SoundJam 2018: Acoustic Design For Auditory Enrichment

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Abstract
This workshop is designed to offer participants an opportunity to explore different kinds of auditory enrichment for a range of animals in different environments. Teams of participants will work together on a small set of briefs provided by domain experts, brainstorming ideas and developing concepts into well-designed blueprints for prototype devices. The day will be organized along the lines of a traditional gamejam.

Author Keywords
ACI, audition, environmental enrichment, auditory enrichment, acoustic design, gamejam, workshop, physical computing.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Animals have evolved forms of communication (signaling) that work in a species-specific environmental context – gestures that can be observed from a range of distances, olfactory cues that can be "posted" and remain until they dissipate, vocalisations and other acoustic signals that act immediately but in some cases with great range, enabling remote contact with conspecifics. Without humans contributing to the

Cross-category enrichment

Fig 1: Puzzle feeder
Capuchin explores pocket filled with ice and strawberries, Lakefield Monkey Sanctuary, 2014.
Courtesy Fiona French.

Fig 2: Suspended straw
Asian elephant family browsing at Dublin Zoo, 2016.
Courtesy Fiona French

soundscape, their auditory perception and associated cognitive abilities would have evolved in relation to what was audible in the surrounding ecosystem.

As human populations expand over the globe, these "natural-sounding" places are slowly disappearing. People use sound insulating techniques to protect their homes and working environments from sound pollution, but animals living in urban and confined spaces must or indeed our proximity, it can be argued that we have a duty to consider their acoustic well-being as part of our attention to their welfare and environment.

On the other hand, many non-human animals also *make* a considerable amount of noise, particularly those living in social groups. Since natural behaviour includes demonstrating the ability to both make signals and interpret others' signals, it is important that an animal has both the opportunity and the motivation to perform this behaviour. It follows that if a social species is housed independently or with a smaller number of conspecifics than would naturally occur in the wild, it is possible that their acoustic repertoire will be diminished, along with the cognitive processing required to discriminate between a range of sounds.

As a consequence of these issues, auditory enrichment for animals in captivity can take two distinct forms – negative, whereby noise levels are reduced, dampened or masked in order to protect animals from intrusive sounds (which could be of human origin or generated by a nearby predator species), and positive, when animals are offered acoustic experiences in order to give them sensory, cognitive or social stimulation.

The workshop will focus on the design of auditory enrichment for a small selection of different animals.

Motivation

Animals living in manmade environments may need protecting from anthropophonic noise. Current research in this area includes passive acoustic monitoring where soundscapes are captured and analysed to infer environmental parameters (Figs 3 & 4) [13], as well as animal behavioural studies [10].

Sensory enrichment uses devices which generate visual, olfactory, tactile and acoustic stimuli. Depending on the type of device, environmental enrichment can encompass different categories – thus, a puzzle feeder (Fig. 1) might simultaneously provide cognitive, food, olfactory and tactile enrichment; a suspended straw bale (Fig. 2) could offer food (foraging), exercise and social opportunities.

Many examples of auditory enrichment involve keepers (and researchers) selecting and playing sounds to the animals in their care. Captive gorillas have shown preference for natural sounds over either silence or music (rock or classical) [12], while captive chimpanzees preferred silence to music [15], as did captive moloch gibbons [14]. On the other hand, Vivaldi (classical) had an observable calming effect on zebrafish [6], "classical music" seemed to reduce stereotypic behaviour in zoo-housed elephants [16], while soft rock and reggae has been documented as reducing stress in kennel-housed dogs [2].

There are many studies in which the purpose of the enrichment is to calm an animal, in which case it makes However, a device designed for auditory enrichment

Technology supporting auditory enrichment

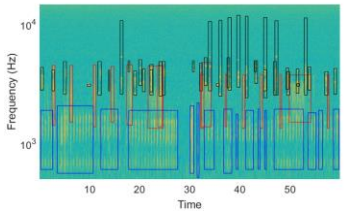

Fig 3 and 4: Songmeter and annotated soundscape
Installed at Mersey Gateway.
Courtesy Paul Kendrick

Fig 5: Grey parrot toy
Courtesy Reinhard Gupfinger

could have the potential to stimulate cognitive activity if the target species was offered a control mechanism that enabled interactivity. This could have the additional benefit of enabling designers to learn more about user preferences.

Several ACI researchers are making progress in this direction. For example, Gupfinger and Kaltenbrunner have developed interactive acoustic devices for captive grey parrots (Fig. 5), which allow the birds to make choices about generating sounds and music, with the aim of gaining insight into how grey parrots perceive and respond to different auditory stimuli [5]. Pons et al. have focused on an exploration of orangutan behaviour in relation to tangible objects with sound-controlling properties [9]. This is specifically in order to offer control and choice to the orangutans using moveable objects that they freely manipulate as part of their normal behaviour.

Biological salience is mentioned by Mancini and Lehtonen [7] as a key factor in ACI design, and this feature is reinforced by Ritvo and Allison [11] who claim that ACI systems should be designed to mimic and augment the user species' natural behavioural tendencies. These examples also showcase the importance of volition and choice when designing sonic enrichment, factors emphasised by Mancini and Lehtonen. We believe that research in this area opens up the possibility for redefining aesthetics so that it is possible to take a more species-centric approach to ACI design.

Aims and activities

The workshop aims to:

- Raise awareness of the value of auditory enrichment amongst the ACI community and beyond.
- Provide opportunities for networking and creative teamwork.
- Investigate novels ways of using technology to support auditory enrichment
- Examine briefs (challenges) relating to different species.
- Generate novel acoustic designs in response to briefs.
- Produce and present design documentation.

We plan to undertake the following activities during the event:

- Brief introductions for participants and members of organizing committee.
- Structured workshop activities enabling people from different backgrounds to meet and discuss specific challenges in the field of auditory enrichment – starting with brainstorming sessions where participants work together to imagine concepts in response to the briefs.
- Discussion of initial ideas leading to formation of small teams focusing on collaborative design briefs and creating early phase concepts.
- Opportunity to present final designs and answer questions
- We plan to share the outcomes of the workshop in a repository of ideas and support future collaborations by keeping a record of participants' skills and interests. There will be a website dedicated to the workshop and we will publicise it via our mailing lists and personal contacts.

www.zoojam.org/soundjam

Biographies

Fiona French is a senior lecturer in the School of Computing and Digital Media at London Metropolitan University. She is course leader for BSc Computer Games Programming and has organised several gamejams and other play related public events. Her research interests include Animal Computer Interaction, physical computing and toy and game design and development. Fiona is currently investigating the design of playful interactive systems for elephants, as part of a PhD in the Animal Computer Interaction Lab at The Open University.

Reinhard Gupfinger is a university assistant and PhD candidate researcher at the Tangible Music Lab at the University for Art and Design Linz, Austria. He is undertaking a study in the context of Animal Computer Interaction (ACI) by designing musical instruments for grey parrots.

Paul Kendrick is an acoustic engineer, with a research focus in AI (machine audition). He has been researching how to use acoustic signals to better understand animals and the environment, focusing in particular on analysis of soundscapes to assess biodiversity.

Call for participation

This workshop aims to bring together expertise from different disciplines, enabling participants to network and move towards designing and developing exciting new auditory enrichment experiences for a range of animals.

The structure will follow the format of previous years' ZooJam and FarmJam workshops [4] [3], which generated a broad range of innovative enrichment concepts in a relatively short time period. The gamejam format shapes the design process by offering both accelerated and constrained design [6] [8] with different rewards for different participants – some focused on outcomes, others on creativity, some on having learning opportunities, others on networking and finding potential research collaborators. To facilitate this, the workshop outputs will be shared publicly.

We invite participants from a wide range of communities, including but not limited to game design, computer science, engineering, education, HCI and ACI, acoustic engineering, animal behaviour and environmental enrichment. This is an opportunity for those with an interest in animal welfare to share ideas and explore the potential of using acoustic technology to enhance enrichment.

We would like prospective participants to contact workshop organizing committee to express their interest.

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