Playful UX for Elephants

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Abstract

This case study describes approaches to the challenge of designing interfaces for an elephant that enable her to control playful systems in her enclosure, for the purpose of enriching her environment. Our contribution to the symposium will showcase the progress of the enrichment toys and explain in detail how we have collected feedback during participatory design sessions with our play-tester Valli, a female Asian elephant. We have attempted to gain information about her enthusiasm for interacting with different systems and also establish how effectively she can use different interfaces by measuring her responses during the sessions.

Background

There is a consensus among researchers [1] [4] that offering animals more control is a positive step, as it provides an opportunity for them to seek out and respond to a positive stimulus. Mills et al [2] explain the importance for animals of being able to anticipate and prepare for what is expected, as well as being able to respond spontaneously to changes in the environment, in order to maintain an optimal physiological and psychological condition. At the same time, the authors highlight the importance of interventions that can enable animals to enrich their cognitive experience through positive stimuli.

Our aim for this work is to develop some novel forms of cognitive and sensory enrichment for captive elephants, facilitated through the use of technology. Mancini et al [3] emphasise the opportunities that technology affords, providing the means to offer personalised experiences to individual captive animals by monitoring usage and implementing smart, adaptive systems. Conditions for captive elephants in the UK vary with regard to their environmental conditions, their social opportunities and the degree of human interaction they experience, amongst other factors. This highlights the potential utility of a system that is adaptable to suit an individual animal in a specific context.

Ultimately, our goal is to design some interactive toys that encourage playful behaviour, which is widely regarded as a hallmark of good welfare in captive animals [1] [5], indicating that they are not stressed and are therefore able to cope, not only with their environmental conditions, but also with the uncertainty inherent in a playful situation.

Smart toys can be designed to provide the animals with both control and stimulation appropriate to their needs. Specifically, on the one hand, the interaction with smart toys can enable animals to access a range of stimuli in the form of system output; on the other hand, they can afford the animals control over what stimuli to access and when to do so by expressing their choices in the form of system input. Both forms of engagement have significant potential for cognitive enrichment.

Work to date

Our current participant, Valli, was orphaned at birth and has been living with human companions at Skanda Vale Ashram [6] for over thirty years. She and her keepers are the main stake-holders, although we anticipate playful systems being tried in various zoos in UK and Ireland.

Figure 1: Elephant shower

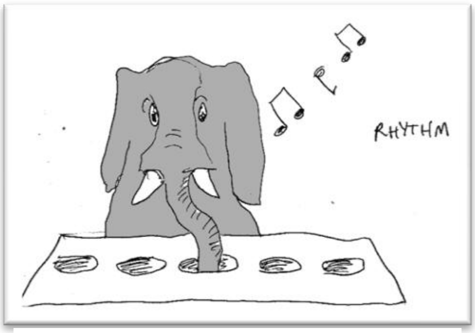

Figure 2: Elephant radio

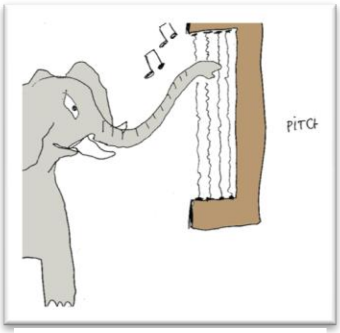

Figure 3: Elephant theramin

Some of the concepts being explored include: (i) a set of shower controls, enabling Valli to control water supply, quality of spray and possibly temperature; (ii) an elephant "radio" system, enabling her to select between different audio outputs; (iii) an acoustic instrument that enables her to manipulate the quality of the sounds emitted.

These toys are works-in-progress, and are being developed using participatory design as much as possible. The design team includes the developer, the keepers and the target user – Valli. All of these stake-holders bring different perspectives to the design challenge, which raises some questions about how we obtain useful feedback. For example, whereas a human might be able to offer a judgment about which controls are most effective for regulating a shower, an elephant can only show us her preferences through her actions.

Our early studies have therefore focused mainly on testing different input mechanisms in order to discover which have most intrinsic appeal for Valli. We have judged a control to be successful if she investigates it without a food reward and is able to easily activate it.

Process

For every design session there are four clear goals that provide focus to the exercise for both the developer and the elephant keepers:

1. Enrichment Goal – e.g. Investigate acoustic enrichment: Does Valli show interest in low frequency audio samples and if so, in what range?
2. Playfulness Goal – e.g. Identify objects and modalities that are conducive to play: Does Valli show signs of object or locomotor play when interacting with this system? Is Valli motivated to use this control in the absence of a food reward?
3. Usability Goal – e.g. Test functionality and evaluate usability: Can Valli effectively use her trunk to activate this switch? Does Valli understand the connection between her input to the system and the resulting output?
4. Technical Goal – e.g. Construct a system that uses capacitance sensing to detect trunk proximity.

At present, during each session, the keepers provide feedback on the enrichment and playfulness potential of a device, while we monitor the extent to which the usability and technical goals are achieved.

We have tested some prototype interfaces, paying particular attention to the aesthetics of the feedback, as we are interested in the quality of the experience for our users. We are aiming to provide naturalistic controls that encourage experimentation and investigation, using natural trunk movements. This is because elephants normally use their trunks to interact with the world and explore places that might not be visible, acquiring chemical and tactile information [7].

Behavioural measurements are used in the design process in two distinct ways: (i) as a way of enabling Valli to control the system (i.e. enabling her to give the system an input) and obtain a stimulus (i.e. receiving an output in return); (ii) as a way for us to understand what kinds of systems might have elephant appeal.

With regards to the first kind of behavioural measurement, her interaction with the most successful controls (from a usability perspective) has been facilitated using hidden sensors that can detect movement or measure proximity. The controls have inbuilt feedback mechanisms, activated by the sensors. This means they provide a tactile indication that she has approached or activated a control, which she is able to sense using her trunk tip. For practical reasons, a control system might need to be mounted in a place where she cannot see the buttons (for example through a hole in the wall), and therefore offering feedback that reinforces her intention and behaviour can be very important.

Figure 4: Valli investigates pipe buttons with hidden sensors

The second type of behavioural measurement involves collecting data about how the system is used. As we are not sure what kinds of sensory output an elephant would necessarily enjoy, the more choices we can offer Valli, the better. To understand Valli's preferences, the usability and playfulness afforded by the different options are being assessed according to how she interacts with a particular system, noting how often and for how long interactions take place. This way, we hope to be able to transcend the (inevitably) human-centred aspect of the designs and allow the elephant to offer us valuable feedback through her selections and modes of interaction (e.g. when, how and how long for she engages with a prototype). This philosophy underpins our approach to participatory design – we enable Valli to make choices about the systems that then contribute to the iterative design process.

Figure 5: Button made from sewing machine pedal

As an example, we have been observing Valli's engagement with buttons made from a variety of materials, including one made using a sewing machine pedal. Watching her spend several minutes exploring a wooden button frame but continuously fail to push the embedded hard plastic pedal led to a revision of the design concept. The keepers concluded that Valli could easily learn to push a large sewing machine pedal if she had sufficient motivation. However, as well as avoiding any associations with food (used to help with training), we aim to develop a system that has intrinsic interest for an elephant. The new design uses natural materials (textiles) in a button that requires no pressure from Valli's trunk but never-the-less provides haptic feedback in the form of patterns of vibration [8].

Future plans

The next stage is to determine what kinds of outputs Valli chooses when she understands that she is in control of the selection. We are investigating systems with acoustic and haptic feedback, as well as offering control over environmental features such as water supply. We will offer Valli a series of identical buttons with similar vibrotactile interfaces. The buttons will be distinguished by the kinds of feedback they activate and we will collect data about how much she uses each button.

In the future, we hope to move from using a digital on/off system for controlling discrete outputs (for example, sound samples pre-selected by a human) to a system that can capture more detailed data about Valli's preferences.

For an acoustic toy, we plan to develop an instrument (similar to a theramin) that allows the user to have control over the quality of the output, for example by manipulating volume, pitch or timbre. We will collect data from the toy so that we can monitor Valli's reactions in the absence of keepers and visitors, hoping to discover what kinds of acoustic experiences engage her interest over a longer period of time. Any results will be fed back into the development process, to refine the design of the toy so that it meets Valli's needs. This kind of data could also be useful for studies that focus on measuring the welfare impact of a technological intervention. There are a number of possible design solutions for such a toy and these will be presented during the symposium with the results of initial trials.

Ethical statement

The Open University Animal Welfare Ethical Review Body (AWERB) have approved the research protocol for this non-licensed research involving elephants at Skanda Vale Ashram and Blair Drummond Safari Park. The work also conforms to the Open University's ACI Research Ethics Protocol.

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