PeopleHawk

THE SCIENCE BEHIND PEOPLEHAWK:

Simplicity is **complexity resolved**

Complexity is a key feature of the modern workplace

Why *g* matters

In general terms, *g* is the ability to deal with cognitive complexity and, in particular, with complex information processing. Everything we do in life involves some complexity, that is, some information processing. Life tasks, like job duties, vary greatly in their complexity (*g* loadedness). This means that the advantages of higher *g* are large in some situations and small in others, but probably never zero.

One of the liveliest areas of research on intelligence today concerns the brain "hardware" and information-processing "software" that compose intelligence. Researchers are just beginning to chart the neural basis of *g*. However, much is known about the behavioural manifestations of these underlying processes. It is these outward signs of what we commonly recognize as intelligence that are most relevant for understanding the role of *g* in practical affairs.

Outward manifestations of intelligence

Although researchers disagree on how they define intelligence, there is widespread agreement that it reflects the ability to reason, solve problems, think abstractly and acquire knowledge (Snyderman & Rothman, 1988, p. 56). Intelligence is not the amount of information people know, but their ability to recognize, acquire, organise, update, select and apply it effectively. In educational contexts, these complex mental behaviours are referred to as higher order thinking skills. Stated at a more molecular level, *g* is the ability to mentally manipulate information – 'to fill a gap, turn something over in one's mind, make comparisons, transform the input to arrive at the output' (Jensen, 1981, p. 62).

Complexity: the “active ingredient” in intelligence tests

One reason that many people have trouble believing that intelligence is important is that the content of intelligence tests often seems remote from everyday demands (arranging blocks to copy specified designs, identifying the missing element in a picture, repeating digits in reverse order) or merely academic (vocabulary, arithmetic, analogies). This means they struggle to understand how the tests could possibly measure anything of benefit in daily life. However, the active ingredient in intelligence tests has nothing to do with their manifest content. This “indifference of the indicator” (Spearman, 1923) was one of the earliest discoveries in intelligence testing (see Jensen, 1980, chap. 5, for an extended discussion).

Instead, the active ingredient in test items seems to reside in their complexity. Any kind of item content - words, numbers, figures, pictures, symbols, blocks, mazes, and so on - can be used to create less to more *g*-loaded tests and test items. Differences in *g* loading seem to arise from variations in items’ cognitive complexity and thus the amount of mental manipulation they require. These sorts of mental processes - contrasting, abstracting, inferring, finding salient similarities and differences - are the building blocks of intelligence as manifested in reasoning, problem solving and grasping new concepts with facility.

Complexity in the workplace

Life is full of uncertainty, change, confusion and misinformation, sometimes minor and at times massive. From birth to death, we must master abstractions, solve problems, draw inferences and make judgments using inadequate information. Such demands are especially intense in school and they continue when one leaves. An examination of job duties in the workplace reveals why.

Many organisations, both civilian and military, use job analysis to understand how work might be better structured, what kinds of workers they should employ and what sorts of training should be provided. Many inventories and standardised procedures are available for this purpose (Harvey, 1991). The Position Analysis Questionnaire (PAQ), for example, assesses almost 200 elements of work and work context under about three dozen categories. Data generated by such questionnaires have accumulated for many decades.

The major distinction amongst jobs is their Cognitive Complexity (*g* loadedness)

When job analysis data for any large set of jobs are factor analysed, they always show that the major distinction among jobs is the mental complexity of the work they require workers to perform (e.g., Miller, Treiman, Cain, & Roos, 1980). Arvey's (1986) job analysis is particularly informative in showing that job complexity is essentially a demand for *g*. His factor analysis of 65 job attributes for 140 jobs in the petrochemical industry showed that the major distinction among them was the degree of mental complexity they posed for workers. The first factor, accounting for 45% of the variance, was Judgment and Reasoning.

Further analysis, as illustrated in Table 1 shows the individual job attributes loading highest on this particular factor, in other words how much mental complexity each job attribute underpinning Judgement and Reasoning contains. All are content-free mental tasks involving learning, problem solving, and information processing - the very essence of manifest intelligence. They arise when workers are confronted with novelty, change, uncertainty, unpredictability and the need to spot and master new information and emerging problems.

TABLE 1
Job Analysis Items and Factor Loadings Associated With Judgment and Reasoning Factor Developed From 140 Petrochemical Jobs

Item	Factor Loading
Deal with unexpected situations	.75
Able to learn and recall job-related information	.71
Able to reason and make judgments	.69
Able to identify problem situations quickly	.69
React swiftly when unexpected problems occur	.67
Able to apply common sense to solve problems	.66
Able to learn new procedures quickly	.66
Alert and quick to understand things	.55
Able to compare information from two or more sources to reach a conclusion	.49

Source. Arvey (1986, p. 418).

Dealing with people tends to be complex

Research indicates that Complexity of Dealings with People, another of Arvey's factors is closely correlated with overall mental difficulty. Other people-related job requirements show how specific activities in dealing with people, like information-processing demands, also vary greatly in complexity. Negotiating, persuading and staff (but not line) functions are all highly correlated with overall job complexity.

Correlations are somewhat lower for the extent of personal contact, instructing, and public speaking, perhaps because they each encompass activities that themselves may range greatly in complexity. Supervising non-employees is also reasonably complex, as is influencing others. Activities dealing with people almost always correlate more highly with the overall cognitive complexity. But perhaps the most important conclusion to be drawn from these people-related ratings is that dealing with people is always fairly complex. This should not be surprising, because other individuals are among the most complex, novel, changing, active, demanding, and unpredictable objects in our environments.

Task configuration affects complexity

The configuration of activities, as the task complexity literature suggests, can also increase job complexity. Task variety, change, ambiguity, and lack of supervision all contribute to complexity. Thus, we find that jobs high on the overall mental difficulty factor tend to be unstructured and entail much self-direction and general responsibility. They also tend to involve time pressure, variety and change, and attention to detail, and to emphasise creative rather than routine activities. The more highly supervised, repetitive and/or physical the job, the less cognitively complex it is.

High levels of education and training are often necessary but not sufficient in highly complex jobs

Jobs high in overall complexity require more education, training and experience and are viewed as the most prestigious. These correlations have sometimes been cited in support of the training hypothesis discussed earlier, namely, that sufficient training can render differences in *g* obsolete. However, prior training and experience in a job never fully prepare workers for all possible situations. This is especially true for complex jobs, partly because they require workers to continually update job knowledge.

As already suggested, complex tasks often involve not only the appropriate application of old knowledge, but also the quick understanding and use of new information in changing environments. Education, training, experience and the job knowledge to which they lead are all important aids in performing jobs well. This fact is aptly captured by discussions of the "practical intelligence" and "tacit knowledge" that is gained through experience (Jensen, 1993; Schmidt & Hunter, 1993; Sternberg & Wagner, 1993; Sternberg, Wagner, Williams, & Horvath, 1995).

Raw intelligence is not enough. Similarly, knowledge is merely a tool that people apply with different degrees of competence to a wide variety of novel situations - some potentially critical (plunging sales, corporate mergers) and others less so (novel questions or complaints from customers, applying and interviewing for jobs, setting behavioural standards). As discussed earlier, the facility with which individuals accumulate these tools (trainability) and the competence with which they apply them (task proficiency) often depend heavily on *g*, especially where there is no close supervision.

Influence of intelligence on overall life outcomes

The effects of intelligence, like other psychological traits, are probabilistic, not deterministic. Higher intelligence improves the odds of success in school and work. It is an advantage, not a guarantee. Many other factors come into play.

To mitigate unfavourable odds attributable to low IQ, an individual must have some equally pervasive compensatory advantage, such as family wealth, winning personality, enormous resolve, strength of character, an advocate, benefactor or similar. Such compensatory advantages may mitigate, but probably never eliminate the cumulative impact of low IQ. Conversely, high IQ acts like a cushion against some of life's adverse circumstances, perhaps partly accounting for why some people are more resilient than others when faced with a challenge.

There are many other valued human traits besides *g* (e.g., see Gardner, 1983, on "multiple intelligences"), but none seems to affect individuals' life chances so systematically and so powerfully in modern life as does *g*. To the extent that one is concerned about inequality in life chances, one must be concerned about differences in *g*.

Figure 1 summarises much of the research in these areas.

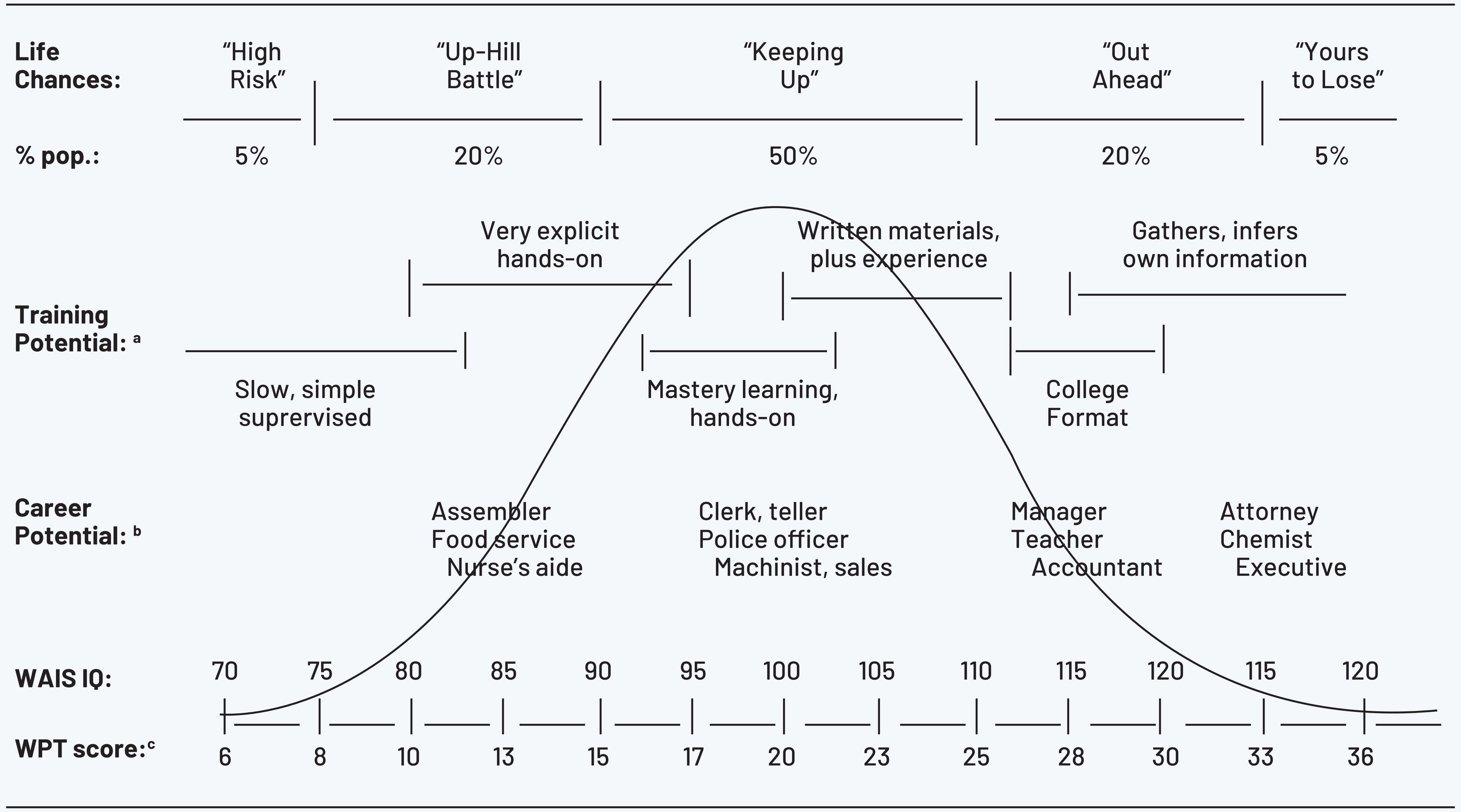

Figure 1. Overall life chances at difference ranges of the IQ bell. [a] Wonferlic (1992, p. 26). [b] Figure 1. [c] Wonderlic (1992, p. 20)

The future trends in complexity

Society has become more complex, and *g* loaded as we have entered the information age and post-industrial economy. Major reports on schools, workforce and economy make the case that work is becoming more complex.

Where the old industrial economy rewarded mass production of standardised products for large markets, the new post industrial economy rewards the timely customisation and delivery of high-quality, convenient products, and increasingly services for specialised markets. Where the old economy broke work into narrow, repetitive and closely supervised tasks, the new economy increasingly requires workers to work remotely, often in cross-functional teams, gather information, make decisions and undertake diverse, changing, and challenging sets of tasks in a fast-changing and dynamic global market. Accordingly, organisations are "flatter" (have fewer hierarchical levels), and increasing numbers of jobs require high-level cognitive and interpersonal skills (Camevale, 1991; Cascio, 1995; Hunt, 1995; Secretary's Commission on Achieving Necessary Skills, 1991).

Such reports emphasize that the new workplace puts a premium on higher order thinking, learning and information-processing skills (see especially Hunt, 1995) - in other words, on intelligence. Gone are the many simple farm and factory jobs where a strong back and good nature could generate a reasonable livelihood, regardless of IQ. Also disappearing as technology advances is the need for highly developed perceptual-motor skills, which were once critical for operating and monitoring machines (Hunt, 1995, chap. 6).

REFERENCES

Arvey. R.D. (1986). General ability in employment: A discussion. *Journal of Vocational Behavior*, *29*, 415-420.

Carnevale, A.P. (1991). *America and the new economy*. Washington, DC: American Society for Training and Development & U.S. Department of Labor, Employment and Training Administration.

Cascio, W.F. (1995). Whither industrial and organizational psychology in a changing world of work? *American Psychologist*, *50*, 928-939.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.

Harvey, R.J. (1991). Job analysis. In M.C. Dunnette & L.M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 2). Palo Alto: Consulting Psychologists Press.

Hunt. E. (1995). *Will we be smart enough? A cognitive analysis of the coming workforce*. New York: Russell Sage Foundation.

Jensen. A.R. (1980). *Bias in mental testing*. New York: Free Press.

Jensen, A.R. (1981). *Straight talk about mental tests*. New York: Free Press.

Jensen, A.R. (1993). Test validity: *g* versus "tacit knowledge." *Current Directions in Psychological Science*, *2*, 9-10.

Miller, A.R., Treiman, D.J., Cain, P.S.. & Roos, P.A. (Eds.). (1980). *Work, jobs. and occupations: A critical review of the Dictionary of Occupational Titles*. Washington, DC: National Academy Press.

Schmidt, F.L., & Hunter, J.E. (1993). Tacit knowledge, practical intelligence, general mental ability, and job knowledge. *Current Directions in Psychological Science*, *2*, 8-9.

Secretary's Commission on Achieving Necessary Skills. (1991). *What work requires of schools: A SCANS report for America 2000*. Washington, DC: U.S. Department of Labor.

Snyderman, M., & Rothman, S. (1988). *The IQ controversy, the media and public policy*. New Brunswick, NJ: Transaction Books.

Spearman, C. (1923). *The nature of "intelligence" and the principles of cognition*. London: Macmillan.

Sternberg, R.J., & Wagner, R.K. (1993). The g-ocentric view of intelligence and job performance is wrong. *Current Directions in Psychological Science*, *2*, 1-5.

Sternberg, R.J., Wagner, R.K., Williams, W.M. & Horvath, J.A. (1995). Testing common sense. *American Psychologist*, *50*, 912-926.