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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://kmbpsychology.jottit.com> and <http://psychologywritings.synthasite.com/>.

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# **1. FREE WILL AND NEUROSCIENCE**

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## **1.1. FREE WILL**

A "strong definition" of free will (as proposed by, for example, Rene Descartes) states that an individual is free if in an identical situation they could have acted differently. While compatibilism sees freedom if an individual can follow their desires and preferences (Koch 2012).

The view on free will, particularly among neuroscientists, is summarised by Shariff and Vohs (2014): "Instead of being the intentional authors of our lives, we are simply pushed around by past events and by the behind-the-scenes machinations of our unconscious minds. Even when we are wide awake, free will is just an illusion" (p62).

Harris (2012) was clear: "Free will is an illusion... We do not have the freedom we think we have" (quoted in Sherman 2012) <sup>1</sup>. This view is based on studies like Soon et al (2013). Volunteers in a functional magnetic resonance imaging (fMRI) scanner are presented with two numbers and told that they can choose to subtract or add them together. Neural activity was observed four seconds before a conscious choice made <sup>2</sup>.

Tse (2013) argued that free will takes place in the internal deliberation about future events (ie: conscious thoughts) because neurons are able to change (the reweighting of synapses). For instance, a nerve cell that

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<sup>1</sup> Nahmias (2015) called this view "willusionist". He listed some reasons to be cautious about this position:

- i) Limits of technical sophistication of scanners etc.
- ii) Evidence of planned and conscious behaviour in everyday life.
- iii) It would not make evolutionary sense to have a brain that uses large amounts of energy that has apparent conscious thoughts which are illusions.

<sup>2</sup> "But this early brain activity predicted a choice with an accuracy only ten percent better than could be forecast with a coin flip. Brain activity cannot, in general, settle our choices four seconds before we act, because we can react to changes in our situation in less time than that. If we could not, we would all have died in car crashes by now! Unconscious neural activity, however, can prepare us to take an action by cueing us to consciously monitor our actions to let us adjust our behaviour as it occurs" (Nahmias 2015 p66).

just responded to a touch on the hand could now fire in response to a stroke on the forehead. This is the brain working at the level of circuits rather than individual neurons.

Tse (2013) summed up the position he is countering: "The argument goes as follows: we act as we do at each moment because of how our brain is physically organised at that time. So because we are not ultimately responsible for the way we are organised then, we are not responsible for the consequences of that action. It had to happen as it did, otherwise a thought could change its own neuronal basis, which is impossible. But with synaptic reweighting, mental events don't change their present physical basis. They change the neuronal basis of possible future events" (p29).

Shermer (2012) talked of "free won't" rather than free will - "if we define free will as the power to do otherwise, the choice to veto one impulse over another is free won't. Free won't is veto power over innumerable neural impulses tempting us to act in one way, such that our decision to act in another way is a real choice" (p73).

When choosing to move a hand, there is the plan to move (intention), the willing of the movement (agency), and the actual movement. The second part of this process relates to the conscious experience of "I am the author of this action" (ie: volition) (Koch 2012).

This conscious experience of volition can be deceived. Wegner et al (2004) (appendix 1A) asked volunteers wearing gloves to stand in front of a mirror with hands hanging down. An experimenter stood behind, dressed identically, and placed their arms under the armpits of the volunteers. So, in the mirror, it appeared that the experimenter's arms were the volunteers. The experimenter then moved their arms, and the volunteers were asked if the moving arms were their's felt. When the experimenter's arms moved in response to a command, the volunteers reported a feeling of having willed the action (as opposed to no instructions).

### **1.1.1. Belief in Free Will**

A separate but related issue is the consequence of the belief in free will. Shariff and Vohs (2014) found that individuals who had just read arguments against free will recommended a shorter prison sentence for a hypothetical criminal than individuals who just read an unrelated passage (ie: less "retributive" punishment - suffer for wrongdoing - as opposed to "consequentialist" punishment - as deterrent). "In effect, free will sceptics treat people who break the law as they would

viruses, raging floods or other natural phenomena: they want to protect themselves against further harm but have no desire to seek vengeance" (Shariff and Vohs 2014 p62).

Less belief in free will has also been found to increase anti-social behaviour, and to reduce the ability to inhibit impulsive behaviour (Shariff and Vohs 2014).

## **1.2. EXPERIMENT AND FREE WILL**

The experiment in general, and specifically in neuroscience and brain imaging studies "proceeds by giving the experimenter a monopoly on interpretive power: she defines the construct under investigation; determines how to operationalise the construct behaviourally; and determines what the subject's behavioural responses mean in relation to the construct being investigated" (Callard and Fitzgerald 2014 p231). The participant is left to be a "passive actor".

If the experience of the participant is taken into account, then a different perspective could emerge. For example, Filevich et al (2013) explored the perception of voluntariness/free will during certain tasks in a brain scanner. The findings "suggest that the phenomenal experience of voluntariness may well be dissociated from brain circuits involved in action selection. Their study thereby challenges many of the implicit assumptions underpinning experiments investigating voluntary action, by intimating that such 'voluntary' actions may well not be subjectively experienced as such. Even more significantly, their experiment dissolves the tight bond commonly assumed between voluntariness (and/or 'freedom') and choice as understood as selection from a wide number of available alternatives. They conjecture that the experience of voluntariness ('feeling free' as reported by participants) appears to be associated with 'how strongly the environment is interpreted as precluding otherwise available alternatives' and not with the number of available alternatives" (Callard and Fitzgerald 2014 p232).

Nahmias et al (2014) presented students with a scenario of future brain imaging technology that could predict everything a person thought and did. The majority of students, despite believing that this could be possible one day, still believed that an individual in such a scanner had free will - "as long as the technology did not allow people's brains to be manipulated and controlled by others, they would have free will and be morally responsible for their behaviour" (Nahmias 2015 p67).

### 1.2.1. Caution

The Royal Society (2011) stated some cautions about interpreting neuroscientific data, particularly in relation to criminal behaviour.

i) Correlation not causation - Brain scans show the area of the brain active or not during a certain behaviour, for instance, but this is a correlation not causation. Or a difference in brain structure between two groups. This difference may have caused the behaviour, or the behaviour caused the brain difference, or both were the consequences of another cause.

ii) The "fallacy of reverse inference" (Poldrack 2006). This is "the misguided and incorrect attempt to conclude from observation of activity in an area that a particular mental process was taking place" (The Royal Society 2011 p7).

iii) Generalising from averages of groups to individuals - Studies comparing two groups usually compare group means, but "a statistically significant difference between two groups does not prove that every individual in each of the two groups can be distinguished. In much behavioural research, within-group differences are often greater than the average difference between two groups. So an individual who belongs to one group may well resemble behaviourally many individuals who belong to the other" (The Royal Society 2011 p7).

For example, in figure 1.1, the mean of group A is higher than group B, but individual B1 is higher than many in group A (eg: A3-6). Using the group mean B for B1 is misleading.

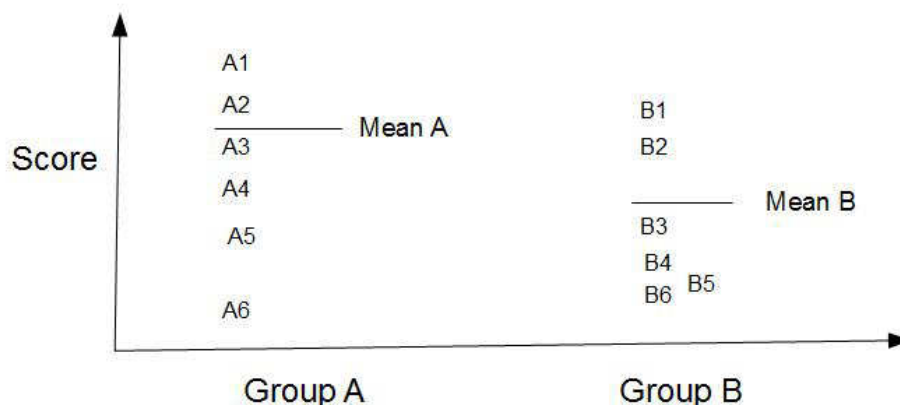


Figure 1.1 - Hypothetical example of group means.

iv) Generalising from convenience samples (eg:

students) to others.

v) Confounders - For example, scanning is very sensitive to changes in the position of the participant.

### 1.3. NEUROSCIENCE

Abi-Rached and Rose (2010) referred to the "emergence and transformation of a panoply of innovative practices, techniques and knowledges focused around the brain" in the 20th century, which they called a "third wave". The "first wave" of the study of the brain was the "birth of neurology" in the 18th century, then the "birth of psychiatry" in the 19th century ("second wave").

The "third wave", which emerged since the 1960s, has "a common reductionist approach to the explanation of complex phenomena pertaining to the brain, behaviour and the nervous system", and "a hybridisation of concepts, methods and practices drawn from various disciplinary backgrounds into novel thought communities" (Abi-Rached and Rose 2010 p12). There is a "neuromolecular gaze" - "a common vision of life itself" (Abi-Rached and Rose 2010)

<sup>3</sup>.

### 1.4. APPENDIX 1A - WEGNER ET AL (2004)

Wegner et al (2004) began: "When you wave your hand in the air, how do you know you're the one who did it? And when someone else's hand waves, how do you know you're not the source of the movement? These questions seem absurd to the normal human, of course, but their very absurdity suggests that each of us has in place an efficient system of mind that gives us an immediate sense of authorship for some actions and not for others. This system seems likely to draw on the fact that we usually know what we are going to do before we do it, and we thus

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<sup>3</sup> "All of this entailed an epistemological shift in the understanding of the brain and the nervous system. The brain was now conceived of as a complex biological system that needed to be dissected and studied from different levels of analysis – cellular, morphological, developmental, behavioural, physiological, etc – and in an integrated manner – what was termed a 'synthetic approach'. However, the fundamental underpinning of such a synthetic approach was the 'molecular' rationale; the molecular techniques, technologies and practices. This effected a mutation in the object of study itself: on the one hand, there was the brain and its 'products', and on the other, there was the subject, the organism now seen as dissectible, reducible to traits, behaviours, cells, genes, brain processes (like vision or consciousness), to atomic elements: neuromolecular parts that could be 'dissected out' and studied separately from the whole. Hence consciousness, learning, behaviour, memory and all aspects of neurobiology could now be investigated by an approach that, on the one hand, radically simplified the problem to be studied, and, on the other, drew on an interdisciplinary dialogue characterized by a shared molecular perspective. There was thus a 'molecular biology of cognition', 'a molecular biology of memory' and 'a molecular biology of behaviour'" (Abi-Rached and Rose 2010 p24).



experience a sense of conscious will for actions we know in advance" (p838).

This sense of authorship is called "authorship processing" (Wegner and Sparrow 2004), while the experiencing of consciously willing an action, Wegner (2002) called "authorship emotion". The former involves "a set of mental processes that monitors indications of authorship to judge whether an event, action, or thought should be ascribed to self as a causal agent" (Wegner et al 2004 p838).

Wegner et al (2004) described the following "authorship indicators":

i) Body and environment orientation cues - knowing where the body is in the environment.

ii) Direct bodily feedback - sensory feedback from the body to the brain.

iii) Direct bodily feed forward - signals from the brain to the body.

iv) Visual and other indirect sensory feedback - eg: seeing self do something.

v) Social cues - eg: obeying commands of another person.

vi) Action consequences - eg: action achieves goal and produces feeling of satisfaction.

vii) Action-relevant thought - appropriate thoughts before the action (eg: thinking "I will raise my hand" and then doing it).

Researchers have manipulated these indicators to produce an illusion of authorship. For example, individuals, unable to see their own hands, who think about certain hand movements while watching a video of the same movements, believe that it is their hands in the video, even if they are physically stopped from doing the movements (Sirigu et al 1999). "Apparently, thinking of the correct action and observing it yielded an illusion of mental causation even when direct sensation of disturbed movement contradicted this experience" (Wegner et al 2004 p840).

Wegner et al (2004) concentrated their experiments on "vicarious agency" (ie: "feelings of authorship for the actions of others") with the "helping hands" paradigm. Participants watched themselves in a mirror as another person hidden behind them puts their arms through

the sleeves of a smock worn by the participants <sup>4</sup>.

In the first experiment, sixteen participants heard instructions given to the hands (eg: "give the OK sign with both hands") (preview group) and seventeen participants heard no instructions. Afterwards, the participants were asked questions about authorship (using a seven-point scale) including:

- "How much control did you feel that you had over the arms' movements?"
- "To what degree did you feel you were consciously willing the arms to move?"

The mean for the two questions combined (vicarious control index) was 3.00 in the preview group and 2.05 in the no preview condition. This is significantly difference, and a higher score indicates a greater perception of control/authorship.

The second experiment had more participants (n = 137), and added an extra condition - inconsistent-preview - where participants heard instructions which were not followed. The mean of the vicarious control index of the preview condition was significantly higher than the other two conditions.

The third experiment, involving 123 more students, varied the timing of the instructions to the hands - three seconds before the movement (early instruction), as the hands moved (simultaneous instruction), or three seconds after the movement (late instruction). The simultaneous instruction condition also included a version with mimicry (where participants imagined copying the instructions) or with distraction (where the participants were asked to think of different hand movements). There was a no-instruction control as well (figure 1.2).

The perceived authorship was highest in the simultaneous instruction with mimicry condition, followed by early instruction condition (figure 1.3).

Wegner et al (2004) summed up: "In all three experiments, this experience of vicarious agency was enhanced significantly by the presence of a preview that allowed the anticipation of the action. Hearing instructions consistent with the action prompted reports of greater control of the action than did hearing no previews in all studies, hearing consistent instructions prompted reports of greater control than did an inconsistent preview in the second study, and hearing

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<sup>4</sup> Picture of procedure at <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.368.7334&rep=rep1&type=pdf>.

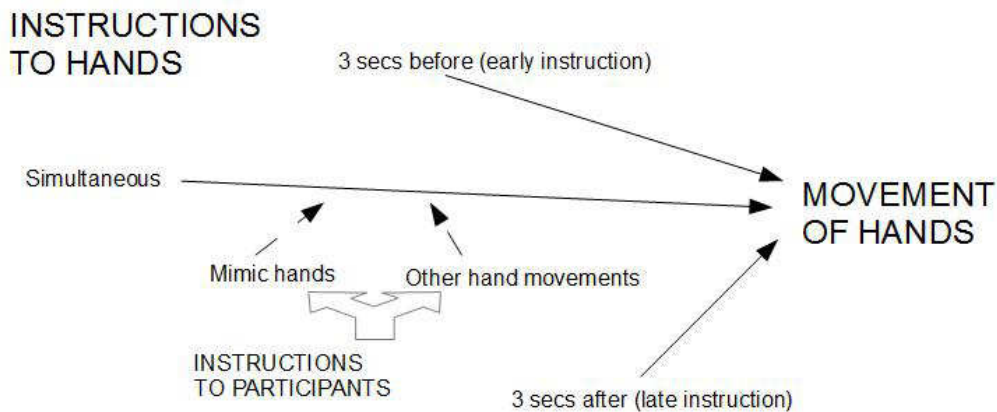
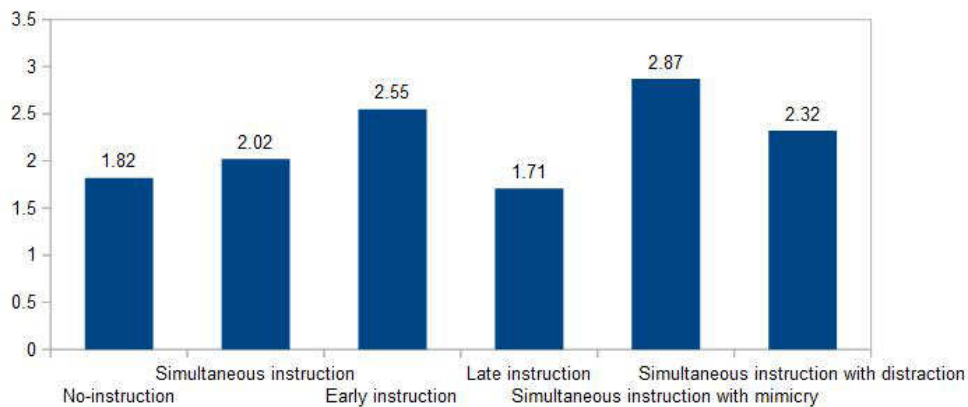


Figure 1.2 - Conditions of third experiment of Wegner et al (2004).



(Data from Wegner et al 2004 table 1 p844)

Figure 1.3 - Mean vicarious control index (out of 7).

consistent instructions prior to the action yielded reports of greater control than did instructions following the actions in the third study" (p845).

In relation to free will, Wegner et al (2004) noted that the experiments showed the following: "No actual agency need take place for the person to experience control, and this observation should be acknowledged in the pursuit of the neural correlates of consciously willed action" (p846).

Table 1.1 summarises the key methodological aspects of the three experiments by Wegner et al (2004).

	Experiment 1	Experiment 2	Experiment 3
Participants	Psychology undergraduates at University of Virginia	Psychology undergraduates at Harvard university	Psychology undergraduates at Harvard university
Number/gender of participants	24 female/9 male	95 female/42 male	69 female/54 male
Number of conditions	2	3	6
Conditions	1.Preview 2.No-preview	1.Preview 2.Inconsistent-preview 3.No-preview	1.Early instruction 2.Late instruction 3.Simultaneous instruction 4.Simultaneous instruction with mimicry 5.Simultaneous instruction with distraction 6.No-instruction
Design	Independent groups	Independent groups	Independent groups
Independent variable(s)	Hear instructions before hands move	Hear instructions before hands move	1.Timing of instructions 2.Instructions to participants

Table 1.1 - Three experiments by Wegner et al (2004).

#### 1.4.1. Use of Hypnosis

The normal sense of control over limb movements is altered in conditions like "anarchic hand" (where the hand moves independent of the owner's intentions), or "delusions of alien control" (where the individual feels their movements are initiated by an outside force). In both cases, "the experience of agency or perceived control of limb movement is lost, but ownership of the limb and awareness of limb movement are retained", as opposed to involuntary movements (ie: "movements not attributed to the exercise of the agent's will") (Deeley et al 2013) <sup>5</sup>.

Voluntary control of movement is studied with hypnotic suggestion while participants undergo neuroimaging. For example, Blakemore et al (2003) suggested to six highly hypnotically suggestible male

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<sup>5</sup> "Involuntary movements associated with narrowing or loss of awareness also occurs in culturally-influenced dissociative phenomena linked to spirit possession, mediumship, and shamanism" (Deeley et al 2013).

participants that a pulley was moving their arm up and down. There was greater activation in the cerebellum and parietal cortex (areas related to movement) in this condition than the control one (ie: voluntary movement) <sup>6</sup>.

But in a similar study, Deeley et al (2013) found less activation of the supplementary motor area (SMA) of the parietal cortex in the loss of perceived control. Fifteen highly hypnotically suggestible individuals <sup>7</sup> moved a joystick with their right hand under different hypnotic conditions whilst undergoing functional magnetic resonance imaging (fMRI).

In the voluntary movement condition the participants were instructed to move their hand, while in the involuntary conditions they were told that hand will move by itself (and they were either aware or not of the movement) (table 1.2).

- 1. Voluntary movement (hypnotised and non-hypnotised)

In a moment you will hear recorded instructions at regular intervals. The instruction will say, 'REST', which simply means not attempting to use or prepare to move your right hand; or 'MOVE' which means move the joystick to the **right** and then to the **left** once with your right hand each time. The instructions will come at regular intervals. Don't guess what is coming, just listen and follow the instructions to the best of your ability.

- 2. Involuntary movement

As before you will hear recorded instructions at regular intervals. When you hear the word 'REST' do nothing - just relax. When you hear the word 'MOVE' your right hand will move **all by itself** ... and will move the joystick to the **right** and then to the **left** once each time. Your right hand will make this movement all by itself; you will feel no control over when your right hand is going to move but you will be clearly aware of the movement of your hand and of the joystick when it occurs. You will remain calm and relaxed during these movements of your hand. The instructions will come at regular intervals. Don't guess what is coming, but at all stages listen to the recorded instructions.

- 3. Involuntary movement and loss of awareness

As before the recorded instructions will occur at regular intervals. When the word 'REST' is spoken your body will not respond - you will simply remain relaxed. When the word 'MOVE' is spoken your right hand will move **all by itself** ... and will move the joystick to the **right** and then to the **left** once each time but you will **not be aware** that it has done so. Your right hand will make this movement all by itself but you will not know that this has happened. You will

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<sup>6</sup> A PET scanner was used in this study.

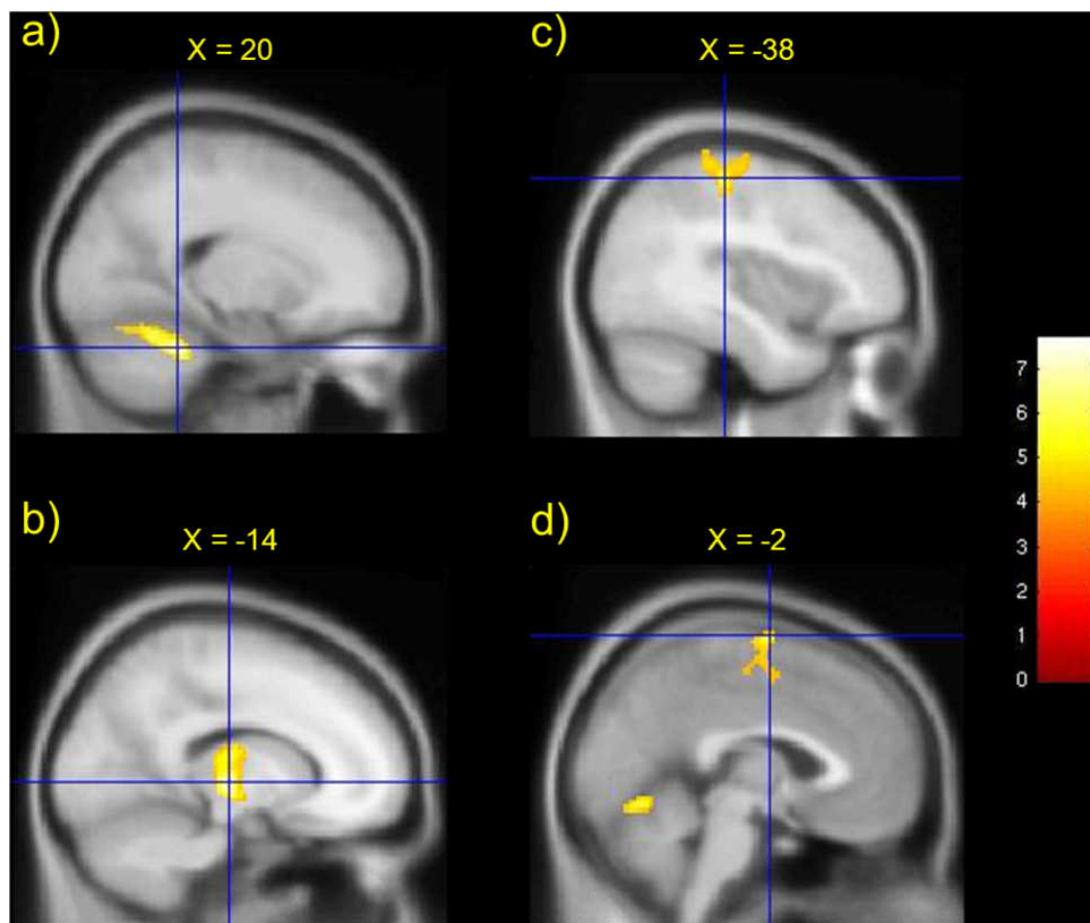
<sup>7</sup> Hypnotic suggestibility was established using the Harvard Group Scale of Hypnotic Suggestibility (Form A) (HGSHS) (Shor and Orne 1962). This involves twelve suggestions (eg: hallucinating a fly in the room) and each is scored as 0 or 1. The average score of the participants in Deeley et al's (2013) study was 9-10.

have no control over when your right hand is going to move and no awareness of the movement of your hand and of the joystick when it occurs. The instructions will come at regular intervals.

(Source: Deeley et al 2013)

Table 1.2 - Key difference in instructions given to participants.

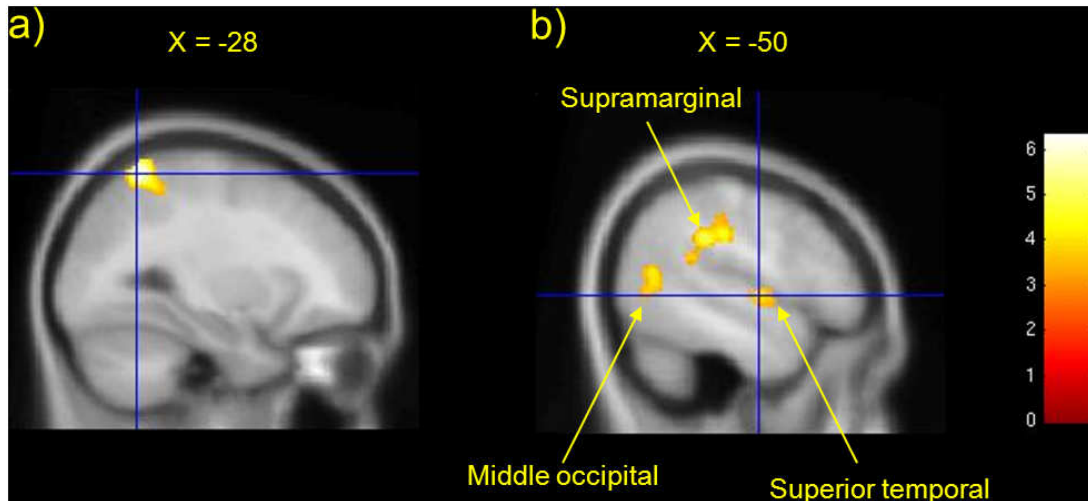
Deeley et al (20013) summed up the changes in brain activation (figures 1.3 and 1.4), thus: "loss of voluntary control of hand movement was associated with reduced connectivity between SMA and components of the motor network involved in movement implementation" (eg: pre-motor cortex, cerebellum).



(Crosshairs show peak activation: a = right cerebellum; b = left thalamus; c = left post-central gyrus; d = left SMA)

(Deeley et al 2013 figure 1)

Figure 1.3 - Brain activation during non-hypnosis voluntary control condition.



(Crosshairs show peak activation: a = left superior parietal lobe; b = inferior parietal lobe)

(Deeley et al 2013 figure 2)

Figure 1.4 - Brain activation during in involuntary movement and loss of awareness condition.

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## **2. POSITIVE BODY IMAGE**

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- 2.2. Definition and measurement
- 2.3. Variations in PBI
- 2.4. Flourishing
- 2.5. Self-compassion
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### **2.1. INTRODUCTION**

Research on body image tends to be skewed towards negative body image, so focus on positive body image is overdue, and Tylka and Wood-Barcalow (2015a) saw it as a "positive complement" <sup>8</sup>.

Tylka and Wood-Barcalow (2015a) listed issues about positive body image (PBI) <sup>9</sup>:

- Definition.
- Measurement.
- Relationship to the prevention of body image problems <sup>10</sup>.
- Its use in treatment of eating disorders.
- The relationship to social identity.

Wood-Barcalow et al (2010) described PBI as the "overarching love and respect for the body" <sup>11</sup> that includes:

- An appreciation of its unique beauty.
- Acceptance of the body.
- Feeling "beautiful, comfortable, confident, and happy with their body".
- Emphasising the body's "assets" rather than imperfections.
- Internalising positive information and rejecting negative information about it.

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<sup>8</sup> The idea of body image as complex, and the move towards PBI is attributed to the work of Cash and Pruzinsky (2002) by Tylka and Wood-Barcalow (2015b).

<sup>9</sup> PBI is not a stable characteristic, and can thus be improved by interventions like self-compassion training (Tylka and Wood-Barcalow 2015b).

<sup>10</sup> Prevention programmes build PBI through, for example, media literacy (ie: understanding the unrealistic appearance ideals) or developing appreciation of the body (Tylka and Wood-Barcalow 2015b).

<sup>11</sup> Halliwell (2015) defined it as "a state of body-self integration that is characterised by feeling 'at one' with the body" (p177).

## 2.2. DEFINITION AND MEASUREMENT

Williams et al (2004 quoted in Tylka and Wood-Barcalow 2015b), using cluster analysis, distinguished three groups of US female students based on their body image evaluation - PBI group (54%), negative body image group (24%), and "normative body image discontent" group (23%). The latter two groups were similar on body dissatisfaction, but the negative group have more emotional distress about it.

Initial measures of PBI placed it at one end of a continuum of body satisfaction-dissatisfaction, whereas most recent research "frames positive body image as a complex, multi-faceted construct distinct from low levels of negative body image and extending beyond body satisfaction or appearance evaluation" (Webb et al 2015 p131) <sup>12</sup>.

In a study with Australian women, Tiggemann and McCourt (2013) found that "positive body image and body dissatisfaction are not mirror images of one another, as it becomes increasingly possible for women to simultaneously experience some level of body dissatisfaction but also to appreciate and respect the body in other ways, especially with age" (Tylka and Wood-Barcalow 2015b pp121-122).

Multi-faceted PBI includes concepts and aspects like (Webb et al 2015):

i) Body appreciation - This is accepting one's body regardless of size and imperfections (body acceptance), caring for it with health promoting behaviours (body respect), and resisting the internalisation of unrealistic standards presented in the media (body protection) (Avalos et al 2005).

Body appreciation and body dissatisfaction are negative correlated (eg:  $r = -0.73$  for women and  $r = -0.64$  for men) (Halliwell 2015).

Avalos et al (2005) developed the Body Appreciation Scale (BAS) with thirteen items, like "my self-worth is independent of my body shape or weight". It covers four areas of PBI: favourable opinion about body, body acceptance, attention to bodily needs, and rejection of media images about appearance ideals (Halliwell 2015).

The original validation sample was female, and a male version has been produced ("I do not allow unrealistically thin images of women presented in the

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<sup>12</sup> Tylka and Wood-Barcalow (2015b) emphasised: "Positive body image is its own construct; in other words, it is distinct from negative body image. Positive body image is not on the same continuum as negative body image, nor should it be represented as low levels of negative body image" (p121).

media to affect my attitudes towards my body" vs "I do not allow unrealistically muscular images of men presented in the media to affect my attitudes towards my body") (Webb et al 2015) <sup>13</sup>.

ii) Positive rational acceptance coping - The ability to cope with body image-related threats (eg: teased about weight) has three responses - positive rational acceptance (ie: positive response to distress), avoidant (ie: escaping such threats), or appearance fixing (ie: altering appearance or hiding "flaws"). Cash et al (2005) constructed the Body Image Coping Strategies Inventory (BICSI) to measure the three coping strategies. For example, "I remind myself of my good qualities" is an item to measure positive rational acceptance.

Positive rational acceptance has been linked to positive psychological functioning in female students, in particular, as individuals, when faced with body-image threats, remind themselves of their good qualities, or that the situation will pass, or it is not important (Cash et al 2005).

iii) Body image flexibility - Developed to cope with body image threats, this idea combines "acceptance skills" and mindfulness as measured by the Body Image-Acceptance and Action Questionnaire (BI-AAQ) (Sandoz et al 2013). An example of the twelve items is: "my thoughts and feelings about my body weight must change before I take important steps in my life".

"For instance, a woman who experiences external criticism directed toward her body would demonstrate body image flexibility by being mindfully aware of the negative emotions that arise, purposefully evoke self-kindness, recognise that most people would have a similar emotional reaction in this situation, and then engage in self-care (eg: journal about the experience, go for a walk, treat herself to a massage, or call a friend)" (Tylka and Wood-Barcalow 2015b).

iv) Body functionality - Different measures of this concept have been constructed to focus on the experience rather than appearance of the body (eg: Objectified Body Consciousness Scale; McKinley and Hyde 1996).

v) Attunement - This is "the ability to

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<sup>13</sup> The BAS-2 (Tylka and Wood-Barcalow 2015c) has "a slightly modified focus on appreciation of the body, broadly defining beauty, body acceptance, and inner positivity influencing outer demeanour" (Halliwell 2015 p178).

appropriately sense and report the body by regularly engaging in adaptive behaviours to attend to its needs" (Webb et al 2015 p135), and can be done by body responsiveness (ie: attuned to the body's needs) and mindful self-care (ie: "the daily practice of being aware of basic physiological and emotional needs and structuring one's environment, relationships, and daily routine to meet these needs"; Webb et al 2015). The Body Responsiveness Scale (BRS) (Daubemier 2005), for example, can be used here (eg: "I am confident that my body will let me know what is good for me").

vi) Body pride - This can involve a narcissistic preoccupation with appearance if the individual invests in looking good according to cultural ideals, but better "if an individual prides her or his body for what it can do for them and what their bodies represent in terms of connectivity with others" (Webb et al 2015 p135).

Groups like "Health at Every Size", and ideas like "connected embodiment" (Piran et al 2002) (ie: "the experience of engaging the body with the world"; Tylka and Wood-Barcalow 2015b) challenge, what feminists called, "body hate or shame-based dialogue or action" (Tylka and Wood-Barcalow 2015b).

vii) Body talk - How individuals talk about their body weight, size or shape can be linked to body satisfaction (eg: "fat talk" and body dissatisfaction).

viii) Body sanctification - Spiritual significance and meaning attached to the body. For example, one woman interviewed by Wood-Barcalow et al (2010) said: "When you believe that you are designed by a creator and that you were thought of and preconceived and put together, you just feel good" (quoted in Webb et al 2015).

ix) How beauty is conceptualised - Tylka and Iannantuono (2015 quoted in Webb et al 2015) developed the Broad Conceptualisation of Beauty Scale (BCBS) to measure beauty beyond cultural appearance ideals (eg: "I think a wide variety of body shapes are beautiful for women").

Tylka and Wood-Barcalow (2015b) pointed out that individuals do not necessarily stop being concerned with their appearance, but they develop "adaptive appearance investment". This is "regularly engaging in appearance-related self-care, such as grooming behaviours that project an individual's sense of style and personality - it is enhancing one's natural features via benign methods. Adaptive appearance investment is not engaging

in potentially destructive appearance-altering methods to fit external standards of beauty, basing self-worth on appearance, or being preoccupied with appearance fixing behaviours" (Tylka and Wood-Barcalow 2015b p12).

Williams et al (2004 quoted in Tylka and Wood-Barcalow 2015b) found that women with PBI had less "self-evaluation salience" (Cash et al 2004) (ie: dysfunctional connection of appearance and self-worth), but similar levels of "motivational salience" (ie: adaptive appearance investment) as other women.

x) Body acceptance by others - eg: Body Acceptance by Others Scale (BAOS) (Avalos and Tylka 2006) based on body acceptance by friends, family, dating partners, society, and the media.

All the aspects of PBI mentioned above are measured by quantitative means, but qualitative assessment is also important. This allows a deeper and more nuanced understanding of the issues.

### **2.3. VARIATIONS IN PBI**

Tiggemann (2015) pointed out: "Although the study of positive body image, like the study of negative body image..., originated in samples of college women and adolescent girls, it has diversified much more quickly. Thus, despite its recency and smaller absolute quantity, the research on positive body image has been conducted with a wide range of individuals of varying characteristics" (p168).

These varying characteristics include:

1. Age - eg: Augustus-Horvath and Tylka (2011) found similar benefits to PBI among three groups of women - 18-25, 26-39, and 40-65 years old. Individuals who experienced positive body acceptance by others had less self-objectification, more PBI, and less eating issues.

Tiggemann (2015) reported studies in Australia that showed that, among women, body appreciation increased with age (but body dissatisfaction did not change).

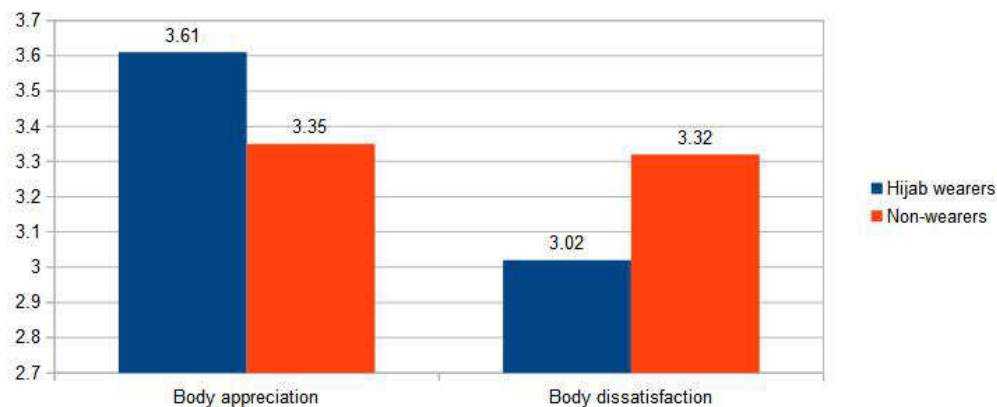
2. Culture - Some studies have found cross-cultural differences in what constitutes PBI (eg: USA vs Malaysia using BAS - ie: unidimensional vs bidimensional factor structure) (Tiggemann 2015).

3. Ethnicity - eg: African American female students are more accepting of larger body proportions than Euro-Americans (Tiggemann 2015).

4. Religion - eg: Swami et al (2014) reported that 369 British Muslim women who wore the hijab (Islamic headscarf) had more PBI (figure 2.1) and less internalisation of media messages about beauty than 218 other British Muslim women in London. The difference between the two groups of women, however, was "very small in most cases".

The researchers developed a "hijab index" based on questions about the frequency of wearing an Islamic headscarf and the type worn. The participants were also asked about actual-ideal weight discrepancy, body dissatisfaction, drive for thinness, and investment in experience.

Swami et al (2014) noted: "Of course, this is not to suggest that Muslim women who wear the hijab are immune from body image issues..., but rather that the use of the hijab may act as a buffer against negative body image" (p360).



(Body appreciation - higher score = more positive attitude; body dissatisfaction - higher score = more dissatisfaction)

(Data from Swami et al 2014 table 1 p358)

Figure 2.1 - Mean scores on two measures of body image (out of 6).

5. Gender - Using the BAS, men scored higher than women in a selection of different samples (Tiggemann 2015).

6. Sexual orientation - There is limited research on PBI here, but Tiggemann (2015) said: "My own prediction is that lesbian women's greater experience of female bodies will contribute to an acceptance of a wide variety of bodies as beautiful (or at least as normal), which will result in more positive body image than heterosexual women, even though they may not differ on body

dissatisfaction. This outcome might be expressed as collective appreciation for their own and other women's bodies, as well as a greater sense of connection with other women than their heterosexual counterparts" (p171).

7. Feminist identity - Tiggemann (2015) pointed out: "One would expect a feminist identity to equip women with a heightened ability to critique traditional feminine roles and cultural pressures related to appearance and thinness. However, a number of studies do not find the predicted relationship between feminism and better body image" (pp171-172).

#### 8. "Special populations"

i) Athletes - eg: Hahn Oh et al (2012) found that body acceptance by coaches and team-mates helped in PBI among female student athletes, and that body appreciation was higher than female students generally.

ii) Dancers - Street, modern, and belly dancers have been found to have better body appreciation scores than non-dancers (Tiggemann 2015).

iii) Fashion models - Swami and Szmigielska (2013) found that London fashion models had a higher drive for thinness, but the same level of body appreciation as matched controls.

9. Disability - Halliwell (2015) observed: "To date, there has been no investigation of PBI among individuals with a visible difference, or disfigurement" (p180).

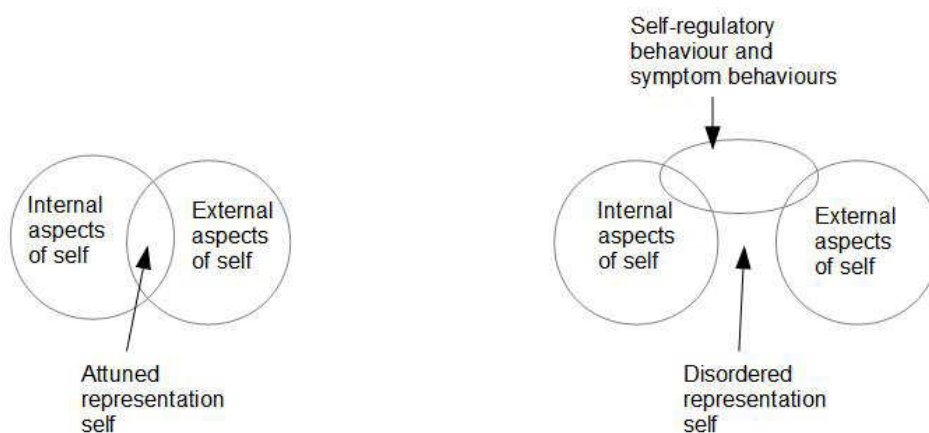
## **2.4. FLOURISHING**

Cook-Cottone (2015) argued that flourishing goes hand in hand with PBI in two ways: "(a) having a healthy, embodied awareness of the internal and external aspects of self, and (b) engaging in mindful self-care" (p158). Together these have a positive affect on the risk of eating disorders (defined as "disordered food- and body-related cognitions, poor self-regulation, and dysfunctional eating behaviours"; Cook-Cottone 2015). This is seen in the Attuned Representational Model of Self (ARMS) (Cook-Cottone 2006), which sees the self as a product of internal and external aspects (figure 2.2).

Internal aspects include thoughts, feelings, and the body, while external aspects cover family, friends, community, and culture. "Healthy, embodied self-regulation occurs when an individual is able to nurture

an awareness and maintenance of the needs of the inner aspects of self (ie: physiological, emotional, and cognitive), while engaging effectively within the context of family, community, and culture" (Cook-Cottone 2015 p159). This is attunement.

Misattunement (or the disordered representational self) can lead to eating disorders. Cook-Cottone (2015) summed up: "The internal aspects of self (ie: thoughts, feelings, and physiological needs) are left without representation or voice. Eating disordered behaviours, thoughts, and motivations take on a critical role in the organisation and function of the self. The internal aspects of self become attuned to the experience of symptoms in a self-perpetuating, self-reinforcing disorder. As a tangible symbol of the self, the body becomes something to control, change, and bring into alignment with cultural ideals. In chronic, clinical cases, the eating disorder becomes the central organising feature of the individual's life; that is, his or her identity" (p160) <sup>14</sup>.



(Based on Cook-Cottone 2015 figure 2 p159 and figure 3 p160)

Figure 2.2 - ARMS and disordered representational self.

Piran (2015) used the concept of "positive processes of inhabiting the body" as a guide to protect against eating disorders. The Developmental Theory of Embodiment (DTE) (Piran and Teall 2012) explored protective and risk factors in this process. The experience of embodiment is affected by factors in three domains (Piran 2015):

1. Physical freedom (physical care of the body) -

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<sup>14</sup> Individuals with eating disorders have been found to have differences in cognitive processing to the general population (appendix 2A).



eg: social experiences that enhance self-care;  
"pleasurable connection to desires".

2. Mental freedom (internalisation of social constructions) - eg: engage in activities unrelated to appearance; take critical stance towards idealised appearance standards.

3. Social power (the body as "social capital"; ie: access to resources related to appearance) - eg: "positive connection to one's embodied social location"; freedom from discrimination.

## **2.5. SELF-COMPASSION**

Western society has a culture of objectification where "women learn to think about their bodies as objects rather than as active agents and start to view their bodies from an observer's perspective" (Liss and Erchull 2015 p5). This is self-objectification, which leads to "body surveillance", where women view their bodies from the perspective of others and cultural ideals. Not surprisingly, this can produce negative mental health, and is linked to eating disorders, for example. Body surveillance is related to disordered eating attitudes and behaviours through "body shame" (Liss and Erchull 2015).

One way to combat this process is self-compassion<sup>15</sup>. This is a non-judgmental attitude towards the self with "kindness and love for oneself in a non-contingent and unconditional way" (Liss and Erchull 2015). Self-compassion can have a positive effect on mental health.

Generally, for example, Johnson and O'Brien (2013) found that individuals writing about a shameful memory who were encouraged to show self-compassion reported less depression and shame later than a control group.

Specifically, Liss and Erchull (2015) found that self-compassion reduced negative attitudes towards the body. Over three hundred female US psychology students completed online a number of questionnaires (which maintained the anonymity but allowed the different scores to be correlated). The main questionnaires were the OBCS (to measure body surveillance and shame), the Self-Compassion Scale - Short Form (Raes et al 2011), and the Eating Attitudes Test-26 (EAT-26) (Garner et al 1982) (to assess negative eating attitudes).

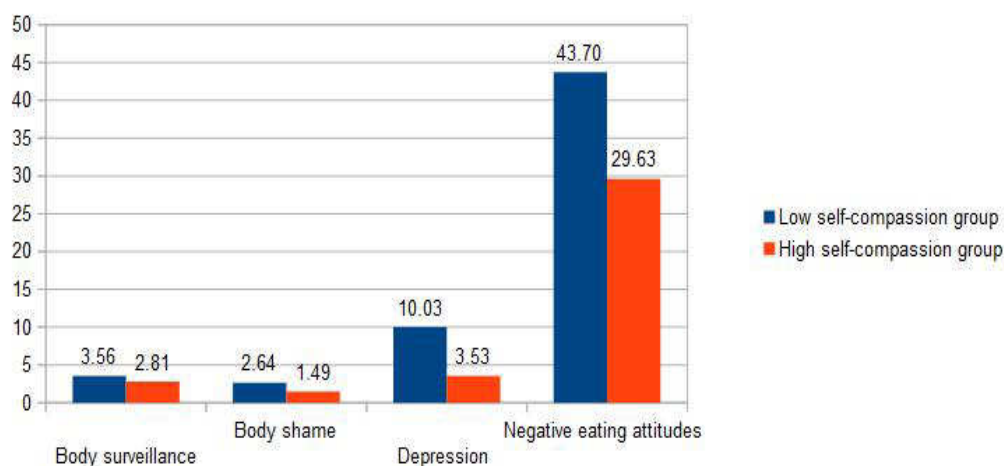
The Self-Comparison Scale had twelve items, like

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<sup>15</sup> This is similar to "body image flexibility" - "the ability to experience negative attitudes about one's body fully and openly without being defensive or judgmental toward the self" (Liss and Erchull 2015 p10).

"when I'm going through a very hard time, I give myself the caring and tenderness I need", each scored 1 (almost never) to 5 (almost always). An average score for each participant was calculated (between 1 and 5), and two groups were distinguished for analysis - high self-comparison group (average scores of 3.11 - 5.00) (n = 106) and low self-comparison group (scores of 1.00 to 2.50) (n = 104).

The researchers predicted that the higher self-compassion group would have lower levels of body surveillance, body shame, and negative eating attitudes. This was found (figure 2.3).



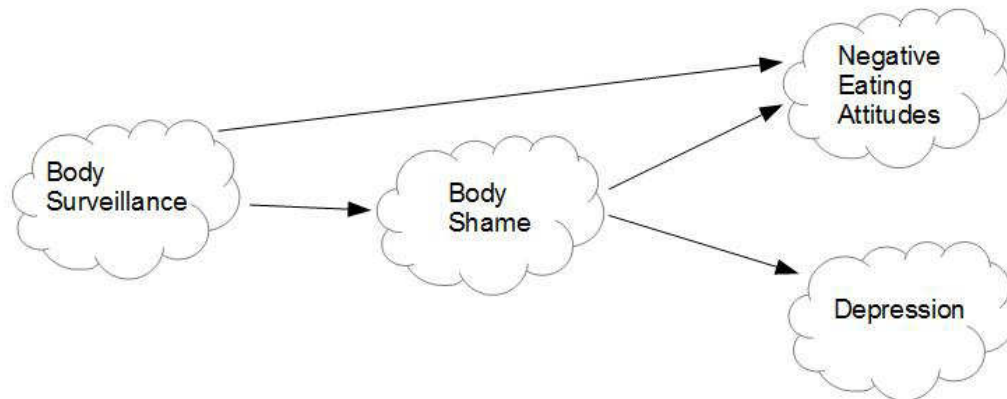
(Body surveillance/body shame = out of 5; depression = out of 24; negative eating attitudes = out of 130)

(Data from Liss and Erchull 2015 table 2 p9).

Figure 2.3 - Mean scores of two groups on four measures.

Liss and Erchull (2015) used the data in a path model to show the significant relationships between body surveillance and shame, and negative eating attitudes and depression (figure 2.4). But "the pathways from body surveillance to body shame and from body surveillance to negative eating attitudes were found to be significantly different between the high and low self-compassion groups. In both cases, body surveillance was more strongly linked to negative consequences among women who were low in self-compassion" (Liss and Erchull 2015 p10). The researchers continued: "Thus, our results suggest that self-compassion acts a moderator, decreasing the potential negative mental health variables related to engaging in body surveillance. Women who are high in self-compassion may observe and monitor their bodies, but when they do so, they are less likely to experience shame about their bodies and negative attitudes toward eating. This is because self-compassion encourages accepting the

self, even when the self is imperfect" (Liss and Erchull 2015 p10).



(Based on Liss and Erchull 2015 figure 2 p9)

Figure 2.4 - Path model of relationships between variables.

Table 2.1 outlines three studies that have shown benefits from self-compassion.

STUDY	DETAILS
Kelly et al (2014)	Individuals with eating disorders who were encouraged to show more self-compassion early in treatment had faster decline in eating disorder symptoms over three months than controls.
Albertson et al (2014)	A three-week self-compassion meditation course helped reduce body dissatisfaction among women with negative body image over three months.
Adams and Leary (2007)	Female students were given a donut to eat, and afterwards half were encourage to think self-compassionately (eg: "people eat unhealthy food at times"). These individuals reported less distress than controls (no self-compassion).

Table 2.1 - Three studies on self-compassion.

## 2.6. APPENDIX 2A - ANOREXIA NERVOSA AND INEFFICIENT COGNITIVE PROCESSING STYLE

Adults with anorexia nervosa (AN) have been found to have an inefficient cognitive processing style. This includes set-shifting problems (moving flexibly between strategies, rules or behaviours), and weak central coherence (bias towards details rather than global). These inefficiencies persist after recovery, and have been observed in unaffected relatives of sufferers

(suggesting a genetic component) (Lang et al 2015) <sup>16</sup>.

The evidence for inefficient processing in children and adolescents with AN is inconsistent. This is partly due to small sample sizes, and different tasks used to measure cognitive processing (Lang et al 2015).

In their study, Lang et al (2015) tried to rectify these weaknesses with a larger sample and standardised neuropsychological tasks. The female sample was forty-one 11-18 year-olds with a DSM-5 diagnosis of AN at a child and adolescent eating disorders service in south London (and forty-three age, gender, and IQ matched healthy controls; HC).

Set-shifting was measured by the Wisconsin Card Sorting Test (WCST) (computer version) (Heaton 1993). Each card has a shape and colour, and participants must sort the cards into categories following rules. The rules are changed, and "completing a set" is scored.

Central coherence was measured by the Rey-Osterrieth Complex Figure test (ROCFT) (Osterrieth 1944), where participants are asked to copy by hand a drawing of a complex shape, and the Fragmented Pictures Task (FPT) (Snodgrass et al 1987). The FPT involves a picture appearing on a computer screen in bits, and participants have to say what it is as quickly as possible. Quicker responses are seen as better global processing. While the ROCFT is scored by how the drawing is copied (eg: focus on whole first or detailed elements).

The AN group showed differences in processing style to the HC group. The former completed less sets, and made more perseverative errors <sup>17</sup> on the WCST. They also had a lower central coherence score on the ROCFT, but there was no difference between the groups on the FPT.

Lang et al (2015) pointed out that "the performance of the AN group in these task cannot be described as 'impaired', however, the AN group display a significantly different processing style to the HC group, characterised by subtle inefficiencies in both set-shifting and central coherence tasks. Overall, despite having similar IQ to the HC group, these results suggest an inflexible thinking style with poorer global integration in the AN group in young people".

Table 2.2 outlines methodological issues with this study.

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<sup>16</sup> "These findings have led to the postulation that this cognitive style is representative of an endophenotype for the disorder. An endophenotype can be defined as a measurable component between a gene and the observable phenotypic characteristics of a disorder" (Lang et al 2015).

<sup>17</sup> This is following the previous rule after the rule changes for the categorisation of the cards.

1. The study mirrored the methodology and findings of studies with adults (though small differences in latter), but adult sufferers will have had AN for a longer period).
2. HC group matched to AN group on three elements - age, gender, and IQ - but not social class, for example.
3. The use of standardised neuropsychological measures.
4. Clear inclusion/exclusion criteria:
  - AN group - DSM-5 diagnosis; ideal body weight for age/gender 90% or less.
  - HC group - ideal body weight 91-120%; no psychiatric disorders; no history of eating disorders; no first- or second-degree relatives with eating disorder.
  - Both - no autism or learning disability; English speakers only.
5. Females only, but the majority of AN sufferers are female.
6. No record of pre-illness weights. "Therefore the degree of weight loss and the severity of starvation of each participant cannot be accounted for in the results" (Lang et al 2015).
7. Potential confounding of cognitive inefficient from AN and lack of development. Lang et al (2015) pointed out that "previous research with healthy population samples has clarified that set-shifting abilities rapidly develop up to the age of eight years, with a moderate amount of development of these skills in early adolescence. In terms of central coherence, there is a lack of developmental studies available, and it is suggested that central coherence can be viewed more as a processing style rather than an impairment or skill, and is based on a continuum from detailed-focused to global integration. The effects of starvation and malnutrition on the brain at such a critical developmental period should not be underestimated and should be considered when interpreting our results".
8. Longitudinal study needed to establish if weight restoration leads to improvements in cognitive processing.
9. Neuroimaging study needed to establish if structural brain differences between AN and HC groups.
10. Large sample for type of study, but only included those attending treatment in AN group.

Table 2.2 - Methodological issues with Lang et al (2015).

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### **3. HUNGER AND BUYING**

Appendix 3A - Lozano et al (1999)  
Appendix 3B - Briers et al (2006)  
Appendix 3C - Belief bias effect  
References

Individuals buy more food if they go round a supermarket when hungry (Thomson 2015)<sup>18 19</sup>, but they also buy more non-food items when hungry<sup>20 21</sup>.

Jing Xu et al (2015) stated: "By directing attention to the consumption of food, which requires its acquisition as a pre-requisite, hunger is likely to activate general concepts and behavioural knowledge associated with acquisition. These acquisition concepts, once accessible in memory, may influence subsequent decisions to acquire objects, even when these objects (say, binder clips) are clearly unable to satisfy the hunger motive... The predicted increase in acquisition of non-food items is not necessarily accompanied by increased liking of these items" (p2688).

Jing Xu et al (2015) performed five studies to show this happening (table 3.1).

#### Study 1

This experiment assessed whether hunger increased the cognitive accessibility of concepts related to acquisition. Sixty-nine students were shown twenty-two words and 22 non-words one by one very fast (50 ms) on a computer screen. They had to type the word afterwards. The words were either semantically related to acquisition (eg: want, get) or hunger (eg: starve, famine), or control words (eg: chair, painting). The level of hunger was self-reported on a ten-point scale after the experiment. The likelihood of perceiving the hunger and acquisition words presented almost too fast to see was significantly related to self-reported hunger, while perception of control words and non-words were unaffected by hunger.

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<sup>18</sup> Hungry influences food attitudes (Lozano et al 1999) (appendix 3A).

<sup>19</sup> The hormone ghrelin is released during hunger and it affects parts of the brain related to reward and motivation (Thomson 2015).

<sup>20</sup> Briers et al (2006) argued that "people's desire for money is a modern derivative of their desire for food". Put another way, hungry individuals desire money (appendix 3B).

<sup>21</sup> This is an example of individuals being far from rational in their decision-making (appendix 3C).



## Study 2

This study investigated whether cognitive accessibility of concepts translated into desirability of items. Seventy-seven individuals at a university in North America were approached individually outside a cafeteria during lunch-time, either before they entered (hunger condition) or coming out (satiation condition). They were asked to rate the desirability of five food and five non-food items on a ten-point scale during an attitude survey.

The desirability of having food items was significantly higher in the hunger condition than the satiation condition, not surprisingly, but so was the rating of non-food items (figure 3.1). However, the rating of liking of non-food items was not affected by hunger. The study showed that "hunger increases the accessibility of general acquisition-related concepts (in addition to hunger-related concepts) and the intention to acquire non-food objects, without affecting liking for these objects" (Jing Xu et al 2015 p2689).

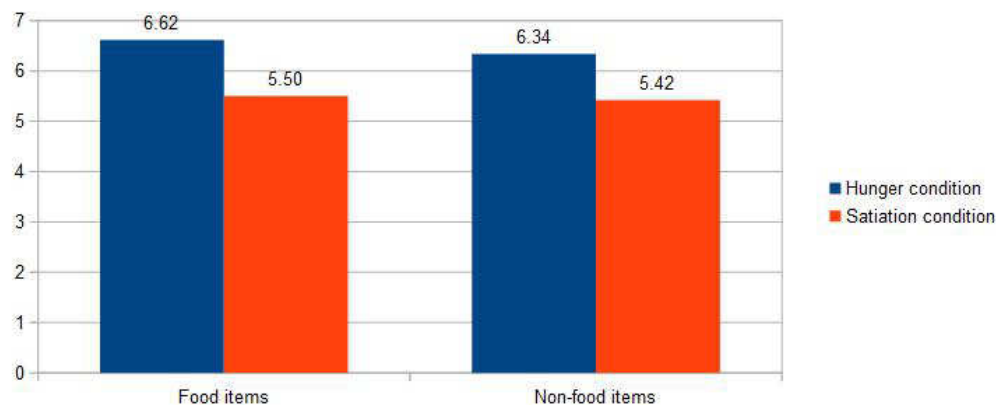


Figure 3.1 - Mean rating of desire to acquire food and non-food items (out of ten).

## Study 3

This study tested whether desirability of an object translated into actual acquisition behaviour. Eighty-four undergraduates completed a consumer survey about a sample of binder clips after examining the object. As a reward for completing the questionnaire, they were allowed to have as many of the clips as they wanted for trial use. This was the measure of acquisition. Self-reported hunger was given at the end of the study. Hunger was significantly positively related to number of binder clips wanted, but evaluation (ie: rating of liking) of binder clips was unaffected by hunger.

#### Study 4

This study was a replication of the previous one with sixty-three more undergraduates, but the researchers manipulated the level of hunger rather than relying on self-reports. Participants were told not to eat for four hours before the study as it was a "blind taste test". Half of the participants were given cake as the taste test, then completed the consumer survey on binder clips (satiation condition), and the other half did the opposite way around (hunger condition).

Participants in this latter condition wanted significantly more binder clips to trial (mean 3.93) than the satiation condition (mean 2.31) ( $p < 0.02$ ). Evaluation of the binder clips was not significantly different (mean 2.76 vs 2.41 respectively).

#### Study 5

The previous two studies were laboratory-based, so the researchers investigated the effect of hunger on acquisition in real-life by approaching eighty-one customers as they left a large non-food department store with shopping. The shopping receipts were used to measure amount purchased, and participants self-reported their level of hunger.

Hungry shoppers purchased significantly more non-food products and spent more money than less hungry shoppers.

STUDY NO.	FINDINGS	TYPE OF STUDY
1	Hunger increased access of acquisition-related concepts	Laboratory experiment
2	Hunger increased stated intention to acquire non-food items	Field study
3	Hunger increased desire to acquire non-food items	Questionnaire
4	Hunger increased desire to acquire non-food items	Laboratory experiment
5	Hunger increased desire to acquire non-food items	Field study

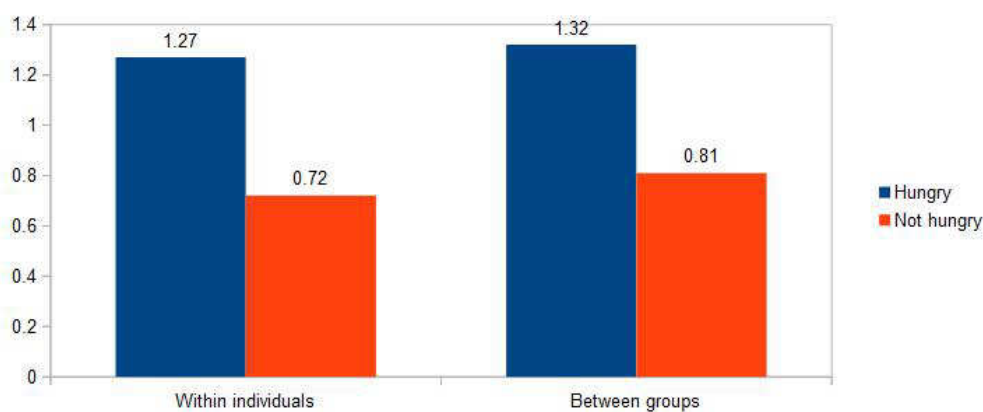
Table 3.1 - Summary of five studies by Jing Xu et al (2015).

The researchers summed up the implications of their studies: "millions of Americans are dieters who deliberately deprive themselves of calories every day. The present findings suggest that such behaviours are

likely to lead to unplanned purchases in non-food domains. Future research could address how unplanned purchases of non-food items are affected by habitual dieting, obesity, and other variables that are likely to influence the frequency of thinking about food consumption. It is also conceivable that the relationship between acquisition-related thoughts and motivation to eat is bidirectional. Much as hunger gave rise to the acquisition of non-food items in the present studies, a desire to acquire non-food items may lead to the unplanned acquisition of food when the opportunity arises. If so, craving an inedible luxury good may turn into a risk to people's waistlines, just as an empty stomach may open their purse strings for binder clips" (Jing Xu et al 2015 p2690).

### APPENDIX 3A - LOZANO ET AL (1999)

Lozano et al (1999) asked ninety undergraduates at the University of Texas at El Paso to complete the same questionnaires on food attitudes when hungry and when not hungry. Food attitudes were significantly more positive when hungry than not hungry, both compared between individuals themselves and between groups, while attitudes towards control items (eg: animals) were unaffected by hunger (figure 3.2). The change in attitude was stronger for high-fat than low-fat foods (figure 3.3).

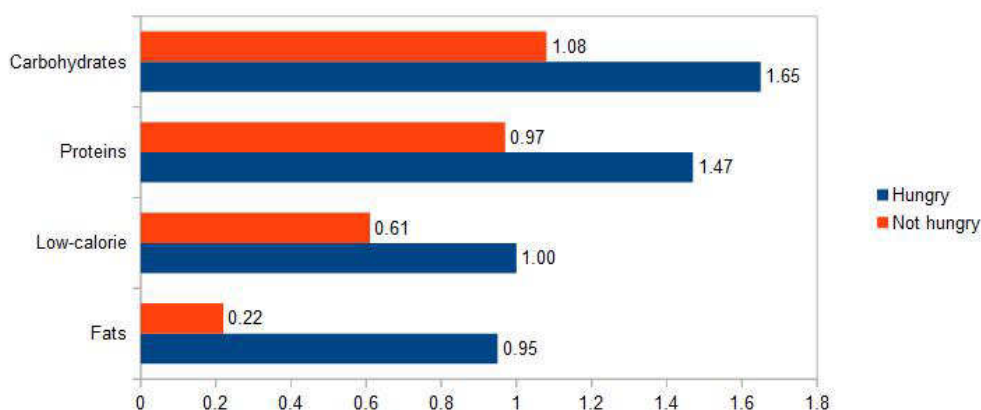


(Data from Lozano et al 1999 table 2 p212)

Figure 3.2 - Mean ratings of foods (out of 3).

Attitudes were measured by a four-point scale for each food (or non-food) item.

Lozano et al (1999) noted that "attitudes have been conceptualised as relatively stable memory constructs,



(Data from Lozano et al 1999 table 2 p212)

Figure 3.3 - Mean ratings of different types foods by individuals when hungry and not hungry (out of 3).

but the present findings suggest that this conceptualisation may not be entirely accurate - at least for food attitudes" (p213). The participants, however, chose when to complete the questionnaires at home (ie: they decided when hungry or not hungry).

#### **APPENDIX 3B - BRIERS ET AL (2006)**

In their Study 1, Briers et al (2006) manipulated the level of hunger of sixty-six (mostly male) undergraduates in Belgium to see the effect on their willingness to donate money to charities. All participants were told not to eat for four hours prior to the study. Half of them were given a piece of cake (as a taste test) before a questionnaire about donating to ten charities (satiation condition), and the other half had the cake after the questions (hunger condition). The hunger condition was significantly less likely to donate to charities than the satiation condition.

In Study 2, with fifty-eight female undergraduates, the experimenters used the scent of baking brownies wafting into the laboratory to create a feeling of hunger as the participants played a computerised sharing game. The hunger condition had a mean donation of 2.7 (out of ten Euros) compared to 3.9 in the control condition. This confirmed the findings of Study 1.

Briers et al (2006) found that manipulating the amount of money altered the amount of food eaten in their Study 3 (ie: the opposite relationship to the previous two studies). Participants given the opportunity to eat

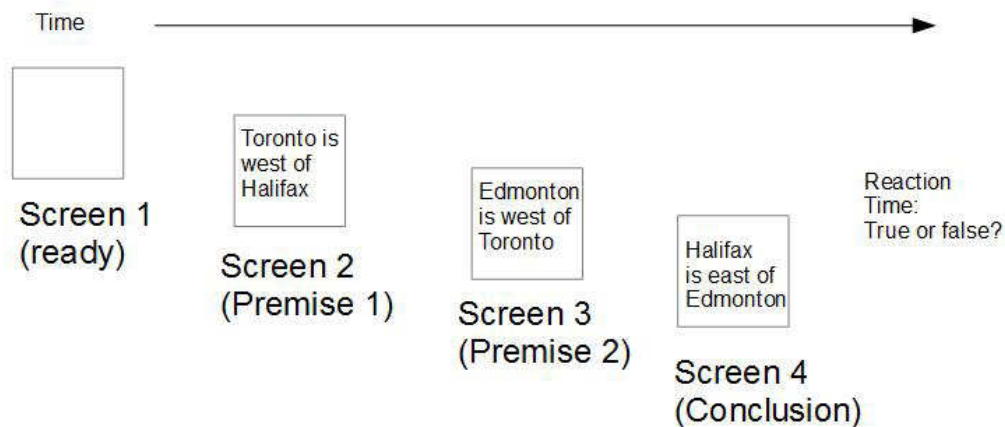
as many sweets as they wanted in a taste test, consumed significantly more if they had been thinking about winning a large amount of money previously (high-desire-for-money condition) than a small amount (low-desire-for-money condition).

Different studies have found that the orbitofrontal cortex is activated by monetary rewards, and by sweet-tasting food, suggesting "a common pathway for processing money and food rewards" (Briers et al 2006).

### APPENDIX 3C - BELIEF BIAS EFFECT

Deductive reasoning can be hampered by the "belief bias effect" (Evans 1989), where the content in a logical argument that conflicts with one's beliefs can hinder the ability to reason (Stollstorff et al 2012).

Stollstorff et al (2012) explored this problem with sixteen Canadian participants undergoing functional magnetic resonance imaging (fMRI). The participants were presented with Premise 1 (P1), then Premise 2 (P2), and then the Conclusion (C) (figure 3.4). The reaction time to say if the Conclusion was correct from Premises 1 and 2 is measured. The premises were related to Canadian geography.



(Based on Stollstorff et al 2012 figure 1 p28)

Figure 3.4 - Experimental procedure.

A congruent argument has no conflict between logic and beliefs; eg:

P1: Toronto is west of Halifax  
 P2: Edmonton is west of Toronto  
 C: Halifax is east of Edmonton

This is factual correct in terms of geography (figure 3.5) and logic (belief-logic congruent). The mean reaction time was 3472 ms.



(Drawn with MapCreator 2.0)

Figure 3.5 - Map of Canada.

An incongruent argument is more difficult to solve because and logic are in conflict; eg:

P1: Toronto is east of Halifax  
P2: Edmonton is east of Toronto  
C: Halifax is west of Edmonton

This is true in terms of the logic of the argument, but not in terms of the beliefs about geography (belief-logic incongruent). The mean reaction time was slower at 3796 ms.

An abstract content-free argument does not have this problem; eg:

P1: Square is left of circle  
P2: Circle is left of triangle  
C: Square is left of triangle

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