Think about your smartphone. What images come to mind? What emotions? Of course, it may seem presumptive to assume that you own a smartphone, but that assumption is overwhelmingly justified. As of early 2014, more than 80% of young adults in the United States owned smartphones, a percentage that has grown steadily for a decade. As a glance across any crowded public setting will confirm, smartphones have become a ubiquitous part of modern society. You probably spend more time with your smartphone than with any other device. You carry it with you everywhere, checking regularly for messages and mail. It connects you with others. And think about what it felt like the last time that you misplaced your smartphone. You probably felt a sense of disconnection, as if a part of you were missing. In short, that simple physical device generates a host of complex thoughts, behaviors, and emotions—much like a close personal relationship.

On September 30, 2011, the New York Times published an opinion-editorial (“op-ed”) piece titled, “You Love Your iPhone. Literally.” Authored by marketing consultant and writer Martin Lindstrom, the piece described an fMRI experiment that was intended to “find out whether iPhones were really, truly addictive, no less so than alcohol, cocaine, shopping or video games.” A group of 16 young adults viewed a series of audio and video stimuli associated with iPhones (e.g., videos of a ringing iPhone). According to Lindstrom, the stimuli did not evoke activation in reward-related brain regions but in the brain’s insular cortex, a region associated with “feelings of love and compassion.” The author’s conclusion: “The subjects didn’t demonstrate the classic brain-based signs of addiction. Instead, they loved their iPhones.”

Predictably—and justifiably—this short op-ed piece generated a cacophony of criticism. It embodied all that seems wrong about popular media coverage of fMRI work: drawing large conclusions from limited data, glossing over all the experimental details, and reporting an outcome of a study before it had been peer reviewed. Worst of all was an exceptionally egregious case of reverse inference: the assertion that activation in the insular cortex means that the participant is experiencing feelings of love. Any experienced fMRI researcher would cringe at such a claim, because insular activation can be evoked by a wide range of processes. In fact, based on large-scale meta-analyses of fMRI...
data, such activation is more likely to represent negative internal states such as pain or disgust than feelings of affection (Figure 14.1). If anything, the piece should have drawn exactly the opposite inference from its data.

This example may seem like an idiosyncratic, extreme sort of misuse of fMRI by the popular media. Yet, in the previous edition of this book, we introduced this chapter with a similar article from the popular media—one applying MRI to evaluations of political candidates—that exhibited many of the same problems and biases. The difficulty in describing fMRI research (and neuroscience research more generally) accurately and responsibly will not go away. We fully expect that the next edition of this book will lead off this chapter with some as-yet-unwritten article about using fMRI to predict the outcomes of football matches, to determine what makes some CEOs successful and others failures, or to explain why reality TV programming is so strangely compelling.

In this chapter, we consider a range of issues related to the practice of fMRI: How should fMRI research be described in the popular media? What can and should researchers say about fMRI data? What restrictions should be placed on the sorts of people to be scanned or the sorts of topics to be studied? What constraints should guide how researchers interact with their participants? What commercial applications should arise from cutting-edge fMRI research? These complex, important questions have no simple answers. Indeed, they often lead fMRI researchers to disagree among themselves. In what now seems like a recurring cycle of promise and caution, four days after the publication of Lindstrom’s New York Times article, a group of 45 fMRI researchers, led by Russell Poldrack, submitted a letter to the editor in response. That brief letter—which outlines criticisms like the ones raised here—was published in print and online form; however, the archived online version of Lindstrom’s original piece contains no links to the neuroscientists’ response. The original “You Love Your iPhone” article remains intact on the New York Times website, where it sits awaiting searches by unsuspecting web visitors.
Interpreting and Presenting fMRI Data

We first examine how fMRI findings are disseminated by news reporters and science writers and by the researchers themselves. As fMRI becomes an increasingly common and important technique, its applications to problems of real-world interest have caught the attention of the news media and the public at large (Figure 14.2). Journalists, bioethicists, and fMRI researchers have grown concerned with the challenges in making complex research accessible. How does one encapsulate, within a few short paragraphs, all the complex physics, physiology, experimental design, and statistics that underlie even the most basic fMRI study? It is a challenge for textbook authors to

Figure 14.2 Functional MRI studies have elicited substantial media coverage, for better or worse. While such coverage has led to increased public interest in neuroimaging, as well as increased recognition of the influence of the brain on behavior, many stories emphasize sensationalism over accuracy. Media reports of fMRI studies share some common properties. Anatomical regions are often generalized, because the intended audience knows neither the anatomy nor the jargon used to describe it (e.g., the frontopolar cortex vs. the prefrontal cortex). Complex concepts like personality, intelligence, and emotion are linked to specific areas, even when the research study describes activation in terms of brain systems. The study's results are applied to common behavior, such as how one can become a better parent or stock market investor. There is also often a focus on studies of individual differences or social psychology that tap into common stereotypes about behavior.