

Uncorrected proof

The Science of Human Intelligence

In this revised and updated edition of Hunt's classic textbook, *Human Intelligence*, two research experts explain how key scientific studies have revealed exciting information about what intelligence is, where it comes from, why there are individual differences, and what the prospects are for enhancing it. The topics are chosen based on the weight of evidence, so readers can evaluate what ideas and theories the data support. These topics include IQ testing, mental processes, brain imaging, genetics, population differences, sex, aging, and likely prospects for enhancing intelligence based on current scientific evidence. Readers will confront ethical issues raised by research data and learn how scientists pursue answers to basic and socially relevant questions about why intelligence is important in everyday life. Many of the answers will be surprising and stimulate readers to think constructively about their own views.

The Science of Human Intelligence

Second Edition

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Dedication

To the memory of our friend Earl (Buz) Hunt, who
championed clear thinking and incisive but
constructive skepticism about intelligence research

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Preface

This book is the second edition to the classic textbook *Human Intelligence* (2011), written by our friend Earl (Buz) Hunt (1933–2016). Hunt’s book provided a balanced and comprehensive presentation of the scientific evidence about human intelligence. We wrote this book to do the same with updated research data, but with this warning: we have our own points of view elaborated after seventy-five years of combined research experience between us, so this book is not blandly neutral on every issue. Not surprisingly, we do not agree about every point or the emphasis it should receive. Our disagreements mirror the field. The astute reader may even detect a bit of tension in passages that are written as compromises of our different views. We often channeled Buz as the tie breaker.

Intelligence is a controversial subject for many reasons. This book presents empirical data that address complex ideas and the issues surrounding them. Many findings might be surprising and contrary to what you may have heard or what you believe. Misunderstandings and mistaken ideas abound, especially in the popular media, about what intelligence is, where it comes from, its importance in everyday life, and the meaning of average differences among populations. This book is intended to inoculate you against erroneous information and to enable you to think and converse about complex topics with facts.

The weight of evidence is a key concept at the core of this book. Questions about intelligence do not have simple answers. No one study is definitive, and it takes many years to sort out inconsistent research results to establish a weight of evidence. Intelligence research has many mysteries, twists, and turns, and, most importantly, know it or not, it is highly relevant to your life.

Our job is to inform you with clear explanations of the best evidence. New data are coming rapidly, especially from neuroscience and genetic studies. Each chapter intends to promote critical thinking about what science already knows and what remains to be learned. There are hundreds of recent good studies we could have chosen to include. We want you to see the forest through the trees, the so-called big picture, so we have focused on some of the best, informative, and interesting research. We often will quote researchers directly when they interpret their findings to give you a feel for how research is communicated by the people who do it. For the same reason, we often reproduce the exact figures and tables of results from the original sources.

With this in mind, [Chapter 1](#), “A Brief Voyage to the Past,” presents historic milestones relevant for understanding the present state of research and preparing for future findings. Common misunderstandings about intelligence are debunked, including opinions that intelligence cannot be defined or measured for scientific research, that intelligence tests do not measure anything important for everyday life, or that intelligence is based exclusively on early environmental and social experiences. These views are not supported by compelling evidence, as we will see.

[Chapter 2](#), “Basic Concepts,” discusses the role of models and hypothesis testing and sets out major questions about intelligence. The need for quantitative assessments is underscored for answering questions at distinguishable but interrelated levels of analysis: psychological traits, cognitive processes, and biology (e.g., the brain, genomes, influences of experiences).

[Chapter 3](#), “Psychometric Models of Intelligence,” covers testing intelligence at the behavioral level, what test scores mean, and what they do not mean. The available evidence supports the conclusions that (1) standardized intelligence tests are among the most reliable and valid psychological assessment tools, (2) people can be reliably ordered on these test scores, and (3) the analysis of these scores supports the view that human cognitive abilities are organized in a pyramid-like structure with a prominent general factor of intelligence (g) common to all tests of mental abilities and that some mental abilities require more g than others.

[Chapter 4](#), “Cognitive Models of Intelligence and Information Processing,” focuses on the dynamics of intelligence within the brain. Perception, attention, learning, and memory have been studied as elements of intelligence. Can intelligence be explained by individual differences in attention and memory ability? Or is intelligence the factor that integrates all these elements into something psychologically meaningful that is more than the sum of its parts? We present evidence that favors explanations somewhere between psychometric and biology-based models by showing how individuals apply their information processing abilities.

[Chapter 5](#), “Intelligence and the Brain,” focuses on a neuroscience approach. Neuroimaging technologies have taken intelligence research deep into the brain. Structural and functional features of the cortex, specific neural circuits throughout the brain, and characteristics of neurons are related to intelligence differences among individuals as assessed by standardized tests. Using patterns of connectivity among brain areas (the connectome), we can now identify brain “fingerprints” that predict intelligence test scores. This is one of the most exciting areas of progress, but further advances are coming quickly, and they are tasty food for hungry minds.

[Chapter 6](#), “The Genetic Basis of Intelligence,” presents overwhelming evidence that genetic variation is related to intelligence differences. Classic behavioral genetics research (based on twin, adoption, and family studies) is now taken to another level with DNA assessment. Polygenic scores can predict intelligence differences among individuals to some degree. This opens a new and exciting field that seeks to understand the molecular biology of specific brain systems related to intelligence. These findings have the science fiction–like potential to evolve into learning how to change brain systems to enhance intelligence. [Chapter 13](#) is fully devoted to the enhancement of intelligence.

[Chapter 7](#), “Experience and Intelligence,” examines the impact of nongenetic environmental factors on intelligence. We know genes have substantial influence, but we also know that they are clearly insufficient for explaining all manifestations of intelligence. Furthermore, the same environmental feature may have a differential impact on each person’s unique genome and connectome. Understanding how complex interactions among genetic and environmental factors contribute to intelligence differences is one of the most challenging topics in all science.

[Chapter 8](#), “Intelligence and Everyday Life,” explains why intelligence matters to you. Intelligence is critical for understanding numerous consequential social outcomes, such as academic achievement, occupational status and success, physical and mental health, longevity, creativity, eminence, income, socioeconomic status, and accident proneness, just to name some of them. We challenge you to find any other psychological trait showing such a large set of social correlates. We explain here how the integrative nature of intelligence might help account for this wide network of findings.

[Chapter 9](#), “Introduction to the Scientific Study of Population Differences,” is intended to provide a context for some of the most complex findings in intelligence research that indicate average test score differences among some populations. We detail these findings in [Chapter 10](#) (sex differences), [Chapter 11](#) (age differences), and [Chapter 12](#) (intelligence in the world). Here we present key points to keep in mind when considering population data. As a preview, here are three of them: (1) making sweeping assertions about population differences must be regarded with skepticism; (2) it is critical to distinguish scientific findings and political recommendations; and (3) when population differences are observed, it may be unclear if they can be attributed to intelligence or to other personal and social/cultural variables.

[Chapter 10](#), “Sex Differences and Intelligence,” deals with our current understanding of average cognitive ability differences between men and women. There is a large research literature and compelling evidence that men and women do not differ on general intelligence (g), but there are average differences in some specific mental abilities. We address structural and functional brain differences and whether these differences could account for men/women disparities across vocations and professions. An important issue is to what, if any, extent these findings might inform social/educational policies.

[Chapter 11](#), “Intelligence and Aging,” addresses the stability of intelligence as people age. There are longitudinal studies showing that intelligence is the most stable psychological trait, but this does not mean there are no changes across the life-span. Different aspects of intelligence age differently, and the effects of age are variable among individuals. Research is trying to discover how genes and environmental factors influence aging effects on intelligence. Since we all age, this research has especially personal meaning.

[Chapter 12](#), “Intelligence in the World,” discusses average intelligence similarities and differences among countries, continents, and ancestry. Devoting a chapter to this complex and delicate subject is necessary because there is much popular discussion and argument about it, especially on social media. Intelligence research is also relevant to what economists call human capital. The role of intelligence for economic development and well-being is an emerging area of interest. Therefore, we discuss competing interpretations of the available data. We acknowledge that we do not yet have a solid weight of evidence about why differences exist, but the issues are important, and we think skipping them would be irresponsible.

[Chapter 13](#), “Enhancing Intelligence,” addresses the most far-reaching and ultimate topic in all of intelligence research: how can we improve general cognitive ability? There is evidence of a generational increase in average IQ scores (Flynn effect) and of a small average increase related to education. However, there have been many claims of large increases for individuals

resulting from early childhood education, computer gaming, memory training, stimulation of the brain, and a host of others. So far, none of them produce replicated or lasting effects. We think advances in neuroscience and genetic research may provide a rational basis for enhancing intelligence through neurobiology, brain development, and perhaps gene expression. We see a glimmer of what might be possible and the thought-provoking questions that will arise.

The [epilogue](#), “A Final Word,” summarizes ten key findings about intelligence that are strongly supported by currently available research evidence. There also is a challenge to think about what the future holds for understanding intelligence beyond test scores.

Let us begin this book with the words of Douglas K. Detterman, a longtime intelligence researcher:

Intelligence is the most important thing of all to understand, more important than the origin of the universe, more important than climate change, more important than curing cancer, more important than anything else. That is because human intelligence is our major adaptive function and only by optimizing it will we be able to save ourselves and other living things from ultimate destruction. ([Detterman, 2016, p. v](#))

We strongly agree, and, perhaps by the time you finish reading, you will agree too.

Reference

Detterman, D. K. 2016. Was intelligence necessary? *Intelligence*, 55, v-viii.