Automated husbandry systems as a method of captive mammal enrichment

Julia Hoy
PhD Student
School of Animal Studies
Background…

What is environmental enrichment?

- Techniques that increase the physical, social and temporal complexity of captive environments

Why provide enrichment?

- To promote the expression of species-specific behaviour
- To reduce the frequency of abnormal behaviour
- To increase ability to cope with challenges
- To improve animals’ wellbeing
Feeding enrichment

Complex – e.g. Puzzle feeders
Feeding enrichment

Simple – e.g. Frozen food
Feeding enrichment

Change how food is presented
Feeding enrichment

Increasing time spent feeding
Tactile enrichment
Social enrichment

Conspecifics
Social enrichment

Contraspécifics
Structural enrichment
Visual enrichment

Mirrors, televisions, reflective items
Auditory enrichment

Natural or artificial sounds, conspecifics or contraspecifics
Olfactory enrichment

Natural or artificial scents
Human-animal interactions

Keeper demonstrations / shows
Human-animal interactions
Interaction with public
Human-animal interactions

Positive reinforcement training
Shoes?  
Gummi Bears?
11 zoo-housed squirrel monkeys

Video cameras recording activity budgets 24/7

4 feeding treatments
- Chopped food on platforms
- Chopped and distributed food
- Whole food on platforms
- Whole and distributed food

Treatments chosen to increase time monkeys spent feeding and foraging, with minimal cost (time or money) to zoo staff
Honours project findings leading to PhD topic

- High individual variation in behaviour
- Most monkeys spent more time feeding
- A few individuals bit keepers initially
- A few individuals stole food from Agoutis
- Very active at night despite being diurnal

- Despite observed improvements in activity budget, and minimal cost in time and money, keepers did not continue with the regime…
Keepers thought the enrichment “worked” so why didn’t they use it?

They have “no TIME to even think about it”!

So... how can captive animals receive lots of enrichment, 24 hours a day, tailored to the needs of individual animals, without requiring any additional staff time?
PhD Research

• **AUTOMATION** = possible solution…

• Radio Frequency Identification (RFID) transponders have been used to automate husbandry in other animal industries

• Link with other equipment to automate processes

• How RFID works:
  - A dormant transponder/tag containing identifying data is activated by a reader to transmit the stored identification number

• Conducted a survey by visiting 30 zoos worldwide
  - Lack of available time as the greatest limitation to providing and evaluating more enrichment
  - Overwhelming support for the development of automated husbandry systems
Survey results: Most beneficial applications of automated systems

- Easy individual provision of food, medication and enrichment
- 24/7 provision of a wide variety of sights, sounds, scents and other stimuli, more accurately replicating nature (increasing reintroduction possibilities)
- Controlling access of animals to different parts of the enclosure
- Recording body temperature non-invasively and regularly
Proof-of-concept trial

- Owl monkeys injected with a temperature-recording microchip with individual identification code
Proof-of-concept trial

- Food or other items placed in up to 24 compartments in an automated feeder unit
Proof-of-concept trial

- When an animal enters the tunnel, their microchip ID and temperature are read, then the tray moves one compartment over the chute, dispensing the contents. Minimum time intervals are set by the operator.
Proof-of-concept trial

- 5 pairs of owl monkeys used
- One monkey has automated feeder, one has “dummy feeder”
- Operational feeder dispenses treats no more than once every 10 minutes
  - raisins, cranberries, peanuts
- Fed standard ration
  - not forced to use device out of hunger
- Exposed to device for 9 consecutive nights
  - due to nocturnality
- Behaviour recorded using 2 types of surveillance camera
Proof-of-concept trial

- Concept proved!

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- But, much more development required…
Thank-you