References

Akins, C.K., Klein, E.D., & Zentall, T.R. (2002). Imitative learning in Japanese quail (*Coturnix japonica*) using the bidirectional control procedure. *Animal Learning & Behavior, 30,* 275–281.

Akins, C.K., & Zentall, T.R. (1996). Imitative learning in male Japanese quail (*Coturnix japonica*) using the two-action method. *Journal of Comparative Psychology, 110,* 316–320.

Akins, C.K., & Zentall, T.R. (1998). Imitation in Japanese quail: The role of reinforcement of demonstrator responding. *Psychonomic Bulletin & Review, 5,* 694–697.

Bandura, A. (1969). Social learning theory of identificatory processes. In D.A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 213–262). Chicago: Rand-McNally.

Custance, D.M., Whiten, A., & Bard, K.A. (1995). Can young chimpanzees imitate arbitrary actions? Hayes and Hayes revisited. *Behaviour, 132,* 839–858.

Dorrance, B.R., & Zentall, T.R. (2001). Imitative learning in Japanese quail depends on the motivational state of the observer at the time of observation. *Journal of Comparative Psychology, 115,* 62–67.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119,* 593–609.

Heyes, C.M., & Dawson, G.R. (1990). A demonstration of observational learning in rats using a bidirectional control. *Quarterly Journal of Experimental Psychology, 42B,* 59–71.

Heyes, C.M., & Ray, E.D. (2000). What is the significance of imitation in animals? In P.J.B. Slater, J.S. Rosenblatt, C.T. Snowdon, & T.J. Roper (Eds.), *Advances in the study of behavior, Vol. 29* (pp. 215–244). New York: Academic Press.

Klein, E.D., & Zentall, T.R. (in press). Imitation and affordance learning by pigeons. *Journal of Comparative Psychology.*

Meltzoff, A.N., & Moore, M.K. (1989). Imitation in newborn infants: Exploring the range of gestures imitated and the underlying mechanisms. *Developmental Psychology, 25,* 954–962.

Mitchell, C.J., Heyes, C.M., Gardner, M.R., & Dawson, G.R. (1999). Limitations of a bidirectional control procedure for the investigation of imitation in rats: Odour cues on the manipulandum. *Quarterly Journal of Experimental Psychology, 52,* 193–202.

Mitchell, R.W. (2002). Kinesthetic-visual matching, imitation, and self-recognition. In M. Bekoff, C. Allen, & G.M. Burghardt (Eds.), *The cognitive animal* (pp. 345–351). Cambridge, MA: MIT Press.

Piaget, J. (1962). *Play, dreams, and imitation in childhood* (C. Gallegno & F.M. Hodgson, Trans.). New York: Norton.

Zentall, T.R., Sutton, J., & Sherburne, L.M. (1996). True imitative learning in pigeons. *Psychological Science, 7,* 343–346.

Movies About Intelligence: The Limitations of *g*

James R. Flynn[1]

Department of Political Studies, The University of Otago, Dunedin, New Zealand

Abstract

There is a strong tendency for the same people to do better or worse on a wide variety of IQ tests. On this basis, some psychologists posit the concept of *g*, or a general intelligence factor. Does *g* show that performance on a wide range of cognitive tasks is influenced by individual differences in brain quality? It may, but if so, *g* lacks a sociological dimension and cannot explain cognitive trends over time or assess their significance. It also encourages a paradox about nature versus nurture and oversimplifies the causes of the Black-White IQ gap.

Keywords

g; intelligence; IQ gains; race

No matter whether mental tests feature vocabulary, general information, verbal oddities, scrambled sentences, logical reasoning, number series, pictorial oddities, spatial analogies, or completion of matrices, the same people tend to do better or worse. Statistical analysis of the data suggests that a single factor accounts for much of this tendency toward consistent performance, and that common factor is what psychologists call *g*. It functions like a correlation coefficient with a value of .65. For example, assume a correlation between height and basketball performance of .65. Given this correlation, if we selected a sample of people at the 84th percentile for height, they would average at the 74th percentile for basketball performance. Similarly, if we knew people's *g* scores, we could predict how well they would perform when using a huge range of cognitive skills.

Cognitive performance in everyday life is influenced by *g*. Siblings who are superior to their co-siblings for *g* tend to enjoy greater academic success; making an omelet is a more cognitively complex task than scrambling eggs and therefore has a higher *g* loading. Jensen believes he knows why *g* influences cognitive performance: "Some property (or properties) of the brain . . . has cognitive manifestations that result in the emergence of *g*" (Jensen, 2002, p. 153). In other words, Jensen believes that *g* measures the influence of brain quality. And a better brain gives you an advantage in school, on the job, wherever cognitive skills are relevant.

The *g* we calculate by the techniques available today may not be a pure measure of brain quality; that is, it may be diluted by picking up the influence of nonphysiological factors like individual differences in motivation. However, throughout this article, I pretend that Jensen's ideal of a purely physiological *g* has been realized. I do this in order to show that the closer we approach that ideal, the more *g* suffers from a peculiar limitation: It becomes sociologically blind. The symptoms are most evident when we take a look at the evolution of cognitive skills over time.

g CANNOT DETECT SOCIOLOGICAL FACTORS

Since 1950, the populations of The Netherlands, Belgium, Israel,

and Argentina have shown gains of about 18 IQ points per generation (30 years) on a test of cognitive ability called Raven's Progressive Matrices. Gains on Wechsler tests (e.g., the Wechsler Intelligence Scale for Children, or WISC), which are often used to measure IQ, have averaged at least 9 points per generation. These IQ gains have been influenced by sociological factors, sometimes almost entirely. Therefore, a *g* that refers to brain physiology can do little to explain them.

The main candidates for physiological factors that might increase IQ scores are nutrition, advances in obstetrics, and increased outbreeding (hybrid vigor). Improved nutrition has been important at certain times and places, but not at others. In America, recent IQ gains have been as large at the middle and top of the curve as at the bottom. Because one would expect improved nutrition to affect primarily the most deprived, and produce disproportionate gains at low IQ levels, nutrition does not seem to have played an important role in causing U.S. gains, at least not since 1950.

Similarly, post-1950 improvements in obstetric and neonatal care have probably had no net effect. For every child who has escaped mental impairment, another who would have died without modern techniques has been saved.

As for hybrid vigor, inbreeding within a small group has a negative effect on IQ. If American history was a story of little isolated communities being replaced by a highly mobile society, that might help explain the massive IQ gains America has made throughout the 20th century. However, Americans never did live in small inbred groups. There was always a huge influx of migrants who settled in both urban and rural areas. There were huge population shifts during settlement of the West, after the Civil War, and during the World Wars. The growth of mobility has been modest: In 1870, 23% of Americans were living in a state other than the one of their birth; in 1970, the figure was 32%.

Sociological explanations of IQ gains seem more promising. Between 1948 and 1989, America gained the equivalent of 20 IQ points on the WISC subtest called Similarities. Similarities asks questions like, "What do dawn and dusk have in common?" Answering such questions demands solving problems on the spot without a learned method for doing so. During the same period of time, gains on WISC subtests like Arithmetic, Information, Vocabulary, and Reading Comprehension were comparatively modest or nil. The content of these tests is very close to school-taught subjects. How can we explain this puzzling pattern, that over the years we have become more mentally agile but learn no better at school?

America's post-1950 affluence brought smaller families in which children's "whys" were taken more seriously. More leisure made it possible to enjoy cognitive challenges ranging from chess to video games (Greenfield, 1998). And more professional work roles demanded independent thinking on the job (Schooler, 1998). People became more disposed to invest mental energy into problem solving for its own sake, or at least problem solving on the spot. At the same time, homework was resented and too much focus on basics thought boring. Americans became unwilling to see formal schooling become more cognitively demanding. The result of these two attitude shifts was that score gains accelerated on the Similarities subtest, and score gains faltered on the school-related Wechsler subtests.

Even if I am mistaken in detail, sociological factors of some sort were the dominant cause of U.S. IQ gains. They would have been important even in nations where nutrition made a contribution. Jensen's *g* simply does not provide a conceptual framework for identifying those factors: It puts its eggs in the physiological basket.

g CANNOT ASSESS SOCIAL SIGNIFICANCE

It is natural to ask whether IQ gains are *g* gains. Jensen answers this question by using what is called the method of *correlated vectors*. For example, you rank the 10 subtests of the WISC in terms of the size of their IQ gains (Arithmetic at the bottom with nil gains and Similarities at the top with huge gains), you rank the same 10 in terms of their *g* loadings (once you have extracted *g* from a set of tests, you can see how much scores on each test correlate with *g* itself), and then you see if the two rankings are positively correlated.

I believe this method has severe limitations. But setting those aside, if IQ gains were not *g* gains, would that drain them of social significance? IQ gains reflect fascinating trends in American intellectual life. The fact that we are better at on-the-spot problem solving is indicative of real-world cognitive gains. We appear better than we used to be at leisure activities that are cognitively demanding. The quality of play in chess tournaments has escalated, and this trend may extend to games like bridge (Howard, 1999; Nunn, 1999). The level of political debate has been enhanced (Rosenau & Fagan, 1997). The fact that more people can think independently helps fill the large number of professional work roles the industrial revolution demands (Schooler, 1998). In addition, the fact that Americans have no greater arithmetic skills, nonspecialized vocabulary, or knowledge of general information has profound social significance.

Published by Blackwell Publishing Inc.

So determining whether IQ gains are *g* gains offers no criterion for assessing their significance—except that *g* gains would mean that brain physiology had been enhanced. However, that is not a prerequisite for progress. There is no reason to believe that the glory that was Greece, the grandeur that was Rome, or the Italian Renaissance was due to anything but cultural change. Fortunately, society can exploit unrealized brain potential, and fortunately, society can ignore the fact that all cognitive skills are correlated at a particular time and place. Over time, it can pick and choose among skills for emphasis. It can encourage on-the-spot problem solving without performing the (perhaps impossible) task of getting us to do more homework.

g CANNOT DETECT MULTIPLIERS

Some 30 years ago, Jensen (1973) noted that twin studies gave a low correlation between IQ and environment (about .33). He concluded that for environment to cause two groups to differ in IQ by one standard deviation, their environments would have to differ by three standard deviations. In effect, the environment of virtually everyone in the higher-IQ group would have to be better than the average environment of the lower-IQ group. This creates a paradox: IQ gains have often been more than one standard deviation per generation, yet positing three or four standard deviations of environmental progress over one generation seems absurd. The twin studies seem to show that what is known to be true (IQ gains are caused by the environment) cannot be true. How can twin studies show environmental effects to be so feeble and IQ gains show them to be so potent? Let us see what sociology can do to answer this question.

Identical twins separated at birth and raised apart grow up with similar IQs. The obvious cause is their identical genes. But things are not that simple. Identical genes tend to get matched with very similar environments and thereby co-opt the potency of powerful environmental factors. Consider a sport analogy. Your basketball genes are slightly better than average, and you are born a bit taller and quicker than average. You live in the basketball-mad state of Indiana. When you go to school, you are a bit better at basketball than your classmates, so you are picked more often to play, practice more than most of them, make your school team, and get professional coaching. In contrast, people whose genes make them a bit shorter and stodgier than average will get matched with a much worse basketball environment.

In Indiana, if identical twins are genetically programmed to be taller and quicker than average to the same degree, then despite being raised apart, they will tend to get matched to basketball environments of about the same degree of superiority. What would a twin study show? Very similar basketball skills, for which their identical genes would get all the credit. The fact that both twins benefited from more practice than their peers, making a school team, and getting professional coaching would be overlooked.

Now for IQ. If John is born with a bit better brain than James, who will like school, get praised for his schoolwork, haunt the library, and get into advanced classes? And if John has a separated identical twin, who enjoys much the same school experience, what will really account for their similar adult IQs? Not identical genes alone. Rather, the ability of those identical genes to co-opt environments of similar quality will be the missed piece of the puzzle.

Within a generation, genes profit from seizing control of a powerful instrument that multiplies their causal potency. A gene-caused ability advantage upgrades the school environment by more homework being done, which upgrades the ability advantage, which upgrades the environment by entry into a top academic track, which upgrades ability further. Each feedback loop acts as a potent multiplier. Could some persistent environmental factor have been at work between generations, seizing control of a multiplier powerful enough to have caused the massive IQ gains of recent decades? Then our paradox would be solved. There would be huge environmental effects on the average IQ difference between generations—effects quite consistent with genetic domination of individual IQ differences within each generation.

The persistent environmental factor that has been at work is the industrial revolution with its social trends, smaller families, more cognitively demanding leisure, and more cognitively demanding work roles. As for the powerful multiplier these trends have used, we might call it the "social multiplier." Its essence is that rising average performance becomes a potent causal factor in its own right.

Back to sports. About 1950, the advent of television sparked much greater and keener participation in basketball. This raised the general skill level; you had to shoot accurately to be better than most other players. Then you had to be able to pass with either hand, then to shoot with either hand. In other words, every escalation of the average performance in the general population meant every individual had to improve to keep up, which escalated the average performance further, which meant a new challenge to each individual—so the multiplier produced a huge escalation of skills in a single generation. The same thing happened

after 1948 for on-the-spot problem solving. Society made new demands on the cognitive content of conversation, leisure, and work. This raised the average performance, and then everyone had to respond to keep up, which raised the average performance further, producing a huge escalation of skills in a single generation.

So all is clear: Twin studies reflect situations in which genes drive powerful multipliers; massive IQ gains occur when environmental trends seize control of powerful multipliers. It all depends on whether genes or the environment is in the driver's seat. Sociology can solve our paradox, and a *g*-ocentric view of intelligence cannot. If you focus primarily on *g* and the fact that *g* differences between individuals are genetically influenced, the paradox simply makes you want to find that IQ gains are caused by some genetic factor like hybrid vigor.

Jensen said that twin studies show how improbable it is that the IQ gap between Black and White Americans is environmental. After all, that IQ gap amounts to a full standard deviation. Who could argue that the average Black environment is three standard deviations below the average White environment? Such an analysis begs the question: Are Blacks like individuals within White society who on average have inferior genes for mental abilities, or instead are Black-White differences in IQ more like generational differences due to persistent environmental factors? McWorter (2000) believes that Black Americans have a sense of victimhood that makes them shun mainstream American culture and see school achievement as selling out to White culture. If so, they would be ambivalent about matching average school performance. Therefore, the social multiplier would spiral the average downward rather than upward!

HOW *g* UNRAVELS: TWO KINDS OF COMPETITION

We use our cognitive abilities to compete with one another. Competition to win creates *g*, and competition to keep up destroys *g*. These two kinds of competition refer not to different motives (one always wants to win), but to different contexts.

Competition to win is a static competition. At a particular time, each person's cognitive performance is measured against the cognitive performance of others. That kind of competition tends to produce a single pecking order. If all players have a level playing field, who wins at a given place and time is influenced by differences in brain quality. That common factor crosses the boundaries between various cognitive skills and weaves them together into *g*.

Competition to keep up is dynamic. It operates over long stretches of time and combines progress with anarchy and simply unravels *g*. The mean of on-the-spot problem-solving skills begins to rise and people compete to keep up, while the mean of boring old arithmetic skills is immobile and people relax. Every day, the enormous potency of an active versus an inactive social multiplier widens the gap between Similarities and Arithmetic scores without any regard to their *g* loadings.

g'S VANISHING ACT: A TRIP TO THE MOVIES

Consider two films. The first is about the life history of individuals. Some become doctors; others cannot pass the chemistry course to get into medical school. Their performance over a wide range of areas is influenced by better or worse brains—and there is *g*. The second film is about American society since 1950. Shifting social priorities raise cognitive skills in one area, stall them in another, with no pattern except that set by the priorities themselves. Average brain quality neither improves nor declines—and *g* vanishes. Individual differences in brain quality still exist, of course. But because they have no influence on the pattern of skill gains, and because *g* is a measure of their influence, skill gains simply will not evidence *g*.

You can get a look at *g* whenever you want, but you have to go to the right film. To lament that you cannot see it when differences in brain physiology do not count is to forget what Jensen's *g* is all about. That *g*, ideally at least, is a pure measure of the brain's influence on cognitive performance.

What society would prioritize cognitive abilities according to which were most influenced by brain physiology? If a society were bizarre enough to do that, you would get IQ gains on various WISC subtests that matched the *g* loadings of those subtests. But that would not be true *g* but *g* mimicked. It would be a mere likeness painted by some mad dictator who had decided to encourage (or discourage) cognitive skills in terms of how much they were brain influenced rather than in terms of social priorities. It would be like a society that refused to allow people to choose between improving their basketball and baseball skills, but rather, imposed rewards and penalties in favor of baseball on the grounds that it was the sport in which performance was most affected by human physiology.

WHAT IS TO BE DONE?

What research might advance our understanding of human cognition, individual and group differ-

Published by Blackwell Publishing Inc.

ences, and how to enhance cognitive skills?

- We need to identify the brain processes that influence cognition. Jensen has found correlations between *g* and elementary cognitive tasks (mental processing speed), the brain's electrical response to stimuli, and how quickly an injection of glucose is absorbed by the brain. Hope for further advance in this area lies in new techniques of viewing what brain centers are active when different cognitive tasks are being done.
- We should learn more about social multipliers. Boozer and Cacciola (2001) showed that when reduced class size raises academic performance, peer interaction multiplies that rise and accounts for virtually all of the long-term gains.
- The relative potency of Whites' and Blacks' social multipliers should be compared.
- Although teaching children "how to think" is desirable, we should recognize that this will not necessarily enhance numeracy and literacy. The focus must be on teaching reading and arithmetic skills. And note that if we really want to enhance those skills, there will have to be an attitude shift, so that Americans welcome core subjects that make greater cognitive demands. If all parents and children were like Chinese Americans, the "nation's report card" would improve dramatically.
- Above all, we must go beyond *g* to develop a theory of intelligence with a sociological dimension. In this theory, *g* will still play an important role. Within every generation, people compete to win, and, therefore, *g* will always help explain why some people excel across so many cognitive skills.

Recommended Reading

Deary, I.J. (2001). *Intelligence: A very short introduction*. Oxford, England: Oxford University Press.

Dickens, W.T., & Flynn, J.R. (2001, April 21). Great leap forward. *New Scientist, 170*, 44–47.

Jensen, A.R. (1998). *The g factor: The science of mental ability*. Westport, CT: Praeger.

Note

1. Address correspondence to J.R. Flynn, POLS, University of Otago, Box 56, Dunedin, New Zealand; e-mail: jim.flynn@stonebow.otago.ac.nz.

References

Boozer, M., & Cacciola, S.E. (2001). *Inside the black box of Project STAR: Estimation of peer effects using experimental data* (Center Discussion Paper No. 832). New Haven, CT: Yale University Economic Growth Center.

Greenfield, P. (1998). The cultural evolution of IQ. In U. Neisser (Ed.), *The rising curve: Long-term gains in IQ and related measures* (pp. 81–123). Washington, DC: American Psychological Association.

Howard, R.W. (1999). Preliminary real-world evidence that average intelligence really is rising. *Intelligence, 27*, 235–250.

Jensen, A.R. (1973). *Educability and group differences*. New York: Harper and Row.

Jensen, A.R. (2002). Galton's legacy to research on intelligence. *Journal of Biosocial Science, 34*, 145–172.

McWorter, J. (2000). *Losing the race: Self-sabotage in Black America*. New York: Free Press.

Nunn, J. (1999). *John Nunn's chess puzzle book*. London: Gambit Publications.

Rosenau, J.N., & Fagan, W.M. (1997). A new dynamism in world politics: Increasingly skilled individuals? *International Studies Quarterly, 41*, 655–686.

Schooler, C. (1998). Environmental complexity and the Flynn effect. In U. Neisser (Ed.), *The rising curve: Long-term gains in IQ and related measures* (pp. 67–79). Washington, DC: American Psychological Association.

Spanking Children: Evidence and Issues

Alan E. Kazdin[1] and Corina Benjet

Child Study Center, Yale University School of Medicine, New Haven, Connecticut (A.E.K.), and National Institute of Psychiatry, Mexico City, Mexico (C.B.)

Abstract

Whether or not to spank children as a discipline practice is controversial among lay and professional audiences alike. This article highlights different views of spanking, key conclusions about its effects, and methodological limitations of the research and the resulting ambiguities that fuel the current debate and plague interpretation. We propose an expanded research agenda to address questions about the goals of parental discipline; the role, if any, that punishment plays in achieving these goals; the effects and side effects of alternative discipline practices; and the impact of punishment on underlying developmental processes.

Keywords

spanking children; punishment; parent discipline

Spanking as a way of disciplining children is a topic of broad interest to people involved in the care and education of children (e.g., parents, teachers), as well as to the many professions involved with children, parents, and families (e.g., pediatrics, psychiatry, psychology, and social work). Hitting children is intertwined with religious beliefs, cultural views, government, law, and social policy and