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# **PSY1102**

# **Introduction to Applied Psychology**

## **Class 9**

## **Intelligence**

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# Creativity: an example

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

# Agenda for today

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1. Genetic and environmental influences on intelligence
2. Twin and adoption studies
3. Heritability
4. Environmental influences
5. Group differences in intelligence test scores
6. The question of bias

# 1. Genetic and environmental influences

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- Just as we have examined genetic and environmental influences on various personality traits and behaviours, so can we consider the nature-nurture issue with intelligence.
- Science works best in a dispassionate environment, but it is obvious that intelligence is, in effect, a charged issue. Even to raise the topic of gender differences or “racial” differences in intelligence is to broach the topic of prejudice and bias.
- For this reason, it is important to exclude personal bias from the discussion and to include only the evidence that seems best to address the issues.

## 2. Twin and adoption studies

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Key findings reported in the textbook (pp. 427-428):

- Intelligence test scores of identical twins raised together are similar to scores from the same person taking the test twice ( $r=0.86$ );
- Next most similar are identical twins raised apart (0.7), leading to the estimate that 50-75% of the variation can be attributed to genetic variation;
- Next most similar (0.6) are fraternal twins raised together;
- Siblings raised together are next (0.45); and finally
- Unrelated individuals raised together (0.32).

## 2. Twin and adoption studies (continued)

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- Scans of brains of identical twins show similarities in terms of grey matter (cell bodies in the cerebral cortex) and very close similarity in areas associated with verbal and spatial capacity. Here, they differ from fraternal twins.
- Research within the past 10 years has begun to point to genetic markers for intelligence. The evidence points to a polygenetic mechanism, involving more than one gene. However, this research remains to be substantiated.
- Finally, genetic – not environmental – influences become more apparent as we age.

### 3. Heritability

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- Heritability is a measure of the percentage of the variability in a population that is attributable to genetic factors. It is not a means of blaming one of your parents for your height and another for your eye colour, for example.
- It is important to understand that (as noted in the textbook) “heritability never pertains to an individual, only to why people differ from each other” (p.429).

### 3. Heritability (continued)

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- Suppose that you did the following experiment:
  - Find a vacant but beautiful island cut off from the rest of the world (good luck with that ...).
  - Populate the island with couples from very different socio-economic backgrounds (some rich, some poor, some middle class).
  - Each couple has 1 baby on the island.
  - All couples live in similar homes, have the same food, same amount of money, etc.
  - When the children are of a suitable age, measure their intelligence.



### 3. Heritability (concluded)

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- Because the environment is mostly constant across children, most of the variability in the intelligence of the children will be attributable to genetic factors.
- If, instead, you did a study where one couple had 10 kids and the kids were given up for adoption at birth, then variability in their later intelligence would largely (but not entirely) be attributable to environmental factors.
- Also, it's important to remember the role of gene-environment interactions. For example, someone who runs just a little faster than someone else has a better chance of being selected for a track and field team, where much more training will be made available.

## **4. Environmental influences**

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- a. Early environmental influences
- b. Schooling and intelligence

## 4a. Early environmental influences

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- Sadly, there are too many cases where children have been raised in unstimulating environments.
  - A classic case from recent history is Romanian orphans left mostly unattended in orphanages in post-Ceausescu Romania.
  - The Iranian orphanage case cited in the textbook is another.
- Briefly, these “abandoned” children had basically no interaction with adults, and so their development was stunted. Moreover, they had never acquired a sense of control over their environments.
  - As a result, their native intelligence was blunted.

## 4a. Early environmental influences (continued)

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- Hunt, working with children from the Iranian orphanage, put the infants into a stimulation programme with caregivers.
- At 22 months of age, these children had language and social skills lacking in others who had been neglected to the same age.
- One conclusion: being raised in poverty is often associated with poor environmental stimulation, which can override genetic differences and stunt intellectual development.
- This general finding is one of the justifications for school breakfast programmes (nutrition) and early intervention programmes.
- Politically, providing stimulation early in life helps develop “intellectual capital” for a society.

## 4a. Early environmental influences (concluded)

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- As with many things, this result is subject to over-interpretation.
- Some parents have placed their young children in an “enriched environment” to give them a competitive advantage in life. However, evidence that you can “build a genius kid” is not strong, although training on skills such as music or athletics can confer limited benefits.

## 4b. Schooling and intelligence

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What effect does schooling have on intelligence scores?

## 4b. Schooling and intelligence (continued)

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- Which type of education do you think is better in terms of yielding intellectual development:
  1. Students are given access to a limitless variety of educational materials and left to their own devices;
  2. Students have fewer resources, but are encouraged to use these resources to complete projects with feedback from the instructor; or
  3. Students are spoon-fed “knowledge”.

## 4b. Schooling and intelligence (concluded)

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- Project Head Start (a preschool programme in the US begun in 1965) worked with children of impoverished families.
- Overall, this and similar programmes elsewhere helped prepare children for school and reduced the likelihood that they would “fail” a grade or be placed in special ed classes.
- Aptitude benefits seemed to dissipate over time, but in a longer-term follow-up there was evidence of reduced criminality and a better attitude towards learning.
- Check out “Global Impositioning Systems” in *The Walrus*, November 2009 ([www.walrusmagazine.com/articles/2009.11-health-global-impositioning-systems/](http://www.walrusmagazine.com/articles/2009.11-health-global-impositioning-systems/)). This article argues that reliance on GPS system is associated with reduced navigational skills.



## **5. Group differences in intelligence test scores**

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- a. Gender similarities and differences
- b. Ethnic similarities and differences

## 5a. Gender similarities and differences

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- Overall, despite all our discussion of differences between genders, males and females are very similar. However, some differences exist (see textbook p. 432-434).
- In the US, females spell better than males.
- At least in tests in Western cultures, females perform better in verbal ability: verbal fluency, word recall, and remembering facts.
- In nonverbal memory females are better in remembering and locating objects, and in picture associations.
- Females are more sensitive to certain senses (touch, taste, odor).
- Females are better at detecting emotions.

## 5a. Gender similarities and differences (cont'd.)

- In math and spatial aptitudes, males and females scored the same, but differences existed on certain tasks:
  - Females were slightly better in math computation, and males in math problem solving.
  - Males seem to be better at chess, but this may be attributable to the number of boys vs. girls entering the field.
  - Males are better in spatial ability tests, including mental rotation of three-dimensional figures; apparently, this ability is enhanced by prenatal exposure to male hormones.
- Some of the “gender differences” were greatest in cultures with more tightly defined gender roles, and smaller in more egalitarian cultures.

Check out Thomas, H., Jamison, W., and Hummel, D.D. “Observation is insufficient for discovering that the surface of still water is invariantly horizontal. *Science*, 13 July 1973, 181, pp. 173-174.

## 5b. Ethnic similarities and differences

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- Two facts reported in the textbook (page 434):
  - Racial groups differ in their average intelligence scores; and
  - High-scoring people are more likely to attain high levels of education and income.
- In terms of the distribution of intelligence scores, the mean for whites is 100, for blacks is 85, for Hispanics midway between these groups. (U.S. data.)
- These data say nothing about individual scores.
- Asian students outperform North American students on math achievement and aptitude tests – but consider the number systems.
- ... etc.

## 5b. Ethnic similarities and differences (continued)

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- It's also important to keep other factors in mind:
  - Race has largely been discredited as a biological concept, although it has some predictive value in some cases (e.g., blood pressure in U.S. males; susceptibility to sickle-cell disease).
  - Skin colour masks similarities between different “racial” groups, and a common skin colour does not imply greater genetic similarity.

## 6. The question of bias

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- a. Two meanings of bias
- b. Test-takers' expectations

## 6a. Two meanings of bias

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- As stated in the textbook (p.437), a test may be considered biased if it detects not only innate differences in intelligence but also performance differences attributable to cultural experiences.
- For example, answer the question below:

*Remedy* is to *nostrum*  
as *saying* is to \_\_\_\_\_

- a. opprobrium
- b. saw
- c. said
- d. nostalgia

## 6a. Two meanings of bias (continued)

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- We've already considered potential immigrants to the US from southern and eastern Europe whose performance on intelligence tests was poor, where the tests were designed by people of northern and western European heritage.
- Given this background (and examples such as the one on the preceding slide), intelligence tests can be biased because even though they are supposed to be an aptitude test, they build on accumulated knowledge. This is one meaning of bias.



## 6a. Two meanings of bias (concluded)

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- The other meaning of bias is the scientific meaning. Does the test have predictive value only for some groups, and not others?
- Based on this definition, the consensus in the US is that “the major U.S. aptitude tests are *not* biased” (p.437).
- Rather, the tests are equally good at predicting performance for males and females, blacks and whites, and rich and poor.

For very current news about test bias, check out this article on the BBC website: [www.bbc.co.uk/news/world-europe-21247053](http://www.bbc.co.uk/news/world-europe-21247053)

## 6b. Test-takers' expectations

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- Research results presented in the textbook about the expectations of people taking an aptitude test suggest that:
  - Females perform better when led to believe that (a) no males are present or that (b) females usually do as well as males on the test; and
  - Similarly, black students tested under threatening conditions performed more poorly than expected; however, when tested by blacks rather than by whites, their scores are higher.
- These results imply a dominance hierarchy in mixed groups, where this hierarchy affects the performance of some groups.
- However, it is probably worth noting that much of this research was conducted in the US; the pattern of results may be different in other countries and cultures.

## Summary: Class 9

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- Genetic and environmental influences on intelligence
- Twin and adoption studies
- Heritability
- Environmental influences
- Group differences in intelligence test scores
- The question of bias

For provocative reading, check out *The Science and Politics of IQ* by Leon Kamin (1974).