

# Analogy, $g$ , and the Architecture of Mind

*Why the ability to perceive that A is to B as C is to D may be the closest thing we can measure to general intelligence itself.*

Consider the humblest-looking item on any aptitude test: **A is to B as C is to —?** It can look like a parlor trick, a puzzle for crossword hobbyists. It is, in fact, something close to a direct readout of the human intellect. What follows is a claim both ancient and, lately, very well measured: that analogy — the perception that one relation mirrors another — is not one mental trick among many, but near the center of thought itself.

## I. Spearman's wager

When Charles Spearman gave us  $g$  — the general factor that emerges, stubbornly, from the positive correlations among all mental tests — he did not describe it as a mysterious quantity of brain-stuff. He described it as an *operation*: the **eduction of relations and correlates**. Given two ideas, perceive the relation between them; given an idea and a relation, generate the correlate. Read that twice, because it is the whole game. *Given an idea and a relation, generate the correlate* is not a description of intelligence in general — it is a description of an analogy. Reaching for the deepest layer of cognition he could name, Spearman named the very thing a verbal analogy asks you to do.

## II. The irony hiding in plain sight

If Spearman was right, the best measures of  $g$  should be, in effect, analogy tests. They are. The instrument psychometricians reach for to estimate  $g$  with a single test is **Raven's Progressive Matrices** — and Raven's is a test of *visual* analogies: this figure transforms into that one as this third figure transforms into — which? In a now-classic 1990 paper, Carpenter, Just, and Shell asked what the Raven test actually measures, and answered, after modeling how people solve it: the processes that separate high scorers from low scorers are "the ability to induce abstract relations." We have been measuring intelligence with analogies all along; we simply did not always say so.

## III. The short chain to $g$

The modern picture tightens the knot. When Jan-Eric Gustafsson modeled a broad battery of tests in 1984, he found that **fluid intelligence is statistically almost indistinguishable from g itself** — the constraint forcing them to be identical did not even meaningfully worsen the model's fit — and that the *inductive-reasoning* factor (relational reasoning) loaded on fluid intelligence at a level "approaching unity." So follow the chain, each link load-bearing: analogy is the model case of relational reasoning; relational reasoning is the heart of fluid intelligence; fluid intelligence is nearly identical to *g*. Validated against other cognitive measures, a pure verbal-analogy test (the Miller Analogies Test) has correlated about **.75 with general reasoning and .88 with verbal ability**. Analogy is not adjacent to intelligence. It is intelligence, caught in the act.

#### IV. The stronger claim

Some go further. The cognitive scientist Douglas Hofstadter — with Emmanuel Sander, in *Surfaces and Essences: Analogy as the Fuel and Fire of Thinking* — argues that analogy is not a faculty the mind possesses but the very activity of which mind consists. Every concept, on this view, is a worn groove of remembered analogies; every act of recognition — *that is a chair, that is a betrayal, that is the same mistake as last year* — is the silent mapping of a new situation onto an old structure. A hub, with memory, language, and judgment arrayed around it as its expressions.

#### V. The honest counterweight

Intellectual honesty requires the rival account, and it is a strong one. Its champions — in a 1990 paper bluntly titled "*Reasoning ability is (little more than) working-memory capacity?!*" — argue that the deeper substrate is **working memory**: the sheer capacity to hold several elements in mind and operate on them at once. Their correlations between working memory and reasoning ran as high as **.80 to .90** at the latent level. On this view, analogy is not the engine but the exhaust — the visible output of a more fundamental ability. The magnitude is contested (a large meta-analysis put the working-memory-*g* correlation nearer **.48**, "related but distinct"), but the challenge stands. So the deepest question remains open: is analogy the architecture of mind, or its most visible façade?

#### VI. The claim worth making

The data underdetermine the metaphysics, so let us separate what can be claimed from what cannot. **Established, robustly**: analogical reasoning indexes general intelligence about as well as any single cognitive operation we can name. The premier measure of *g* is an analogy

test; relational reasoning is nearly identical to fluid intelligence, which is nearly identical to *g*. To be good at analogies is, measurably, to be generally intelligent. **Not established:** that analogy *generates* the other faculties. That remains a wager — but a good one. When the founder of intelligence testing, looking for the floor of cognition, found "the education of relations"; when the best single test we have is a wall of analogies; when the most *g*-saturated talent a person can display is the talent for seeing that *this is to that as the other is to a fourth thing* — the convergence is too clean to be coincidence.

## VII. The vocabulary objection

There is a deflationary reading worth answering, because it is the one a skeptic reaches for: *surely a verbal analogy test is merely a test of vocabulary — a measure of how many words one has happened to accumulate. A fund of knowledge. Erudition, not intelligence.* It is comfortable, and it is wrong. Vocabulary is not a sideshow to general intelligence; it is its single best stage. In the standardization sample of the Wechsler Adult Intelligence Scale, **Vocabulary carries the highest g-loading of any subtest — .87** — outscoring the matrix puzzles that *look* far more like pure reasoning. Decompose a vocabulary score and **55 to 61 percent of its variance is g**, while only a sixth to a third is knowledge-specific. A vocabulary test is mostly an intelligence test in the costume of a knowledge test; crystallized ability as a whole loads on *g* at roughly **.89**. Cattell's *investment theory* explains why: crystallized knowledge is fluid intelligence *invested*, over years, into learning — the sediment a powerful current leaves behind. The objection survives in one form only: *narrow, specialized* knowledge is weakly tied to *g* (correlations near .4), while *general* verbal knowledge is the high-*g* signature (near .6 and above). Encyclopedic command of one trivial domain proves little; a wide, deep, general fund of knowledge proves a great deal. A high score on a verbal analogy test, then, is not a receipt for a well-stocked memory — it is, like the matrices, another reading of the same dial.

## Coda

To build a contest scored on analogy — to rank minds by their command of *A is to B as C is to D* — is, knowingly, to build an instrument that measures something real and stable: not trivia, not luck, but the mind performing its most characteristic act. To see likeness across difference is not a trick at the edge of intelligence. It may be the center around which the rest revolves. Which leaves only one question, and it is not a theoretical one: *how good is yours?*

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## Sources

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