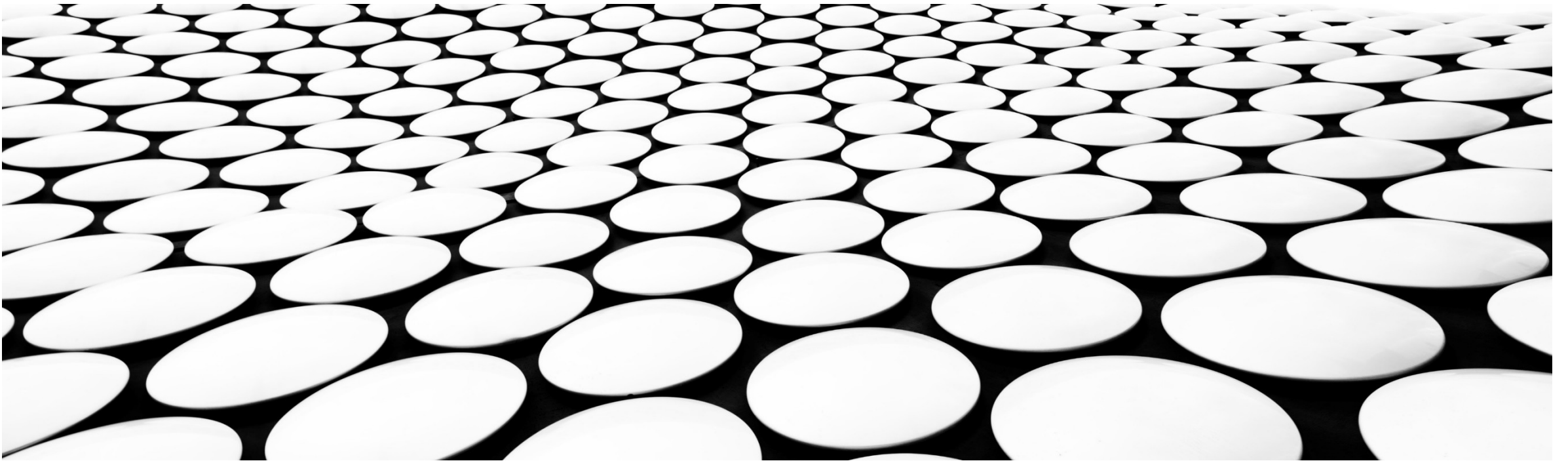# PSYC100 GENERAL PSYCHOLOGY INTELLIGENCE

LEARNING OUTCOMES

- Defining intelligence

- Theories of intelligence

  - Two-factor theory of Spearman

  - Fluid and Crystallized Intelligence theory of Cattell

  - Sternberg's theory

  - Gardner's theory

- Intelligence testing

  - Standford-Binet test

  - Wechsler tests

  - Raven's progressive matrices

- Gender differences in IQ

- Racial differences in IQ

- The Flynn Effect

WHAT IS INTELLIGENCE?

'It seems to us that in intelligence there is a fundamental faculty, the impairment of which is of the utmost importance for practical life. This faculty is called judgement, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances. To judge well, to comprehend well, to reason well ...' (Binet, 1905)

'An individual is intelligent in proportion as he is able to carry on abstract thinking.' (Terman, 1921)

'... innate, general, cognitive ability' (Burt, 1955)

'... the aggregate of the global capacity to act purposefully, think rationally, to deal effectively with the environment' (Wechsler, 1944)

'... the effective all-round cognitive abilities to comprehend, to grasp relations and reason' (Vernon, 1969)

'Intelligent activity consists in grasping the essentials in a situation and responding appropriately to them.' (Heim, 1970)

'... the ability to deal with cognitive complexity' (Gottfredson, 1998)
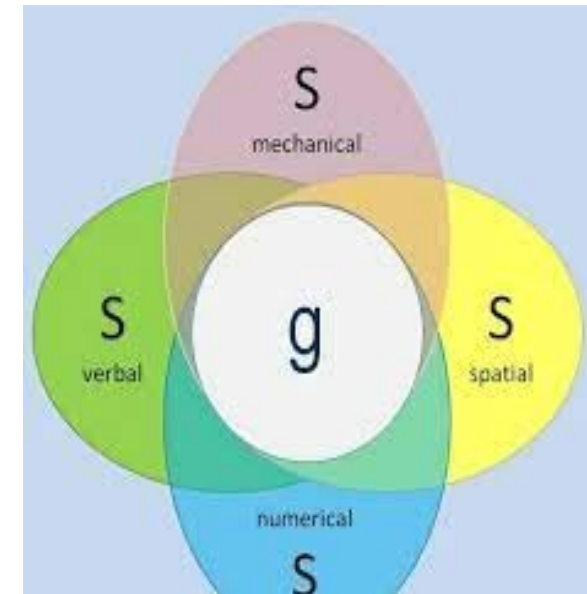
HOW WOULD YOU DEFINE INTELLIGENCE?

"A VERY GENERAL MENTAL CAPABILITY THAT INVOLVES THE ABILITY TO REASON, PLAN, SOLVE PROBLEMS, THINK ABSTRACTLY, COMPREHEND COMPLEX IDEAS, LEARN QUICKLY, AND LEARN FROM EXPERIENCE."
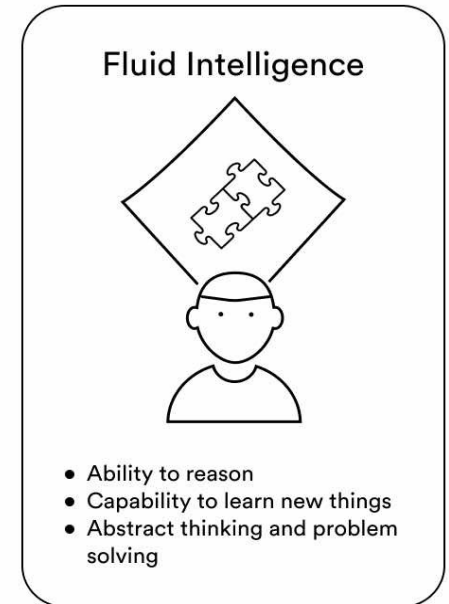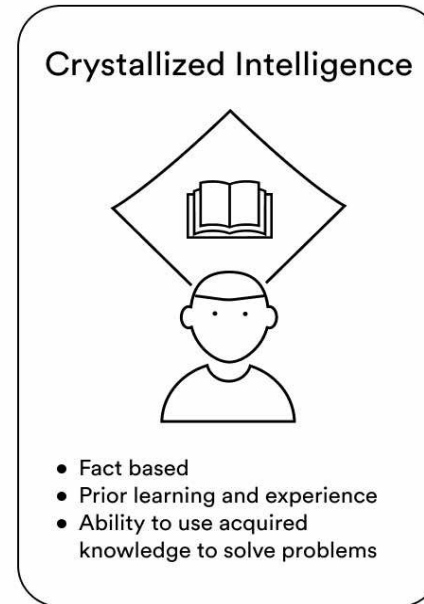
THEORIES OF INTELLIGENCE

- **Spearman's two-factor theory (1904)**

  - All intellectual activities share a **common underlying factor (g)**, along with **specific factors (s)** unique to each task. So performance on any mental task depends on how intelligent you are overall (g) plus how skilled you are in that specific area (s).

  - There is a **single general intelligence (g)** that influences performance on **every** cognitive task.

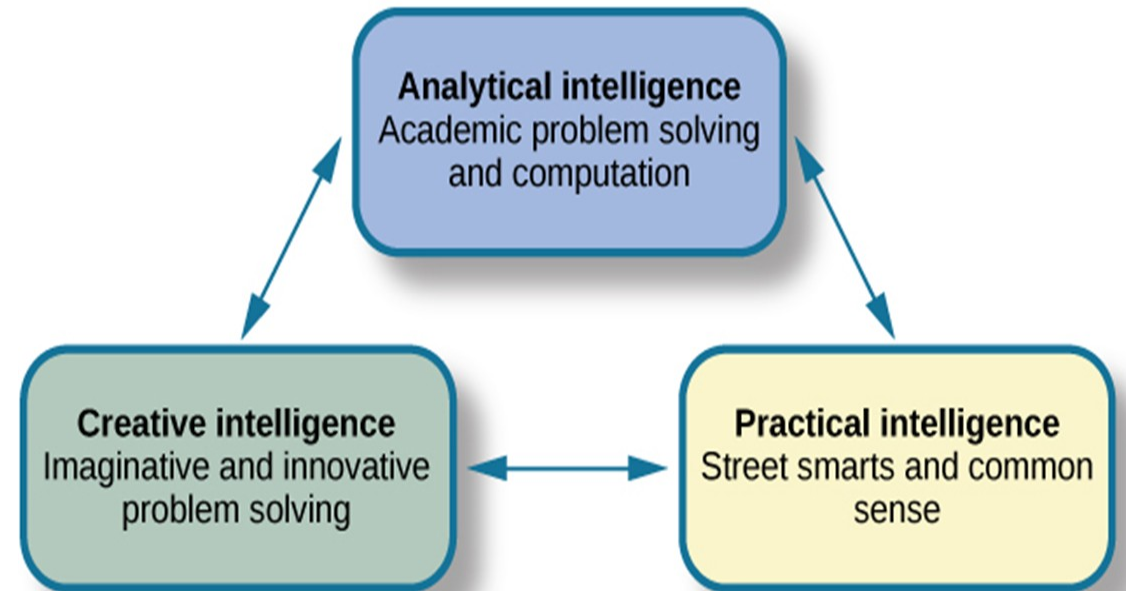 - There are also many **specific abilities (s)** unique to each task.

THEORIES OF INTELLIGENCE (CONT.)

- **Fluid and Crystallized Intelligence theory of Cattell (gf-gc theory)**

  - Cattell (1963) argue that g can be subdivided into two major dimensions – fluid and crystallized intelligence.

  - Fluid intelligence (gf) - The ability to **reason, think abstractly, and solve novel problems**—independent of prior knowledge or experience.

  - Crystallized intelligence (gc) - The ability to **use learned knowledge, skills, and experience**. It grows through education and cultural exposure.

Crystallized Intelligence

- Fact based
- Prior learning and experience
- Ability to use acquired knowledge to solve problems

Fluid Intelligence

- Ability to reason
- Capability to learn new things
- Abstract thinking and problem solving

adaface

THEORIES OF INTELLIGENCE (CONT.)

- Sternberg's Theory
  - Three types of intelligences

THEORIES OF INTELLIGENCE (CONT.)

- Gardner's Theory
  - Eight types of intelligences
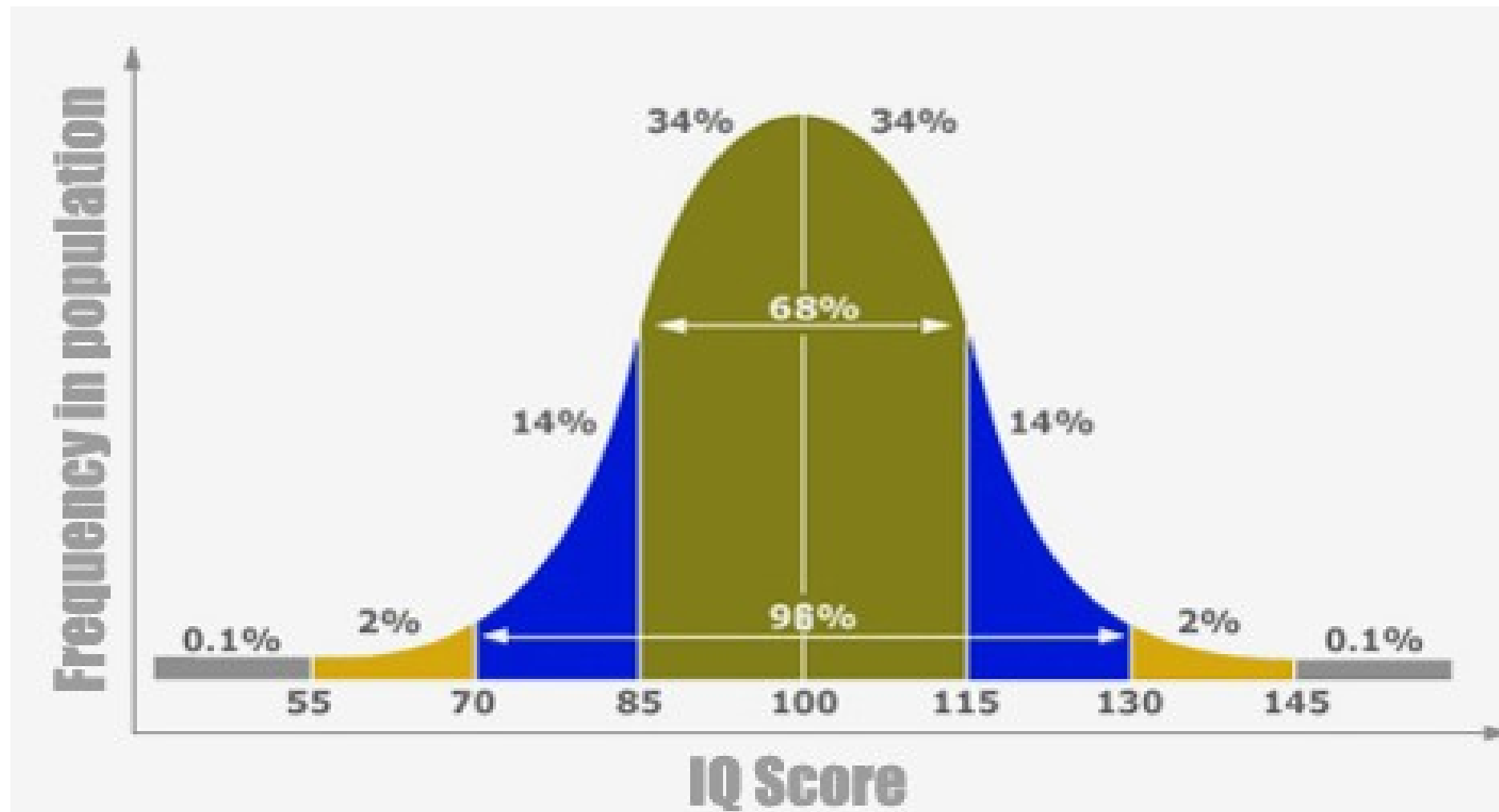

HOWARD GARDNER'S
THEORY OF MULTIPLE INTELLIGENCES

naturalist — understanding living things and reading nature

spatial — visualizing the world in 3D

musical — discerning sounds, their pitch, tone, rhythm, and timbre

coordinating your mind with your body — bodily-kinesthetic

linguistic — finding the right words to express what you mean

intra-personal — understanding yourself, what you feel, and what you want

logical-mathematical — quantifying things, making hypotheses and proving them

interpersonal — sensing people's feelings and motives

INTELLIGENCE TESTING

- Standford-Binet test

- Wechsler tests

- Raven's progressive matrices

THE STANDFORD-BINET TEST

- In 1904, Binet and Simon were commissioned by the French government to devise a test which would identify those children who wouldn't benefit from ordinary schooling because of their lower intelligence.

- The result was the Simon–Binet test (1905), generally accepted as **the first INDIVIDUAL intelligence test**.

- Revisions led to Standford-Binet test

- 1986 – 4th revision and 2003 – 5th edition

  - Verbal and nonverbal scales are balanced (based on gf-gc theory)
  - **Mean 100, SD 15**
  - Verbal IQ, nonverbal IQ, full-scale IQ

ARMY ALPHA AND ARMY BETA IQ TESTS

- These were the very first **GROUP** intelligence tests in history, developed in 1917–1919 by the U.S. Army to screen and classify over 1.7 million recruits during World War I.

- Army Alpha - Designed for literate recruits (those who could read and write English well).

- Army Beta - Designed for illiterate recruits or non-English speakers (mostly recent immigrants from Southern/Eastern Europe and some African Americans).

ARMY ALPHA

Test for Literates

Test 1 Following Oral Directions.

"When I say 'go,' make a cross in the first circle and also a figure 1 in the third circle."

⊕ ◯ ① ◯ ◯ ◯

Test 2 Arithmetical Problems

Ex: If it takes 6 men 3 days to dig a 180 - foot drain, how many men are needed to dig it in half a day. Answer: (36)

Test 3 Practical Judgment

If a man made a million dollars, he ought to
[ ]   Pay off the national debt
[x]   Contribute to various worthy charities
[ ]   Give it all to some poor man

Test 4 Synonyms - Antonyms

Samples: good - bad   same - opposite
           little - small   same - opposite

Test 5 Disarranged Sentences

leg flies one have only   true - false

Test 6 Number Series Completion

2   3   5   8   12   17   23   30

Test 7 Analogies
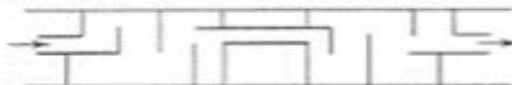
gun - shoot : : knife - run cuts hat bird

Test 8 Information

The Wyandotte is a kind of:
horse   fowl   cattle   granite

ARMY BETA

Test for illiterates and foreign language speakers.

Test 1 Maze. Credit for correct tracing of mazes

Test 2 Cube Analysis. Correct count of cubes.

4

Test 3 X - O Series. The series is to be carried out to the end of the line.

X O X O X O X O

X O X O

Test 4 Digit Symbol. The appropriate symbol is to be written under each number.

1 2 3 4 5 6 7 8 9

3 1 2 1 3 2 1 4 2 3 5 2 9

Test 5 Number Checking. Correct response indicated.

699310 . . . . X . . 699310
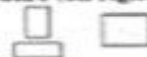251004818 251004418

Test 6 Picture Completion. Identify missing parts.

(mouth missing)

Test 7 Geometrical Construction. Construct a square (on right) out of figures on left.
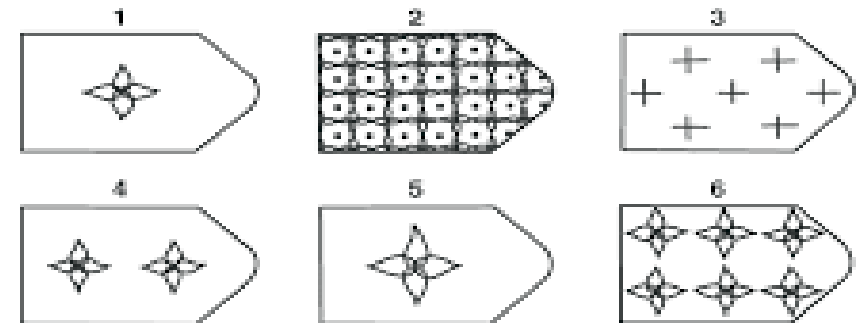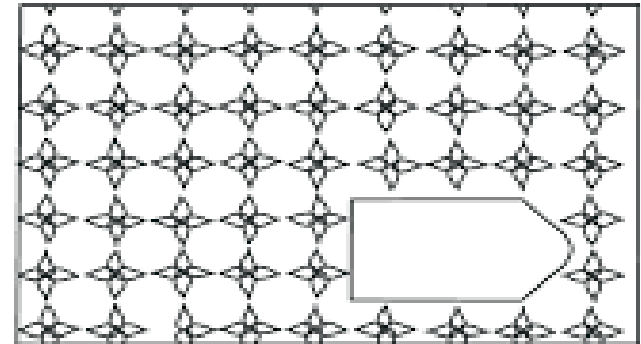
WECHSLER TESTS

- Balanced verbal and nonverbal scales

- The most commonly used IQ tests globally

- Most recent versions:
    - Wechsler Preschool and Primary Scale of Intelligence (WPPSI – IV, 2012) – 2.5 – 6 yrs old
    - Wechsler Intelligence Scale Children (WISC – V, 2014) – 6-16 yrs old
    - Wechsler Adult Intelligence Scale (WAIS-V, 2024) – 16-90 yrs old

RAVEN'S PROGRESSIVE MATRICES

- Raven's Standard Progressive Matrices (SPM), Advanced Progressive Matrices (APM), and Colored Progressive Matrices (CPM for children) (Raven, 1938; 1998).

- Non-verbal

- Culture-reduced

GENDER DIFFERENCES IN IQ - GENDER

- Most IQ tests have been constructed so that there are no differences in scores between genders
- Any difference between genders may only have been negligible (Terman, 1916)
- Meta-analyses reporting scores for men average 5 IQ points more than women (Irwing & Lynn, 2005) have small effect sizes

GENDER DIFFERENCES IN IQ

- Males better on **visuo-spatial tasks** (e.g. mental rotation). Mean of male distribution on mental rotation is almost one standard deviation above that for females (Masters and Sanders, 1993)

  - Constructing models, furniture assembly

- Males also score higher on **mechanical reasoning** (e.g. Maintainig, repairing, operating equipment) **and quantitative tasks** (maths)

- Females perform better than males on a number of **verbal tasks**, such as synonym generation, and verbal fluency. Mean of female distribution is between 0.5 and 1.2 standard deviations above that of males.

- Females may also perform better than males on some **memory tasks**.

WHY?

Biological:
•Brain size: Males have ~10% larger brains on average, correlating with ~0.3-0.4 IQ points per gram (though females have higher neuronal density).
•Hormones: Prenatal testosterone exposure predicts better spatial skills and male-typical play; estrogen supports verbal memory.
•Evolution: Hunter-gatherer hypothesis posits male spatial edges from navigation/hunting; female verbal from social/child-rearing roles (supported by cross-cultural consistency).
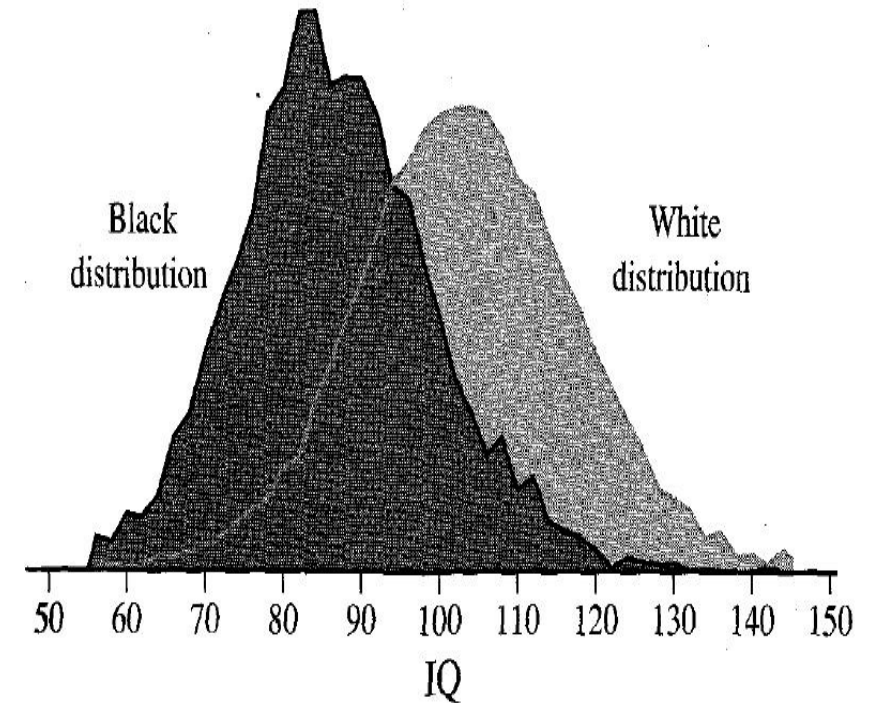
Environmental:
•Socialization: Girls encouraged in language arts, boys in STEM toys (e.g., LEGO studies show early gaps).
•Education: Gaps narrow in gender-equal societies (e.g., PISA data from Nordic countries), but high-end math differences persist.
•Gender differentiated toys

GENDER DIFFERENCES IN IQ - RACE

- A number of studies (based in USA) have reported that some racial groups differ in intelligence

- Jensen (1969) suggested that white children were more intelligent than black children, and Asian children were more intelligent than either. He claimed that such differences were **largely due to genetic factors**

- Herrnstein and Murray published *The Bell Curve* (1994), suggesting a difference of one standard deviation between mean IQ scores of Blacks (mean = 85) and Whites (mean = 100) in USA

- Herrnstein and Murray further suggested that the **differences are genetic in origin**

GENDER DIFFERENCES IN IQ - RACE

- American Psychological Association assembled a task force to investigate Herrnstein and Murray's findings (see handout Neisser et al., 1996)

- Task force agreed that there were differences between average IQ scores of African Americans and white Americans, but suggest that differences may be due to **cultural factors.**

WHY?

- Three possible explanations for race difference on IQ scores
    - Test bias
    - Genetics
    - Environment

TEST BIAS

- This explanation posits that IQ tests are not neutral but reflect the cultural knowledge, language, and experiences of the dominant group (typically White, middle-class Americans), disadvantaging minority groups. Differences in scores, therefore, do not measure true intelligence but familiarity with test content.

GENETICS

- This view argues that racial groups have evolved genetic differences in cognitive abilities due to historical selection pressures (e.g., climate, migration), leading to inherent IQ disparities

- Race is primarily a social construct, not a biological one; No genes for "intelligence" have been identified that differ systematically by race.

- Nisbett, R. E., et al. (2012). "Intelligence: New findings and theoretical developments." American Psychologist, 67(6), 503–504.
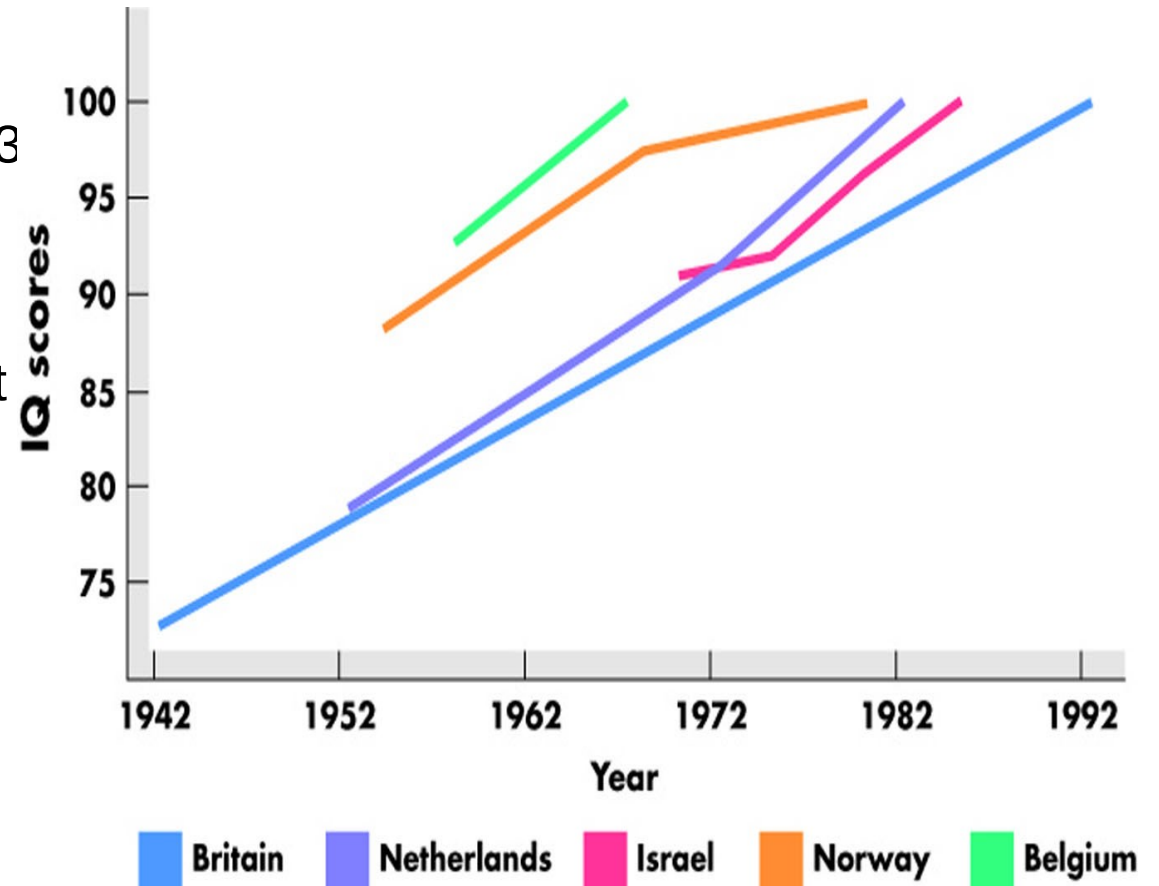
ENVIRONMENT

- This dominant explanation attributes gaps to unequal access to resources, education, health, and opportunity, which shape cognitive development from prenatal stages onward. Racial categories proxy for systemic inequities (e.g., racism, poverty).

- **While all three explanations have been proposed, the overwhelming scientific consensus is that environmental factors, compounded by historical and ongoing inequities, account for nearly all racial IQ differences.**
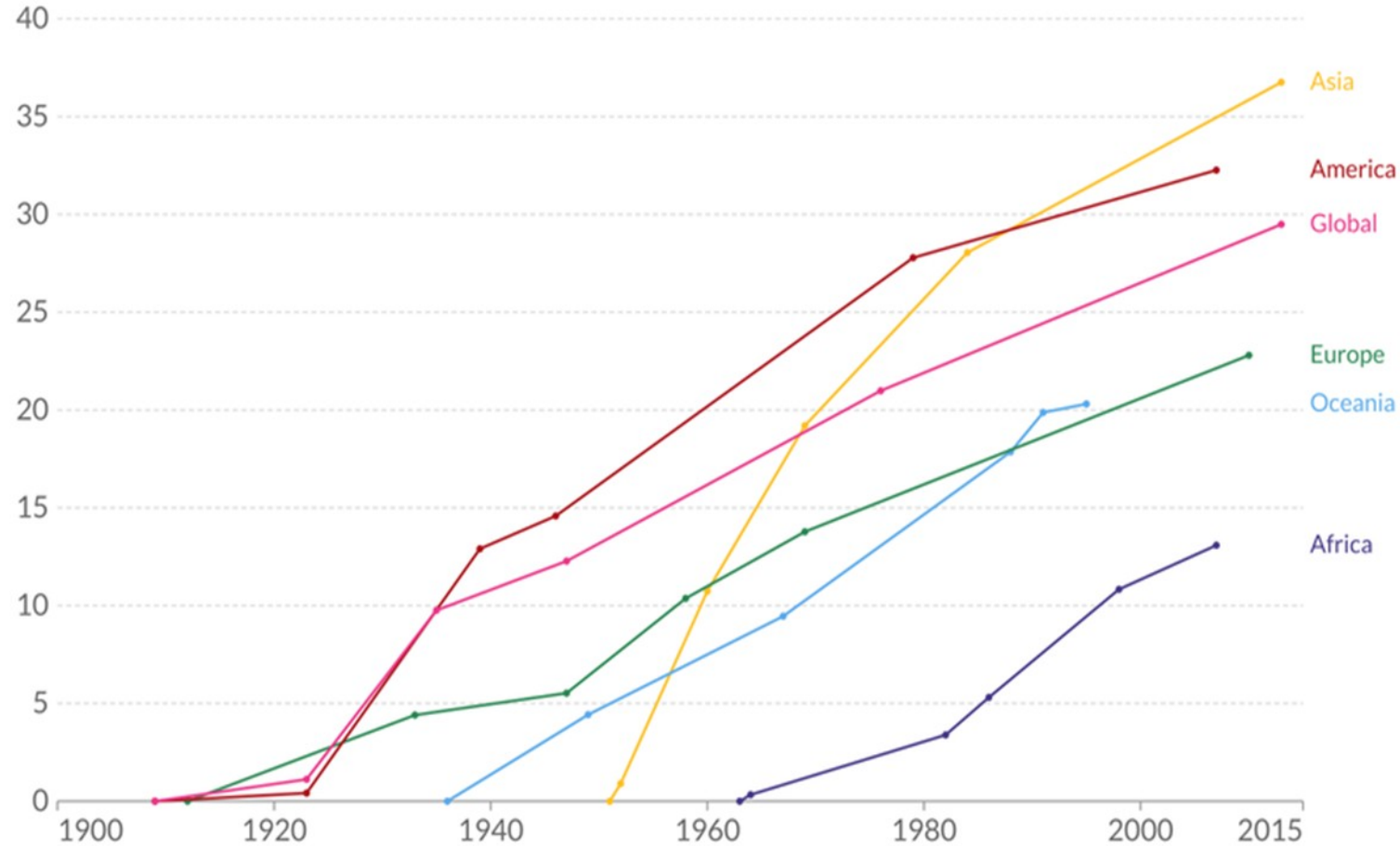
THE FLYNN EFFECT

- IQ has increased over time, on average around 3 IQ points per decade

- Largest gains in fluid intelligence (reasoning, pattern recognition—e.g., Raven's Matrices), not crystallized (vocabulary, facts).

- Observed in >30 countries, including developing nations.

- Slowing or reversing in some developed nations (Norway, Denmark, UK) since the late 1990s.

Britain | Netherlands | Israel | Norway | Belgium

The Flynn Effect: Gains in mean IQ for world regions
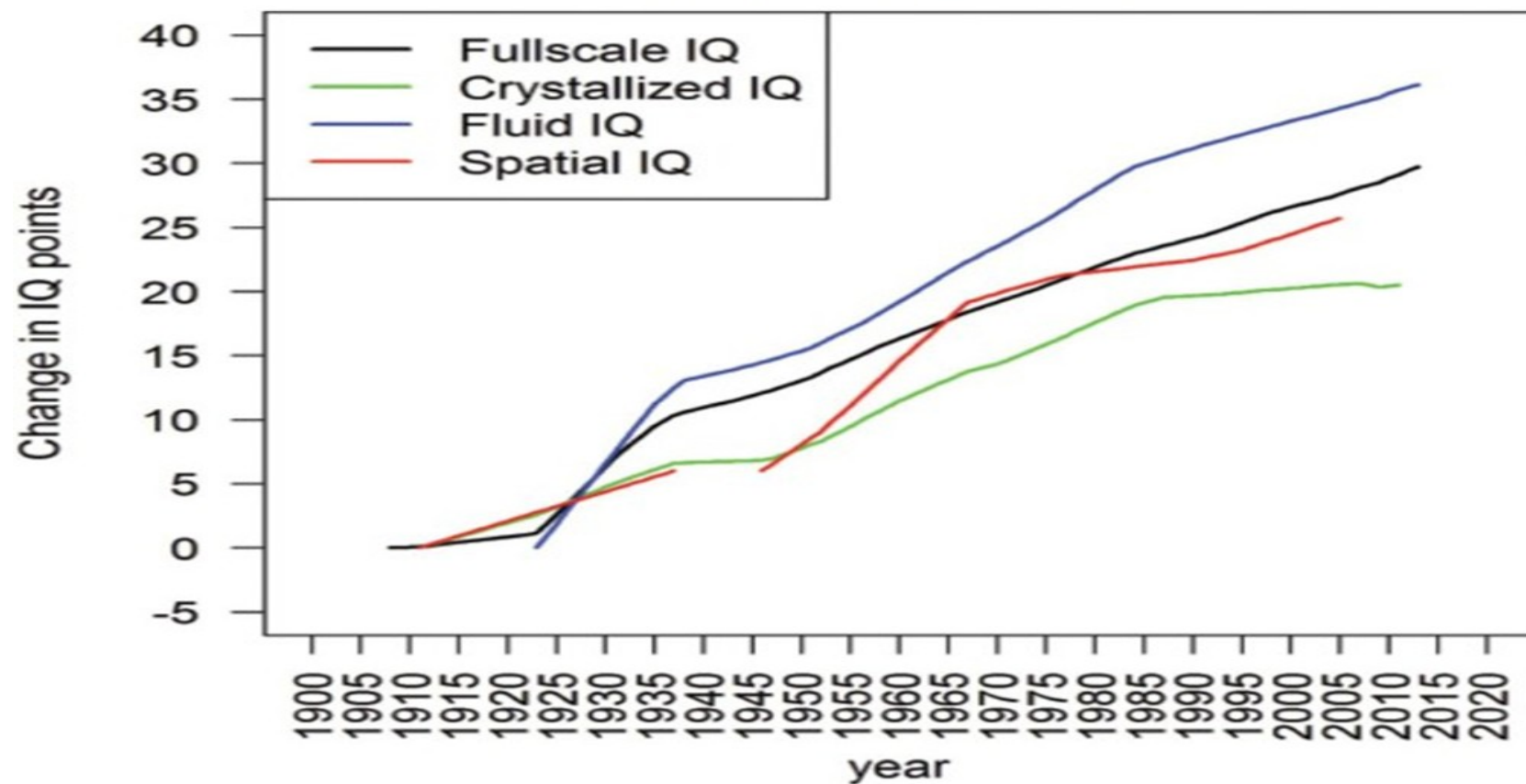
Gain in mean fullscale IQ (Intelligence quotient) for world regions.

Source: Pietschnig and Voracek (2015)
Note: This only shows how quickly advances were being made. Cross-country comparisons are of limited usefulness in this context since the data is incomplete.
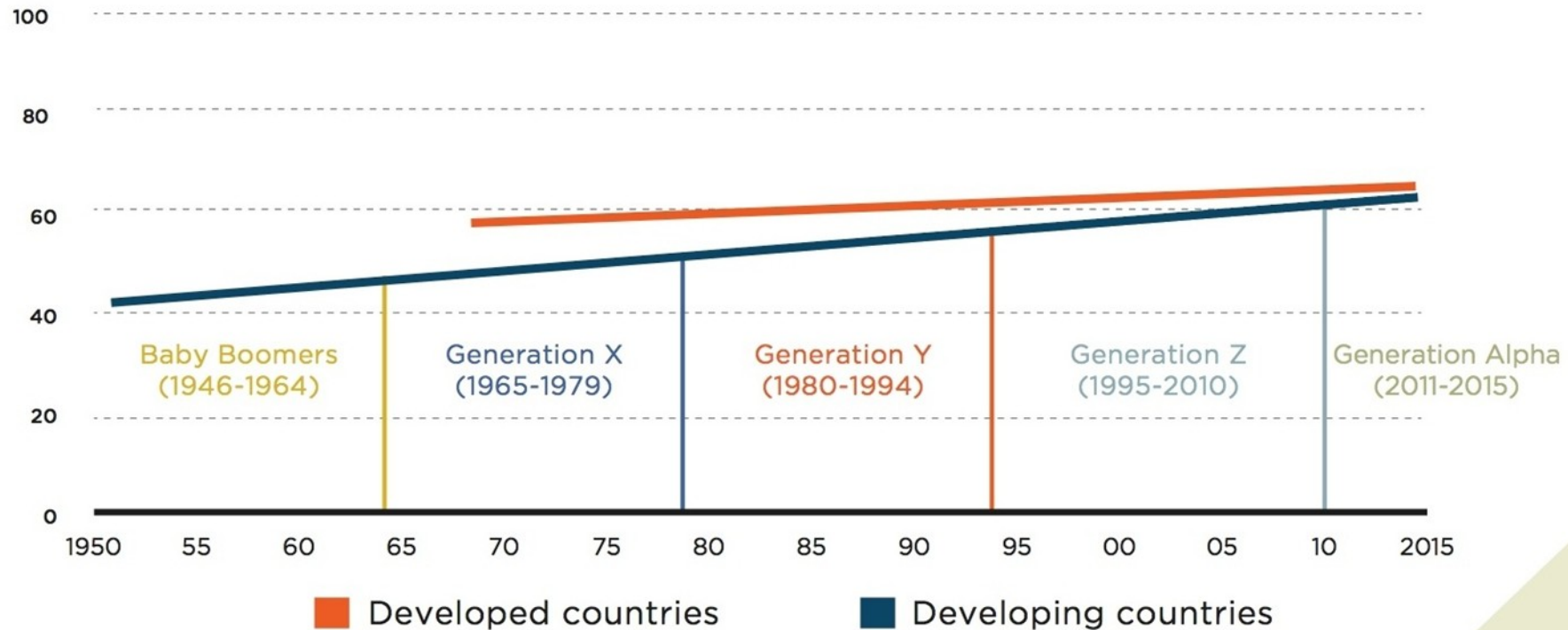
Change trajectories

THE FLYNN EFFECT

Improved worldwide IQ test performance

Baby Boomers (1946-1964)
Generation X (1965-1979)
Generation Y (1980-1994)
Generation Z (1995-2010)
Generation Alpha (2011-2015)

Developed countries
Developing countries

WHY?

- Nutrition: Better prenatal and childhood nutrition → brain growth

- Education: Longer schooling, abstract thinking training

- Cognitive Stimulation: TV, puzzles, video games, VR

- Smaller families: More parental attention per child

- Test familiarity: Practice with multiple-choice, abstract problems

HEREDITY OR ENVIRONMENT?

- Both heredity and environment contribute to intelligence

- Heredity and environment interact in various ways

- As people's genetic similarity increases, generally so does the similarity of their environments. This can be overcome by comparing the IQs of **Monozygotics reared together with those raised apart.**

- MZsRA are still more similar than same-sex Dizygotics reared together, suggesting a strong genetic influence.

  - However, studies of MZsRA have been criticized on several important **methodological grounds**.

- Further support for the influence of genetic factors comes from **adoption studies**. But when children from disadvantaged parents are adopted into high SES families, substantial gains in IQ can occur.

The Milwaukee Project (Heber *et al.,* 1968)

- Mothers living in the slums of Milwaukee with IQs under 80 (less than half the total of all mothers) accounted for almost 80 per cent of children with similarly low IQs.
- An intensive intervention programme involving 40 poor, mostly black families, began with the birth of their babies, and continued until the children started school at age 6. Twenty of the women were given job training and sent to school (the 'experimental group'), while the other 20 received no job training or special education (the 'control group').
- At the point of starting school, the 'experimental group' children had an average IQ score of 120.7, compared with 87.2 for the control group. By age 10, these were 104 and 86, respectively. Educationally too, the experimental group was clearly superior.
- But after 10, both groups' performance fell below national norms and, over time, the experimental group declined, first to the lower levels of the city of Milwaukee, then still lower to the level of inner-city schools. When assessed at 12–14, mean IQs for the experimental and control groups were 100 and 90, respectively.
- Like OH, the Milwaukee project showed that vigorous and relatively prolonged intervention can make a difference to severely disadvantaged children's cognitive performances. But much of the gain is lost in the years following the end of the programme (Rutter & Rutter, 1992).
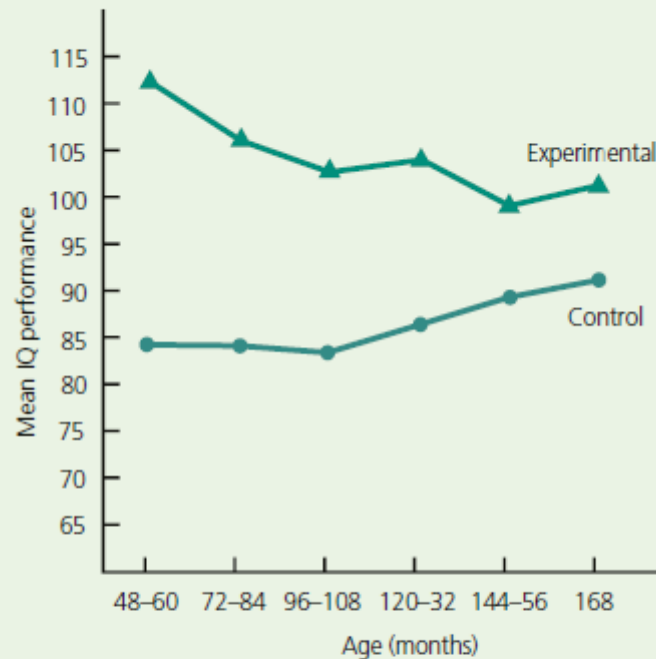

Figure 41.14 IQ performance with increasing age of severely disadvantaged children participating in a broad-ranging intensive intervention programme in the preschool years. (Data from Garber, 1988, and taken from Figure 6.5 (pp. 212–213) in *Developing Minds: Challenge and Continuity Across the Life Span,* by Michael Rutter and Marjorie Rutter (Penguin Books, 1992), copyright © Michael and Marjorie Rutter, 1992)

LECTURE SUMMARY

- Definition of intelligence
- Theories of intelligence
  - Two-factor theory of Spearman
  - Fluid and Crystallized Intelligence theory of Cattell
  - Sternberg's theory
  - Gardner's theory
- Intelligence testing
  - Standford-Binet test - first IQ test
  - Wechsler tests - most widely used IQ test
- Gender differences in IQ
- Racial differences in IQ
- The Flynn Effect