow for learning through play by the use of metaphors to express the link between abstract concepts and lived experiences [39]. Games promote social skills by encouraging collaboration, shared decision-making [49,62] and learning through shared experiences [22], which are required to manoeuvre different real-life situations. The materiality and physicality of the board game [63] also create a multisensory environment for play and learning. Board games often cater to enthusiastic learners, gamers and non-gamers alike, who are more interested in learning about the game theme and its design journey as opposed to striving for mastery in playing [63]. Moreover, it helps individuals to be away from the distractions of digital media and enjoy some quality time together with friends and family [8]. Hence, it is not surprising when Weisholtz [73] noted that the sales of board games increased during the pandemic as more families played board games to bond and have fun with each other in their free time [34].

Consequently, board games have been explored as a medium to create empathy-based learning for different topics. For example, Arslan and colleagues [4] designed a marine-themed board game to help players recognize marine life and environments through a question-and-answer approach. Keep Cool is a board game that creates awareness about the influence of factories on our environment [19]. HIVEMIND is another board game that is developed to teach young kids the nectar feeding and social behaviour of honeybees [56]. Finally, Wingspan is a commercial board game [27,74] in which players compete to discover birds and attract them to wildlife reserves. The global success of Wingspan and the various awards it has received inspired us to explore the area of human-bird cohabitation in cityscapes. Drawing on the above listed benefits, we chose the medium of board games over other interactive technology for players to learn and experience the nuances of the lives of various birds in the city collectively and have productive discussions about cohabitation.

3 INTRODUCING *Life on Wings*

Life on Wings is a novel board game that aims to create awareness about the challenges faced by birds in urban landscapes through empathy. As the name suggests, the game enables players to experience everyday events in an urban landscape from a bird's perspective. While navigating the game, players need to accomplish different everyday activities of individual birds. They experience unique seasons of tropical weather along with other unforeseen changes (like construction sites, dump yards, bird feeders and water holes) that often occur in the landscape of a city. It enables players to imagine an alternative present that depicts the complexity of the underlying urban ecological systems [20]. Playing as a bird with the goal of making it through the different seasons invokes empathy among players.

Figure 3: The triangular game board represents the map of a city with diverse landmarks including residential areas, industrial areas, office spaces, restaurants, construction sites, dump yards, parks, garden patches, and water bodies (river, fountain, and lake).

The game has seven components (refer Figure 3 and 4):

1. Three-game boards one each for summer, monsoon, and winter seasons, wherein the city landscape remains the same with the variation in food available for birds (refer Figure 3).
2. Six bird character cards: One card per bird species (Parakeet, Crow, Kite, Tailorbird, Sunbird, and Kingfisher). Each card contains information about the type of food consumed by the bird. Image (Figure 4) shows the Crow card on top of the pile. It can feed on insects and dead waste. The card also includes a list of activities that a bird can perform, the amount of energy these activities require and the associated rewards (Crow can perform 5 actions in any season viz. Fly, preen, rest, bathe, and chase kites. While flying one distance-unit requires 1 energy point and rewards no stars, chasing kites requires 3 energy points and rewards 3 stars). The bird card also helps the player to document their actions, scores and rewards to claim badges.
3. Four sets of colored beads representing different types of food items available at the city landmarks. Areas like parks, garden patches and water bodies are high-resource regions and contain at least two types of food. Residential areas, restaurants and dump yards are low-resource regions and contain one type of food. Finally, industrial areas, office spaces, and construction sites are no-resource regions and do not contain any food.
4. Eighteen situation cards: These cards provide a set of random events that may occur in the city and may affect birds' activities. These are designed to fit on the city map using the numbers provided at their vertices. Some cards are permanent that remain on the map until the end of the season while others are temporary that remain on the map until the end of the day.
5. Two six-sided food dice: The food dice represent the availability of food resources in different seasons with the summer season having the least food supply. The numbers on the dice represent the energy points that a bird receives with every chance. In the winter and monsoon season rounds, players use food dice that are numbered 1 – 6 while in the summer round, a 6-sided die with numbers 1 – 3 (each number repeated on two sides is used).
6. Two types of markers: (a) Player markers include bird tokens, bird nests, and energy markers as beads. (b) Day marker is represented through a black bead, which indicates the time of the day, (i.e., morning, afternoon and evening time). Players move the marker ahead on the board after playing a round for one time of the day.
7. Two types of badges that players receive based on their performance: (a) Star badges are awarded for scoring the maximum number of stars, and (b) Master flyer badges are awarded for scoring the maximum number of flights. Badges are rewarded at the end of every season.

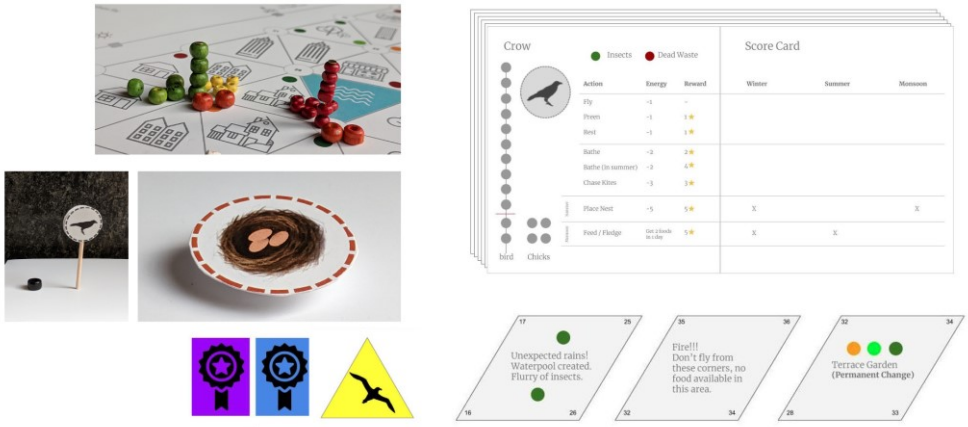

Figure 4: Components of the game. Clockwise from top right: Bird cards, situation cards, master flyer and star badges, bird tokens and nest markers, beads representing food at city location.

3.1 Game setup

The game operates over a period of one year comprising three seasons: winter, summer and monsoon. These seasons have varying food resources and activities for birds (Refer Table 1). Each season consists of three days and each day includes three times of the day (morning, afternoon and evening). At the end of the day, the birds take rest in the night, which is not played through dice but played as a default activity for which fixed number of energy units get deducted. Thus, players play 9 rounds in each season and 27 rounds in the entire game (Figure 5). We chose three days in each season to give a quick flavor of the activities involved in different seasons. In each day, the turns are temporally separated – one turn each for morning, afternoon and evening giving players a chance to iteratively make decisions on their actions.

Table 1: Season specific mechanics about feeding quantities and activities that give rise to survival related dynamics and the aesthetic of 'Challenge' in Life on Wings.

Winter	**Summer**	**Monsoon**
Abundant food *(Use dice 1 to 6)*	Limited food *(Use dice 1 to 3)*	Plenty of insects *(Use dice 1 to 6)*
Limited Activities (Fly, rest, preen, bathe)	Seasonal activity: Placing nest	Seasonal activity: Feed fledglings twice a day
No fixed roost, Can take night rest anywhere	Come back to the nest at night, if not the nest goes out of the game	Come back to the nest at night, if not the nest goes out of the game

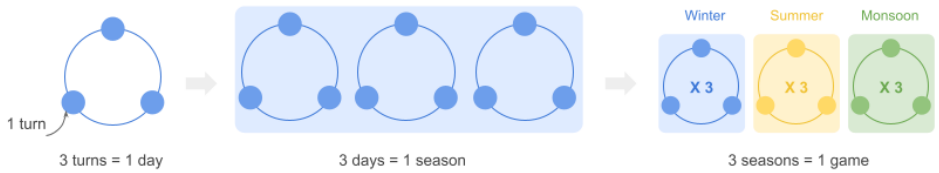

Figure 5: Representation of number of turns, days and seasons that constitute the game.

The game setup is as follows:

1. The game starts by placing the winter board in the centre of the playing area. After 9 turns (3 turns each day) of the winter season, the game moves to the summer board and finally to the monsoon board.
2. Day marker is placed on the morning icon on the board and is moved ahead every turn.
3. The situation cards are drawn from a shuffled deck. 1 to 3 numbered die is rolled thrice for placing the the situation cards face down on the time of the day equal to the number revealed on the dice, e.g., 1 for morning and 2 for afternoon. When the day marker reaches the turn with a situation card, it is placed at its appropriate location on the map.
4. Color beads are placed on the map depending on the food available at different landmarks. When a player lands at a location, they collect as many beads as indicated by the rolled dice.
5. The deck of the bird character cards is shuffled, and each player pulls out one bird card to play the game. Every player then gets the player markers, i.e., a standing bird token, its nests, and a bead to mark every level on the bird card. Players can decide where to start playing on the board and place their bird token at a location of their choice. The game starts when all the birds have been placed on the map.

3.2 Gameplay

The goal of the game is to survive through all three seasons and scoring maximum points by performing different activities. Before presenting the game rules, we first provide an example of the journey of a bird character in the game.

Let's say a player gets to play as a Sunbird during the game. Sunbird has a high metabolic rate, so it is beneficial for the player to stay close to nectar and insect resources and gain quick energy points. The sunbird characteristics are as follows - The journey will involve many flights and energy consumption with a few other activities to earn extra points. The summer season poses new challenges to a Sunbird, where it has to perform high energy- sink tasks like nest-building, while also not falling beyond the threshold energy levels (i.e., 2 units). From the point of view of other birds, resting might be one activity but for a Sunbird, resting especially during the summer seems like a very expensive activity.

1. Each player starts the game with a minimum energy level of 2 points as mentioned in their bird character card.
2. On his/her turn the player can decide to fly to a location where they want to eat and roll the dice once and gets equivalent energy points. P. They can eat only as much as the number on the dice. Feeding is a default activity, and they can combine it with any other activity from the list mentioned on the bird card, if they have the needed energy

points. After filling up the energy level to its maximum, a bird cannot eat more if it has eaten to its max capacity (energy marker is at the top end on the bird card).

3. For every turn, players document their actions on the scorecard and move the energy marker on their bird card.
4. At any point in the game, birds can perch at any vertex (location) on the map. Multiple birds can also perch together or nest next to each other.
5. After all the players have taken their turn, move the day marker to the next time, and repeat the previous steps.
6. After three turns, i.e., at the end of the day, all players reduce one energy point to account for the energy consumed through the night. The season may also specify mandatory actions to end the day e.g., birds can roost anywhere at night in the winter season, however they have to fly back to their nest in the summer and monsoon seasons - which may need more energy.
7. When players encounter a situation card on their turn, players need to follow the instructions provided on the card to decide the next activity. e.g., if the situation card mentions a fire outbreak in a block, then any nest built in the area gets destroyed - which means the player exits the game as nests are mandatory in summer and monsoon seasons. The temporary situation cards are discarded at the end of the day, whereas the permanent situations are discarded at the end of the season.
8. At the end of every season, players calculate their actions and the collected stars. The player with the maximum number of flights wins the Master Flyer badge. The player who has accumulated the maximum number of stars wins a Star Badge. In the case of a tie, both players get to keep the respective badge. The reward badges rotate amongst the players as they play further across seasons.
9. Players continue to play until their birds have the minimum energy level of 2 units. Otherwise, the bird dies and the player exits the game.

4 RATIONALE

Life on Wings is an outcome of multiple discussions, explorations and iterative prototyping done over a period of one year. The project began with literature review of diverse domains viz. ornithology, urban avian ecology, cohabitation, serious game design, and more than human design. The team consisted of researchers with expertise in ornithology, game design, interaction design and digital health. We conducted a series of brainstorming sessions to come up with ideas for a playful intervention that could aid in enabling the players to empathize with urban birds and their lives. Game concept that met this objective was shortlisted for prototyping. We employed the Research through Design (RtD) [78] methodology to develop the game. RtD is an approach that intends to generate new knowledge about the world through design. In RtD, the unfolding of the design process is a crucial activity to understand the chain of reasoning that leads to a final artifact and to populate the intermediate space between the particular artifact and general theory [43].

The concept was further developed using the Triadic Model of Serious or Applied Game Design [28]. This model maps the design space of an applied game concept into three regions - reality, meaning and play. Reality space depicts the domain, context, problems and opportunities that the game is supposed to address. The space of Meaning explores the purpose, value and contribution of the game. The Play space deals with interactivity, uncertainty and engagement in order to create an immersive play experience for the players. Designing a good game using the Triadic Model involves managing the tensions within and between the three regions.

The game depicts the scenario of tropical weather, where the weather is warm and humid throughout the year. We started the design journey of *Life on Wings* by defining its reality space by selecting bird species and their activities. It was followed by shortlisting urban habitats that provided appropriate context for the game. The meaning space of the game was established using the relationship between the bird activities and the city landmarks in terms of energy resources. The introduction of seasonal variation and situation cards provided the randomness and uncertainty to the gameplay. While designing each of the elements, the game concept underwent a series of iterations which led to the emergence of innovative gameplay and shaped the play space of the game. Below we describe the key design decisions that were taken along the way. For gaining more clarity in the design description, we describe the design of each game element separately, however, they were intertwined; and many design decisions for different game elements were taken in parallel.

4.1 Selecting the different species of birds

While selecting birds for the game, our goal was to select birds that people are familiar with, and those that they might potentially interact with. We also tried to include a diversity of traits or characteristics to make the overall play experience engaging. The distribution of birds within the city depends on different factors like seasonal variation, metabolic rate, access to habitat, and availability of food in their surroundings [9,61]. For example, Sunbirds have a higher metabolic rate and thus, have to feed more frequently as opposed to those with lower metabolic rates. We initially shortlisted ten different urban-dwelling birds of which six birds Kite, Crow, Parakeet, Kingfisher, Tailorbird, and Sunbird made the final cut (refer Figure 6). We eliminated Pigeon, Seagull, Cormorants, and House Sparrow from our list after finalizing the landmarks for the city map. These birds were eliminated as our final cityscape maps had little to support their survival.

Additionally, while several bird species are opportunistic feeders and can feed on multiple food types, we have broadly classified them based on what they most commonly feed on to keep the gameplay simple. We represented different types of food through four sets of colored beads. viz. green represents insects, orange represents nectar (flowers), yellow represents fruits, red represents dead waste. Every bird can consume only a certain type of food, which is indicated by these colors on the bird cards (e.g. common crow can eat dead waste and insects). On the cityscape map, these food types are shown through colored circles at different landmarks, where these beads are placed.

4.2 Shortlisting bird activities

The core mechanic of this game revolves around different bird activities [61]. The initial list only included the frequent and essential tasks like flying, feeding, bathing, preening, and resting. With these activities, the gameplay was monotonous. Hence, we added season-specific activities like nesting and feeding fledglings, and bird specific activities like social flights for Parakeets, singing/ calling for Tailorbirds and gliding for Kites, to make the game more engaging (Figure 7).

Figure 6: Bird characters in the game. Photo credits: "Purple Sunbird" by Shanthanu Bhardwaj is licensed under CC BY-NC 2.0, "Common tailor bird" by Shantanu Kuveskar from wikimedia commons, "Rose-ringed Parakeet" by Imran Shah is licensed under CC BY-NC 2.0, "Common Kingfisher" by shahin olakara is licensed under CC BY 2.0, "Only Common" by martcatnoc is licensed under CC BY-NC-ND 2.0, "Black Kite Bird" by Alex E. Proimos is licensed under CC BY-NC 2.0.

Figure 7: Common activities of birds. Left to right: Flying, Gathering nesting material, Bathing, Preening. Photo credits: Pigeon flying: CC0, Male House Sparrow carrying nesting material by Keith from Wikimedia commons, Bird bathing: CC0, Preening photo by Bernard Spragg (picture in Public Domain).

To perform an activity in the game, birds need energy. The bird card lists the amount of energy consumed in each activity. Birds gain energy by consuming food available at different landmarks in the city. We kept feeding as a default activity that could be paired with any other activity, which means that a bird could first fly to a landmark and eat, or a bird can eat first and fly later. Some of the activities like flying, gliding and social flights require players to move around in the city. All these activities involve traversing the edges of triangular sectors made on the map. The players can decide to traverse as far as they would like to during each turn. Each unit of distance covered in a flight consumes 1 unit of energy of the bird. To end the flight, players can stop at any vertex of the triangle. On the other hand, some other activities like preening, resting and singing do not involve any movements and players perform them by remaining at their position on the map. As players continue different activities, become eligible for different rewards. Consequently, a self-driven intellectual challenge is created, thus motivating players to accomplish the game's goal of keeping the bird alive across all three seasons.

4.3 Capturing the birds' eye view of the city

A city is a vibrant amalgamation of various landmarks. Looking at a city from a bird's perspective provides a classification that is based on the availability of resources interspersed with anthropogenic elements. Different landmarks offer different access to food resources, with some offering more opportunities (like a garden) than others (like a construction site). We shortlisted three categories of landmarks (high, low and no) to show this variation in available food (Figure 8).

Figure 8: Three categories of landmarks in the city.

After shortlisting landmarks, the next step was to design a way to traverse the map, which however involved multiple iterations. We started with a map that included pathways that were more organic in nature (Figure 9). However, it made keeping track of the birds' movements while counting their energy utilization cumbersome.

Figure 9: A map that included organic pathways. However, it made keeping track of the bird movement while counting energy utilization cumbersome.

In the next iteration we placed different landmarks in distinct sections of the map based on distinct habitat (Figure 10). However, such a design restricted the bird's movement. Hence, we decided to make the city landscape heterogeneous and interspersed with diverse habitats.

Figure 10: To depict the stark difference between the habitats, we placed them in distinct sections of the map. We observed that such design restricted bird movement. We decided to make the city landscape heterogeneous, interspersed with diverse habitats.

We then explored geometric representations on the map, which helped us achieve a midway between making traversing purely organic and restrictive. Finally, we shortlisted a triangular design as it simplified both measurements, i.e., bird movement as well as energy consumption (Figure 11). After finalizing the visual representation of the map, we introduced season-based variability of the resources at various locations eg. availability of insects in the monsoon season.

4.4 Relating Food Resources to Energy Requirements (Introducing Food Dice)

We wanted to incorporate the real-life unpredictable nature of finding food into the game, as birds may not always find the required resources for their activities. Hence, we used food dice, where the dice component helped in introducing chance-based food gathering in the gameplay. The mechanic of throwing the dice informs how much food the bird can consume at that location in that turn. Additionally, access to food for birds differs with seasons. For example, while birds have limited food resources to feed on in the summer season, winter and monsoon seasons offer an abundance of food to the birds. Hence, we used two six-faced food dice: (1) 1 to 6 numbered dice for the winter-monsoon seasons, giving 1 to 6 energy points to the player; and

(2) 1 to 3 numbered for the summer season, giving 1 to 3 energy points to the player. The usage of dice also simplified depicting seasonal variations in the type of food available in the cityscape.

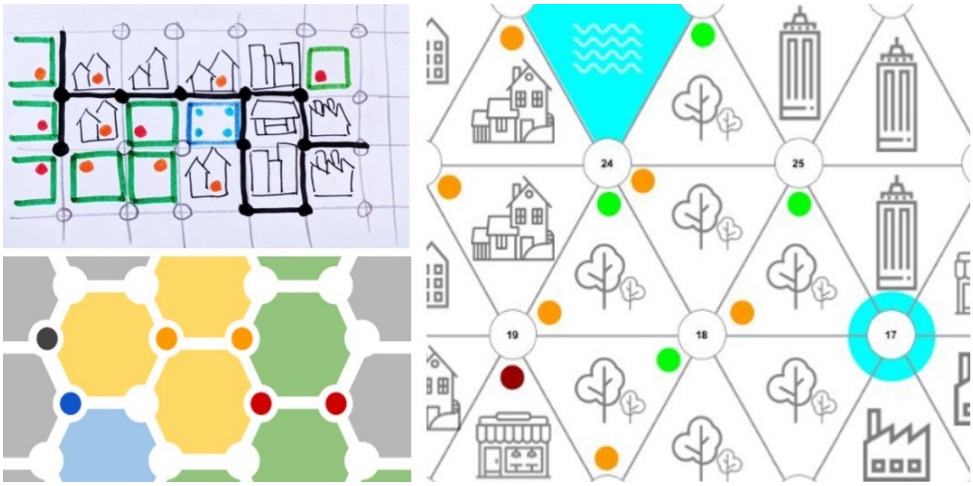

Figure 11: To enable easy tracking of flying activity, we moved to geometric representation of the map. Square shaped tiles posed a question of diagonal movement, Hexagonal tiles added multiple small steps into the count. We finalized the triangular tile design as it simplified both measurements i.e. movement as well as energy consumption.

4.5 Dynamics of situation cards

A city is full of erratic changes and situations. To emphasize the frequent changes that happen in a city and their effects on the birds, we introduced situation cards in the game. They comprise of events with positive impacts (e.g., an increase in the number of insects after unpredicted rain, thus offering more food supply for birds to feed on) and negative impacts (e.g., a fire accident in one block of the city makes the area inaccessible). We introduced two types of situations cards in the game: (1) permanent situations that remain on the board until the end of the season, e.g., a fire outset in an area of the cityscape, and (2) temporary situations that remain on the board until the end of the day. Since the frequency and occurrence of such events in the real-world are random, we made the appearance of situation cards unpredictable in the gameplay. Hence, we used 1-3 numbered dice to introduce these cards randomly in the game, where the number on the dice represents the time of the day a card will be placed on the board. Introducing situation cards gave rise to a new dynamic making the game more challenging and also provided an element of surprise.

4.6 Introducing variety in activities based on seasons

To represent the seasonal variation in the activities and all aspects of the life of a bird, we also included demanding tasks like making a nest and feeding the young ones. The addition of these tasks introduced new mechanics into the gameplay, creating three distinct levels of the game. Winter season became the easy level where the players could perform any actions as birds, and they could remain on the move. The summer season marked the energy-intensive action of nesting and required returning to the nest at the end of the day. Monsoon season posed itself as

the most difficult level wherein players need to feed themselves as well as their fledglings while making sure to return to their nest at night.

Figure 12: Situation cards are designed to fit on top of the map with the help of the numbers given on their vertices.

4.7 Choosing the materials for building the game

While designing the game elements, our emphasis was on using sustainable materials. We started our explorations with paper-based sketches but finally used card sheets to achieve more durability. Hence the cityscape maps, the bird character cards, situational cards, badges all were created using the card sheet. To make the game visually appealing, we also introduced a more realistic three-dimensional look to the cityscape by cutting and folding different parts of the board. However, we opted to use black and white design as a minimalistic way of representing the cityscape.

To represent the birds' food and energy levels, we initially considered edible food. In pursuit, we tried creating pools of 'energy pods' next to the different resource locations on the map. However, selecting appropriate food items that resemble birds' food and keeping a count of the consumption was tedious. We therefore switched to using different colored wooden beads, where each color represents a specific food.

Finally, to represent the birds and their nest, we also explored the use of beads and wooden coasters (refer Figure 4). However, this representation felt too abstract and was difficult to remember. Later, we created standing tokens using a drawing sheet and wooden skewers. Although we did not explore the use of 3D models of the birds due to the lack of resources like 3D printers, physical models however could be used in future to make the gameplay more engaging.

5 USER STUDY OF *Life on Wings*

We conducted a usability study of *Life on Wings* to investigate whether and how the game creates awareness and the overall experience of playing the game. The playtesting was also aimed at gauging how the game contributes to learning about the life of urban dwelling birds. We used a convenience sampling method to recruit participants. The study was conducted with 11 participants (9 males, 2 females) who were in their final year of Masters degree course on

Game Design. The participant age-group ranged from 23 to 28 years. We chose to recruit game design students as our aim was to evaluate the design of the game. We aimed at leveraging their expertise in getting critical feedback on the game components and the overall gameplay. Being game design students, all of them were avid players of digital as well as board games. The testing was conducted as part of a course module on Applied Game Design. The participants were from different states of India and were acquainted with the distinct flora and fauna of different parts of their country. None of the players had specific expertise or experience related to ornithology or birdwatching. All of them had heard and seen four out of the six birds of the game - Kite, Crow, Parakeet and Kingfisher. However, Sunbird and Tailorbird were relatively new to them.

We followed the ethics protocol recommended by the University of the fourth author. Participants were not provided with any financial compensation or course credits for their participation

5.1 Study Setup

The user study was conducted in a studio environment at the university campus. Before starting playtesting, players were given a description of all the elements of the game: the six bird characters, their traits and the associated activities, the game board and game rules and other components. Participants were then randomly divided into 3 groups of 3, 3 and 5 players. Group members were batchmates, but they were not close friends. The groups played the game simultaneously. Each game session lasted for a duration of approx. 30 to 45 minutes.

5.2 Data Collection

We collected data through participant observations and post-study interviews. During the play testing sessions, three authors of the paper allotted themselves to one group each. As the games started, authors made notes on observations about the gameplay, group dynamics, expressions, bodily gestures, actions being taken, over the table discussions and banter. They also took photographs for documentation. Once the group had completed playing the game, the allotted researcher interviewed the participants individually. The objective of the interviews was to gather information about the players' perception of the gameplay. Each interview lasted for about 20 minutes. The interviews were audio recorded and transcribed verbatim, i.e., only those parts of the interviews were transcribed that matched with the research aims. We conducted thematic analysis on the observation data and the interview quotes which generated six themes that we discuss next.

Figure 13: Photo-documentation of playtesting sessions.

5.3 Study Findings

Our qualitative research does not attempt to uncover any generalizable understandings or theories with respect to the effectiveness of the game for fostering empathy. Instead, we focused on obtaining feedback from users who have relevant experiences or knowledge in game design. The qualitative evaluation, in turn, gives us a fair impression into players' attitudes and emotions to help us further refine our game. In this section, we describe the insights gained from the study across six themes. We also describe the caveats in the design of *Life on Wings* that we found through the study.

5.3.1 Learning through collaboration During the playtesting sessions, we observed that players were immersed and engaged in playing as birds. They discussed ways of flying to and from various resource locations as well as strategies to perform more activities amongst each other. They collectively reacted to the random situations and events that occurred in the city and contributed to each other's assessment and understanding of the cityscape and its challenges. For instance, in one group, when a situation card about 'Park is hosting a flower show' appeared, players playing as Tailorbird, Sunbird and Parakeet exclaimed together saying "*it's party time, let's go to the park*" and flew to the location to feed themselves. In another instance, when a situation card introduced the installation of a glass facade, players discussed how they can avoid it while flying. One participant appreciated the collective gameplay and said, "*The immersive experience in itself is sufficient to enjoy the game. I do not think the winning situation adds any further motivation to play the game.*"

5.3.2 Scoring to win hindered learning The scoring mechanism of the game was a mismatch to the game objective. The urge to score more hindered participants' exploration of bird life. Some participants focused more on the winning conditions and performed those activities that could help them score more. They focused less on risky activities like building nests, as it involves responsibilities of taking care of the fledglings and risk of getting out of the game if the nest gets burnt in fire. Instead, participants played a safe game and performed activities that helped them remain alive while scoring more to win the game. For example, going out, getting food and coming back were the most prominent actions of the players. Besides, bathing and gliding activities were also used a lot to score more points.

One participant explained his frustration of how other game players took advantage of the scoring mechanism to win the game and did not play for the real purpose of the game: "*They were playing to win the game. They took baths, 4 times a day. I think birds wouldn't do that. They were playing as players, not as birds. But I played like a bird and I lost the game.*" Another player described his game strategy for a safe game play, "I*f you have found the correct spot to get food, water, etc., you don't need to fly. Only until there's fire or something - if that happens then you have to move.*"

5.3.3 Localised knowledge supported connection Participants appreciated the use of local birds to play the game, as it helped them think about their surroundings. One participant reflected on the reason to see crows in everyday routine, "*Now I know why I see so many crows around but so few tailorbirds. Basically, crows can eat anything. They can also fly longer distances. But Tailorbirds can't fly long distances and need to eat constantly to thrive. So they may not want to fly to residential areas with no or less green.*" Another participant mentioned, "*I learnt how the*

sunbird struggles. Because it cannot store much energy, it has to eat constantly. Now that I know about a couple of birds, I think I will pay more attention to the birds around me."

5.3.4 Bird character cards were informative Participants described learning a lot about the birds and their actions from the character cards. Although they knew about their local birds, the information of their activities was new to them. One participant described how he learnt about the nesting behaviour of birds, "*I did not know when birds put their nests. I had always thought that they live in nests all year round."* Another participant added, *"I found it fascinating to learn all about making the nests, the mating season, feeding the young etcetera.*"

Participants also learnt about the varied feeding patterns of different birds. One participant said, "*Now I know why insects matter. They look like a nuisance but are so important for birds and their fledgelings.*" Another participant similarly described learning about the Kingfisher's feeding behaviour. As Kingfishers feed on aquatic insects and fish, he said, "*I learnt that water is very important for a Kingfisher."* Another participant also quoted, *"I did learn a lot more about how birds exist in general and what do they do every day, something I didn't think much about until today.*"

5.3.5 Use of natural situations supported imaginative gameplay Participants liked the use of natural situations in the game. Although the game followed minimalistic design in terms of the visuals and game elements, participants appreciated the attention to details One participant said, "*I liked the season-based maps. I also liked the use of three days, I think three [days] is just enough to get a flavour for each season and to understand the overall life-cycle of a bird."* Another participant reflected on the different natural conditions like fire and variation in food resources at different sites and said, *"The imbalance of the natural ecosystem is very well understood via gameplay.*" Another participant further added, "*I liked the use of situation cards. They add randomness to the game and make the gameplay more interesting. Like you could imagine how a nest can catch fire, and then how sad a bird would be.*"

5.3.6 Contrasts in life of different birds generated empathy Different birds have different traits and their traits define their movements in the game. For instance, crows can eat anything and can fly long distances, whereas a Sunbird has to eat regularly to sustain energy and cannot fly longer distances. In the words of a participant, "*I learnt about other birds through contrast in the energy levels and the activities they did.*"

One player who played as a Sunbird felt empathetic to it and mentioned, "I could see how kites were behaving [through another player]. They could store a relatively maximum amount of energy which allowed them to go wherever they wanted. It made me feel like a powerless bird" Another participant also shared similar thoughts, "I felt that the game was imbalanced. My opponent [who played as a Kite] was just flying around the map and winning. There was no prospect for a come-back. And that made it frustrating." These differences in the birds' traits made the game more interesting and participants were also keen to play the game again as a different bird.

5.3.7 Issues with the game design We also found some problems with the game design and gameplay. Firstly, actions like bathing and gliding were manipulated a lot, to score more points. There should be some limitation on the different activities that a bird could perform. Secondly, the city map (game board) had few locations that acted as optimum places (some players called

these locations as "premium spots"). These locations not only remained unaffected by any disturbances happening in the rest of the city but also facilitated almost all the activities that birds could perform to gain more points. In reality, birds would also pick such an optimum spot to survive. However, to keep the game engaging and to motivate players to try out more activities across the city, the city map needs to be improved such that identifying or reaching optimum places becomes difficult.

Finally, randomness of the situations in the situation cards was not well balanced. Some players were getting only the positive situations and had abundance of food and water, whereas others were disadvantaged. The contrast in the life-history of different birds further widened this imbalance and some players struggled to find any food resources. The situation cards should have a balance of positive and negative events so that players do not feel disadvantaged by the game design.

6 DESIGN IMPLICATIONS

Based on the insights gained from the study, we present three design implications to encourage future explorations on human-bird cohabitation.

6.1 Focus on collaboration over competition

Our study highlighted that participant learnt about different bird characters through collaboration. They helped each other in understanding the consequences of different natural situations and in formulating their game actions. The collaboration supported shared empathy, where participants felt happy when the other players had happy situations and vice-versa. While all players were playing parallelly as a different bird character, players learn from the experiences of other players. Players felt empathetic to birds who are at a disadvantage due to their specific characteristics like their feeding behaviour affecting their flying. They also tried to best utilize specific characteristics of their birds as powers. On the contrary, the competitive element like scoring was found counterproductive as participants tried to score more by doing activities that were not true in real-world scenarios. Participants tried to play a safe game that will help them keep their bird character alive without doing any of the key activities that a bird typically does in different seasons. The scoring mechanism in fact caused frustration among participants.

Drawing on these insights, empathy-based games should follow a different reward mechanism from scoring. For instance, Pandemic [40] is a board game that allows players to learn about and deal with a deadly contagious disease through collaboration. Players need to team-up to contain the disease and keep the world safe in the game. All players win or lose together. Berland & Lee [11] evaluated the game and found that the game created a space for players to learn about different diseases through collaboration. As such, although the scoring mechanism is independent, it should encourage players to live fully like a bird and to take risky actions however the collective play experience should guide them to understand birds and their natural history better.

While the current version of the game mainly focuses on the birds and the associated activities, we anticipate that the game mechanics and insights from the design process open up several new design opportunities for designing in the space of human-animal coexistence. For example, collaborative games can be designed to create awareness on human-wildlife conflicts and strategies to resolve them, which is the essence of human-wildlife coexistence [45,46,64]. The game narrative can then include both human and animal counterparts, where both parties

to understand the problem from different perspectives. Similarly, we can create more complex games by involving more elements of the ecosystem together like plants, animals, birds and humans, each influencing others through their actions.

6.2 Encourage Local Game Movement

By Local Game Movement, we suggest connecting urban dwellers with wildlife in the same geographic region through playful interventions. Our study highlighted that participant appreciated the use of local birds that they see everyday. They reflected on their everyday observations on why they see certain birds like crows more often than other birds like Sunbirds and Tailorbirds. The use of local context allowed users to connect to the birds used in the game, thereby creating empathy for them. Hence, we suggest that while designing to support empathy, it is important to link it to the local context so that users can convert the gained knowledge into informed actions.

Life on Wings follows a minimalistic design. The game is designed using materials that are easily available, e.g., an A3 card sheet can be used to create the game board and bird character cards. The main motive behind these choices was to support easy customisation of the game based on different cityscapes. For example, apps can be designed that allow easy customisation of the game elements like seasonal boards, bird character cards and situation cards, such that users can print them at their home. These apps can be connected to Google Maps and other local databases such as the municipal corporation or forest department to weave the underlying challenges of human-bird cohabitation of a specific location within the game. For example, data about lack of garden infrastructures, loss of bird habitats due to natural calamities, and associated ecological trends can be incorporated into the game play. The dynamics of the game can also be enhanced by linking the game with a database of real situations in the city, so as to create realistic situation cards for the chosen city map. Furthermore, the game can also be integrated with citizen science initiatives to engage citizens in local activities associated with animal life, as was explored by Gordon and Schirra [25] and Poplin [60]. For instance, these works suggest that serious games are a viable solution to engage community members in urban planning, as it provides a structured yet engaging way to generate solutions for the existing problems.

Learning from previous work [35,57], a hybrid version of the game with both physical and digital media can also be developed in gardens, playgrounds and streets to allow play in public spaces. The game board can be shown digitally on tabletops or a big screen or on the floor using a projector, while some elements of the game can be played with natural elements. For instance, a mobile app can be designed to generate bird sounds during a game play to create an immersive environment. The bird calls can be generated automatically by detecting the movements of the players on the game board, similar to the detection technique explored by Mandryk and colleagues [44]. Physical elements like nests, eggs and bird characters can also be added to further enhance the experience and learning through tangibility. For instance, players can build the bird's nest using play, grass and stems from the surroundings. Alternatively, the game board can be designed manually on the floor, players can perform the birds' action like preening, flying and sleeping physically, and the scorecard can be maintained digitally by the players. Having a combination of both physical and digital media would help in creating an engaging hybrid gameplay [44].

6.3 Facilitate longitudinal first-person perspective

Using first person perspective is not new in games to support empathy. Instead of giving only a snapshot of birds' lives, we provided a longitudinal view by letting players perform different activities spanning different seasons. Players also experienced challenging situations like fire and floods in different parts of a city map, where they made decisions like birds. Our approach to create empathy is different from the existing work [1,38,58], where the focus has been on providing short-term reflection on someone's life and allowing the players to live it in the game momentarily. In our study, we found that thinking as birds helped the players to think about the impacts of human actions on their surroundings. They were able to make connections on why they see certain types of birds more often than others. We however also acknowledge here that we are fundamentally different beings to birds, and as Thomas Nagel [53] argues in his seminal work 'What is it like to be a bat?', we will probably never be able to experience what it is like to be a bird, but rather we can only postulate what it would be for us to be a bird.

A variety of VR and AR based experiences have been developed previously to help individuals experience different situations from a first-person perspective [36,38,69]. However, the majority of these explorations are mainly limited to individual experiences and lack social experience. Learning from work in other contexts [6,77], we suggest creating social AR and VR based games, where the social construct of playing with others would create a better learning experience for players. Players can become birds in the digital medium, and these bird characters then do different activities that feature in the game either digitally or physically. For instance, players can mimic the bird actions physically that can be mediated into the VR and AR medium accordingly. Given the affordances of VR and AR based technologies, we could also add activities such as eating real food like a bird in the game to make the game multi-sensorial, as was explored previously in a VR based game [3]. However, some researchers [59] also noted that the realistic exposure of the animal species through AR and VR technologies may reduce the enthusiasm of individuals to interact with the real-world animals. Hence, we suggest that instead of replicating the activities of animals directly in the mediated digital world, more emphasis should be given on nudging. In *Life on Wings*, we focused on nudging players to know more about the urban birds by providing them sufficient details on their everyday life activities and struggles. We believe that playing the game, may prompt players to venture out in the wild to seek further knowledge about birds or to pay more attention birds in their neighbourhood.

There were certain challenges in terms of how we could portray different seasons and corresponding activities in a board game. For instance, we used different boards to denote different seasons and the corresponding activities. Digital game designers can leverage the digital platform to create more realistic portrayal of seasons and corresponding activities. Designers could also design games with different levels where players experience the life of animal characters over a long course to create empathy. For instance, games can be designed where players can experience the entire lifetime of an animal and face different life challenges along the way. Alternatively, games can focus on certain important events of birds' life such as migration and highlight the challenges birds face during migration.

7 CONCLUDING REMARKS

In this paper, we presented *Life on Wings*, a novel game that aims to create awareness on how birds live in the city landscapes. The game presents a variety of bird activities that six tropical bird species perform throughout the year. Players experience and learn about different traits of birds such as their feeding habits, social and nesting behaviours across three seasons along with

the associated challenges that an urban landscape poses. We illustrated the development process and the design thinking behind our game along with the critical reflection on the selection of distinct bird species, their activities, city habitats and dynamic changes caused due to human interventions. The goal of the game was not to highlight the negative impacts of humans on the environment but rather to create empathy through the gameplay. Our situation cards introduce both positive and negative conditions for birds created by human activities and encourage players to deal with them, as a bird would. This would indirectly encourage people to reflect on the negative impacts of human actions on wildlife rather than preach right and/or wrong about human actions and their implication.

We also presented insights from a preliminary usability study to evaluate the game mechanics. Our study highlighted that participant appreciated the collective reflection aspect of the game. Use of local birds and natural situations was very much appreciated. Participants learnt about different birds and their behaviour through the bird character cards. Playing as birds living in the urban habitat helped participants notice how human activities can help or harm natural habitats, which generated empathy among participants. Based on the insights gained from the study, we presented three design implications to guide further development of playful experiences aiming to create awareness on the human-wildlife cohabitation. These implications talk about supporting collaboration over competition, encouraging local game movement and facilitating longitudinal first-person perspective in the game design through physical and digital counterparts.

While the usability study presents key insights on the game mechanics of *Life on Wings*, the study is not sufficient to understand whether and how the game supports empathy. Understanding empathy and its influence on the user-actions needs a longitudinal field study with board game enthusiasts, which is our next step.

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Received February 2021; revised June 2021; accepted July 2021.