

P / REFERENCES OF DESIGN

COLLABORATIVE DESIGN FOR URBAN BIRDS DRIVEN BY BIRDS' ACOUSTIC DATA VISUALISATION.

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REFERENCES
OF
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REDEFINING
DATA
BOUNDARIES

Digital Interactive Light Show in Sanhaowu Park, Tongji University

Digital Interactive Light Show Activity in Sanhaowu Park

At the Digital Interactive Light Show Event, we displayed moving graphics created from real-time NDSI index data on the trunks of camphor trees and the foliage of shrubs, plants like the octagonal golden disc. These fixtures are situated at a lower level in the park, which makes it easy for visitors to observe the graphics without disturbing habitats. The graphics change dynamically based on the real-time NDSI index data values, which is affected by the level of anthropogenic activity. If the sound level exceeds a particular value, it will cause a drastic change in the graphics, reminding the visitors that their behaviour is causing disturbance to the birds' habitat. The park also has sensors that trigger the lights, creating a playful and natural digital experience.

Dynamic graphics are projected onto plants at lower heights.

Citizens are interacting with dynamic graphics in Sanhaowu Park.

Abstract

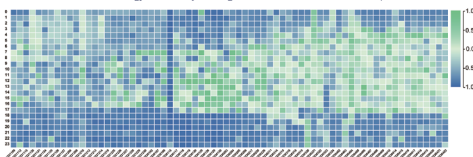
Along with the global ecological crisis, city activities profoundly affect birds' habitats. With the development of data science, birds' acoustic data is considered an ecological indicator for observing and evaluating birds' habitats in urban natural environments. Our research focuses on activating ecological spaces in urban areas that allow birds and citizens to live harmoniously through a collaborative design process. These spaces enhance the natural environment, foster community, and promote sustainable living. Research visualised birds' acoustic index dataset in a specific period to identify the characteristics of bird habitats in a particular urban space. Driven by the data visualisation findings, public events and activities are strategically designed to account for the dynamic interplay between birds and anthropogenic activities. This data-driven empirical research process provides an emerging practice and methodology for designers, urban science researchers and urban citizens to engage together in urban bird conservation.

Research Objectives

Our research aims to develop a collaborative design method for urban bird conservation by utilising birds' acoustic data. It promotes an empirical approach to activating ecological spaces in urban areas. Through analysing and visualising birds' acoustic datasets from Sanhaowu Park, located at Tongji University in Shanghai, China, we aim to learn more about the birds' habitats and how human intervention affects their activities. Drawing inspiration from data discovery, designers, urban science researchers, and citizens from different fields co-create public events or activities to promote urban bird conservation and increase ecological-friendly awareness.

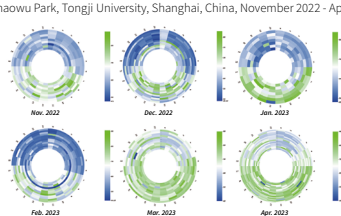
Research Process

Visualisation of the Normalised Difference Soundscape Index (NDSI) at Sanhaowu Park, Tongji University, Shanghai, China, November 2022 - April 2023



The visualisation graph contains hourly NDSI values for each recording day in the six months. Values trending towards 1 indicate higher levels of biophonic than anthropogenic activity, and values trending towards -1 indicate higher levels of anthropogenic activity.

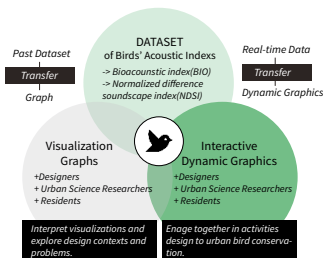
Visualisation of Bioacoustic Index (BIO) at Sanhaowu Park, Tongji University, Shanghai, China, November 2022 - April 2023



The visualisation graph contains hourly BIO values for each recording day in the six months. The level of BIO values represents bioacoustics' strength, i.e., biological activity, in the natural space.

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Methodology and Tools



A Data-driven Design Process:
Transfer and Re-interpretation of Birds' Acoustic Data

This study collected birds' acoustic datasets, including the Bioacoustic Index (BIO) and the Normalised Difference Soundscape Index (NDSI), from November 2022 to April 2023 in Sanhaowu Park, Tongji University, Shanghai, China. The BIO index represents the bioacoustic intensity, indicating the activity level of birds, while the NDSI index represents the proportion of biophonic and anthropogenic activity. During the initial stage, we examined the characters of two datasets - BIO and NDSI - which contained hourly values of corresponding indexes on each recording day of the different months. After comparing various visualisation methods, we concluded that heat maps offer a more accurate and intuitive representation of changes in birds' acoustic data throughout seasons and periods. (as shown on the left.)

Then, our research organises designers, urban science researchers, and citizens from different fields to observe and interpret visualisation graphs. Based on our data discovery, we applied the Four Orders of Design proposed by Richard Buchanan - symbols, artefacts, actions and events, systems and environments - to explore how we could use birds' acoustic data to activate Sanhaowu Park as a natural space where both humans and birds can co-exist harmoniously. Inspired by NDSI index data visualisation, our study co-create a Digital Interactive Light Show Activity in Sanhaowu Park that focuses on the natural and dynamic relationship between birds and human activity. Real-time birds' acoustic data is transferred to dynamic light graphics that change based on the real-time data values. By observing the dynamic state of the graphic, individuals will notice and discern the current activity level of birds, thereby minimising any disruption to their behaviour. This activity promotes greater awareness and protection of urban birds, creating eco-friendly natural spaces within our cities.

Obtained Results

Our research employs acoustic data from birds to develop a collaborative design methodology for urban bird conservation. This approach relies on visualising complex data into diagrams to facilitate exploration, comprehension, and problem-solving among multidisciplinary teams with varying degrees of knowledge. We explore the multiple design possibilities using the Four Orders of Design framework. The Digital Interactive Light Show transfers real-time data into dynamic graphics, conveying information through symbolic language and raising awareness of protecting urban birds through the interactive process. Such a data-driven design process provides a new approach for designers, urban science researchers, residents and other groups in different fields to participate in conserving urban birds and constructing eco-friendly urban spaces.

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P/REFERENCES OF DESIGN

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Conference Website

cumulusbudapest2024.mome.hu

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