

RESEARCH METHODS
USED IN COMPARATIVE
PSYCHOLOGY

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INTRODUCTION

Comparative psychology is concerned with the study of non-human animals usually and how their behaviour can be applied to understanding human behaviour. Table 1 gives the main advantages and disadvantages of the study of non-human animals to understand human behaviour.

ADVANTAGES

1. Can be used where humans couldn't.
2. Greater control of variables.
3. Whole process of development can be observed, and several generations studied in relatively short period of time (example A).
4. Similar physiology among mammals.

DISADVANTAGES

1. Ethics of use and of inflicting pain and suffering.
2. Ignores role of language and culture in human behaviour.
3. Flexibility of humans to learn.
4. Cognitive processes, like attribution, cannot be studied.
5. Human and physiology is different.

Table 1 - Main advantages and disadvantages of studying non-human animals to understand human behaviour.

EXAMPLE A: SELECTIVE BREEDING

Broadhurst, P.L (1975) The Maudsley reactive and non-reactive strains of rats: a survey Behavioural Genetics 5, 299-319

The "Maudsley Reactive rats" are a specially bred group, which, over a number of generations, shows high emotional reactivity.

Emotional reactivity is measured by the amount of defaecation when placed in an unfamiliar environment. A control strain of rats was also bred with low emotional reactivity.

This study is used to support the argument for the inheritance of the characteristic of anxiety.

EXPERIMENTS

Within psychology generally, the experiment is the most commonly used method. This is because it allows the researcher to control the variables, and focus on specific areas to study (ie: the independent and dependent variables). It is the only method by which researchers can talk about cause and effect.

A "true" experiment will have a number of controls:

- The random assignment of the participants to the conditions (known as randomisation).
- Standardised procedures in all conditions, except for the independent variable.
- Control over the variables in the experiment. In particular, the independent variable (controlled by the experimenter) can be clearly seen to lead to behaviour change (the dependent variable). Confounding variables should be eliminated if possible or compensated for. Otherwise confounding variables can render an experiment's results as untrustworthy; ie: it is not clear that the independent variable caused the dependent variable.

There are three main designs for an experiment: independent design (sometimes called between-participants design) (example B), repeated measures design (within-participants design) (example C), and matched design. Table 2 shows the main advantages and disadvantages of the three experimental designs.

LAB EXPERIMENTS

Here the research takes place in the lab. There are always problems of participants reacting to being studied (ie: changing their behaviour), and this is heightened in the lab experiment. This could be seen as confounding variable.

Table 3 lists the main advantages and disadvantages of using the lab experiment.

INDEPENDENT
DESIGN

REPEATED MEASURES
DESIGN

MATCHED DESIGN

DETAILS

Random allocation
of participants
to one condition
only

Each participant
takes part in
all conditions

Participants are
paired together
based on similarity
in relevant variable,
and then each do
one condition only

ADVANTAGES

- no order
effects*

- each group
identical

- advantages of
other designs

- ideal for
comparison
of two groups

- less participants
needed

DISADVANTAGES

- no guarantee
that groups will
be similar

- order effects*

- difficult to match

- need many
participants

* Order effects are where the participation in one condition influences participation in the later condition. For example, the participants may be tired (fatigue effect) or their performance improves the second time (practice effect).

Table 2 - Main advantages and disadvantages of the three main experimental designs.

ADVANTAGES

1. Establish cause and effect relationship between variables.
2. Control of participants and variables.
3. Comparison of participants.
4. Replication possible because of standardised procedures used.
5. Measure behaviour precisely in lab.

DISADVANTAGES

1. Low ecological validity; ie: artificial study of behaviour.
2. Narrowness of independent and dependent variables.
3. Measures behaviour for short limited period only.
4. Experimenter effects.

Table 3 - Main advantages and disadvantages of lab experiments.

EXAMPLE B: LAB EXPERIMENT WITH INDEPENDENT DESIGN

Villagra, C.A; Ramirez, C.C & Niemeyer, H.M (2002)
Antipredator responses of aphids to parasitoids change as
a function of aphid physiological state Animal Behaviour
64, 677-683

BACKGROUND

Prey will use a number of anti-predator behaviours to survive, but the choice of behaviour is influenced by the energy costs, and risks. For example, running away is a good strategy, but uses a lot of energy. This means that more food is needed, and getting food increases the risk of predation. Animals have an anti-predator decision-making process which assesses these factors.

AIM

To see how food deprivation influences the decisions about anti-predator behaviour among pea aphid (*Acyrtosiphon pisium* Harris) with the parasitoid *Aphidius ervi*, which lays eggs in the host.

METHOD

Three groups of aphids were used: those not deprived of food (control group), and those deprived of food for 24 and 48 hours.

Three main anti-predator behaviours were measured: (i) kicking the parasitoid away with hind legs while shaking the body vigorously; (ii) dropping off the leaf using gravity; (iii) walking away to another feeding area.

The behaviour of the aphid was videotaped for three minutes after first contact between the aphid and the parasitoid.

RESULTS

The aphids showed different anti-predator behaviour depending upon the level of food deprivation. The main findings were (and table 4):

- walking away significantly declined with food deprivation;
- kicking away increased with food deprivation;
- dropping off the leaf significantly declined with food deprivation.

CONCLUSION

With increasing food deprivation for the pea aphid, "the predominant anti-predator response against *A.ervi* changed

from walking away and dropping to kicking" (p679).

	CONTROL GROUP	48 HOUR FOOD DEPRIVATION GROUP
Approximate mean number of walking aways	60	15*
Approximate mean number of kicks	2	4
Approximate mean number of drops	1.5	0*

(* = significant at p0.05)

Table 4 - Summary of main findings of aphid anti-predator behaviour.

EVALUATION

a) This was a lab experiment using artificial conditions; eg: aphids on alfalfa leaf in a petri-dish.

b) The aphids and parasitoids were collected from their natural environment and taken into the lab.

EXAMPLE C: LAB EXPERIMENT WITH REPEATED MEASURES DESIGN

Leonardo, A & Konishi, M (1999) Decrystallization of adult birdsong by perturbation of auditory feedback Nature 3/6, 466-470

BACKGROUND

Young birds need to hear their species' song (auditory feedback) in order to develop normal songs. The completion of song development is known as crystallization. Birds who are deafened when young do not achieve crystallization. It is assumed that once crystallization has occurred, the adult bird's song remains unaffected.

AIM

To see if adult birds' song is influenced by hearing other adults sing.

METHOD

This experiment used five adult zebra finches in a repeated measures design. The birds were placed individually in a sound chamber where their song was recorded, then played

back to the bird in a changed form. This was the first condition. The second condition involved playing back the correct song of the birds. The whole experiment took up to 20 months.

RESULTS

After the first condition, four of the five birds showed decrystallization; ie: their song had become abnormal with stuttering, creation (added "syllables"), deletion (missing "syllables") and distortion. The second condition led to the recovery of the original song.

CONCLUSION

"Our results demonstrate that zebra finches need auditory feedback to maintain their songs in adulthood" (p469).

EVALUATION

a) Small sample size of 5 birds only.

b) The birds were kept in an artificial environment of "custom-designed plexiglass cages" with playback speakers.

EXPERIMENTS WITH SINGLE PARTICIPANTS

There are situations where the number of participants are limited, even to one.

It is still possible to maintain the rigour of the experimental method. Though it appears to be similar to the repeated measures design, it is technically classed as an unrelated design, particular for the statistical test used (Coolican 1998). The only requirement is that the scores are obtained independent of each other.

Table 5 shows the main advantages and disadvantages of this method. Example D shows the use of a single participant experiment in comparative psychology.

ADVANTAGES

1. Useful when few participants are available.
2. Useful when a lot of time and/or cost required to prepare and/or train participants.

DISADVANTAGES

1. Results cannot be generalised like in the lab or field experiment.
2. It is dependent on the participants still being available or experiment stops.

Table 5 - Main advantages and disadvantages of experiments with single participants.

EXAMPLE D: EXPERIMENT WITH A SINGLE PARTICIPANT

Watson, J.B & Rayner, R (1920) Conditioned emotional reactions Journal of Experimental Psychology 3, 1, 1-14

BACKGROUND

Behaviourists believe that all behaviour is learnt by all species through classical and operant conditioning. Thus even sophisticated human behaviours can be explained in the same way.

AIM

The aim was to see if a young child could be conditioned to be afraid of a white rat.

METHOD

The researchers used a nine month old boy called "Albert B". Initially he was presented with the rat and showed no fear reaction (control condition). The experiment began when "Albert" was 11 months 3 days old: as he began to reach for the rat, a metal bar was struck loudly behind his head. This made "Albert" jump violently. This was done twice that day. The fear was created after seven pairings of the loud noise and the rat.

RESULTS

The researchers write with triumph: "The instant the rat was shown, the baby began to cry. Almost instantly he turned sharply to the left, fell over on left side, raised himself on all fours and began to crawl away so rapidly that he was caught with difficulty before reaching the edge of the table".

CONCLUSION

It was possible to teach "Albert" to become afraid of a white rat through classical conditioning.

EVALUATION

a) This research is now seen as highly unethical and thereby unacceptable: "Watson and Rayner were knowingly deciding to cause him distress" (Gross 1990).

b) The control of variables was not very good as "Albert" was only tested intermittently when he was available for study. His mother was not aware of what was happening.

FIELD EXPERIMENT

This is an experiment that takes place in a natural setting. It attempts to maintain all the control and rigour of the experimental method, but outside the lab. The experimenter goes to the participants' natural habitat (example E).

In table 6 are the main advantages and disadvantages of this method.

ADVANTAGES

1. Natural settings used; ie: high ecological validity.
2. Certain topics not possible to study in lab environment.

DISADVANTAGES

1. Less control over variables and participants than lab experiment.
2. Where possible to control, sample is not representative.
3. Replication difficult.

Table 6 - Main advantages and disadvantages of the field experiment.

EXAMPLE E: FIELD EXPERIMENT

Forsman, J.T & Monkkonen, M (2001) Responses by breeding birds to heterospecific song and mobbing call playbacks under varying predator risk Animal Behaviour 62, 1067-1073

BACKGROUND

One anti-predator strategy used by prey is to make mobbing calls. An individual prey who spots a predator or is

being attacked makes this call which attracts other prey.

For example, a mobbing call by a small bird attracts many other small birds of different species to the caller. It is assumed that a large number of birds coming together will reduce the individual risk of being attacked (the dilution effect).

AIM

To see the effect of the mobbing calls of willow tits and redwings on other small woodland birds.

METHOD

The researchers recorded genuine mobbing calls of the two species, and also their territorial songs. With a control recording of classical music, this gave the researchers five different recordings to use. Randomly one of the five tapes were played in a Finnish woodland for ten minutes per day at the same time of day, and the researchers counted the number and types of birds attracted by the recordings.

RESULTS

The mobbing calls attracted more birds than the territorial songs, and this was more than the control tape. The mobbing calls were more likely to attract smaller birds than larger ones.

CONCLUSION

The mobbing calls of willow tits and redwings attracted other smaller birds.

EVALUATION

a) The researchers have less control of all the variables compared to the lab experiment.

b) The presence of the researchers in the woodland may have change the behaviour of the birds.

OBSERVATION

This method attempts to study participants without interfering with their behaviour if possible. The focus is upon what can be learnt from participant in their own habitat acting naturally.

The two main types of observation are (i) structured or systematic observation, and (ii) unstructured.

Table 7 lists the main advantages and disadvantages of observations.

ADVANTAGES	DISADVANTAGES
- Natural environment observed	- Lack of control or causality
- Where experiment not appropriate	- Difficulties of measurement
- Means of identifying new problems/hypotheses	- Relatively small sample
- Where fuller picture of behaviour needed than in experiment	- Some aspects of behaviour not observable
- Describe chronology of behaviour	- Important behaviour may be missed
- Subtlety of interaction can be observed	- Observer bias
	- Difficult to replicate

Table 7 - Advantages and disadvantages of observations.

Often the observation methods are mistakenly assumed to be easy. However there are a number of issues involved in the construction of an observation project.

CODING OF BEHAVIOUR

There are a number of ways to record the data observed: frequency or the duration and intensity of the behaviour. The frequency can be recorded by behaviour coding: counting the number of a particular behaviour (figure 1). While behaviour rating can be used for the duration or intensity of a behaviour (figure 2). Behaviour rating involved scoring each behaviour on a scale.

TICK CHART FOR BEHAVIOUR OBSERVED

Record every time behaviour seen:

1. knees trembling
2. face flushed
3. swallows
4. perspires on face
5. perspires on hands
6. perspires, other areas

Figure 1 - Example of behaviour coding system for rating anxiety during public speaking.

SCORE FOR EACH BEHAVIOUR (using 5 point scale)

1	2	3	4	5
no	just	slightly	quite	very
sign	noticeable	noticeable	noticeable	noticeable

1. shuffles feet
2. hand tremors
3. breathes heavily
4. voice quivers

Figure 2 - Example of behaviour rating system for rating anxiety during public speaking.

SAMPLING

A structured or systematic observation must sample the behaviour being observed. Other observation methods may also sample, but it is less important. This can be time, event, or point sampling.

i) Time sampling

The observer does not watch for long periods but samples the time; for example, five minutes in every hour.

While partial interval time sampling notes the behaviour if it appears for some of the time, and with whole interval time sampling, the behaviour must be present throughout the whole period observed. Momentary time sampling looks to record the behaviour present at the beginning and the end of the time period.

ii) Event sampling

This records every time the behaviour appears. Whole interval event sampling (Oldfield 2001) records the occurrence or not of the behaviour every "x" seconds (whatever the time period being used).

iii) Point sampling

This records the behaviour shown by each individual in turn. It is useful for small groups.

RELIABILITY OF OBSERVATIONS

When observing a large amount of data, it is possible to miss a certain amount or selectively concentrate on the more "interested" aspects. This is observer bias, and challenges the reliability of the observation. This is a example of "chance response tendencies" (Dunnette 1996). The behaviour observed is not representative of the behaviour generally. This can also occur in structured and systematic observations with poorly defined behaviour categories.

It can be overcome by the use of multiple observers (to establish inter-observer reliability), practising with the behaviour categories beforehand (pilot study), and video recording the behaviour to be observed.

Dunnette (1996) adds three other sources of error for reliability: inadequate samples (due to poor sampling), changes in the participants' behaviour (reactivity because they know they are being watched), and changes in the environment due to the observation. The use of unobtrusive observation can reduce the last two problems.

RECORD-KEEPING

When to record the information is more of a problem than it seems. The simple answer is while observing (running or specimen record-keeping). Specimen record-keeping is more detailed than running record-keeping. This mean recording the data later (anecdotal record-keeping). Table 8 compares the different means of record-keeping.

ANECDOTAL RECORD-KEEPING	RUNNING RECORD-KEEPING	SPECIMEN RECORD-KEEPING
ADVANTAGE		
Not rushed	Observe the behaviour as it happens	
DISADVANTAGE		
Memory problems	Difficult to observe and record at same time	

Table 8 - Advantage and disadvantage of three methods of record-keeping in observations.

STRUCTURED OBSERVATION

This makes use of detailed coding frames prepared before the observation. It usually concentrates on specific behaviours and collects quantitative data (examples F and G). Many of the issues discussed earlier (eg reliability) are important here.

Table 9 lists the main advantages and disadvantages of this method. Table 10 compares structured and unstructured observations.

ADVANTAGES

1. Comparison on data possible.
2. Ease of coding observations.

DISADVANTAGES

1. Limited use because such narrow focus.
2. Ignores events other than the observed behaviour.
3. Depends on clarity of definition of behaviour categories.

Table 9 - Advantages and disadvantages of structured observations.

STRUCTURED OBSERVATION

1. Concentrates on specific behaviour.
2. Checklist devised before observation begins.
3. Reliability possible to establish.

UNSTRUCTURED OBSERVATION

1. All behaviour in situation observed.
2. No checklist used, but any and all data recorded.
3. Difficult to establish reliability.

Table 10 - Comparison of structured and unstructured observations.

EXAMPLE F: STRUCTURED OBSERVATION

Jennings, D.J; Gemmell, M.P; Carlin, C.M & Hayden, T.J (2003) Is the parallel walk between competing male fallow deer, *Dama dama*, a lateral display of individual quality? Animal Behaviour 65, 1005-1012

BACKGROUND

Males competing for females can lead to male-male aggression. Fighting has high risks of injury for the males. So threat displays have evolved by which animals can show their "strength" and "quality" without the need for actual aggressive contact.

One such threat display is the parallel walk by male deer. This involves the males walking side-by-side to show their body size and resolve conflicts without physical contact.

AIM

To see if parallel walking among male fallow deer reduces the amount and duration of fights during the mating season.

METHOD

This study is based on observations of the fallow deer population in Phoenix Park, Dublin, and the videotaping of a sample of fighting behaviour. A total of 3296 contests between males (4 years or older) were observed in September-October 1996 and 1997. 189 fight sequences were sampled for study.

The researchers had a coding frame (defined categories) for the behaviour being observed - fight ("interaction that involved antler contact"); parallel walk ("two individuals interacted by walking parallel in close proximity to each other").

RESULTS

A total of 50.8% of all the fights included parallel walking (before/during or after physical contact). Of the video-sampled fights, more of them were not resolved by a parallel walk prior to fighting (34 to 21), and more fights were resolved before contact without parallel walking (42 to 24). The time spent fighting was also not shorter with the presence of parallel walking than when not present.

CONCLUSION

The researchers could not support their hypothesis, and

found that parallel walking was not associated with less fighting. "Fighting duration and rate of engagement in risky behaviour is not related to the presence or absence of a parallel walk" (p1010).

The researchers note that parallel walking occurred often after a fight had started, and suggest an alternative reason for their findings: "the parallel walk may permit weaker animals to withdraw from fighting after a period of direct physical assessment and thereby limit exposure to risky activity" (p1010).

EVALUATION

a) There was no control of the behaviour, and the researchers had to wait for it to happen spontaneously.

b) This method cannot establish the cause and effect relationship between parallel walking and fighting.

EXAMPLE G: OBSERVATION WITH SOME INTERFERENCE

Thusius, K.J; Peterson, K.A; Dunn, P.O & Whittingham, L.A (2001) Male mask size is correlated with mating success in the common yellowthroat Animal Behaviour 62, 435-446

BACKGROUND

Within evolutionary theory is the concept of "female choosiness". This means that females of the species decide which are the best males for them to mate with. Thus males must show the "quality" of their genes in some way.

For the male common yellowthroat (small North American bird), it is the size of the "face mask" (black patch on the face).

AIM

To see if male yellowthroats with larger "face masks" fathered more offspring than those with smaller "face masks".

METHOD

Male yellowthroats at 59 sites were individually caught. The size of the "face mask" was measured after being videotaped for each bird, and blood samples were taken for "DNA fingerprinting". This would allow determination of the fathers of the offspring. The birds were also measured, and given leg bands to identify them. The size of the "face mask" was measured to the nearest square centimetre using two pictures of each side of the

head.

The researchers were later able to take blood samples of the chicks to determine the father.

RESULTS

The number of offspring has a positive correlation with the size of the male's "face mask".

CONCLUSION

Male large "face mask" size is a way to attract females in the common yellowthroat bird.

EVALUATION

a) Catching the birds to take their details is an intervention that might influence the bird's behaviour. So this is not a complete naturalistic observation.

b) Taking blood samples of the birds is invasive, and can be stressful to the birds.

UNSTRUCTURED OBSERVATION

Used often at the beginning of research projects, the aim is to record as much as possible. This not only includes the specified behaviour, but the context and surroundings of the behaviour. It is not often used in comparative psychology.

Table 11 lists the advantages and disadvantages of this method.

ADVANTAGES

1. Whole context of behaviour observed.
2. Ecological validity.

DISADVANTAGES

1. Observer bias (with no clear focus).
2. Interpretations by observer.

Table 11 - Main advantages and disadvantages of unstructured observation.

CASE STUDY

This method is concerned with collecting a large amount of information about the subject of the study, which may be a single participant (example H) or a small group. Table 12 lists the advantages and disadvantages of the case study method.

ADVANTAGES	DISADVANTAGES
- Builds up detailed picture	- Not possible to generalise findings
- Source of future hypotheses	- Cause and effect not possible to establish
- Outstanding cases can be studied	- Situation and time bound
- Insight can be gained from one example	- Poor replicability
- Tentative support for theory or challenge orthodox view	- Biased observer
- Documents rare cases	

Table 12 - Advantages and disadvantages of the case study method.

EXAMPLE H: CASE STUDY

Gardner, R.A & Gardner, B.T (1969) Teaching sign language to a chimpanzee Science 165, 664-672

BACKGROUND

Behaviourists believe that language in humans is learnt through conditioning, and there is no innate mechanism that humans have that non-human animals don't have. If language is learnt, then it must be possible to teach it to non-human animals, like apes and monkeys.

AIM

To see if a chimpanzee can be taught to understand and use language.

METHOD

This research involves a project to teach American Sign Language (ASL) (based on gestures and hand movements) to a

female chimpanzee called "Washoe". The project began in June 1966 when "Washoe" was between 8-14 months old (her exact age not known).

ASL was taught through imitation, and operant conditioning. The latter involved the reinforcement of the use (and correct use) of signs, and not reinforcing the lack of signs. For example, stopping tickling (reinforcement) unless "Washoe" signed "more".

Twice a day researchers filled in a checklist of signs used, and "at least one appropriate and spontaneous occurrence each day over a period of fifteen consecutive days was taken as the criterion of acquisition".

RESULTS

After 22 months of the project, "Washoe" showed 30 signs that met the acquisition criterion. Some combination of signs spontaneously appeared (eg: "go-sweet").

CONCLUSION

"Washoe" showed evidence of the correct use of a number of signs within ASL. The researchers say: "We have been able to verify the hypothesis that sign language is an appropriate medium of two-way communication for the chimpanzee". (This research continued after this report of the first two years of the project).

EVALUATION

a) Has "Washoe" learnt ASL in the same way as humans learn vocal language? Even the researchers admit that it is difficult to answer such a question, or a question like "Do you think Washoe has language?"

b) This is a single case study of a chimp reared by humans, and given special attention and teaching. Any findings cannot be generalised to chimpanzees or apes and monkeys as a whole.

BIBLIOGRAPHY

Breakwell, G.M et al (1995) (eds) Research Methods in Psychology Sage: London

Coolican, H (1994) Research Methods and Statistics in Psychology (2nd ed) Hodder & Stoughton: London

Coolican, H (1998) Teaching psychological methods and statistics at A(ny) level. In Jarvis, M (ed) 1998 ATP Conference Association for Teaching of Psychology: Leicester

Davis, T (1995) The experimental method in psychology. In Breakwell et al op cit

Dunnette, M.D (1996) Personnel Selection and Placement Wadsworth: Belmont, CA

Gross, R (1990) Key Studies in Psychology Hodder & Stoughton: London

Leary, M.R (2001) Introduction to Behavioural Research Methods (3rd ed) Allyn & Bacon: Boston

Oldfield, S.J (2001) A critical review of the use of time sampling in observational research Nursing Times Research 6, 2, 597-608

Wilkinson, J (1995) Direct observation. In Breakwell et al op cit