

Moon Jam 2023

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Enhancing welfare for nocturnal species

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This workshop will use a *zoo jam* methodology to explore how technology can support the design and management of systems that enhance visitor experiences while supporting the enrichment and welfare of nocturnal species. Animals that are active in the dark can sometimes be overlooked by humans, simply because we do not perceive them, or we are not being active ourselves. During the event, participants will collaborate to address a series of workshop-themed briefs provided by animal experts from zoos and conservation organisations, with the aim of designing technology-enhanced solutions to the challenges expressed.

CCS CONCEPTS • Human-centred computing • Interaction design • Interaction design process and methods • User centred design

Additional Keywords and Phrases: Design, Animal-Computer Interaction, animal-centred computing, animal-visitor interaction, animal welfare, ecology, control, aesthetics, nocturnal animals, night vision, night perception, game jam

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1 Introduction

The behaviours and needs of nocturnal and crepuscular animals are often poorly understood, partly because they are not easily perceived by humans, due to our poor night vision and usual waking hours. As a consequence, less provision has been made for their welfare, compared with diurnal species, in both wild and managed environments.

This workshop explores some of the issues faced by nocturnal species, using a *zoo jam* methodology, which was first used in 2016 to devise enrichment for hunting animals [8] and aims to extend the reach of design beyond human experience to become inclusive of other species and their interactions with technology [7]. Inspired by game jams, teams of participants in a zoo jam are required to design a focused and feasible output that meets a themed brief, within a limited time frame. A selection of briefs relating to specific species, and based around the jam theme, are provided by species experts who will be available to offer feedback during the event. The briefs are released on the day, to encourage participants to engage spontaneously with the challenges and with each other, supporting a collaborative approach. Design teams are supplied with craft materials so they can model rough prototypes that demonstrate an awareness of scale, potential materials, engineering challenges and environmental infrastructure. French et al. [7] point out that crafting low fidelity designs is '*inclusive and offers a more flexible, unassuming editing process*', compared with sketching, which tends to put visual representation in the hands of one artist in the team. Moreover, 3-dimensional objects offer tactile possibilities and foster an appreciation of perceptual and aesthetic properties. They lend themselves to verbal descriptions, since the labelling that accompanies diagrams and drawings may not be obvious or available, and this facilitates a human-focused mode of presentation.

A multi-species perspective is a crucial aspect of designing for animal welfare in a managed environment, since successful stewardship often imposes limitations on freedom, space and time, both for the animals and for their carers. In the case of zoos, interventions might also impact on visiting members of the public. It is therefore important to consider all relevant stakeholders during the design process, and to aim for solutions that satisfy everyone's needs.

The Moon Jam brings together participants from different disciplines to share skills and ideas. We are discussing welfare and enrichment-related challenges provided by animal experts from local zoos (in North Carolina, USA) and from abroad (in Europe and Australasia), aiming to design and model a range of feasible technology-enhanced solutions. Species experts will be available to respond to questions and offer advice during the event and outputs will be presented locally and disseminated online via the Moon Jam website [18].

2 Background

One of the themes that emerges in our consideration of nocturnal species is the disparity between human requirement for light, in order to perceive the world, and the potentially negative impact this can have on species that have evolved to be active in the dark. Light pollution has been documented as having a negative impact on the ecosystem [19], as it affects metabolic homeostasis in numerous animals, including humans, by altering hormone levels. Most work so far has focused on melatonin production, which affects circadian rhythm and can impact sleep patterns, food intake, immune function, activity budgets and reproduction [11, 17]. It seems to be widely acknowledged that more research is required to find out the long-term impacts of melatonin suppression caused by artificial light, and that certain taxa (amphibians and reptiles) are yet to be studied (Fig. 1).



Figure 1: Frog at night in London garden (flashlight). 2023.

Human artificial light pollution occurs in the wild, as populations spread across the globe, and it also happens in managed environments, such as domestic settings, laboratories, zoos and farms. In the context of farm animals, some research on lighting has been done with indoor-housed poultry [14], finding that supplementary ultra-violet (UV) light, which is present in sunshine but outside human perception, improves chickens' welfare by lowering stress. Meanwhile, rodents, such as hamsters, mice, rats, guinea pigs, are often kept as companion animals and some are used for research purposes, which implies that they are kept in conditions where they are ignored by humans during the night, and possibly kept in solitary enclosures. However, rodents are typically active at night, and many are highly sociable and inquisitive.

Zoo missions usually include education and entertainment, as well as promoting conservation and undertaking research, meaning that visitor experience is paramount. The challenge of providing visitors with the chance to view nocturnal species is often managed by creating a false indoor day-night system. Lights are kept on during the night and turned down during the day, to encourage the nocturnal animals to become active when visitors are present. However, this can give rise to welfare implications, as nocturnal animals are never able to go outside, because they are kept on a night reversal cycle opposite of the actual day-night cycle. A particular area of concern for animals that do not have access to natural sunlight is the link with Vitamin D deficiency, as well as the inability to express behaviours such as basking etc. Moreover, the transition from day to night can be unnaturally abrupt (light switch on timer), unlike the slow fade we experience as the sun sets. Most nocturnal animals, and many diurnal species, such as elephants, are partially crepuscular by nature, so they are well-adapted to lower light levels.

The colour of 'moon light' used in enclosed nocturnal housing is also an issue (many still use blue lights) [9]. In addition, even if sunrise and sunset are replicated, light levels that do not vary during the night do not represent the lunar cycle and may also conflict with microgravitic/magnetic effects [24, 10]. While it is conceivable that light levels could be replicated, some other effects would be very difficult to reproduce.

Another complication associated with indoor housing is temperature, because it also influences behaviour patterns in nocturnal species. For example, some armadillo species may be more active at night due to lower external temperatures and may transition to show higher levels of diurnal activity if temperatures are sufficiently low [2].



Figure 2: Male African elephants visit waterhole at dusk, Namibia. 2015.



Figure 3: Female Asian elephant taking an evening stroll in Wales. 2022.

Studies with zoo-housed elephants [13, 23] have shown that these animals have 24-hour behavioural needs (Fig. 2, 3). We also know that flamingos, for example (Fig. 4), are as active in the evening as they are during the day [20]. Tigers have been observed to move around a lot from 6-10pm [22], while lions and cheetahs sleep more at night in captive settings than they do in the wild [21]. 24-hour enrichment has also been recommended for primates [4, 15], and research with pygmy lorises has shown that they prefer to nest in pairs at night, when given the opportunity and sufficient space [1].



Figure 4: Flamingos at dusk, shoreline, Namibia. 2015.

Understandably, zoo staff regular working hours are limited, which means there is probably no supervision of nocturnal and crepuscular species at night. Although it may be convenient to house animals separately or in smaller spaces when staff are not present, it seems clear there may be negative impacts on socialisation, foraging, exploring and sleeping patterns. Brando et al. suggest: “*Utilising food-based enrichment systems that negate unpredictability due to caregiver schedules and offer greater access to food throughout a 24-hour period enables closer replication of species natural foraging patterns.*” [4]

In many cases, provision of enrichment has been shown to reduce stereotypical and antisocial behaviours during evening hours. Research with kinkajous [3] demonstrated that the provision of complex feeders and scented cloths reduced nighttime stereotypy, while positive affect resulting from olfactory enrichment and foraging opportunities has also been associated with armadillos, bushbabies and sloths. [5] Aardvarks showed increased affiliation and an overall improvement in welfare when given the chance to forage at night [12]. Pygmy dormice were given raised platforms for nesting in the dark and consequently spent less time scratching the glass in their enclosure, which had previously been a stereotypical behaviour [16]. Studies on giraffes, using camera traps, revealed that more foraging opportunities decreased pacing behaviours at night [6], so there is certainly progress being made with some zoo-housed species.

We propose that there is a lot of potential for research and development in this area, which has motivated the topic for this workshop. Nocturnal animals are adapted to tactile, auditory, and olfactory environments but have fewer opportunities to express their full natural range of behaviours/activity budgets, since their environment experiences fewer

changes while we sleep. That creates an area of improvement for us, and therefore, an opportunity arises to develop solutions using technology that help humans observe features and activities they are unable to see or hear very well themselves, and thereby gain insight and understanding about the nature of animals that thrive in a different time zone.

3 Activities

- Ice-breaker activities and small team formation.
- **Presentation of design challenges:**

Animal experts present short species-specific briefs that include information about wild animal behaviours and enrichment goals for zoo-housed conspecifics. Teams assess each brief and brainstorm ideas as mind maps – within strict time limits.

- TEA BREAK
- **Expert feedback:**

Participants share mind maps for each brief as a group exercise, with animal experts providing feedback on concepts. This is an opportunity to filter and refine ideas.

- LUNCH
- Team formation based around individual briefs. Participants select which brief to work on in the afternoon.
- **Collaborative design:**

Each team produces a focused, feasible design that offers a response to the brief, with expert support available.

Important considerations include:

- context – environment, time constraints and ease of use for human carers;
 - logistics – skills and resources required, financial implications;
 - zoo mission statement – educational and entertainment objectives for visitors;
 - meeting enrichment goals – nocturnal behaviours;
 - research potential – design evaluation, iteration and testing with users;
 - more-than-human aesthetics – sensory modalities, cognitive and physical characteristics, social and environmental preferences;
 - animal-centred design principles – consent, control, choice, challenge, competence, confidence etc.
- TEA BREAK
 - Co-crafting miniature physical representations of prototype designs in context (giving consideration to their proposed location, fixings and infrastructural elements) using a range of materials, such as card, paper, pipe-cleaners, bricks, coloured pens, playdough etc.
 - Team presentations of outputs, showcasing and explaining designs, and responding to questions and comments. This will be recorded (with appropriate permissions) and shared publicly online via the Moon Jam website: <https://zoojam.org/moon/>.

4 Aims

- To explore welfare and enrichment opportunities for nocturnal species, through group discussions and collaborative design sessions.
- To address a series of animal welfare briefs provided by experts, by producing focused technology-enhanced designs for enrichment and welfare opportunities.
- To incorporate animal-centred design principles throughout.
- To network and share skills amongst participants.
- To disseminate outputs within the ACI community and beyond.
- To form small teams of researcher-developers who are motivated to take concepts forward into development, prototyping and testing.

5 Outputs

- A specific design that addresses the challenge associated with each brief.
- A shared repository of designs, available online.

6 Call for Participation

The Moon Jam is an exploratory design workshop that considers how we might enhance the welfare of nocturnal species, with the support of technology. Animals that are active in the dark can sometimes be overlooked by humans, simply because we do not perceive them, or we are not being active ourselves.

This is an opportunity for those with an interest in designing for unseen animals, to offer them enriching experiences in managed environments, and to support them to thrive in the wild. We will simultaneously be considering ways of using technology to share insights about nocturnal species with interested humans, such as zoo visitors, researchers and animal stewards.

During the workshop, participants will be presented with a set of briefs provided by different domain experts, each one relating to a specific challenge faced by nocturnal species. These might relate to a managed or a wild environment. Participants will form teams to discuss these briefs in detail and devise potential solutions. The workshop will facilitate collaborative and cross-disciplinary practice, offering everyone an exciting opportunity for creative development.

We welcome participants from a wide range of backgrounds, including but not limited to animal welfare and care, game design, computer science, engineering, landscaping, education, HCI and ACI, animal behaviour and cognition, environmental enrichment, urban planning and architecture.

Please visit the Moon Jam website: <https://zoojam.org/moon> for more information and how to register, as well as links to resources.

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