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# **PSY1102**

# **Introduction to Applied Psychology**

## **Class 7**

## **Intelligence**

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# Agenda for today

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1. What is intelligence?
2. Is intelligence one ability, or several?
  - Multiple intelligences
3. Intelligence and creativity
4. Emotional intelligence
5. Is intelligence neurologically measurable?
  - Brain size and complexity
  - Brain function

# 1. What is intelligence?

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What's your answer?

What does “intelligence” mean to you?

# 1. What is intelligence?

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- Is intelligence one aptitude, or several?
- Does intelligence refer to the knowledge that a person has, or the cognitive tools s/he uses to make use of this knowledge?
- Is intelligence related to the speed of processing information?
- Can we “see” intelligence neurologically?

# 1. What is intelligence?

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- Intelligence is a socially constructed concept, not a thing. It's important not to reify intelligence.
- As noted in the textbook (p. 386):

Intelligence is a mental quality consisting of the ability to learn from experience, solve problems, and use knowledge to adapt to new situations.
- Specific examples of intelligence will differ from one culture to another.
  - For example, a farmer will have different challenges than a city-dweller.

## 2. Is intelligence one ability or several?

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- a. Spearman
- b. Thurstone
- c. Kanazawa
- d. Gardner
- e. Sternberg

## 2a. Is intelligence one ability or several? Spearman

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- In the first half of the 20<sup>th</sup> century, Spearman believed that we have one general intelligence (g), although he agreed that individuals could also have specific abilities.
- Spearman was instrumental in developing factor analysis, a statistical tool that can be used to identify clusters of related items.
  - Spearman noticed that people who got high scores in one area (e.g., math) typically scored above average in other areas (e.g., verbal).
  - As a result, he posited the existence of the g factor, which – in his view – underlies all of our reasoning ability.
- The existence of a general intelligence is controversial even today.

## 2b. Is intelligence one ability or several? Thurstone

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- Thurstone, an opponent of Spearman, administered 56 different tests to many people, then mathematically identified seven clusters of abilities, including:
  - Word fluency
  - Verbal comprehension
  - Spatial ability
  - Perceptual speed
  - Numerical ability
  - Inductive reasoning
  - Memory
- Although Thurstone argued for specific intelligences, others noticed that people who scored well on one cluster generally scored well on the others, supporting the *g* notion.

## 2c. Is intelligence one ability or several? Athletics?

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- Is intelligence analogous to athletic ability, where someone may excel in one sport but will generally do better than the average person on many of them?
- More recently (2004), Kanazawa has posited that general intelligence is an ability that helps people solve novel problems.
  - Solving more common (or more traditional) problems requires a different sort of intelligence.
  - Kanazawa argues that general intelligence scores correlate well with the ability to solve novel problems, but not with problems that have become familiar through human development.

## 2d. Theories of multiple intelligences: Gardner

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- Spearman and Thurstone were primarily concerned with academic performance, but more recently investigators have looked at a broader concept of intelligence.
- Gardner sees intelligence as several abilities, some of which are “packaged” together.
  - For example, brain damage can destroy one ability without damaging others.
  - Also, savant syndrome is seen in people who score low on tests but exhibit an “island” of brilliance, for example in music, art, or some other area. (About 80% of savants are male, often – but not always – with autism.)
  - Thus, Gardner argues that we have intelligences, and identifies 8 of them.
  - Ericsson posits the 10-year rule: 10 years of daily, intense practice is a common ingredient in expert performance.

## 2d. Theories of multiple intelligences: Sternberg

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- Sternberg proposes three intelligences in a triarchic theory:
  - Analytical intelligence (academic problem-solving), assessed by tests;
  - Creative intelligence, where people generate novel ideas and react adaptively to novel situations; and
  - Practical intelligence, including performance on common tasks.
- In combination with the US College Board, Sternberg has developed new measures of creativity and practical thinking, which seem to predict first-year university grades and do so with smaller differences between ethnic groups.

See Table 10.1 (page 391) in the textbook for a summary of different theories of intelligence.



## 3. Intelligence and creativity

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- What is creativity?

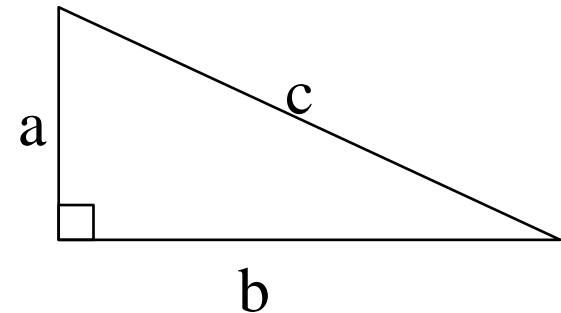
What's your answer?

What does “creativity” mean to you?

### 3. Intelligence and creativity

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- The Pythagorean theorem states that, in a right triangle, the formula  $a^2 + b^2 = c^2$  can be used to find the length of the hypotenuse of the right triangle, where  $c$  is the hypotenuse.



- Fermat's last theorem – referred to, but not described in the textbook – states that no three numbers  $a$ ,  $b$ , and  $c$  exist such that  $a^n + b^n = c^n$  is true for any integer value of  $n$  greater than 2.
- Fermat proposed this theorem in 1637, but it was not proven until 1995 – 358 years later.
- In the end, Fermat's last theorem was proven by a Princeton mathematician when the answer “just came” to him.

### 3. Intelligence and creativity (continued)

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And thanks for the trouble you took from her eyes.  
I thought it was there for good, so I never really tried.

-Leonard Cohen, *Famous Blue Raincoat*

[www.youtube.com/watch?v=bPlpxHhzSp0](http://www.youtube.com/watch?v=bPlpxHhzSp0)

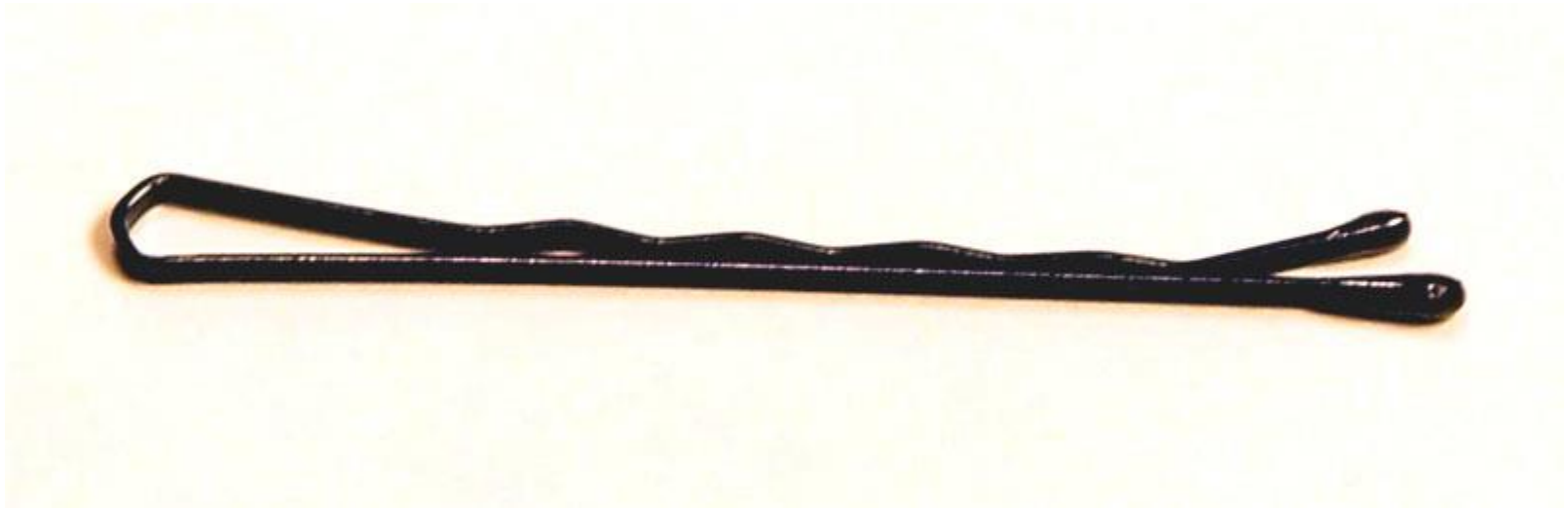
Turn off your mind, relax and float downstream ...  
But listen to the colour of your dreams.

- Lennon / McCartney, *Tomorrow Never Knows*

[www.youtube.com/watch?v=tisjsgsgtZU](http://www.youtube.com/watch?v=tisjsgsgtZU)

# Creativity: an example

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Crozier, Lorna. *The Book of Marvels: A Compendium of Everyday Things*. Greystone Books, Vancouver, 2012.

### 3. Intelligence and creativity: tests

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- One definition of creativity is that it is the ability to produce ideas that are both novel and valuable.
- Studies have suggested that a score of at least 120 on a standard intelligence test is necessary, but not sufficient, for creativity.
  - In other words, it's possible for someone who scores more than 120 to not be creative.
  - Therefore, creativity requires intelligence, but is not the same as intelligence.
- Intelligence tests require convergent thinking; by contrast, creativity tests require divergent thinking.
- As shown by Kolb & Whishaw, damage to parts of the frontal lobes will destroy imagination but leave reading, writing, and other skills intact.

### 3. Sternberg's five components of creativity

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1. Expertise, or a well developed knowledge base (building blocks).
2. Imaginative thinking skills provide the ability to see things in novel ways, to see patterns, and to make connections.  
Copernicus inverted the mechanics of the solar system.
3. A venturesome personality, who seeks new experiences, tolerates ambiguity and risk, and is persistent.
  - Edison said that “genius is 1% inspiration and 99% perspiration.”
4. Intrinsic motivation involves being driven by internal pressures rather than by external pressures.
5. A creative environment helps spark and support creative ideas. Also, it helps to acknowledge debts to others.
  - Newton said, “If I have seen further, it’s by standing on the shoulders of giants.”

## 4. Emotional intelligence

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- So far, we've discussed academic intelligence (including, for example, verbal and math) and creativity. Another type of intelligence is social intelligence.
- According to the textbook (p. 390), social intelligence is “the know-how involved in social situations and managing yourself successfully.”
- Otherwise capable people are not better than average at managing friendships, marriages, and other social dealings.
- One aspect of social intelligence is emotional intelligence, “the ability to perceive, understand, manage, and use emotions” (p. 390).

## 4. Emotional intelligence (continued)

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- Emotional intelligence, according to researchers, has four components, the abilities to:
  - Perceive emotions in music, faces, stories (see next slide);
  - Understand emotions, including predicting them and how they change and blend;
  - Manage emotions, knowing how to express them in varied situations; and
  - Use emotions to enable adaptive or creative thinking.
- Emotional intelligence should not be confused with self-esteem or optimism.

## 4. Emotional intelligence: example

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- Here's an example of being able to perceive emotions in music.
- Before we start, examine your current emotional state to get a baseline measure.

[www.youtube.com/watch?v=SJwb\\_KXWsbk](http://www.youtube.com/watch?v=SJwb_KXWsbk)

- When the song has finished, compare your emotional state at that time to your baseline state.

## 4. Emotional intelligence: social interactions

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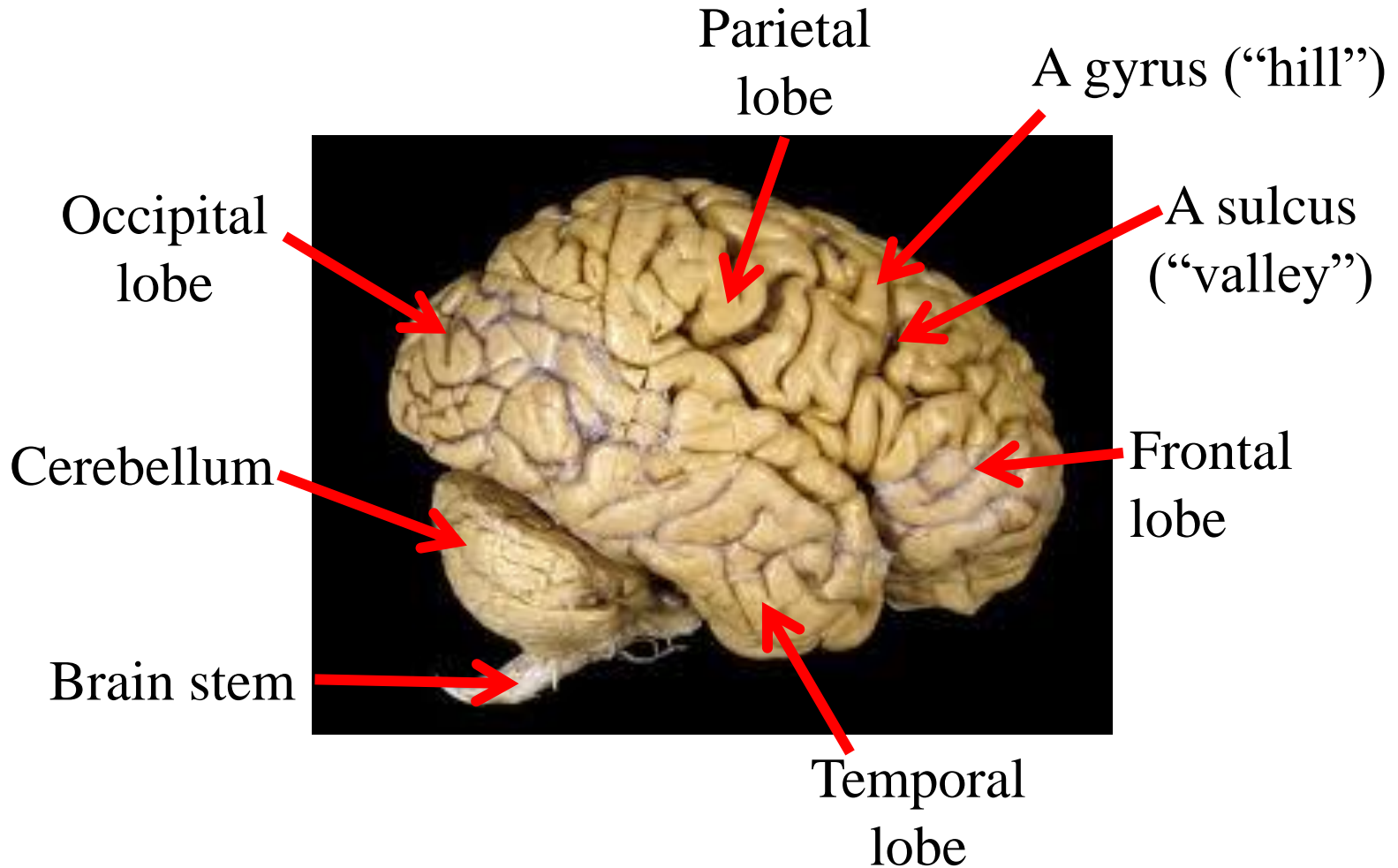
- People scoring highly on managing emotions have higher-quality interactions with friends and avoid being thrown off-track by depression, anxiety, or anger.
- They know how to read emotions in others and respond appropriately.
- They are able to delay gratification, avoiding impulsive behaviour to achieve longer-term goals.
- Perhaps as a result, they are often successful in their jobs, marriages, and parenting roles.
- However, there is still debate (by Gardner, among others) about whether emotional intelligence is a misnomer; he fears that it may dilute our characterisation of intelligence.

## 5. Is intelligence neurologically measurable?

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- Over the past few decades, powerful neurophysiological tools have been developed to let us see inside the working brain. Will these tools help us understand the neurological basis of intelligence?
- First, let's consider the historical perspective.

# 5. Intelligence and neurology: the human brain



## 5. Intelligence and neurology: brain size

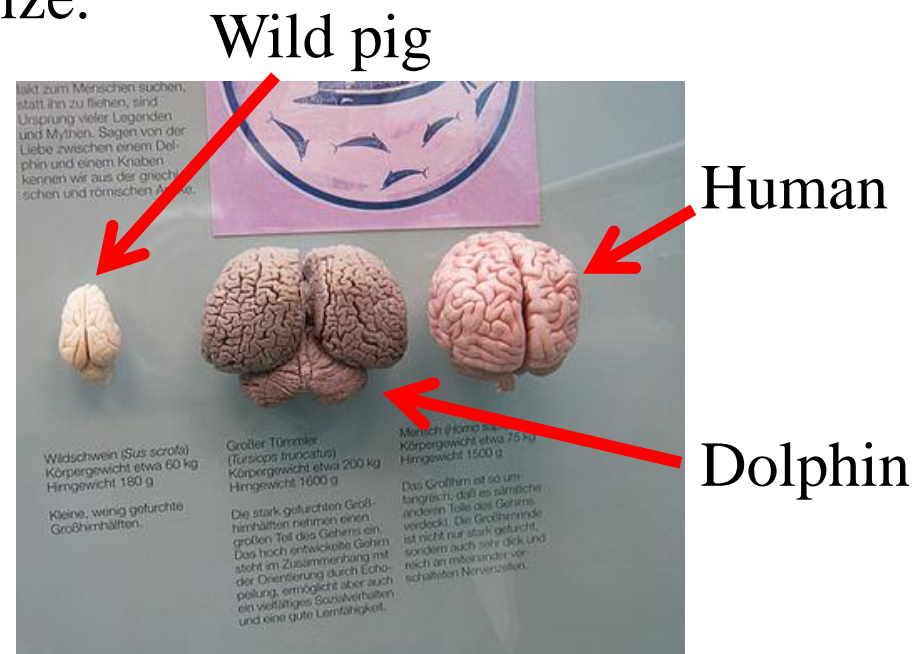
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- Many years ago it was suggested that the gross anatomy of the brain is related to intelligence.
- Although some “geniuses” (e.g., Lord Byron) have had large brains, it is clear that the size of the brain is not a determining factor for intelligence.
  - For example, men’s brains are larger than women’s brains, yet there is no gender difference in intelligence.



## 5. Intelligence and neurology: brain convolutions

- Across species, it seems to be the case that animals with convoluted brains – that is, with gyri and sulci (“hills and valleys”) – are more intelligent than smooth-brained animals.
- The convolutions of the brain increase the surface area of the brain within a skull of fixed size.
- For example, human, dolphins, and the great apes all have brains with many convolutions.
- Rats are smooth-brained animals; cats, dogs, sheep, and other large mammals are in between.



Source: [http://en.wikipedia.org/wiki/Cetacean\\_intelligence](http://en.wikipedia.org/wiki/Cetacean_intelligence)

## 5. Intelligence and neurology: brain complexity

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- There is a correlation ( $r=0.33$ ) between brain size and scores on intelligence tests. Also, with aging both intelligence scores and brain size get smaller.
- Witelson (1999) noted some increased development of certain areas of the brain in Einstein, among others, especially the area of the lower parietal lobe, associated with the processing of mathematical and spatial information.
- Increased brain size could be a function of better circulation, diet, environmental stimulation, and other factors that affect brain “health”, which may also correlate with test scores.
- Postmortem analyses show that highly educated people die with more synapses than less-educated people, perhaps a result of better environment or better neural plasticity during development.

## 5. Intelligence and neurology: brain function

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- Are more intelligent people quicker to respond to questions requiring information retrieval? Sometimes:
  - The speed of retrieving information from memory seems to predict verbal intelligence scores.
  - People who recognise rhyming words or other similarities perform better on tests of verbal ability.
- Perceptual speed – that is, the speed of taking in information – correlates moderately with intelligence scores.
- Neurological speed. Do highly intelligent people have faster neural processing? Several studies show that their brain waves register a stimulus more quickly and with greater complexity than others.
- We have no clear answer why faster speed should predict intelligence.

# Summary: Class 7

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