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Kevin Brewer

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Kevin Brewer BSocSc, MSc

An independent academic psychologist, based in England, who has written extensively on different areas of psychology with an emphasis on the critical stance towards traditional ideas.
     A complete listing of his writings at http://psychologywritings.synthasite.com/ and http://kmbpsychology.jottit.com.

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1. LIMITATIONS AND BIASES IN SPORT

1.1. INTRODUCTION

The home advantage is "the consistent finding that home teams in sports competitions win over 50% of the games played under a balanced home and away schedule" (Courneya and Carron 1992). Studies of different sports, like baseball, basketball, and football, covering over 200 000 games find a home-win advantage of between 54-68% (Nevill et al 2002).

But what causes the home advantage? Courneya and Carron (1992) identified factors like learning and familiarity with ground, travel, rules, and most importantly, crowd. For example, home wins increased with crowd density - 55% in stadia less than half full to 57% when greater than half full in Major League baseball (Schwartz and Barsky 1977). The effect of the crowd is in raising the home team's performance and/or subconsciously influencing the officials (Nevill et al 2002) [1].

In the latter case, studies have found more subjective decisions in favour of the home team (eg: penalties and sendings-off in English and Scottish football; Nevill et al 1996).

While Lehman and Reifman (1987) found an interaction between home advantage and status of professional basketball players. So, "star" players were penalised significantly less at home than away, but there was no difference for other (non-star) players.

But studies assessing the subjective bias of officials do not always take other factors into account - eg: perception errors by officials. These can be influenced by crowds. For instance, time constraints on decision-making lead to a focus on the most salient cues rather than all options. The presence of crowd noise, particularly in relation to contentious decisions, exacerbates the perceived time constraint (Nevill et al 2002).

Askins (1978) offered this explanation as well: "during the course of any contest there are many incidents which appear ambiguous, even to the most

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[1] Human performance in sports generally may have reached a peak (appendix 1A).

veteran officials. When this occurs, officials do basically what all humans do in such a situation, they seek clarification through any means available at the time. Crowd reaction may sometimes provide the cue which prompts the decision" (quoted in Nevill et al 2002).

1.2. NEVILL ET AL (2002)

Experimental studies attempt to isolate factors and influences, but are not real-life. One such experiment was performed by Nevill et al (2002) on crowd noise and referee decision-making in football.

Forty qualified referees from England, with varying years of experience, were asked to decide on the legality of 47 tackles/incidents in a video-recorded match from the English Premier League. Using an independent design (table 1.1), referees watched the incidents with the original crowd noise or in silence. The referees had six seconds in each case to decide either "home foul", "away foul", "no foul", or "uncertain".

- Participant design - independent measures.

- Independent variable - presence or absence of crowd noise during decision about tackles.

- Dependent variable - rating of tackle using four options (nominal type of data).

- Sample - volunteer.

- Hypothesis (one-tailed) - "crowd noise results in fewer fouls against home players and more fouls against away players" (p265) (partially supported by data).

Table 1.1 - Aspects of experimental design of Nevill et al (2002).

The participants were significantly more certain in the silent condition (ie: less "uncertain" responses - mean 3.7 vs 7.4), and chose more "no foul" responses (mean 19.2 vs 17.2 in crowd noise condition). They also chose more "home foul" responses (ie: foul against home player) in the silent condition (mean 14.8 vs 12.5 in crowd noise condition - ie: 15% more). There was no difference in number of "away foul" responses (ie: foul against away team) (mean 9.9 in crowd noise condition vs 9.3). The "dominant effect of crowd noise was to significantly reduce the number of fouls awarded against the home team, rather than increase the number of fouls gains the away team" (Nevill et al 2002 p269).

Nevill et al (2002) offered a possible explanation

for their findings in a real match: "Given that making a bad call and crowd noise will raise levels of stress in the noise group referees in a similar way to that of the match referee (sources of stress felt to be difficult to control), the coping strategy is likely to be one of avoidance. As the crowd is likely to make it clear if they feel a decision was 'wrong', avoidance could be interpreted as simply not making the unpopular decision to penalise the home team when assessing less clear or contentious challenges. Whenever a home player commits a foul, the crowd's reaction is capable of activating the potent stressor of making a bad call, thus increasing the level of uncertainty or indecision among referees, resulting in no decision (avoidance) and fewer fouls against the home team" (p270).

The external validity of the experiment was assessed by comparing the decisions of the participants with those of the match official. Removing the "uncertain" option, for the other three responses the participants in the crowd noise condition "agree very closely with those of the match referee" (Nevill et al 2002).

1.2.1. Evaluation

1. Use of qualified referees as participants, with varied experience (less than one year to 43 years [2]). But volunteers (no details, including if any female, though probably not), from one area of England. Good sample size, but no details of why forty.

2. Standardised procedure with video recorded tackles and noise level. But extracts from one match only (Liverpool FC vs Leicester City FC in the 1998-9 season), and the referees knew the teams. Better to use another league unfamiliar to all. The experiment involved watching a televised game which is not the same as refereeing a real game [3].

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[2] The evidence generally on refereeing experience and influence of the crowd is inconclusive (Dohmen and Sauermann 2015).

[3] Pettersson-Lidbom and Priks (2010) were able to use a real-life example in Italian football in the 2006-7 season as 24 games had no crowd due to bans after hooligan violence. Significantly less yellow cards and fouls were awarded against the home team as compared to the away team in games with crowd noise than not by the same referees. There were 2.6 fewer fouls against away players without a crowd compared to with spectators, and home players had 1.7 more fouls in empty compared to full stadia (Pettersson-Lidbom and Priks 2007).

Pettersson-Lidbom and Priks (2007) stated: "Soccer referees are supposed to be neutral. Yet, we find evidence that Italian referees change their behaviour in games played without spectators. The evidence we provide is consistent with the idea that individuals are likely to change their behaviour under influence of social pressure. An alternative explanation of our findings is that players, rather than referees, change their behaviour in games without spectators. However, for this explanation to be true, home players must play less intensively in games with spectators compared to without. We find it more

3. Random allocation of participants to two conditions. But not equally - 22 in crowd noise condition and 18 in silent condition. No details about whether participants tested alone or in group, nor the context of the experiment (eg: training course). Thus, did the participants know it was an experiment? No mention of ethical considerations, though there are few concerns. Asking participants to sign a consent form, for example, may change the nature of the perceived situation as compared to a training course.

4. Good number of tackles to assess with clear response options. But "uncertain" response not available in real game. No details of how 47 tackles chosen.

1.3. REFEREE BIAS

Studies, usually statistics-based, have looked at the specifics of referee bias. For example, Dohmen (2008) focused on the awarding of penalty kicks in football. Home teams were more likely to be awarded a penalty kick in ambiguous situations (as rated by independent observers), especially when the home team was one goal behind.

In terms of the awarding of yellow and red cards, for example, Boyko et al (2007) found evidence of less yellow cards for home team players compared to a statistical prediction based on relative team strengths. Other studies linked this difference to crowd density or size (Dohmen and Sauermann 2015) [4].

Referee bias is less evident when supporters are physically further away (eg: stadiums with running tracks around the outside of the football pitch) (Dohmen and Sauermann 2015).

Garicano et al (2005) found bias in the adding of stoppage (injury) time by football referees in close games in the Spanish Primera Division. Using data from the 1994-5 and 1998-9 seasons, stoppage time at the end of the game was 35% longer when the home team was behind by one goal as compared to the average (three minutes), but this reduces by 29% when the home team was ahead by one goal. This difference was not evident for stoppage time at the end of the first half.

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reasonable that home teams play more aggressively in games with spectators. Thus, we are probably understating the true referee bias effect" (p5).

[4] For example, Garicano et al (2005) found that the size of the crowd increased referee bias - eg: one standard deviation increase in crowd size equalled 20% more home team favouritism.

In terms of one team scoring during injury team at the end of the game, the stoppage was 15% longer if the visitors scored than if it was the home team.

Garicano et al (2005) also found more bias in 1998-9 when a win was worth three points compared to two points in 1994-5. Bearing their findings in mind, the researchers estimated that "bias changed the result of approximately seven games or 2.5% of all games in our sample" (Garicano et al 2005 p215).

Among other studies, Dohmen (2008) found the difference in end of game stoppage time to be only twenty-two seconds in an analysis of 1166 close games in the German Bundesliga. "These findings suggest that social pay-offs influence the referee's decision who seeks social approval and tries to avoid social sanctioning by the crowd" (Dohmen and Sauermann 2015 p8).

In all cases, where the game was not close (ie: two goals or more difference) this bias was not found (Dohmen and Sauermann 2015).

1.4. APPENDIX 1A - PEAK ATHLETIC PERFORMANCE

Berthelot et al (2015) argued that "human capabilities cannot progress indefinitely and have reached a state of stagnation". They collected data on world records (WRs) from five disciplines - track and field athletics, cycling, speed skating, weightlifting, and swimming - since the 1896 Olympics. "A decrease in both the frequency and the relative improvement of WRs was discovered, revealing a major decline in progression, suggesting an exponential - thus limited - development with time" (Berthelot et al 2015).

Berthelot et al (2015) reflected on the factors that could explain the "performance stagnation" now and in the future:

i) Technological innovations - "Every effective innovation results in a rapid improvement in athletic performance, and each technological ban has been followed by a downward shift of the best athletic capacities... Without technology, the level of many disciplines would not have risen to the current standard. However, money, through the cost of technology, may act to raise the next limitation step" (Berthelot et al 2015).

ii) Morphology (ie: body mass and height) - A levelling-off of growth in athletes.

iii) Phenotypic selection - Athletes with the more adapted phenotypes (ie: "best genes") have risen to the top, but a limitation may "rise from the exhaustion of new demographic pools, when all potential phenotypes have

been detected, selected and trained" (Berthelot et al 2015).

　　iv) Socio-cultural influences - eg: "Cold War" accelerated progress in performance.

　　v) Environment - eg: "climate change".

　　vi) Economic factors - eg: in terms of financing sport.

　　vii) Random effects - eg: injuries.

　　Berthelot et al (2015) offered a selection of solutions to "performance stagnation" - new resources (eg: nanomaterial), refined measurement (eg: millimetres or milliseconds), allow banned technologies and substances, and rule changes.

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2. RESIDENTIAL PSYCHOLOGY

- Appendix 2A - Influence of cleaning smell
- Appendix 2B - Personality and environment
- References

A person's home is "more than a place in which an individual resides but rather a unique place where a person's past, present, and future selves are reflected and come to life" (Graham et al 2015 p346). Studying the home is a part of environmental psychology that covers topics like community, privacy, self-expression, and personal identity (Graham et al 2015).

Israel (2003) argued that the appearance of the home is a reconstruction of past spaces in which a person felt secure. Thus, for instance, a person may "unconsciously incorporate features into a space that evoke qualities from a well-loved grandmother's home. The motives behind these decisions may be propelled not by conscious tastes and preferences but rather by the emotional connections promoted by these elements" (Graham et al 2015 p347).

Gosling et al (2013) described three features of the space within a home:

i) The physical features of the room (eg: lighting levels, temperature, colour) influence the activities performed there [5]. For example, the crowded and chaotic environment of a house has been linked to differences in children (eg: cognitive performance; negative behaviours) (Graham et al 2015).

ii) The arrangement of items in a room give an impression to others of the owner of the space. For example, Carney et al (2008) described differences in the living spaces of Americans, with "liberals" having indicators of travel and culture (eg: world map on the wall) and "conservatives" signs of convention (eg: US flag) (appendix 2B).

iii) Features of the room influence the emotions experienced there. For example, individuals with photographs of loved ones displayed [6] report less loneliness and social isolation (Gardner et al 2005).

Graham et al (2015) designed a survey called the Inventory of Desired Ambiance in the Ideal Home (IDAIH)

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[5] Also the smell (appendix 2A).
[6] Termed "social snacks" ("tangible reminders of connections to others"; Graham et al 2015).

to study the "psychological ambiances in the home". It
contains a list of eighteen rooms or spaces in a home
(table 2.1), and respondents are asked to imagine the
ideal version of each with the question: "As you enter
each of the following spaces, what are the most important
emotions or perceptions you would like to evoke within
yourself and others?" [7]. A list of twenty-nine options are
offered (eg: privacy, safety, wealth) (table 2.2), of
which two were chosen for each room/space.

Master closet	Master bedroom	Master bathroom
Study	Guest room	Entryway
Living room	Dining room	Guest bathroom
Front porch	Kitchen	Pantry
Media room	Game room	Sitting room
Utility room	Garage	Backyard

Table 2.1 - 18 rooms/spaces used by Graham et al (2015).

Abundance	Family	Wealth	Comfort
Inviting	Relaxation	Love	Rejuvenation
Romance	Friendship	Community	Tranquillity
Quiet	Productivity	Creativity	Fun
Self-expressive	Organisation	Safety	Privacy
Togetherness	Inspirational	Joyousness	Excitement
Spirituality	Entertaining	Cosy	Uniqueness
Sophistication			

Table 2.2 - Options to describe ideal room/space.

Among 200 Internet respondents, the most popular
options overall were "inviting", "organisation", and
"relaxation". There was strong consensus for each room
(average 65%) (table 2.3). On average, sixteen of 29
options were chosen throughout the house. However, there
were individual differences with extraverts, for
instance, reflecting the desire for their spaces to
encourage interaction with others.
Factor analysis of the 29 options resulted in six
factors - Restoration (eg: privacy, relaxation), Kinship
(eg: family, togetherness), Storage (eg: organisation,

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[7] "Your ideal home is your perfect house, the one you would build if you had unlimited time and
money, the one you would design if you could have anything you want. It fits you like a glove, and
fulfils your every need. Imagine you are in your ideal home. You have all the money in the world, so
there is no limit to what you can create in your ideal home. Additionally, no matter what you pick for
your home, it's perfect with everything else you choose, and your taste in décor is flawless. There is a
door to every room in your ideal home. In your ideal home you can feel exactly the way you want to
feel in each living space. As you enter each of the following spaces, what are the most important
emotions or perceptions you would like to evoke within yourself and others? Pick the words that best
describe the emotional goal or feeling you want to feel in each room" (Graham et al 2015
supplementary material p2).

abundance) Stimulation (eg: fun, entertainment), Intimacy (eg: romance, comfort), and Productivity (eg: productivity, quiet) [8].

Room/space	Popular options
Front porch	Inviting Relaxation Quiet
Living room	Family Comfort Relaxation
Master bathroom	Relaxation Rejuvenation Privacy
Pantry	Organisation Abundance Productivity
Master closet	Organisation Abundance Privacy

(Data from Graham et al 2015 figure 1 p352)

Table 2.3 - Most popular options in selected rooms.

APPENDIX 2A - INFLUENCE OF CLEANING SMELL

Within any environment will be smells (eg: odours, scents or aromas), and these will have a non-conscious effect on cognition and behaviour. Pleasant smells are used to influence consumer behaviour, for example, particularly in relation to good associations (Holland et al 2005).

Holland et al (2005) focused on cleaner scent in their three experiments. In the first one, exposure to such scent increased the access to cleaning-related words. Fifty undergraduates in the Netherlands were randomly exposed to the citrus scent of an all-purpose cleaner or no scent while performing a lexical decision task. This involved the speed of recognising a word fragment as a real word in forty trials (with twenty real words, of which six were related to cleaning, and 20 non-words). Participants responded significantly quicker to the cleaning-related words than the other words in the scent condition (mean 590 ms vs 625 ms), and to both types of words in the control condition. The participants reported no conscious awareness of the cleaning smell in the scent condition. The researchers believed that this

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[8] Five options did not load on the 6 factors (eg: uniqueness, wealth).

study was "initial support for the idea that a scent can facilitate access to behaviour concepts that are semantically associated with the scent without participants' conscious awareness of this effect" (Holland et al 2005 p691).

In a second experiment, with 56 more Dutch undergraduates, participants were asked to write down five activities that they were intending to perform later in the day (in the presence of a cleaning smell or no scent). Two independent judges scored the activities as cleaning-related or not. Participants in the scent condition listed cleaning-related activities significantly more than the control condition (36% vs 11%). Again the participants reported no conscious awareness of the scent during the experiment. This experiment suggested that "the scent brought the cleaning concept into consciousness. This 'entering of consciousness' effect may not be a direct cause of the exposure to the scent itself, but rather may have emerged because participants relied on accessible information in order to list activities for future action" (Holland et al 2005 p692).

However, this experiment only measured intention, whereas the third experiment included actual cleaning behaviour. Twenty-two more Dutch undergraduates completed a filler questionnaire (ie: not related to the study) in the presence of citrus scent or not. Then they moved to a room with no scent to sit at a table and eat a crumbly biscuit. Cleaning behaviour was scored as the number of times the participants removed crumbs from the table. Independent judges did the scoring from video recordings. The researchers felt that this measure was "well suited to assessing the non-conscious influences of scents on behaviour, because participants' attention is directed to eating and not to cleaning" (Holland et al 2005 p691). However, there is a question over the validity of such a measure, and there was no scent in the second room.
The participants made significantly more cleaning movements in the scent than control condition (mean 3.54 vs 1.09).
All three experiments are seen as "compelling evidence that scent can have a non-conscious influence on thinking and doing" (Holland et al 2005 p692).

APPENDIX 2B - PERSONALITY AND ENVIRONMENT

Gosling et al (2002) argued that individuals "select and craft physical environments that reflect and reinforce who they are", and so observers can form impressions of occupants from their environments.
There are four aspects of this process (Gosling et

al 2002):

i) Self-direct identity claims - Spaces are adorned with "symbolic statements made by occupants for their own benefit, intended to reinforce their self-views" (Gosling et al 2002).

ii) Other-directed identity claims - Displays that make a statement to others: "occupants may be intentionally communicating their attitudes and values to others. These statements might be sincere and intended to convey truthful messages about what the individual is really like, but they may also be strategic, even deceptive statements intended to portray the individual in a certain light. For example, the occupant of an office who has frequent client visits may be motivated to decorate the space in ways that suggest to others a conscientious, hard-working, and honest disposition. Similarly, the occupant of a dorm room may be motivated to decorate his or her space with posters of rock stars and hip movies to be seen as cool by potential visitors" (Gosling et al 2002 p381).

iii) Interior behavioural residue - These are "physical traces of activities conducted in the environment" (Gosling et al 2002).

iv) Exterior behavioural residue - These are physical traces outside the home, for example.

Gosling et al (2002) designed two studies to investigate four elements of the personality cues in the environment:

a) Inter-observer consensus - Do observers agree about the personality from a cue?

b) Observer accuracy - Are observers' impressions of personality from the cues correct?

c) Cue utilisation - Which cues in the person environment do observers pay attention to?

d) Cue validity - Are cues accurate signals of personality characteristics?

In the first study, eight observers examined the personal workspaces of 94 office occupants, and six different observers and one the same visited the personal living space (students' dorms) of 83 occupants in the second study. The observers had no contact with the occupants and the assessments were open-ended (ie: no criteria given). The assessments were then categorised into the dimensions of the Five-Factor Model (FFM) of

personality (McCrae and Costa 1999) - Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability.

The findings were presented in relation to the four issues above:

a) Inter-observer consensus - Based on correlations between the observers, Openness had the strongest consensus and Emotional Stability the least in both studies.

b) Observer accuracy - An index of accuracy was calculated for the observers as compared to self- and peer ratings. Accuracy was highest for Openness and lowest for Agreeableness in both studies.

c) Cue utilisation - The relationship between specific cues and personality were calculated (eg: uncluttered office and Conscientiousness) [9]. This was highest for Openness and Conscientiousness in both studies.

d) Cue validity - This was calculated by comparing the index of accuracy with cues (eg: Conscientious individuals do have uncluttered offices). Conscientiousness and Openness were valid in both environments.

Gosling et al (2002) summed up: "Our findings suggest that an observer who has briefly examined an individual's living or working environment will form impressions that are remarkably consistent with other observers' impressions. Furthermore, these impressions are often accurate" (p393).

The living spaces of the students offered stronger information about the personality than the office spaces. Gosling et al (2002) proposed five explanations:

• Students, at that age, are more self-expressive than adults (ie: stronger self-directed identity claims).
• There is greater freedom to decorate a bedroom than an office.
• Individuals in offices are more concerned with other-directed identity claims.
• The observers were students, and "perhaps were relatively well versed in the cultural meaning of the possessions and icons found in student living spaces but less so in the meanings of cues in office spaces" (Gosling et al 2002 pp393-394).

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[9] Openness, for example, covers the traits of curious, imaginative, and unconventional, so it is expected that the space will have varied magazines and books, and a distinctive decor (Gosling et al 2002).

- The college bedroom hosted many different activities from sleeping to studying to social interactions.

There are some key limitations with this study:

i) Tidying or altering of spaces before observers came. "Occupants may craft their environments to project specific impressions that they deem desirable. For example, they may display socially desirable symbols (eg: an award for public service), they may fabricate behavioural residue (eg: a made-up bed), or they may deceivingly display anticipated behaviour cues they have no intention of using. The present design did not permit us to examine the extent to which self-presentational concerns drove the occupants to actively manipulate their personal environments to portray themselves in a positive light..." (Gosling et al 2002 p395).

ii) Open-ended observations were categorised into five dimensions to aid statistical analysis. This produced an element of artificiality to allow correlations between observers, for instance.

iii) A small number of students acting as observers.

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3. TO EAT BREAKFAST OR NOT

Regular breakfast consumption (BC) has been associated with lower body mass index (BMI), for instance, but this is only a correlation. BC individuals tend to have more physical activity and better diet profile than non-BC individuals (Clayton et al 2015).

On the other hand, breakfast omission (BO) is often used by individuals wanting to lose weight. Experimental studies are divided as to whether this is compensated for by greater intake later in the day. For example, Astbury et al (2011) found that individuals [10] allowed to eat as much as they wanted [11] at lunch fully compensated for energy loss from BO [12], while Farshchi et al (2005) (the same researchers in an earlier study) found increased energy intake during the day as compared to BC [13]. But there are methodological issues - for example, the latter study had participants consume breakfast at 7 am (BC) or at noon (BO) (figure 3.1) (Clayton et al 2015).

	Breakfast consumption	Breakfast omission
0700-0800	Cereal	Nothing
1030-1100	Snack	
1200-1230	Nothing	Cereal
1330-1400	Lunch	
1530-1600	Snack	
1800-1830	Dinner	
2030-2100	Snack	

Figure 3.1 - Design of Farshchi et al (2005).

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[10] Twelve volunteers from the University of Nottingham, UK.
[11] Known as ad libitum.
[12] Energy intake was 17% greater in the BO than BC group.
[13] This study involved ten healthy, lean women aged 19-38 years old at the University of Nottingham, UK and two 14-day periods.

But in the Bath Breakfast Project with thirty-three participants [14], Betts et al (2014) found that six weeks of BO reduced daily energy intake by around 2250 kJ. But this reduced intake was not as great because individuals expended less energy during the day to an equivalent of 1850 kJ (figure 3.2) (Clayton et al 2015). This study allowed unrestricted food intake after noon each day.
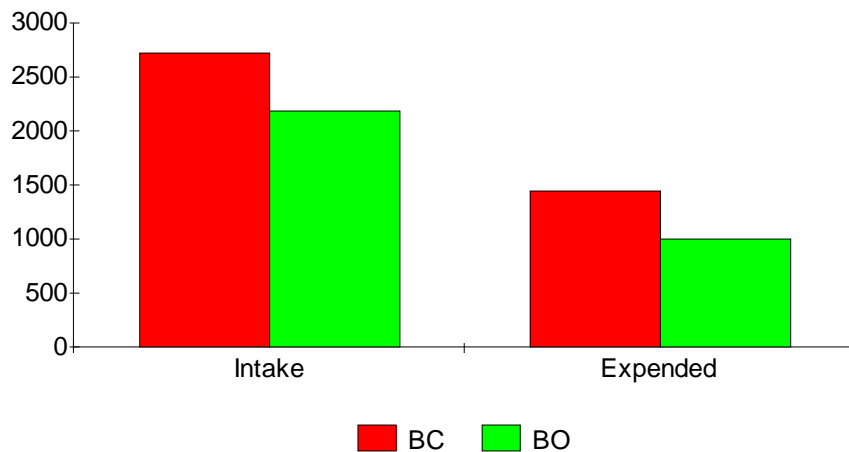

Figure 3.2 - Mean calories per day (kcals/d) intake and expended in Betts et al (2014) study.

Based on this finding, Clayton et al (2015) investigated the effect of BO on evening exercise performance with ten active male students. Baseline measures of peak oxygen consumption (VO²peak) were taken on an exercise bike.

The experiment took place on two separate days beginning at 7.30 am, and the participants were not allowed to have eaten since 9.30 pm the previous day. On one day the participants were allocated to the BC group and the BO group on the other, and vice versa (known as randomised crossover design) [15].

Lunch was at 12.30 pm, and all participants were instructed to eat until "comfortably full and satisfied". Exercise took place at 5 pm, and involved two 30-minute sessions on the exercise bike.

Lunch energy intake was significantly greater after BO than BC, but post-exercise dinner was the opposite (figure 3.3). Over the day, energy intake was 19% greater after BC than BO. Energy expended during the exercise test was about 5% greater in the BC than BO group [16].

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[14] Individuals at University of Bath, UK.

[15] The participants were not blind to their condition, and BO may have produced an expectation of performance decline (Clayton et al 2015).

[16] BC is known to improve exercise performance in the morning compared to BO (Clayton et al 2015).
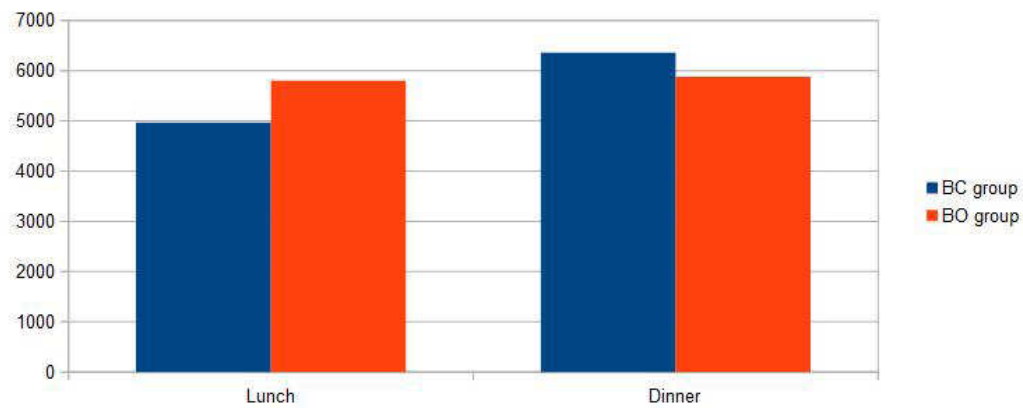
(Data from Clayton et al 2015 table 1 p2648)

Figure 3.3 - Mean energy intake (kJ).

        Clayton et al (2015) summed up: "From a weight
management perspective, occasional BO could be used as a
viable means of energy restriction in habitual breakfast
consumers, although this may slightly impair exercise
performance" (p2649).

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4. SEVEN RECENT STUDIES RELATED TO DOMESTIC AND UTILISED ANIMALS

4.1. ELEPHANT RE-INTRODUCTION

With wild elephants being endangered for a number of reasons including poaching for ivory, and habitat destruction, the re-introduction of individuals raised in captivity is a possible strategy. But this strategy depends on released elephants forming herds as this is the best way of survival. This was found to be the case in the Queen Elizabeth National Park in Uganda (eg: Nayakaana et al 2001).

Elephants have also been re-introduced in Uda Walawe National Park in Sri Lanka (eg: Miththapala 2009), and in three areas of Thailand (Thitaram et al 2015). In the latter country, 104 elephants were re-introduced after finding them working at tourist camps or in the logging industry, captive, or wandering in cities.

Thitaram et al (2015) reported observations of one hour per week for the year after re-introduction for fifty-three elephants in Thailand. An association index was developed to assess whether the individual was part of a group. At each observation, an elephant was scored as a group member if it moved in a co-ordinated manner with others within fifty metres of it, while elephants 1000 metres from others were classed as lone.

Based on two sites, thirty-three elephants were group members in twelve groups (of which five contained calves) and twenty alone, and this was not linked to genetic relatedness of individuals.

Thitaram et al (2015) summed up: "Our results showed that group formation and cohort preference were not genetically based. However, the presence of an elephant calf appeared to aid group formation. Thus, when recruiting elephants from different places for re-introduction or placement in zoos, tourist camps or sanctuaries, including a calf may help promote bonding of elephants in unrelated groups" (p56).

4.2. ATTRIBUTION OF EMOTIONS TO ANIMALS

Attributing emotions to other humans is well-studied, but what about to non-human animals?

Bilewicz et al (2011), for example, compared the emotion attributions of vegetarians and meat-eaters (omnivores) towards pigs and dogs. The latter attributed more emotions to dogs than pigs, while vegetarians did not differ. Wilkins et al (2015) felt that "this biased view is motivated by moral disengagement in the omnivore, enabling individuals to justify their participation in the killing of animals for human benefit and reducing the guilt felt for this action" (p358).

Other factors that influence the attribution of emotions include pet ownership/familiarity with animals, belief in animal mind (BAM), the species involved, and gender (Wilkins et al 2015).

Wilkins et al (2015) designed an online questionnaire to investigate these factors. It was completed by 347 UK-based participants recruited via snowball sampling and online advertisements at the University of Southampton, UK. Emotion attribution was measured by a specially designed questionnaire which covered twenty-four animals [17], and four primary emotions (joy, fear, anger and sadness) and three secondary emotions (pride, guilt, and jealousy). Each animal was rated for each emotion, giving a range of total scores between 0 and 168. A higher score signified more attribution of emotions to animals.

The researchers tested eight hypotheses:

1. Emotions will be attributed more frequently to mammals than non-mammals. This was supported by the data. Mammals were attributed the most emotions, followed by birds, reptiles, fishes, and invertebrates (figure 4.1).
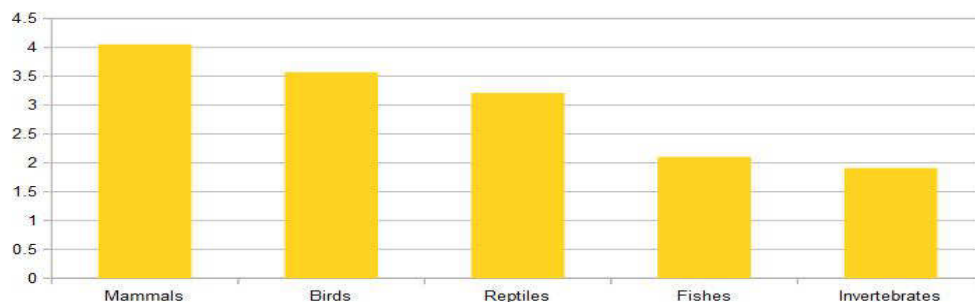
(Data from Wilkins et al 2015 table 2 p363)

Figure 4.1 - Mean ratings based on taxonomic category.

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[17] Pet animals (eg: dog, horse, parrot), Used species (eg: chicken, cow, fruit fly), and Pests (eg: pigeon, wild rat, cockroach).

2. Emotions will be attributed more frequently to Pet species than Use species or Pest species. This was the case (figure 4.2).
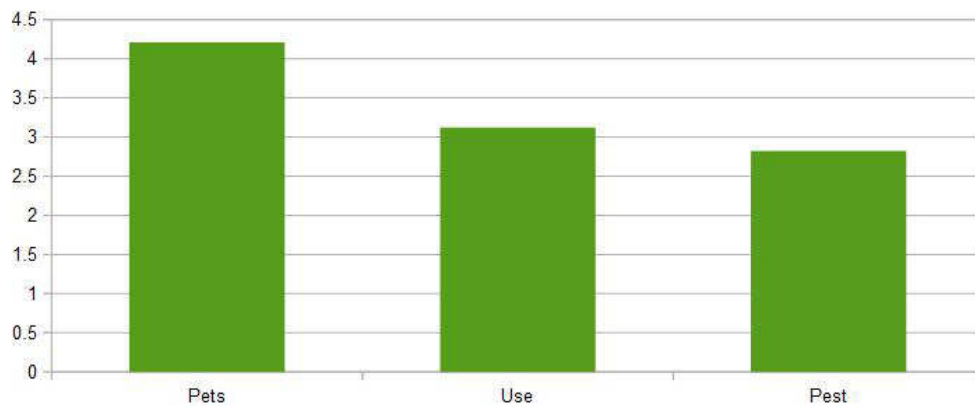

Figure 4.2 - Mean ratings based on animal's function.

3. High emotion attribution will be linked to high emotional intelligence (EI). EI was measured by the sixty-item Empathy Quotient (Baron-Cohen and Wheelwright 2004). The data did not support this prediction.

4. Emotion attribution will be higher for a species by owners of that species. Ownership of birds significantly increased the number of emotions attributed to that species, but not other animals (figure 4.3). Most of the differences related to primary emotions, except for horses who were attributed significantly more secondary emotions.
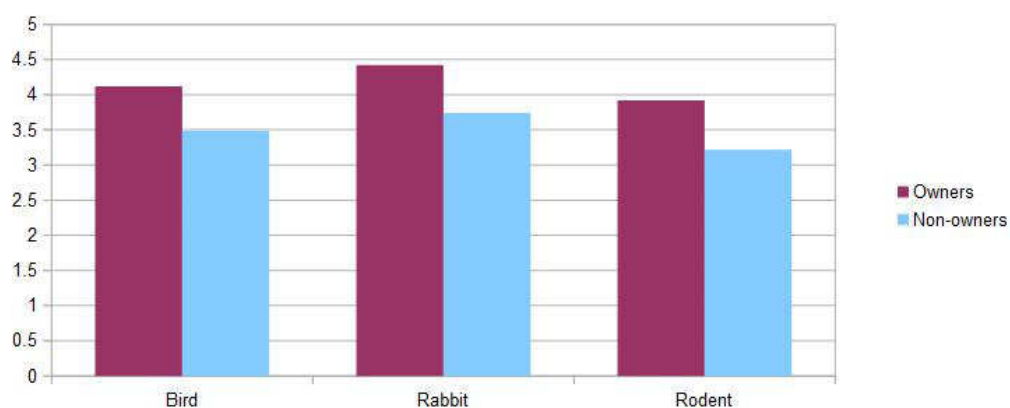

Figure 4.3 - Mean ratings based on ownership.

5. Pet owners will attribute more emotions than non-owners. No general difference was found.

6. Females will attribute more emotions than males. No general difference was found.

7. High BAM will be associated with high emotion attribution. BAM was measured by four items about animals' awareness, thoughts and feelings developed by Hills (1995). "If a person believes an animal has a mind, the they are more likely to believe that emotions are part of that mind" (Wilkins et al 2015 p366).

8. Vegetarians and vegans will attribute more emotions than omnivores. No general difference was found based on eating orientation.

Overall, primary emotions were attributed significantly more than secondary emotions.
Wilkins et al (2015) summed up: "Emotions are not attributed consistently to all animals"

i) A hierarchy of emotion attribution (with mammals at the top) based on belief of animals as "cognitively and behaviourally similar to them".

ii) The function of the animal influenced emotion attribution - namely, Pet species as compared to Use and Pest species. "This could indicate that fewer emotions are attributed toward Use and Pest species to allow exploitation to occur without feelings of guilt arising" (Wilkins et al 2015 p365). However, there were contradictions. For example, 72% of participants (including meat-eaters) attributed primary emotions to cows.
Wilkins et al (2015) offered some psychological explanations for this "complexity":

• Emotion attribution is a cognitive process with no empathy for the animal's welfare involved.

• Emotion attribution is separate to moral concern.

• A dissociation between the animal and its function for humans.

• Other ways to reduce tension between emotions attributed and welfare (eg: "humane" methods of pest control).

iii) BAM was the only individual difference, surprisingly, that significantly predicted attribution of emotions.

4.3. PET OWNERSHIP AND SUBJECTIVE WELL-BEING AMONG OLDER ADULTS

Older pet owners report higher aspects of subjective well-being in some studies (eg: less loneliness in English women; Pikhartova et al 2014), lower in other (eg: more depressive symptoms in 60-64 year-old Australians; Parslow et al 2005), and no difference to non-pet owners (eg: Rijken and van Beek 2011) (Bennett et al 2015).

Where pet ownership is associated with positive outcomes (eg: increased life satisfaction), establishing causality from human-animal interaction (HAI) is not easy. One reason is that studies use retrospective self-reports to measure daily experience (ie: thinking back over the day), and so are prone to recall bias. An alternative is experience sampling methodology (ESM), where individuals record their feelings at the time (eg: when a random electronic alarm sounds).

Bennett et al (2015) used ESM to explore the nature of HAIs with cats and dogs, and subjective well-being among sixty-eight community-living [18] over 65s in Victoria, Australia. Forty-one of the locally recruited volunteers [19] were pet owners. A number of questionnaires were completed beforehand and during the study to gauge normal activities and behaviours, psychological state, and how typical the study week was. Experience was randomly sampled six times per day for seven days by completing a ten-item questionnaire each time (which included current mood, and presence of pet).

Analysis was performed on the data for different groups - pet vs no pet, dog vs no dog, and cat vs no cat. Initially, five comparisons were significant - pet owners felt (i) more sociable, but (ii) more worried than non-pet owners; dog owners reported (iii) higher satisfaction with community-centredness (eg: number of human social partners), and (iv) higher global well-being, but (v) more worried than non-dog owners. These differences were not evident after controlling for confounding variables. So, overall, no statistically significant group differences.

The presence of a pet at the moment of sampling significantly predicted overall well-being, and less depression and stress, but not loneliness. The presence of a dog was linked to increased global well-being, lower loneliness, and satisfaction with standard of living, for instance, and the presence of a cat with satisfaction

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[18] Community-living included working up to twenty hours per week.

[19] The study was advertised as being "concerned with investigating the daily activities, emotions and perceptions of older adults living independently, either alone or with other persons or pets, in the community" (Bennett et al 2015).

with personal health and personal safety. The frequency of the presence of the pet seemed to be key, irrelevant of what the participant was doing.

Bennett et al (2015) concluded that "frequent presence of a pet, rather than pet ownership per se, may positively affect psychological wellbeing in older, community-dwelling, persons" (p417). However, the sample was not representative of the general population, with more women (49 of 68). But "they were ordinary Australians, aged over 65 years and going about their daily activities either in the presence or absence of one or more pets" (Bennett et al 2015 p417).

4.4. CHILDHOOD PETS AND ADULT DEPRESSION

Individuals who develop secure attachments to their caregivers as children are less likely to report internalising symptoms (eg: depression and anxiety) as adults. Does this protective effect apply for strong bonds with pets as children?

Studies have found benefits in childhood of pet ownership. For example, after one year of pet ownership, children bonded to those pets were described as "fearful" less often than before the pets (Paul and Serpell 1996).

While pet ownership as an adult is beneficial. For example, older adults bonded to their pets were less depressed than non-bonded pet owners (Garrity et al 1989).

Alternatively, witnessing physical abuse or neglect of a pet as a child can have longer term consequences. Among undergraduates, for instance, two-thirds who had witnessed animal cruelty reported still being bothered by it (Flynn 2000).

Girardi and Pozzulo (2015) used a sample of over 300 Canadian undergraduates in their research. Participants completed a number of questionnaires covering childhood pets and current mental health. These included:

- The Lexington Attachment to Pets Scale (LAPS) (Johnson et al 1992) - This measures the bond between humans and pets (eg: "My pet means more to me than any of my friends", "Quite often I confide in my pet").

- The Exposure to Pet Aggression Scale (EPAS) - This was specially designed to cover who was aggressive to childhood pets, how often, the severity, and for how long.

Pet bonding and pet aggression were not separately associated with depression and anxiety, but individuals with a medium level bond to their childhood pet who witnessed aggression/cruelty to that pet had

significantly higher depression and anxiety scores as
students than low or high pet bonders, and no pet
aggression witnessed. Girardi and Pozzulo (2015) summed
up: "Children who care more about their pets may
experience more emotional distress as a result of
witnessing aggression directed toward their pets. If
children do not feel an emotional connection to their
pets, then witnessing pet aggression may not be as
distressing to them" (p430).

Why were the high level bond group not affected
most? Girardi and Pozzulo (2015) offered a "purely
speculative explanation" - "children with the highest
bonds experienced a greater protective effect of pet
bonding than those in the medium bond group. Although the
high bond-group may have been distressed by witnessing
pet aggression, the increased social support,
companionship, and/or comfort provided by a very strong
bond with the pet may have helped to buffer the negative
effects of exposure to pet aggression" (p431).

Chur-Hansen et al (2009) proposed a curvilinear
relationship between pet bonding and mental health. "They
suggested that individuals with very strong bonds with
pets may socially isolate themselves resulting in poor
mental health, that those who have low bonds with pets
may not experience benefits associated with pets, and
that those with moderate bonds may experience the most
benefit" (Girardi and Pozzulo 2015 p431).

The main limitations of the Girardi and Pozzulo
(2015) study were:

i) Retrospective data about childhood pets from
self-reports with no independent verification.

ii) Convenience sample of psychology students (aged
18-25 years old), and four-fifths were female, which
limits generalisability.

iii) Only eighty participants had witnessed
aggression towards their pets, which limited comparison.

iv) Not possible to establish causality as it was a
cross-sectional study.

v) Potential confounding variables not included -
eg: family history of depression, current level of social
support.

4.5. USING PIGEONS' VISUAL ABILITIES

Pigeons have high levels of visual discrimination
and memory, which has been shown in experiments with
stimuli not met in the wild. They can recognise letters

of the alphabet after training, and recall more than 1800 taught images, for instance (Levenson et al 2015). "Importantly,... the anatomical (neural) pathways that are involved, including basal ganglia and pallial-striatal (cortical-striatal in mammals) synapses, appear to be functionally equivalent to those in humans" (Levenson et al 2015).

Levenson et al (2015) showed that pigeons could be taught to discriminate medical images using the principles of operant conditioning (eg: food reward for pecking the correct response button when presented with two images) [20]. Sixteen pigeons kept at the University of Iowa, USA, were trained and tested in three experiments using an operant conditioning chamber (figure 4.4).
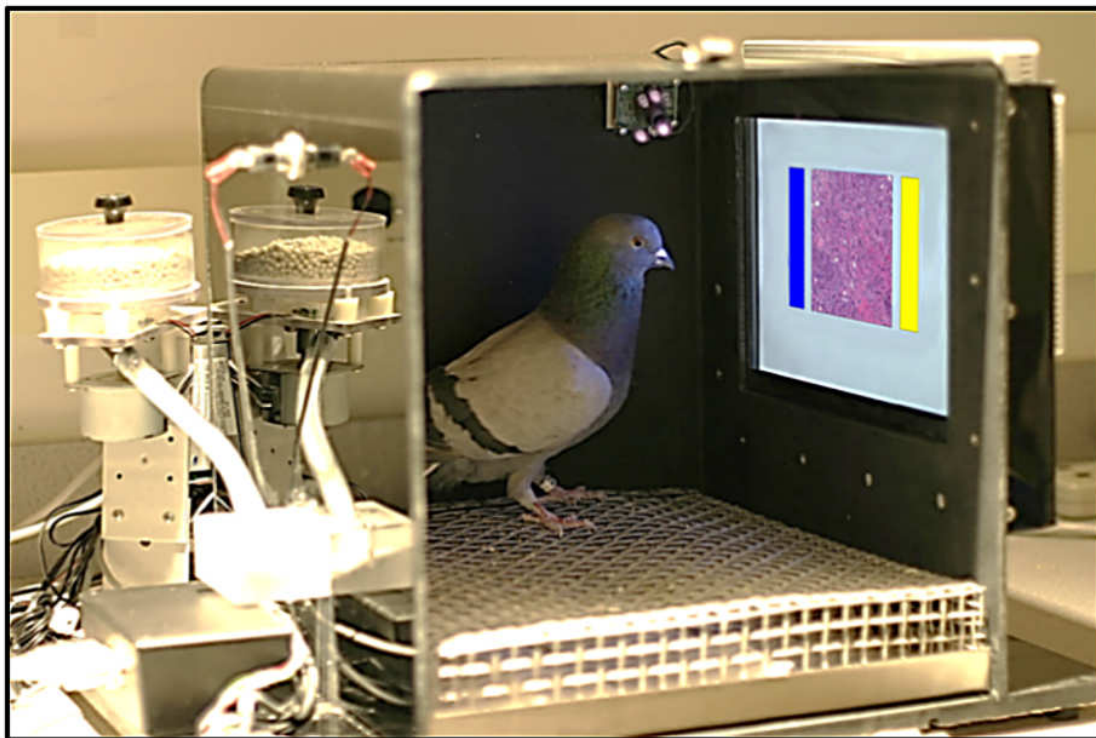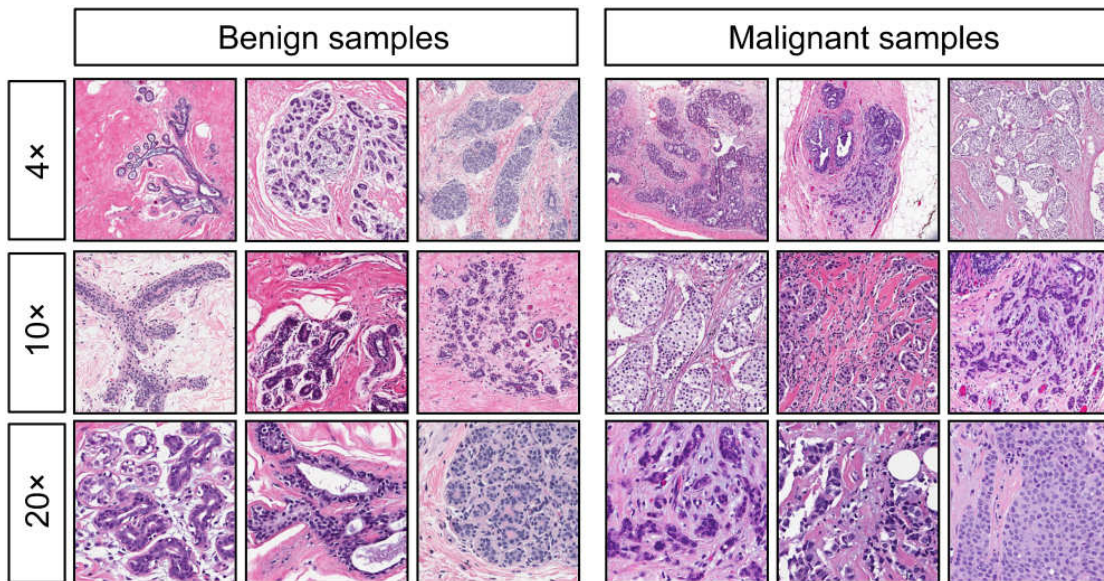

(Source: Levenson et al 2015 figure 1)

Figure 4.4 - Operant conditioning chamber.

An image was presented in the middle of the screen, and the pigeon had a choice of a blue or yellow button to peck in response.

In the first experiment, microscope images of benign and malignant breast tissue were used (figure 4.5). After fifteen days of daily training, the birds were tested

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[20] The pigeons are kept at 85% ideal food level in order to motivate them in the experiments.

with images not seen before, of a different magnification or orientation, or monochrome instead of colour over four days.

(Source: Levenson et al 2015 figure 2)

Figure 4.5 - Examples of images at different magnifications used in Experiment 1.

By the end of training, the pigeons were 85% correct (which is significantly better than chance - 50%) (figure 4.6), and were around this figure in tests (figure 4.7).
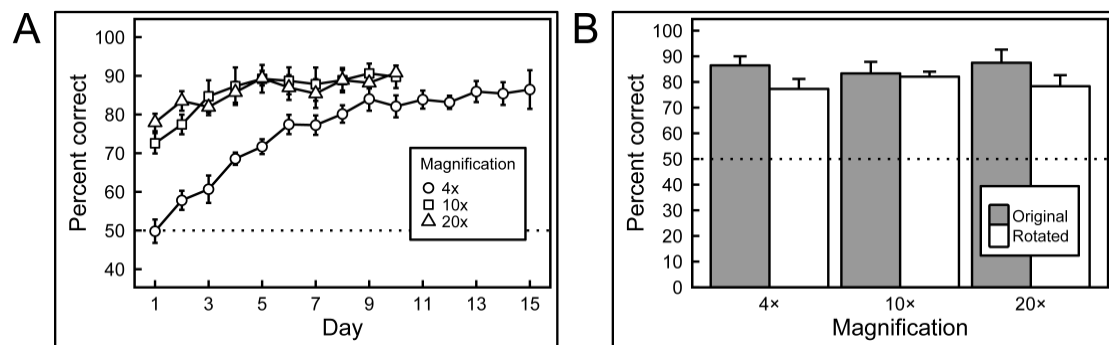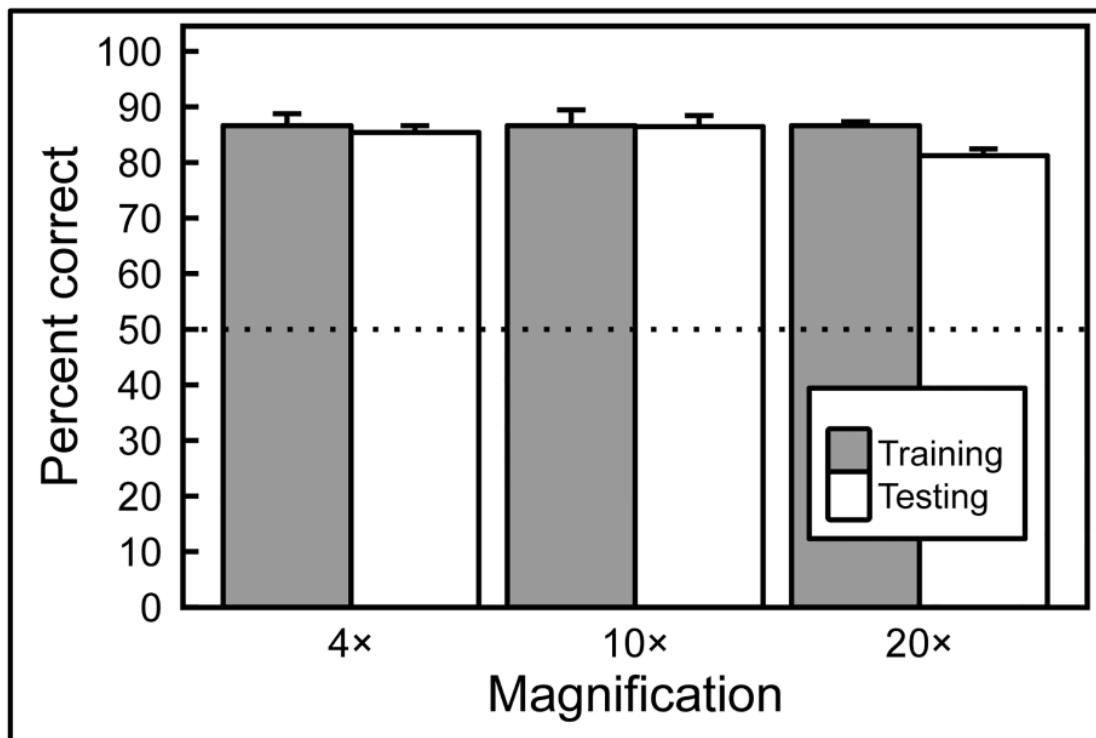

(Source: Levenson et al 2015 figure 6)

Figure 4.6 - Accuracy of pigeons during training period based on magnification (A) and rotation of image (B).

Accuracy was not affected by magnification. "Remarkably, the pigeons were able to distinguish benign from malignant breast histopathology virtually as well on test image sets as they did on the training sets, at all

magnifications, indicating that they had somehow learned to detect critical discriminating features. The pigeons proved to have an affinity for histopathology, as they achieved stable high performance as fast as or faster than with other visual discrimination problems studied in our Iowa laboratory. Moreover, if instead of scoring per-bird performance, a 'flock-sourcing' approach was taken, in which the birds in essence voted, then even higher levels of accuracy could be achieved: when a cohort of 4 birds was shown the full set of uncompressed images, the resulting 'group' accuracy level reached an amazing 99%" (Levenson et al 2015).
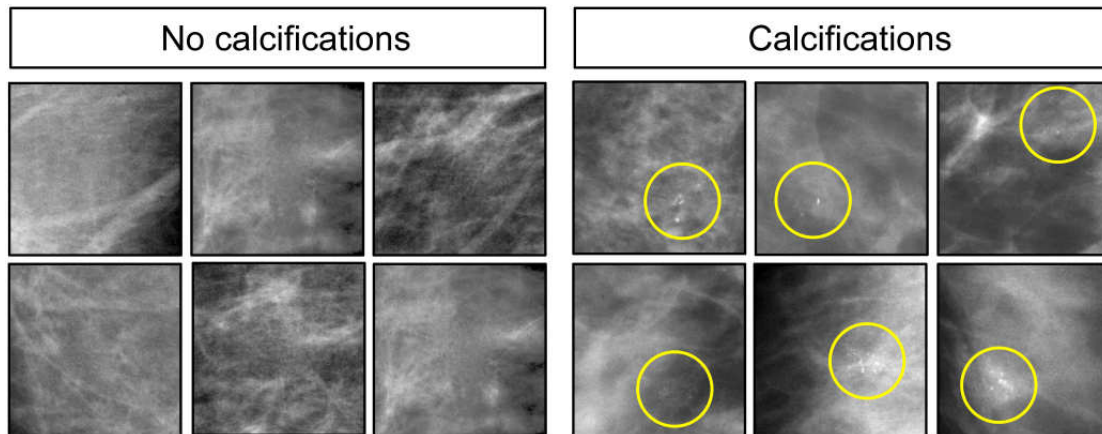

(Source: Levenson et al 2015 figure 7)

Figure 4.7 - Average accuracy in training and testing based of magnification.

In the second experiment, mammogram images, which showed micro-calcifications or not, were used (figure 4.8). Accuracy averaged over 80% for familiar images, and around 70% for novel ones. This latter accuracy was similar to the accuracy of human radiologists in a study by Krupinski (1996).
"Sensitivity to the presence of micro-calcifications was learned and then applied to novel images with much the same success and trajectory as with the histopathology images, with the birds learning within a week, and generalising reasonably well. The problem of
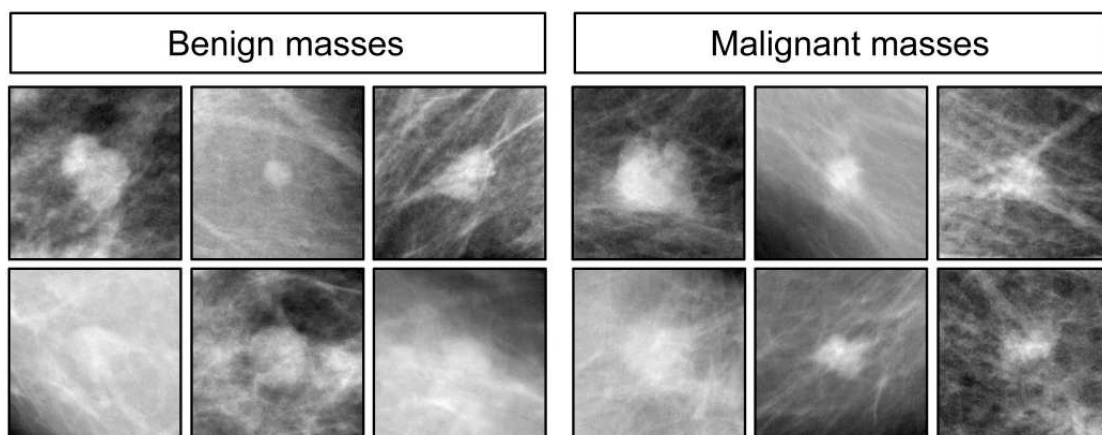
(Source: Levenson et al 2015 figure 4)

Figure 4.8 - Examples of images used in Experiment 2.

finding little white specks in a complex background would seem to mirror the problem encountered in the pigeons' native environment, of locating and ingesting seeds distributed in a visually cluttered environment — an obvious survival skill" (Levenson et al 2015).

The third experiment involved mammogram images classed as benign or malignant masses, but micro-calcification free (figure 4.9). Recognition of familiar images was around 70%, but only chance for novel images.

"These data suggest that the birds memorised the masses in the training set, but never learned to key in on those features (for example, stellate margins) that can correlate with malignancy. This result reflects the difficulty of the task, with which even human experts struggle, and indicates that birds may be relatively faithful mimics of the strengths and weaknesses of human capabilities when viewing medical images" (Levenson et al 2015).

(Source: Levenson et al 2015 figure 5)

Figure 4.9 - Examples of images used in Experiment 3.

Levenson et al (2015) summed up: "Although pigeons are unlikely to be called upon to offer clinical diagnostic support, it does seem quite possible that their discriminatory abilities may be turned to a useful purpose. [...] our results suggest that pigeons can be used as suitable surrogates for human observers in certain medical image perception studies, thus avoiding the need to recruit, pay, and retain clinicians as subjects for relatively mundane tasks" (Levenson et al 2015).

4.6. SOCIAL RELATIONSHIPS AND THE IMMUNE SYSTEM

Primates have greater sociality than other mammals. This means that adults interact and associate all the time, whereas other mammals are limited to when females are receptive or to particular relationships (eg: adult females and young) (Capitanio and Cole 2015).
"The fact that primate sociality has evolved over tens of millions of years suggests that their sociality is embedded in a basic way in their biology. This is, perhaps, most evident in central nervous system organisation, in which areas of the brain appear specialised for processing explicitly social information" (Capitanio and Cole 2015 p1). It also means that sociality is linked to physical health (eg: social isolation and health problems, or the presence of others buffers the negative consequences of stress). This linkage is via the hypothalamic-pituitary-adrenal (HPA) axis, which responds to stress, and the sympathetic nervous system, which controls the "fight or flight" response (Capitanio and Cole 2015).

The effects of the social environment can be seen in experiments by Capitanio et al (eg: 1998). Rhesus monkeys infected with simian immunodeficiency virus (SIV) were allowed to socialise for 100 minutes per day for several weeks, either with the same 2-4 animals (stable group) or different animals each time (unstable group). The monkeys in the latter group were more stressed, and died earlier than those in the stable group.

Capitanio and Cole (2015) built on this work by investigating the immune system response to SIV inoculation and a change from a stable to an unstable group (for five weeks) before a change back to a stable group (figure 4.10). The immune response was compromised by the change to the unstable group (eg: less NK cells [21]), but went back to normal after the return to the

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[21] Natural killer (NK) cells are produced to fight "invaders" (eg: infections), and more cells is a sign of a healthy immune system.

stable condition.

These studies showed that "our basic biology is highly responsive to the qualities of our social relationships", and Capitanio and Cole (2015) particularly found that a return to stable social conditions can reverse the negative effects on the immune system in "a relatively short time-frame" (Capitanio and Cole 2015).
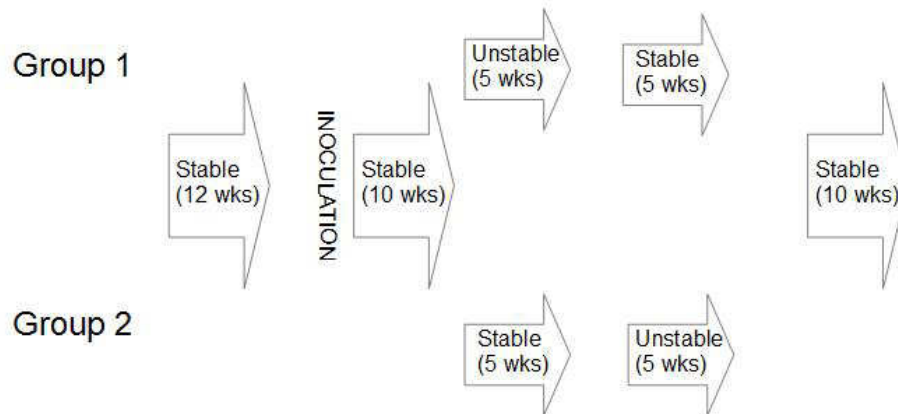

Figure 4.10 - Design of Capitanio and Cole (2015).

In summary, Capitanio and Cole (2015) stated: "measures of endocrine activity, immune function and lymph node biology demonstrate remarkable plasticity in response to social conditions, showing changes in response to conditions becoming stressful, and, at least for plasma and urine measures, changes back to pre-stress levels when unstable social conditions end. Our data provide strong evidence for the role played by social relationships in regulating health-relevant immunological processes in social species" (p9).

4.7. CALMING DOGS IN KENNELS

The kennel environment, whether it be for rescue, boarding, quarantine or laboratory-related, can be stressful for dogs because of the limited social interactions, restricted space, high noise levels, and lack of control (Brayley and Montrose 2016). Auditory stimulation can help.

For example, Wells et al (2002) played recordings of human conversation, classical, pop, and heavy metal music to dogs in rescue kennels. Classical music resulted in the most time resting and the least time barking. These behaviours were taken as signs of lower stress.

Brayley and Montrose (2016) found similar benefits

with audio-books. Thirty-one dogs at a re-housing centre in Oxfordshire, England, were used in a repeated measures experiment that played either an audio-book ("The Lion, the Witch and the Wardrobe" by C.S Lewis), classical music (Beethoven), pop music (a variety), psychoacoustically designed dog music, or no sound for two hours. The dogs' behaviour was scored from video recordings on fifteen criteria every five minutes during the two-hour periods of audio stimulation (figure 4.11).

Day 1	Day 3	Day 5	Day 7	Day 9
10am-noon	10am-noon	10am-noon	10am-noon	10am-noon
Silence	Pop music	Classical music	Audio-book	Psychoacoustically designed dog music

Figure 4.11 - Design of Brayley and Montrose 2016).

The audio-book condition resulted in significantly less walking, sitting/standing, barking and other vocalisations (eg: howling), and more resting/sleeping than the other conditions (figure 4.12). Brayley and Montrose (2016) felt that the "changes in behaviour induced by audio-books are therefore suggestive of enhanced welfare in dogs".
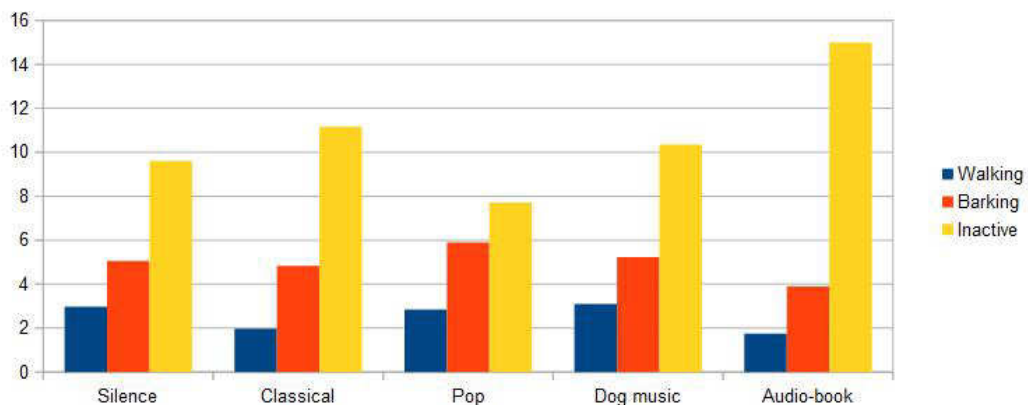
(Data from Brayley and Montrose 2016 table 2 p11)

Figure 4.12 - Mean number of times for selected behaviours.

But the exposure to a particular auditory stimulus was only once for a limited time period. The authors

noted: "Investigation of the effects of daily exposure to audio-books over a longer time frame would be useful to determine whether audio-books are effective at reducing stress experienced by kennelled dogs in the long term. In addition further research should occur to determine what aspects of audio-books are important in reducing canine stress. Investigating dog behaviours in response to such factors as the narrator's gender, age, accent, voice pitch and speed of narration would be of interest in determining which audio-books to play to best enhance the welfare of kennelled dogs" (Brayley and Montrose 2016 p114).

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