



# Measuring Behaviour

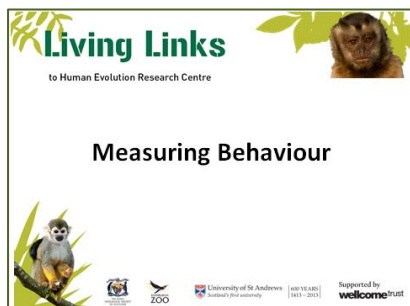
## Teacher's Guide

# Measuring Behaviour

## Suggested Delivery for Power point

**Note:** There is additional information and web links in the notes section of the power point.

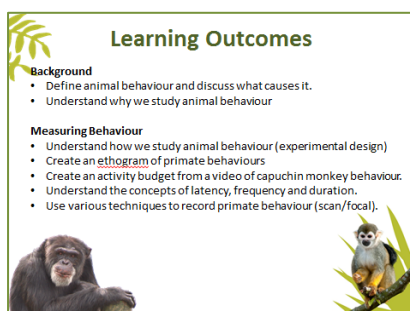
### Slide 1



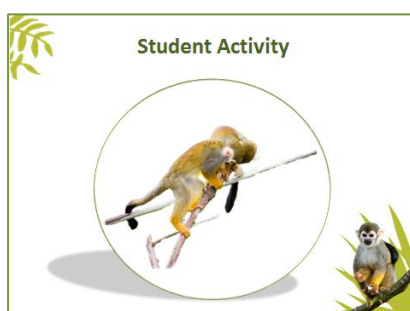
This power point can be broken down into multiple sessions or delivered as a whole.

You may have students read the paper (Leonardi, R., Buchanan-Smith, H., Dufour, V., MacDonald, C. and Whiten, A. (2010). Living Together: Behaviour and Welfare in Single and Mixed Species Groups of Capuchin (*Cebus apella*) and Squirrel Monkeys (*Saimiri sciureus*). American Journal of Primatology 72:33-47.) before, during or after the power point.

### Slide 2

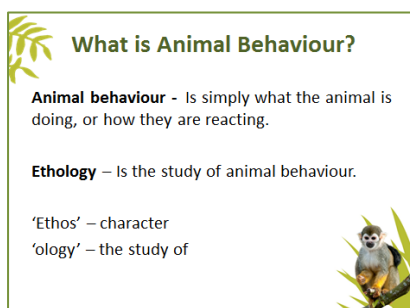


### Slide 3



Whenever this symbol appears on a slide it indicates there is a student activity that can be done to support the learning outcomes.

### Slide 4




Text on this slide comes up on clicks. You may wish to talk through each section by asking the students questions.



## Slide 5

**What causes animal behaviour?**

- To some extent all behaviours are genetic  
*(i.e. a monkey will act like a monkey, and a bird a bird)*
- It is also a response to external/internal environments.
- External environment** – e.g. rain, heat, cold, etc.
- Internal environment** – e.g. hormones, disease, parasites.




Text on this slide comes up on clicks. You may wish to talk through each section by asking the students questions.

## Slide 6

External Environment	
Factor/Stimuli	Behaviour response
Cold	
Rain	
Predator seen	

Internal Environment	
Factor/Stimuli	Behaviour response
Hormones	
Disease	



Text on this slide appears in the right column by white rectangles disappearing on each click. Get the students to discuss what they think the behavioural responses are to the stimuli described in the left column.


External Environment ....Ask students what is the behaviour response?  
-- go find shelter when it rains, huddle together when it's cold, interact with another animal

Internal Environment .... Ask students what is the behaviour response? – hormones - seek a mate, perform courtship behaviours, illness - rest

## Slide 7

**Why Study Animal Behaviour?**

- Analysing animal behaviour informs us about the evolution of how we think, act and interact.
- Understand why animals behave the way they do.
- Understand when an animal has a need and thus use this information to make changes for the animals' welfare.




Discuss **why animals behave the way they do** by using the example of capuchin social structure changes, which are described in the notes section of this slide.

The point about **animals needs** in the zoo can be illustrated by working through the paper 'Living Together', in particular in the discussion about changing the monkeys' enclosures.

## Slide 8

**How to Study Behaviour**

- Formulate initial questions and make preliminary observations.
- Formulate hypotheses and make predictions.
- Choose behavioural measures and research design (methods).
- Define each measure
- Select the appropriate recording methods.
- Practice the recording methods
- Collect the data
- Analyse the data
- Draw some conclusions and return to step 1.



You may wish to spend a bit of time discussing steps 1-4 using the photos with their explanations below. Then explain we will use the rest of this presentation to work through the whole process in more detail.

### **1. Formulate an initial question and make preliminary observations.**

The question that you ask may stem from previous knowledge or observations of that animal or a similar species.



(For example, you may have heard that chimps use tools in the wild, do they use tools in zoos?) Top picture is of a chimp with cracked open coconuts, did she use a tool to do this? Well in a way she did as she would have thrown them against a hard surface to crack them open.

A period of *preliminary observations* allows you to become familiar with the species, their behaviours and their environment. The observation time will also allow you to shape your hypotheses and methods.

(For example finding the best locations to observe from, choosing to observe the whole group or just one etc.)

## **2. Formulate hypotheses and make predictions.**

After your initial observations, begin to think about making predictions from your initial questions.

A hypothesis is tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.

Classic examples of hypotheses are if, then statements.

**If** the primates are stressed by the number of visitors **then** we will see an increase in scratching behaviour as the number of visitors increase.

*General info = Captive primates have been known to scratch more when they are in stressful situations.*

'Dr Ross and his colleagues report in the *American Journal of Primatology* that among their chimpanzees, aggressive behaviour increased when the animals were placed inside holding areas. Chimps spent about 0.1% of their time being aggressive when they were in the enclosures. That rose to 0.5% when the animals were in the holding areas. The researchers also found that chimps scratched and groomed themselves much more. Scratching increased fourfold. Chimps spent 0.4% of their time in the enclosures having a scratch. That went up to 1.6% in the holding areas. Self-grooming, a gentler activity than scratching, increased from 12.3% to 17.4%. In contrast, time spent foraging for food dropped from 18.1% of the total in the enclosures to 10.5% of it in holding areas.'

<http://www.economist.com/node/16963942>

## **3. Choose behavioural measures and research design.**

**Design** - Choose if you are going to do an observational or experimental study. Are you going to observe the animals without making any changes or are you going to alter their living conditions to test your hypotheses.

**Measures** - Ensure you choose measures that are relevant to your hypothesis.

While observing feeding behaviours you may/may not chose to include feeding location. This all depends on your hypotheses.



If you predict the chimps in Edinburgh zoo will spend more time feeding on the ground than up on the climbing frames it would be very important to note where they are feeding from in your observation records. However if your hypothesis is just looking at the amount of time one group of chimps feeds compared to another group the location may be irrelevant.

#### 4. Define each measure

Create and categorise your ethogram. Be very specific in your definitions.

Chimp yawning/chimp screaming example.

If I were to say

\_\_\_\_\_ - a chimp opens its mouth wide and makes a sound.

Would you say this is a yawn or a scream or a call?

*Answer – you could not be sure of what I meant unless I defined it further to say...Yawn - a chimp opens its mouth wide, while in a resting position and makes a quiet sound. You could even further define 'resting position' or refer to another term that you have already defined.*

Create enclosure diagrams if necessary

Define times of day or weather categories if necessary.

To illustrate (steps 1-9) the scientific method we will use the paper – Living Together as an example to work through

Leonardi, R., Buchanan-Smith, H., Dufour, V., MacDonald, C. and Whiten, A. (2010). Living Together: Behaviour and Welfare in Single and Mixed Species Groups of Capuchin (*Cebus apella*) and Squirrel Monkeys (*Saimiri sciureus*). American Journal of Primatology 72:33-47.

Pg 22 & 23 Martin and Bateson- schematic of the process

#### Slide 9



The following section examples are loosely based on this research paper.

Leonardi, R., Buchanan-Smith, H., Dufour, V., MacDonald, C. and Whiten, A. (2010). Living Together: Behaviour and Welfare in Single and Mixed Species Groups of Capuchin (*Cebus apella*) and Squirrel Monkeys (*Saimiri sciureus*). American Journal of Primatology 72:33-47.



## Slide 10 & 11

	Capuchin Monkeys	Squirrel Monkeys
<b>Taxonomy</b>	Animalia, Chordata, Mammalia, Primata, Cebidae <i>Cebus opella</i> or <i>Sapajus opella</i>	Animalia, Chordata, Mammalia, Primata, Cebidae <i>Saimiri sciureus</i>
<b>Size</b>	1.3 – 4.8 kg, with males being larger than females.	0.55–1.25kg, males and females similar in weight.
<b>Habitat &amp; Range</b>	South American forests 	South American forests 
<b>Diet</b>	Mainly fruits and invertebrates, but also eat small animals and plants.	Mainly insects and fruits but also eat other parts of plants, and occasionally small animals.
<b>Social Structure</b>	Group size ranges from 6-30. One alpha male and female and a variety of dominant/submissive interactions throughout the rest of the group. No linear hierarchy exists.	Group size 30-70. There are more adult females in a group than adult males. There is an alpha male and female and a variety of dominant/submissive interactions throughout the rest of the group. No linear hierarchy exists.
<b>Ecological Niche</b>	Forest living insectivore-frugivores that are arboreal and diurnal. They are also prey for wildcats, such as jaguars, birds of prey and crocodiles.	Forest living insectivore-frugivores that are arboreal and diurnal. They are also prey for wildcats, such as jaguars, birds of prey and crocodiles.
<b>Communication</b>	Capuchin monkeys have a wide range of vocalisations, but they also communicate with a variety of visual signals and social behaviours.	Squirrel monkeys scream and give high pitched 'peep' and 'whist' calls. They also communicate with visual signals and social behaviours.

Discussion about the two species we will be researching. You may wish to explain the importance of background/literature research prior to designing a study.

There is an additional pdf document about these two species in the measuring behaviour resources area of the Living Links page


<http://www.living-links.org/resources/materials-for-teachers/measuring-behaviour-lesson-plan/>

Link to Scottish Curriculum - Higher Biology (Unit 3 – Sustainability & Interdependence) - Primate Behaviour

## Slide 12

### 1. Formulate initial questions and make preliminary observations

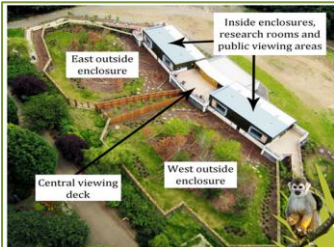
- How do the primates react to living in a mixed species group?
- How does living in a mixed group effect their behaviour and welfare?
- Do they interact in a positive, negative or neutral way?
- When and where should I study the primates?
- How many primates can I study?



Your initial questions may come from background reading, previous knowledge of a species or from discussions with other people working with the animals already.

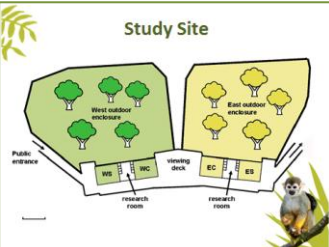
Slides 13, 14, 15 can be used to illustrate the last two questions.

## Slide 13, 14 and 15



East outside enclosure  
West outside enclosure  
Central viewing deck  
Inside enclosures, research rooms and public viewing areas

### Study Site



Public entrance  
West outdoor enclosure  
East outdoor enclosure  
Viewing deck  
Research rooms

### Study Subjects

WEST		EAST	
Capuchins	Sq. monkeys	Capuchins	Sq. monkeys
3 adult females	1 adult male	1 alpha male	1 alpha male
2 young males	3 young males	3 younger males	6 adult females
1 male infant	7 adult females	1 adult female	2 male infants
1 infant one unknown	1 young female		1 female infant
	3 male infants		
<b>Total=7</b>	<b>Total=15</b>	<b>Total=5</b>	<b>Total=10</b>
5.5:1	7.7:0	4.1:0	8.7:0

If you are studying enclosure use it may be important to draw a diagram of your study site. The study subjects slide indicates the number of monkeys that were present at the time of the study. Zoo notation for numbers of animals is depicted as males .females. unknown sex






## Slide 16

**2. Formulate Hypotheses**

1. Squirrel monkeys will be the initiators of interactions, however the capuchins will be dominant over the squirrel monkeys.
2. A change in the enclosure design will have a positive effect on the relationship between the two species.



Use the questions on slide 12 to create these hypotheses. There were multiple hypotheses in the paper however we will only focus on two of these for this lesson


Explain hypotheses are made based on previous knowledge of the species. To get to your hypotheses for this study you would have had to do some background research on mixed species exhibits and wild interactions. This information is in the Introduction section of the paper.

## Slide 17 & 18

**3. Choose behavioural measures and research design (methods)**

**Hypothesis 1** - Squirrel monkeys will be the initiators of associations, however the capuchins will be dominant over the squirrel monkeys.


**Behavioural measure**  
Record species associations, and the direction of the associations.



**3. Choose behavioural measures and research design (methods)**

**Hypothesis 2** - A change in the enclosure design will have a positive effect on the relationship between the two species.

**Behavioural measure**  
Record species interactions before and after the change.




Present the 2 hypotheses then ask the students what behavioural measures should be recorded to prove/disprove them. Behavioural measures appear on a click.

## Slide 19

**4. Define each measure**  
**Ethogram**

- **Ethogram** - A comprehensive list, inventory, or description of all the behaviours of an organism.
- A complete ethogram of behaviour for one species is very long and so we will be creating condensed ethograms which are also known as 'ethnograms'



The concept of ethograms is essential to studying animal behaviour. An ethogram is a comprehensive list, inventory, or description of the behavioural repertoire of an organism. Complete ethograms require thousands of hours of observation.

An *ethnogram* is a chart that lists all the behaviours observed in categories.

## Slide 20

**4. Define each measure**  
**(Behaviour Categories and Definitions)**  
Say what you see, not what you think !

Behaviour Category	Definition
Aggression	Chasing, biting, hitting or screaming at another monkey. May include threat displays, such as shaking branches or lunging at another.
Play	One monkey chases or wrestles with another, in a non-aggressive manner.
Resting alone	Lying or sitting away from the group
Resting together	Lying or sitting in contact with another monkey
Feeding	Searching for/manipulating/ingesting food
Moving alone	Locomoting across the ground or in the trees without another monkey.
Moving together	Locomoting across the ground or in the trees with another monkey.



This is a condensed ethogram/ethnogram which COULD relate to this particular study, NOT the one that was used, that one is more detailed.

Ask the students what behaviours may be 'missing' not included in this table.

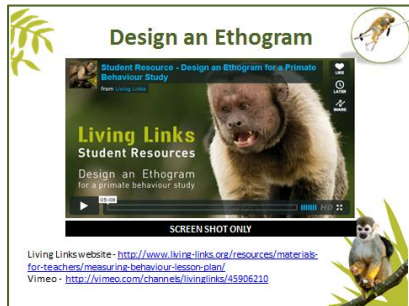
Some that may be of importance would be vocalisations, facial expressions, courtship.

Never use the same word in your definition as the category of



behaviour. Example, category term = sleeping, definition should not include the word sleep or sleeping.  
Sleeping – monkey is asleep.

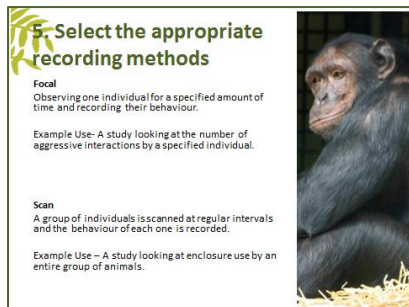
## Slide 21



Use the video (Design an Ethogram) to create a general capuchin ethogram for a study that wants to look at the variety of behaviours that capuchins do.

There is an excel file that explains the variety of behaviours that can be recorded and at what time in the video that they are displayed.

## Slide 22



Picture of dominant male chimpanzee can be used to explain both methods – Studying one individual within a group (eg. Dominant male) or scanning the entire group of chimps.

### Discuss pros and cons of each method.

Focal Problem - Individual disappears from view

Scan Problem - might not catch all behaviours if the group size is large

There are different types of scans (tallying all behaviours of the group without individuals being specifically recorded or specifically recording each individual's behaviour, i.e. Qafzeh – grooming, Emma feeding etc).

## Slide 23



Decide what is important to your hypotheses, the animals' states or events?

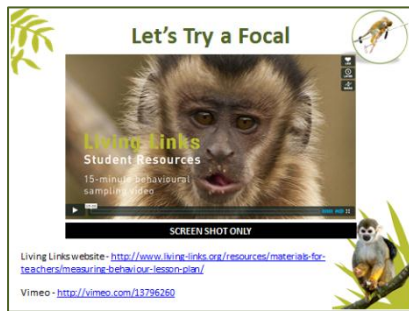
Many examples can be used to illustrate the differences between States and Events

Ask students to give you examples before you click ahead for them to appear.





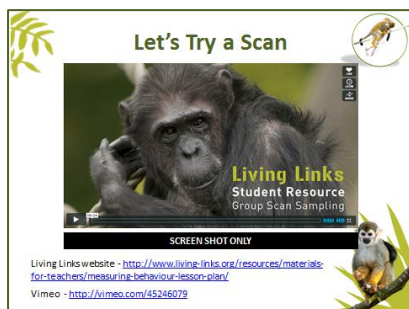
## Slide 24



During the presentation you can get students to shout out what Popeye is doing, on a continuous basis – play by play (for about 1 minute)

This video will also be used for a variety of behaviour recording activities.

## Slide 25



Using session 1 try doing 30 sec intervals and get the students to shout out what the group is doing, and how many are in what activity.

This video will also be used for a variety of behaviour recording activities.

Ensure the scan is systemised by scanning from left to right.

## Slide 26

### 5. Select the appropriate recording methods

**Ad libitum Sampling** – Observer records key behaviours of interest whenever they occur.

**Continuous Sampling**  
All occurrences of behaviour are recorded. When they start and when they stop.

**Point/Instantaneous Time Sampling**  
Behaviour is sampled periodically at regular intervals.

If you let the students shout out what Popeye was doing as a play by play then you could explain that this was an **ad lib** and **continuous** way of sampling.

If you let the students shout out what the group of chimps were doing at 30sec intervals you can explain this is an **instantaneous time sampling** method of **scanning** the group's behaviours.

For another example of **time sampling** you can also go back to the Popeye video and ask them to say his behaviour at 15 or 30 sec intervals.

## Discuss pros and cons of methods

**Continuous sampling** – This is a very difficult method to use on groups unless you have a team to help. It is a very useful method as it catches all the behaviours and their durations (states and events). It is most often used when doing focal samples. Continuous sampling can be utilised well when you have animals that do not go out of view (often) or when you have large easy to follow individuals.

**Point/Instantaneous time sampling** – This method can miss behaviours, it only provides an estimate (not true frequencies or durations) and it is not normally suitable for sequences of behaviour (e.g. reciprocity). However this type of sampling does give a reasonable estimate, a larger number of categories can be recorded and it is simpler/less demanding than continuous recording



## Slide 27

Which recording methods were used in Living together?

<b>Focal</b>	<b>Continuous</b>
<b>Scan</b>	<b>Instantaneous</b>
	<b>Adlib</b>

More than one technique may be employed simultaneously.

**Scan sampling** and **Adlib sampling** were used in the study Living Together. When you click the words they will turn green. Do this after you have asked the students which methods they thought were used.

For more info on behaviour sampling see - Altmann J. 1974.

Observational study of behavior: sampling methods. Behaviour 49:

227-267 [reprinted in Foundations of Animal Behavior, L.D. Houck &

L.C. Drickamer, eds. U Chicago Press, 1996]. PDF here: [princeton.edu/~baboon/publications/1974Behav49.pdf](http://princeton.edu/~baboon/publications/1974Behav49.pdf) on pg 247.

## Slide 28

**Latency, frequency & duration**

**Latency** – Is the time (sec, min, hrs) from a specific event to the start of a behaviour.

**Frequency** – the number of times a behaviour is displayed per unit of time.

**Duration** – The length of time that a single behaviour lasts.

Using the 15 minute video of capuchin behaviour illustrate the following terms.

**Latency** – How long does it take before a squirrel monkey touches the boxes (answer 1min 52 sec) – Latency to approach.

**Frequency** – using Popeye's scratching behaviours for frequency over a certain period of time.

Example - Scratches – 5 times in 5minutes, therefor frequency would be 1 scratch per minute.

**Duration** – Use Popeye video for continuous sampling from time 0:00 to 3:00 to get durations of three different behaviours. Ensure you represent duration information as \_\_\_\_ out of \_\_\_\_ time.

Or

One easy example is duration of time interacting/touching/near the boxes

Popeye is interacting with boxes in some way for 1minute and 26 seconds out of the 3 minute time sample.

## Slide 29

**6. Practice the recording methods**

Capuchin and chimpanzee videos

Extra challenge – Live Squirrel Monkey Cam  
<http://www.edinburghzoo.org.uk/monkeycam.html>  
 or Live Snow Monkey Cam  
<http://www.hIGHLANDWILDLIFEpark.org/snow-monkey-webcam>

Watch our Squirrel Monkey Cam



**Slide 30** - This is not the datasheet used in the study

**7. Collect the Data**  
Example Data sheet

EAST Wing Scan Sampling Check Sheet – 5 Capuchins (C), 10 Squirrel Monkeys (S)

Time: \_\_\_\_\_ Date: \_\_\_\_\_ Weather: \_\_\_\_\_

Behaviour/ time	Aggression	Play	Resting alone	Resting together	Feeding	Moving alone	Moving together	Other	Out of view
Start	II (C-S)	II (C-C)	II (S)	III (S)	I (C)				I (C)
1 min									
2 min									
3 min									
4 min									
5 min									

It is very important to record the time date and weather on every data sheet.

**Ask the students why this important?**

**Answer** – All these factors affect the behaviour of the monkeys, for example if the weather is cold or rainy they are likely to be inside instead of outside, if it is the end of the day they may be more likely to be sleeping if they are a diurnal species of monkey.

You can use a tick tally system to record numbers of monkeys in which behaviour when knowing individuals are not necessary for your study.

**Slide 31 & 32**

**Using your behaviour categories to group data for analysis**

Behaviour	Definition	Type of Interaction
Aggression	Chasing, biting, hitting or screaming at another monkey. May include threat displays, such as shaking branches or lunging at another.	–
Play	One monkey chases or wrestles with another, in a non-aggressive manner.	+
Resting alone	Lying or sitting away from the group	N
Resting together	Lying or sitting in contact with another monkey	+
Feeding	Searching for/manipulating/ingesting food	N
Moving alone	Locomoting across the ground or in the trees without another monkey.	N
Moving together	Locomoting across the ground or in the trees with another monkey in non-aggressive manner.	+

**8. Analyse the data**

Table - Frequency of directions of interactions between the two species

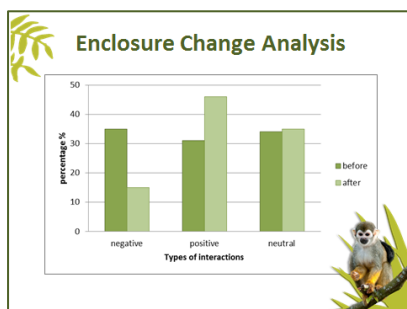
Direction	Negative	Positive	Neutral	Total
Capuchin to Squirrel Monkey	14	10	13	37
Squirrel monkey to capuchin	13	4	4	21

**Slide 31** – Note – In the definition of play it says Non – aggressive – see definition of aggression.

**Slide 32** - In the Leonardi et al 2010 study data was collected on the number and directions of interactions between the

squirrel monkeys and capuchins. The types of reactions were also recorded (positive – affiliative, negative – aggressive and Neutral). This slide shows a table of these interactions. What would you conclude by looking at these results?

**Slide 33**



Discuss analysis with regards to percentages of interactions with regards to the types of those interactions.

**Slide 34**

**7&8. Collect and Analyse the data**

- Collect data and create a simple activity budget for the group of chimps.
- or
- Collect the data and create a simple activity budget for the capuchin Popeye.
- or
- Collect the data and create a simple activity budget from the create an ethogram video.

Use session 3 from the chimp video – students will use time sampling to record the chimps

Students can choose to use continuous or time sampling for the activity budget of Popeye.



## Slide 35



Either create an activity budget for the capuchin Popeye using continuous sampling (15 minutes)

Or

Instantaneous time sampling – Frequencies – Chimp group

## Slide 36 & 37

**9. Draw conclusions**

- **Hypothesis 1** - Squirrel monkeys will be the initiators of associations, however the capuchins will be dominant over the squirrel monkeys.
- **Incorrect** – Capuchins were more likely to initiate associations.
- **Correct** - Capuchins did appear to be the dominant of the two species *(in most cases)*

**Conclusions**

- **Hypothesis 2** - A change in the enclosure design will have a positive effect on the relationship between the two species.
- **Correct** – The frequency of interaction between the species stayed the same however the proportion of positive interactions increased and negative ones decreased.

## Slide 38 & 39

**Anthropomorphism**

**Anthropomorphism** – Applying human qualities (emotions or actions) to non-human animals or things.

Eg. The wind tried to strip the cloak off the man

**Why would anthropomorphism be bad in an animal behaviour study?**

Play/Content Face Sad Face

Fear Grin Happy Grin

Ask students the question – Why would anthropomorphism be bad in animal behaviour study?

Show first picture and ask, what is the chimpanzee doing? What message is he giving?

Show next pic of the person, what is she doing? What is the message?

Third picture, same questions.

Then explain...

Very similar behaviour, completely different meaning to other individuals of that species.

We smile to show we are happy, a chimp will show this type of mouth posture when they are showing fear or submission to a more dominant individual.

The third picture is a chimp exhibiting a play face/relaxed content facial expression.

## Slide 40



Show video

## Slide 41 & 42

