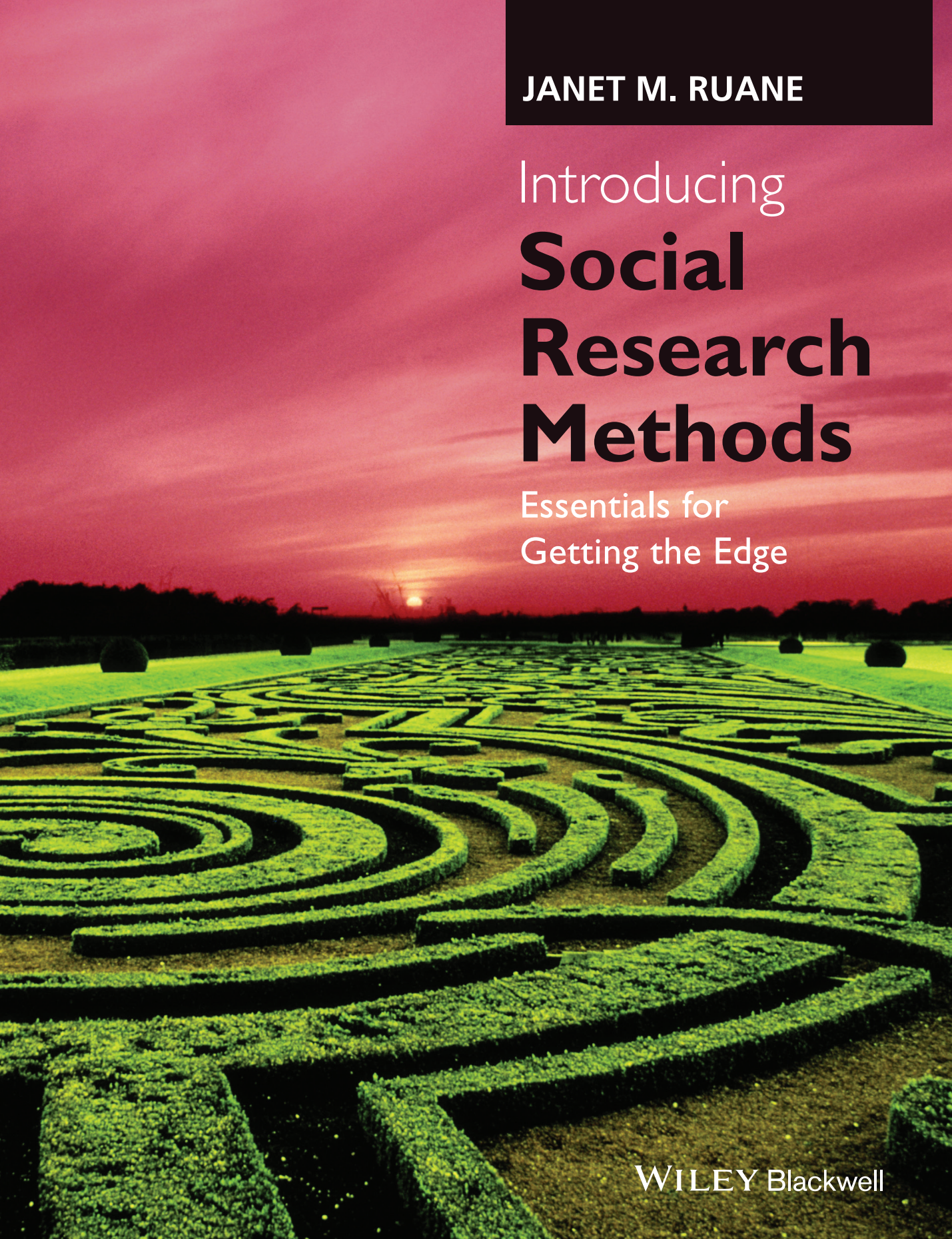
JANET M. RUANE
Introducing
Social Research Methods
Essentials for Getting the Edge
WILEY Blackwell

Introducing Social Research Methods

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For students:
- An annotated list of TED talks on topics covered in the text
- Links to further resources available on the web

For instructors:
- A test bank with chapter-by-chapter multiple choice questions

Introducing Social Research Methods

Essentials for Getting the Edge

Janet M. Ruane

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Chapter 1

How Do We Know What We Know? Science as a Superior Way of Knowing

Introducing Social Research Methods: Essentials for Getting the Edge, First Edition. Janet M. Ruane.

FIRST TAKES

Be sure to take note of the following:
Scientific vs. Non-Scientific Knowledge

- Competing *non-scientific* ways of knowing
  - Tradition
  - Authority
  - Common sense
  - Intuition
  - Rationalism
  - Strict empiricism
- Science – a superior (less error prone) way of knowing
  - A distinctive way of knowing
    - The defining traits of science

How do we know what we know? This is both a rather simple but also a rather complex philosophical question. Those who seek the path of least resistance are often willing to forgo the consideration of this question altogether. But in order to achieve a deeper appreciation of science and its distinctive edge in the production of knowledge, we need to take a moment and ponder this basic question. We need to explicitly acknowledge the common tendency of many to rely on competing non-scientific ways of knowing. These non-scientific ways of knowing are well established "go to" practices for many of us that help us cope with the dynamic nature of the social world and the flood of information we all must process every day.

To be sure, we live in an information-dominated world. Every day, like it or not, we are bombarded by facts, figures, news items, opinions, tweets, and blogs; we are connected to countless information sources about our local community, our society and our world. On any given day, *Yahoo* will present us with 100 or so "headlines" prompting us to click for more information. Many now go to bed with their electronic devices tucked under their pillows so as not to miss the latest tweets or news flashes. (Indeed sleep specialists worry that dependency on smartphones is creating vamps – i.e. youth who forgo sleep and stay connected all night long.) Those same devices travel with us throughout our days so we can stay connected 24/7. If you are old-fashioned enough to get your news from a TV screen, you nonetheless understand it is not your "father's" news broadcast. As any one story is being aired, texts of other headlines are continuously scrolling across the bottom of the screen. If you rely on the Internet for your daily news, you will experience countless links that can quickly bring you more in-depth or totally different information.

In recent years, our information age has taken an alluring, perhaps compelling, "personal" turn. To a large extent, the personal computer and the Internet allow us (even encourage us) to customize the information that comes our way. Web browsers allow us to set up personal weather forecasts, stock quote pages, or alerts for news items of special interest. We can arrange for daily emails about our favorite sports teams, current topics and

celebrities. And as we all know, today's "search" on the Internet will deliver unsolicited ads and feeds courtesy of sites watching our every move or click.

Given all the ways of knowing that are available to us, and given our growing ability to get exactly the information that *we* want via cellphones and computers, students of research methods may wonder why we need to learn the methodical and labor-intensive procedures of science and research methods? Isn't all the information we need readily at our fingertips? Given the wealth of information available on the Internet, can't we be satisfied to just sit and click?

Perhaps a recent Internet banner ad for the *New York Times* offers the best answer to the question: "What's the point of an information age without the right information?" Information is only useful if it is accurate. And if there is one hallmark of science, it is its penchant for accuracy.

The incredible amount of information that confronts us (and the relative ease of accessing it) makes us all the more vulnerable to misinformation. Indeed, Internet inaccuracies are so common there are several webpages devoted to detecting and debunking falsehoods and myths: Consider four "claims" that recently circulated on the Internet:

- The state of Kansas in caving to the religious right is introducing legislation to keep the newly updated science show *Cosmos* off Kansas television.
- Google Earth detected a British woman who was lost at sea signaling for help on a deserted island.
- The use of antiperspirants causes breast cancer.
- Bananas from Costa Rica (and more recently from South Africa) carry a flesh-eating bacteria.

All of these assertions grabbed a lot of attention (and no doubt clicks) on the Internet. Yet, *not one* of these statements is true. The news about Kansas originated on a satirical webpage but nonetheless started circulating as a "fact." The Google Earth story was revealed to be a hoax but not before it traveled sea to sea. Both medical researchers and the National Cancer Institute assert that there is insufficient evidence to warrant linking antiperspirants to cancer. The flesh-eating banana bacteria story is a hoax that has been circulating on the Internet for many, many years. Internet rumors, however, are particularly hard to squelch because individuals are quite willing to believe anything they learn from the "all-knowing" computer. Though false, these rumors still exact a price. The International Banana Association has referred to the banana rumor as an incident in Internet terrorism.

The Competition: Non-Scientific Ways of Knowing

When confronted by an information glut, how are we to know which information is accurate? How are we to decide which information to trust? To answer these questions, we need to give some thought to the various sources of knowing that contribute to our "stock of knowledge" and drive our information society. We need also to consider if some sources

of knowledge are more worthy of our trust than others. Hopefully, after reviewing several of the most popular ways of knowing, you will come to appreciate that not all ways of knowing are as worthy of trust as others.

Time-Based Knowing – Traditional Knowledge

Consider a popular "fact" asserted by many in today's society: marital stability is compromised when wives earn more than husbands. This twist on the long-standing norm of males being primary breadwinners has been gaining more attention in the United States since the recession of 2007, a recession that took a bigger toll on male than on female workers. And early in 2015, economic forecasters maintained that middle-class job growth will be concentrated in workplaces more open to women (Aisch and Gebeloff 2015; Searcey, Porter and Gebeloff 2015). Some marital advisors suggest that when husbands earn less than their wives, special effort should be made to restore the husband's importance in the family. Indeed, there is research to suggest that couples in these situations actually respond to the pay imbalance by embracing *more* rather than less traditional marital roles. And why not? Everyone *knows* that the male family role dictates that men should be heads of households. At least everyone "knows" this if they rely on traditional knowledge. (But it remains to be seen if this piece of traditional knowledge can survive the new economic reality of a changing job market.)

Traditional knowledge – knowledge based on the passing of time.

With **traditional knowledge** the *mere passing of time* provides the basis for claiming knowledge or making knowledgeable assertions about the world. Many of us know that all good things must end, but this knowledge is rooted in our learning this adage from parents who learned it from their parents who learned it from their parents and so on. Consequently, traditional knowledge can be particularly tenacious in its hold on us. Who are we to second guess what has been "known" for so very long? This tendency to defer to the "age" of an idea as the acid test of its veracity feeds the strength and influence of traditional knowledge. In surviving the test of time, long-standing ideas or enduring assertions about the world are automatically assumed to be true – indeed, if these assertions were not true, we ask, how could they still be around? One of the classic urban myths is the rumor about the FCC (Federal Communications Committee) banning God from TV. One of the reasons this falsehood still is given credence is because it has been circulating for the last 30 years! The same can be said about the flesh-eating banana story – it has been going strong for 15 years. Or think about the many "facts" you heard while growing up: eating carrots is good for eyesight; an apple a day keeps the doctor away; you catch cold by standing out in the cold or by getting caught in the rain; we lose the most body heat through our uncovered heads; Epsom salt baths are good for de-stressing; warm milk helps us fall asleep.

True or not (all of the before mentioned have been challenged as myths), these adages (and many, many more) are firmly planted in our everyday stock of knowledge. When we hear the same thing over and over, we frequently conclude that there simply must be some truth to it – after all everyone *knows* that where there is smoke, there is fire. But herein rests the major flaw of traditional knowledge: the mere passing of time *does NOT in itself* establish something as true. Consider the fact that for thousands of years, "everyone knew"

that the earth was flat. Navigators chartered their trips to accommodate this fact. Mapmakers were content with two-dimensional maps. But claiming the earth was flat did not make it so. The mere passing of time did not verify the assertion. (If anything, the passing of time is exactly what showed this assertion to be unequivocally false.)

Similarly, until the fifteenth century, astronomers held that the earth was the center of the universe. It was unthinkable to challenge this fact. (Recall the fate of Galileo for bucking the system – he was excommunicated from the Catholic Church for promoting a sun-centered model of the universe.) Once again, however, thousands of years of asserting that all heavenly bodies revolved around the earth did not make it so. Most recently the genetic mapping evidence of the genome project challenged the traditional view of race as a biologically determined category. Despite age-old arguments to the contrary, human races are not genetically distinct. Humans share 99.9 percent of their DNA. Racial similarities, not differences, are in our genes.

Or consider one last example that has received much attention in the last few years: the danger of same-sex couples raising kids. To be sure there are still those who hold on to the long-standing belief that kids raised by two moms or two dads will suffer grave consequences. But research on this issue is consistently finding that the kids are/will be OK (e.g. see The Australian Study of Child Health in Same-Sex Families (http://www.achess.org.au/) or Gartrell and Bos's 2010 US longitudinal study of adolescents raised by same sex parents).

As these examples show, traditional knowledge with its unthinking acquiescence to the passing of time can be very risky knowledge. The "age" or enduring nature of an idea or a belief does not necessarily prove its accuracy or truth.

Box 1.1 Sharpening your research vision: father knows best … or does he?

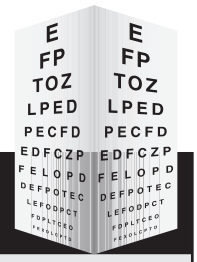
A pretty long-standing adage is that wisdom resides in men. It is a convenient "truth" used to justify the unequal statuses and treatment of men and women world-wide. This "wise male" view is also behind one of the most outrageous and long-standing traditional practices in many countries around the world: honor killing. In the summer of 2014, a Pakistani father stoned his daughter to death. Her offense? She married a man without her father's approval. Witnesses stood by and watched but did not intervene. Some powerful evidence of the power of traditional "knowing."

Credential-Based Knowing – Authoritative Knowledge

Authoritative knowledge is another extremely popular way of coming to know what we know. After a long bullish ride, many financial experts predicted that the start of the new millennium would see a major correction in the stock market. Some smart investors took the correction warning to heart and changed their investment strategies.

Authoritative knowledge – knowledge based upon credentialed expertise (i.e. specialists or respected sources of information).

With **authoritative knowledge**, we defer to experts when looking for accurate assertions or claims about the world. In trusting experts we are deferring to their credentials and training. We accept as accurate and true that which experts tell us.



Box 1.2 Sharpening your research vision: authority addicts

The willingness of Americans to trust authorities has led some to observe that the United States is a society of "authority addicts." Many of you may already be familiar with a rather famous study by Stanley Milgram (1974) that poignantly revealed our willingness to defer to authorities. In this study, Milgram discovered that ordinary civilians would administer electrical shocks to others when directed by authority figures to do so. (Study participants were told to administer shocks to those who had failed at a learning task. While participants thought the jolts of electricity were being administered to "learners" who made mistakes, no shocks were actually delivered.) Indeed, in various replications of the study, Milgram found that a majority of study participants were willing to administer the electrical jolts even when they thought the shocks were causing others severe pain. Milgram's research indicated that humans are willing to accept uncritically an authority figure's perceptions and definitions of reality. But lest anyone think that "addiction" is unique to US culture, consider this: Milgram's research was prompted by his desire to understand the Holocaust and the failure of so many Europeans to stand up to and resist authority.

Our reliance on authoritative knowledge extends to many arenas. We take our cars in for "diagnostic" check-ups and trust our mechanic's assessment of needed repairs. In buying or selling homes, most of us rely on the expertise of realtors or credentialed home inspectors. In the area of health, many patients would not dream of second-guessing their physicians. We hesitate to question whether the pharmacist has properly filled our prescriptions. At present, countless Americans are investing for their financial futures on the basis of the economic expertise of financial planners. Many of us feel secure about the accuracy of any information if we have read it in the *New York Times*, the *Wall Street Journal* or the UK's *Financial Times*. There is no doubt about it – authoritative knowledge offers us a certain comfort zone and we like it that way.

As with traditional knowledge, however, authoritative knowledge can be wrong. Frequently our trust in experts is misplaced. Credentials do not always give experts the corner on truth. Most of us know this all too well from our first-hand experiences with such things as weather forecasts, election projections, or media hype. Meteorologists warn of a

severe snowstorm and we wind up with a mere dusting. During the 2012 US presidential campaign, Republican strategists (as well as a rather authoritative polling organization) predicted a Romney victory that never happened. And let us not forget the millennium's Y2K bug which was supposed to wreak havoc on computers worldwide. Despite the big hoopla and dire forecasts, computer experts were essentially wrong about the expected calamity.

Of course, the stakes of our misplaced trust in experts can be higher than is suggested by these last examples. Many financial experts, for instance, failed to foresee the famous stock market crash of 1929 – they were confident that stocks had achieved a new but safe high plateau. As a result, countless Americans who trusted the experts were financially ruined in the aftermath of Black Thursday (October 24, 1929).[1] Prior to 9/11, we might have thought that national security experts knew best about any significant and credible threats to the safety of US citizens and territory. Yet post 9/11 reviews of "who knew what and when" suggest that experts had trouble connecting the dots that pointed to, and forewarned us about, the worst terrorist attack on US soil.[2] Our faith and trust in experts clearly failed us on this issue of homeland security. Why? Surely, one of the reasons for the failure is that credentials do not automatically give people a corner on truth. Experts work with facts, information and ideas *as they see them.* And as 9/11 painfully showed us, there is not necessarily any common agreement regarding experts' perceptions/interpretations of facts and information. In the days prior to the US military campaign in Iraq, intelligence "experts" claimed that Iraq had weapons of mass destruction. Those weapons have yet to be found. More recently, experts lined up behind the austerity programs adopted by many European nations in order to combat recessionary times. Today, there are experts saying these programs were a huge mistake.

Note too that credentialed authorities can sometimes *intentionally* mislead us. Experts can distort information when they have a vested interest in doing so. For example, during the Vietnam War, military authorities obscured American participation in combat and doctored enemy casualty reports in order to offset resistance to the war.[3] Starting in the 1950s, the tobacco industry spent several decades denying the health risks of cigarettes despite the fact that its own research were showing the opposite to be true. As early as 1963, cigarette makers knew the addictive properties of nicotine but intentionally withheld the release of this damaging information.[4] While some consider the misinformation offered by the intelligence community prior to the US Iraqi war to be an intelligence "failure" others believe that some officials intentionally misused the information to justify the war. Or consider the recent charges that the Tokyo Electric Power Company (Tepco), operator of the Fukushima nuclear power plant crippled by the 2011 tsunami in Japan, has been misleading the public with regard to the continuing dangers presented by contaminated water leaking into the ocean.

On a less sinister note, authorities can also mislead us when they move outside their areas of training and expertise. Prior to the American Revolution, most American medical practitioners were ship's surgeons, apothecaries or clergy (Cockerham 2004). It was not until the early 1900s that the American Medical Association was able to effectively limit the practice of medicine to those with a medical degree (Starr 1982). Prior to the emergence of a secular worldview, legal rulings were frequently left in the hands of religious authorities. Divinely ordained inquisitors were given the job of deciding a person's innocence or guilt on the basis of trials by ordeal (i.e. trials by torture). Many authorities may very well be credible, but trusting them when they move beyond their areas of expertise can certainly be a foolish or misguided decision.

More Risky Knowledge Sources – Common Sense and Intuition

Two additional knowledge sources are frequently employed: common sense and intuition. As with tradition and authority, each of these ways of knowing can be compelling.

Common sense knowledge – knowledge based on personal experiences.

Intuitive knowledge – knowledge derived from extraordinary or paranormal sensations or sources.

Common sense uses our personal experiences and the experiences of those we know as the source of "practical" knowledge. Common sense tells us that 6-year-olds should not be in charge of family meal plans or setting bedtimes. Common sense tells us that the mentally ill should not own guns. And common sense tells us that if someone hits us before marriage, he or she is likely to hit us after marriage as well.

Intuition can be thought of as "direct access" knowledge; it refers to a way of knowing that operates on "gut feelings" without the use of intellect. Intuition can be a powerful source of information – even a real lifesaver. (My intuition saved me from an assault and robbery when I was in graduate school.) Many of us have experienced occasions where our intuition has steered us away from making bad choices or steered us into "good bets." (My only winnings at the racetrack have come from betting hunches.)

Still, as with traditional and authoritative knowledge, common sense and intuition are not error-free ways of knowing. Common sense places a very high premium on *personal* experiences as a basis for *universal* truths. To be sure, deferring to personal experiences can be a very powerful and influential source of knowledge. Consider how often you turned to others who have already "been there, done that" in order to get some useful guidance or feel securely "in the know." Young mothers will ask their mothers what to do with fussy babies. Younger siblings will often rely on older, more experienced siblings for advice about dating. Yet personal experience, because it is tied to the individual and unique circumstances, is not the best basis for generalized knowledge. Just imagine the health risks entailed when one person (say, a husband) shares his prescription drugs for high blood pressure with another (say, his wife). There is a rather high likelihood that the drugs that benefit one person could actually be less effective or even prove detrimental to another. Indeed, medical research now understands that small differences in our genes can greatly affect how we react to medicine. In order to avoid the mistakes of overgeneralizing, the medical field is also becoming more diligent about conducting research on a greater variety of research subjects.

The National Institutes of Health has encouraged scientists to include more female lab animals in their preclinical research (Clayton and Collins 2014). In doing so they are addressing a long-standing practice and problem in medical research: too many animal and cell studies rely on male-only samples and fail to consider the significance of sex-based differences in their studies. By allowing this sex bias to exist, these studies are losing an opportunity to see how drugs, supplements and treatments might impact male and female rodents differently and in turn may ultimately negatively impact health care for humans. What's good for the goose, it seems, may not be so good for the gander. And so by extension, what worked or was true for one person may or may not be true or work for someone else.

Similarly, information that is true for one nation or culture may not hold true for another. Ethan Watters in his article "We Aren't the World" (2013) draws attention to the tendency of Western researchers who rely heavily on samples of Western nations (or more pointedly on samples of American college students) to nonetheless proclaim universal truths (see Box 1.3). To paraphrase an old saying, one size experience does not fit all.

Box 1.3 Newsworthy research: what can we learn from the weirdest people in the world?

In a paper about "The Weirdest People in the World," social scientists Joe Henrich, Steven Heine, and Ara Norenzayan consider how frequently samples of Westerners and, more specifically, Americans are used to draw conclusions about the rest of the world. But they note the problem in doing so – Westerners are very different from the rest of the world and Americans are very different from other Westerners. In the end, we wind up with generalizations based on what they call "outliers among outliers." They liken this dilemma to trying to learn about all birds by studying penguins. The experiences of penguins are not the experiences of so many other birds. And so making generalizations about all birds based on the experiences of just penguins … really won't fly.

Source: Henrich, Heine, and Norenzayan (2010): 61–135.

Intuition might best be thought of as "extra-sensory" knowing. Because intuition operates outside the realm of intellect and reason, it is often hard to understand – indeed we are often unable to explain how we "know" something intuitively ("I don't know, I just had a funny feeling about the situation – I just knew something was wrong.") Intuitive knowledge might be described as "direct access" knowledge that occurs without use of reasons or normal learning. In fact, there is an entire psychic industry that has evolved around the *inability* of most of us to listen to or "hear" our intuitive voice. Many of us turn to intuition "specialists" to help us make sense of our extraordinary or paranormal experiences. Our reliance on intuition is further complicated by our common sense. Common sense tells us to be suspicious of intuition or of charlatans who claim to know something beyond reason. Common sense reminds us that while many of us eagerly broadcast times when our intuition has paid off, many of us will also conveniently forget all of the times when our hunches were wrong. (Think of all the losing horse and lottery bets that were placed because of hunches.)

More Reasonable and Tangible Ways of Knowing: Rationalism and Empiricism

Before we take a good long look at the distinctiveness of scientific knowing, we might consider two additional ways of knowing that can be thought of as providing a "bridge" to science: **rational knowledge** and strict **empiricism**.

The key to rationalism as a way of knowing is found in its use of the deductive syllogism: an appealing self-contained or closed system of reasoning that leads one to a logical conclusion. At first glance, rationalism seems to be a foolproof way of knowing. In using the deductive syllogism, the

Rational knowledge – knowledge derived from the power of reasoning to deduce logical conclusions about reality.

Empiricism – knowledge based on sensory evidence: seeing, hearing, touching, tasting, smelling.

powers of critical thinking are applied to both a major and a minor premise and a logical conclusion is derived. A major premise refers to a statement about a general principle (i.e. a universal affirmative). A minor premise is a statement about a particular or specific instance (i.e. a particular affirmative). In reasoning about the major and minor premises, a logical conclusion is reached. Consider for instance the major premise: All humans are mortal. Next consider the minor premise: Janet is human. A logical conclusion follows: Janet is mortal. The simplicity of the deductive syllogism makes it an appealing way of knowing. But there is a weakness inherent in pure rationalism. Consider another major premise: All birds fly. Next consider the minor premise: Penguins are birds. What's the logical conclusion? Penguins fly! (If you have seen one flying, please let me know a.s.a.p.!) Of course, penguins waddle and swim but they do not fly. So what happened here? If either the major or the minor premise is in error, so too is the conclusion that follows. Despite its use of reason and critical thinking skills, rationalism needs something more to protect itself from logical errors; it needs a way to assess the accuracy of both major and minor premises. Without this independent empirical assessment, rationalism can also be a rather risky way of knowing (remember, penguins do not fly).

Strict empirical knowing places a high premium on sensory evidence as the basis for making informed statements about the world around us. We take to be true that which we see, or hear, or taste, or touch, or smell. At first glance, this may appear to be a foolproof way of knowing – seeing after all is believing, right? We can trust what we "heard with our own ears" can't we? Any of you who have ever had an experience where your "eyes" and ears deceived you know first hand the weakness of strict empiricism as a way of knowing. To be sure, sometimes our senses do fail us. As any contested court battle demonstrates, eye witnesses often "see" different realities. An argument can show us that two people do not necessarily hear the same things in an oral exchange. The simple fact is that not all "vision" (or hearing, tasting, etc.) is perfect. We often get less than the full picture of something and so we can wind up with faulty knowledge. Partisan talking heads have quite the talent for taking quotes out of context and making it seem as if the speaker is saying something very different than what is reported. Consider Goode's take on pure empiricism:

> Very often, information is spotty, patchy, scattered; it comes in bits and pieces. Many of the things we might want to observe are not so homogeneous that they always appear in the same way. We may observe certain things, but our observations may be flawed by the fact that we have seen only a small part of their reality … You know it rains a lot in Seattle, but you stayed there for a week and didn't see a drop of rain. Your observations were empirical – you used the data of your senses. But they were very partial, very selective, and not a good cross-section. (Goode 2000, p. 25)

To further complicate our knowing via strict empiricism, science has documented that humans are "hard-wired" to see the familiar in vague images. (A phenomenon known as pareidolia.) This tendency explains why we can look at clouds in the sky and see bunny rabbits or elephants and why we so easily can "see" the man on the moon or a face on the surface of Mars. (Perhaps some of you know of the Mazda 3's dilemma over its "smiling" car fronts. Some design critics felt the cars looked silly. Mazda dropped the smiles in its 2014 models.) As good as sensory evidence is, it nonetheless must be tempered with something more before we can be confident about accepting it as trustworthy. This is science's mission.

Figure 1.1 The "face on Mars" and a "smiling" Mazda 3. *Source:* (1.1a) NASA/JPL; (1.1b) By S 400 HYBRID (Self-photographed) [Attribution], via Wikimedia Commons

Where does all of this leave us? Hopefully, you now have a new-found realization that much of the information that bombards us every day is based on some rather popular but questionable ways of knowing what we know. Many of our most familiar and comfortable ways of knowing may be fast and easy or logically appealing – they are in our comfort zones. But we need also appreciate that they can be risky, error-prone ways of knowing. Traditional and authoritative knowledge, common sense and intuition are all alike in that they encourage an uncritical acceptance of information. Ideas that have been around a long time, ideas that are presented by authorities, ideas that are practical or "feel right" can wind up being accepted as true *even when they are false*. Pure rationalism, while featuring the power of logical reasoning can, nonetheless, lead to erroneous conclusions if major and minor premises are factually incorrect. Strict empiricism can also mislead us if we are not careful about obtaining the "full" or non-distorted picture of what it is we are "seeing" (or "hearing," tasting," "touching," or "smelling"). Still, we need not despair; there is one way of knowing that is distinctively different from those we have just reviewed: science. Science and its research methods promote a critical assessment of information before that information is accepted as accurate.

Science – Providing an Accuracy Edge

Science as a Trustworthy Way of Knowing

If we are interested in obtaining the highest quality of information, we are well advised to embrace science. In the broadest sense, **scientific knowledge** represents a hybrid way of knowing that utilizes both critical, rational thinking skills (a rational, theoretical component) *and* concrete evidence (an empirical component). Theory and evidence, Goode says, are the "lifeblood" of science. With the distinctive "tools" or techniques of science, we can evaluate the wealth of information we receive each day in light of some very

Scientific knowledge – knowledge derived from the merger of theory and research; knowledge based on the integration of rational reasoning and empirical evidence.

discerning standards for assessing accuracy or validity. An understanding of the scientific method enables us to become critical consumers of information.

Theory – a set of propositions or statements about how the world or some entity operates.

Science is a Distinctive Way of Knowing

Science is distinctive in that it places a high premium on reason and logic. Scientific research is guided by **theory** – reasonable propositions or statements about how the physical and social world operates. Propositions that are unreasonable or that are untestable are beyond the realm of scientific inquiry. I may firmly believe that good people will be rewarded in a heavenly afterlife but my belief is an issue of faith not an issue of science. Or consider that science's dismissal of the paranormal turns on the simple notion that such beliefs are not plausible or reasonable. Levitation is unreasonable given the laws of gravity. (The critical relationship between theory and scientific research is explored further in Chapter 4, on design.) The ongoing debate between creationism and evolution clearly illustrates that not all theories about the origins of the universe or mankind are scientific. Creationism is essentially a belief that an intelligent designer created the universe. But since it is impossible to assess this theory with empirical evidence, creationism is outside the realm of science. It is an untestable belief based on religious faith. The theory of evolution, on the other hand, is based on the testing and assessment of empirical fossil evidence dating back tens of thousands of years.[5]

Science is also distinctive in that it employs set methodical procedures that aim to reduce or control the amount of error that creeps into the process of knowing. Indeed, Goode notes that science is defined by its *methods*, not by its content. So in the name of methods, the scientific approach demands **empirical evidence** to support any assertions about the world. Its empirical nature means that science places a high premium on the observation of concrete phenomena. Science also insists on our following systematic, methodical "rules" for gathering our empirical evidence. Evidence that is obtained in an unsystematic way is regarded as tainted or problematic; it is seen as less trustworthy. And science insists that the evidence we find in support of our assertions be *replicated* by other studies before it is considered trustworthy. This repetition of studies in search of the repetition of findings is an essential safeguard against our jumping to false conclusions. Each of these standards and a few more distinctive traits of science are elaborated below.

Empirical evidence – tangible, sensory evidence.

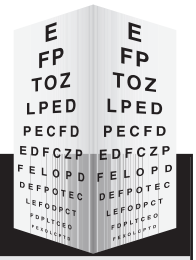
Empirical Evidence

Empirical evidence – Science as a way of knowing – is not willing to accept assertions about the world at face value. In science, it is not sufficient, for instance, to maintain (as traditional knowledge does) that gays in the military are bad for soldier morale. Science demands tangible evidence to substantiate any claims of fact. Science requires that assertions be backed by concrete, objective evidence that shows or reveals the accuracy of the statements. With this demand for empirical evidence, science is highlighting its inherently skeptical nature – unless we "show it" to be so (via the empirical world around us), claims about reality are merely that – just "claims" and nothing more. Science is not willing to trust a mere assertion – it demands empirical documentation that allows us to assess the accuracy of any assertion. The insistence on empirical evidence may be one trait of science that the public readily appreciates.

In March 2014, Malaysia Airlines Flight 370 mysteriously disappeared from the sky. The plane's black box had yet to be recovered and more than a year after the incident the world is still clueless as to what happened to the plane. The Malaysian government has officially declared the disappearance an accident. But more telling is the response of the families and friends of the flight's passengers. They have said that as long as there is no evidence to show what happened to the plane, they will not accept that their loved ones are gone. The wife of one passenger put it as follows: "How can they presume they are dead? There is no evidence. There is nothing" (Tan 2015).

Systematic, Methodical Rules

In the interest of curtailing error, science utilizes standardized procedures that guide our search for accurate information about the world around us. There are rules for developing and assessing the accuracy of the ways we try to document or measure the world around us. In Chapter 6 we review several "tests" that are used to check whether or not measures are really measuring what they claim to be measuring (i.e. criteria for establishing measurement validity). There are "rules" that govern our ability to discern causal connections between events or between characteristics and behaviors (i.e. criteria for establishing internal validity). There are rules that govern which people, things, or events we should focus on when studying the world around us (i.e. criteria for selecting units of analysis). And there are rules that govern whether or not it is appropriate to generalize our research findings beyond the study at hand (i.e. criteria for establishing external validity). These rules constitute the heart of research methods. And while learning these rules is challenging work, they promise a benefit not offered by any other way of knowing. The methodical rules of scientific research minimize the likelihood of error. In abiding by the discerning methodical rules of research, we gain confidence that our findings are accurate or error free.



Box 1.4 Sharpening your research vision: the most powerful women in the world

Forbes regularly keeps tabs on the most powerful people in the world. In constructing the 2015 list of the world's top 100 powerful women, Forbes considered three factors: (1) money, (2) media presence, and (3) spheres of influence. Women's monetary standing was assessed in terms of either their company earnings (for CEOs), their personal earnings or net worth (for celebrities or billionaires), their countries' GDPs (for politicians), or the money spent by their non-profits or NGOs. Media presence was determined by the total number of media mentions in the past 12 months as well as by the women's media presence as indicated by Facebook fans, Twitter followers, and so on. Lastly, the most powerful women had to be actively powerful in multiple spheres of influence. So … who made it to the top five using these measures?

(1) Angela Merkel, Chancellor, Germany; (2) Hillary Clinton, former Secretary of State, United States; (3) Melinda Gates, philanthropist, United States; (4) Janet Yellin, Chair, Federal Reserve, United States; (5) Mary Barra, CEO, General Motors, United States. Do you agree with the results and/or the measures used?

Source: http://www.forbes.com/sites/carolinehoward/2015/05/26/ranking-the-2015-worlds-100-most-powerful-women/.

Commitment to Causal Analysis

Science is also distinctive in embracing a causal view of the world; an underlying assumption of science is that every outcome has a cause. With this causal commitment, science rejects any unnecessary mystification of the world. Instead, science proceeds by applying its rules and its tools in the service of discovering causal mechanisms. It remains open to the possibility that mysteries can be solved. An entire chapter of this text will be devoted to the issue of causal research.

Replication – repeating a study to see if original results/findings are obtained again with different subjects or under different settings.

Replication

To regard findings as true and reliable, science insists that those findings be observed more than once. This insistence on repetition of studies and findings reveals a fundamentally conservative side to science. **Replication** is a safeguard against our drawing premature, and therefore possibly false, conclusions about the world. Findings that cannot be replicated arouse suspicion – isolated findings are regarded as flukes and are not considered worthy of our trust. (Recall the earlier discussion of Milgram's study of obedience to authority. He was not willing to draw any conclusions on the basis of just one study. Instead, he repeated the study over and over again to see if the findings continued to hold.) Indeed, the insistence on replication is simply the skeptical "show me" attitude of science coming full circle – if the findings are true, they should show up time after time under similar research conditions. One-time findings (like one-time sales offers) are usually too good to be true. Our confidence that our findings are accurate is further bolstered each time our findings are replicated by others employing the same rigorous methods of research to examine the same research question.

Science is a Public Endeavor

Science must be committed to an open or public distribution of its workings. There should not be any secrets in science. This public commitment serves science's high regard for accuracy. The researcher must be willing to show others their work: what research design, what measures, what sampling, what analysis was done in the name of their research? This sharing enables others to review the work with a critical eye. Putting research out there for public review provides others with the opportunity to see if any errors can be detected. Science's commitment to "going public" also supports the interest in replication. The ability to "reproduce" and study and verify if findings "hold" beyond any one study only is possible if subsequent researchers have unfettered access to previous studies.

Box 1.5 Sharpening your research vision: the search for errors

In their very informative book *Evaluating Information*, Jeffrey Katzer, Kenneth Cook, and Wayne Crouch explain how they adopt the "error model" in their approach to research. Good research is about minimizing error – the researcher and those evaluating research must become aware of potential errors and the steps that can be taken to minimize them. No matter what the research, there are some "likely suspects" when thinking about sources of error. Error, for instance, might be due to a bad sampling strategy or execution. Error can arise from extending findings beyond their limits. Error might be due to poor measurement decisions or to poor research designs. Error can result from using inappropriate techniques or statistics for data analysis. The point is a simple but important one: science more than any other way of knowing engages in a relentless search for "possible errors" and ways to offset or correct them. It is this dedication that gives it the edge in the production of knowledge. Hopefully, by the time you finish this book, you will have improved your skill level for spotting errors.

Tentative

Perhaps somewhat ironically, science is also a tentative enterprise; when it reaches a conclusion it does so with an understanding that future revision may be needed or be in order. This may surprise some readers given science's efforts to minimize error in the research process. Why not have more faith in its product? The tentative or provisional nature of science has everything to do with its concern with accuracy and with an unrelenting concern with keeping an open mind to new research possibilities: new discoveries, new tools, new theories, and so on. Rather than speaking in terms of certainty, science adopts the langue of *likelihood* and *probability* and *increasing confidence* in findings that are replicated. But ultimately, science must remain open to new developments that might well challenge current ideas and propel us into new territories and findings. Members of the Cloud Appreciation Society (37,000 gazers worldwide) have found a new cloud – *undulatus asperatus* – and are asking for its official designation by the United Nations World Meteorological Organization. If the designation goes through (and it is expected) this will be the first new cloud discovered in over 50 years (Phillips 2015).[6] And thanks to the powers of DNA testing, oceanographers are swimming in the glory of a new discovery: scientists have now discovered a third species of seadragons. A CT scan of the new species, Ruby Seadragon, also revealed a distinctive skeletal structure of the deep red sea dragon. For over the last 150 years, oceanographers thought there were only two seadragon species; the Ruby seadragon demonstrates the need to amend this position (Cuthbert 2015). And recently in Myanmar, a bird thought to be extinct for nearly 75 years was found to be alive and living in the grasslands of an abandoned agriculture station (*Yahoo* News 2015).

Table 1.1 Strengthening your research vision: defining traits of science

Science is …
• theory based
• empirical
• systematic and rule guided
• committed to causal model
• invested in replication
• a public endeavor
• tentative
• an essentially skeptical enterprise

Science as an Exercise in Skepticism

To truly appreciate the distinctive nature of scientific knowing, we must recognize one last important trait, one that is clearly foreshadowed by the last few traits: skepticism. Science is a highly skeptical way of knowing. When confronted by a claim or "assertion" about the world, science's first reaction is to "doubt it." This knee-jerk or reflexive reaction is the driving force of good science. Scientific skepticism is essentially about unrelenting fact-checking. Every time science is skeptical it forces those making claims to up their game. Scientific skepticism insists that the quality of evidence being offered in support of a claim be of the highest order. Indeed, it is this theme of skepticism that helps explain science's insistence on collecting empirical evidence, on the use of standard, logical methodical rules and procedures and on the value of replication. It is no accident that meteorologists have been *considering* the recognition of a new cloud type for nearly a decade! (mentioned above). And more than ten years after the first sighting of the presumably extinct ivory-billed woodpecker, there are those who still doubt the bird's return from the great beyond (see Box 1.6).

Box 1.6 Newsworthy research: birds take flight

In 2005, the birding world was aflutter with news that the ivory-billed woodpecker thought to be extinct in the United States for over 60 years was alive and living in the swamps of Arkansas! Initial 2004 claims about the bird's return were met with great skepticism and demands for additional evidence. (Those claims were based on a snippet of a very blurry videotape.) Further evidence was offered in the form of audio recordings made over the course of several months. Ornithologists who reviewed the new audio recordings were persuaded and declared the ivory-billed woodpecker to be back in business. To be sure, some ornithologists still remain skeptical (i.e. they believe that the audio recordings were from the Pileated woodpecker) and not all birding sites have closed the book on this case. One thing we can say for sure is this: skepticism will never be extinct in the workings of science.

Using Research Methods to Become Critical Consumers of Information

While relatively few of us will be directly involved in the *production* of research, all of us will be involved in *consuming* such information. Thus, you might regard the learning of scientific research methods as a matter of personal empowerment. We stand to gain by arming ourselves with scientific know-how. Our stakes in obtaining accurate information about our world are higher than ever. The sheer volume of information and the speed with which it travels carries grave ramifications concerning the consequences of misinformation. The damage of erroneous information can be as insidious as a computer virus. Consequently, the ability to evaluate information as more or less trustworthy is a crucial skill.

Tip 1.1
Failure to Replicate – a Warning Sign

The failure to replicate findings is often the first "clue" that something is amiss in scientific research. Dr. Andrew Wakefield's early 1998 findings suggesting a link between childhood vaccines and autism could not be replicated in subsequent studies. Concerns about the accuracy and ethics of his research arose. Eventually, co-workers withdrew their support of the research and the journal that published Wakefield's original study, the *Lancet*, retracted the paper.

Our ability to evaluate information is directly tied to our knowledge of scientific research methods. Information that is the product of carefully conducted scientific research is less likely to be in error, more deserving of our attention and trust. In the end, it may be your understanding of research methods that helps you make some critical life decisions. What is the most prudent diet or health regime for someone of your age, race, or gender? Which course of medical treatment is the best for you if you are a female heart attack victim rather than a male victim?[7] Can e-cigarettes help smokers quit? Are genetically altered foods safe for us to eat? Is there a real danger to using cell phones? Is there a good reason to pay higher prices for organic fruits and vegetables? Can nations halt global warming? Is home schooling the right choice for your family? Should parents have their children vaccinated? Or is feeding infants peanut butter a good way to offset the development of later and more dangerous peanut allergies? Is your retirement fund safer in the hands of the government or in the hands of private investors? In large measure, finding the right answers to these and other questions will depend on our ability to judge the quality of relevant information. In the end, your knowledge of research methods could very well be a life-enhancing, even a life-sustaining, resource.

TAKE AWAYS

- Non-scientific ways of knowing, while common, are nonetheless prone to error
  - Traditional knowledge – knowledge based on the passing of time; not all enduring ideas are correct
  - Authoritative knowledge – knowledge that relies on credentialed experts or respected sources of information; credentials don't assure accuracy of information
  - Common sense knowledge – knowledge that relies on personal experiences; personal knowledge is not necessarily generalizable

(*Continue*)

(*Continued*)

- Intuitive knowledge – knowledge derived via a special, paranormal "sixth" sense; operates beyond realm of empirical evidence
- Rationalism – knowledge derived via the use of deductive reasoning; faulty premises will lead to erroneous conclusions
- Strict empiricism – knowledge derived from senses; faulty or distorted "vision" or incomplete evidence can lead to erroneous conclusions

- Science is a distinctive and less error prone way of knowing
  - Linked to theory
  - Requires empirical evidence
  - Embraces a causal view of the world
  - Adopts standard methodical rules to assure "quality control"
  - Values replication – recognizes the importance of consistency in the verification of findings
  - Must be a public endeavor – rejects secret science
  - Values a healthy amount of skepticism

Sharpening The Edge: More Reading and Searching

- Listen to a short lecture by Ethan Watters on how cultures influence perceptions of trauma and mental illness and how American culture is often at odds with views in other settings at:
  http://on.aol.com/video/author-ethan-watters-discusses-crazy-like-us-502044888
- The top sites for debunking urban myths can be found at:
  http://www.techrepublic.com/blog/tech-of-all-trades/top-10-sites-to-debunk-urban-legends/
- Internet information – should we trust it or not? The query is prompted by the fact that information on the Internet is not screened for accuracy. Anyone, after all, can post anything on a webpage. For a good tutorial on how to evaluate a webpage, visit the following site maintained by the University of California, Berkeley: "Evaluating Web Pages: Techniques to Apply and Questions to Ask":
  http://lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html
- Those wanting to delve further into the questions of knowing and truth and objective reality should take a look at the first few chapters in:
  Earl Babbie's *Observing Ourselves: Essays in Social Research.* Prospect Heights, IL: Waveland Press, 1998
- For any number of the topics covered in this text, you will find additional reader-friendly information at Bill Trochim's Web Center for Social Research Methods:
  http://socialresearchmethods.net/
  Once on the page, click on the Knowledge Base link, and then click the Contents link. Scroll down until you find the topic of interest to you. A good place to start would be with the links to "Language of Research" and "Five Big Words."

Exercises

1. Visit one of the sites devoted to debunking urban legends (see second entry under Sharpening the Edge above). Review several of the legends and see if you can identify the "way of knowing" on which they are based. Do you see any pattern?

2. Review a week or two of letters to the editor in your local newspapers. Identify the dominant knowledge source being used to support the claims/assertions made in the letters.

3. Carefully consider current print or television commercials or some political campaign ads. For each of the knowledge sources reviewed in this chapter, locate one or two commercials/ads that invoke non-scientific sources in order to convince us of the merits of their product or candidate claims (e.g. an old Hebrew National hot dog commercial had the voice of God telling us the product is good – this is clearly asking the consumer to defer to the ultimate authority figure).

4. Do a quick search on *Yahoo!* or your favorite internet search engine and locate a few science articles that discuss some newly released study. As you read through the articles, can you see evidence of the major traits of science discussed in this chapter?

Notes

1 In the three years following the 1929 crash, national income was cut in half and there were some 15 million unemployed Americans – up from 1.5 million in 1929 (Garraty and Gay 1972; Wiltz 1973).

2 FBI superiors elected to dismiss warnings from local agents in Minnesota and Arizona who were concerned about flight training activities of individuals under surveillance (Hirsch and Isikoff 2002). INS authorities failed to stop Mohamed Atta from entering the United States despite the fact that he had an expired visa and links to known terrorists. On the very day of the attacks, airport security agents singled out nine of the terrorists for special scrutiny but did not prevent them from boarding the planes (*The New York Times* 2002).

3 The efforts by President Johnson and military advisors to paint a positive picture of US involvement in the war eventually contributed to a serious "credibility gap" with the American public (Braestrup 1982).

4 These cover-up efforts by the tobacco industry lasted decades coming to light only in 1994 with the leak of a "smoking gun" (no pun intended). An anonymous "Mr. Butts" released over 40 years of internal company documents detailing how much tobacco industry experts knew but wouldn't tell about the dangers of its product (Zegart 2000).

5 To look further into the creationism/evolution debate, see the ongoing discussions by Bill Nye (aka the science guy) and Ken Ham the founder of the Creationism Museum: http://www.christiantoday.com/article/bill.nye.vs.ken.ham.debate.live.stream.free.watch.online.creation.vs.evolution.debate.here.start.time/35688.htm.

6 For a stunning video of the new clouds see: http://www.weather.com/news/news/undulatus-asperatus-clouds-20140925#.

7 The need for gender-based clinical studies is finally receiving more focused attention of medical researchers.

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Chapter 2

The Language of Science and Research: Learning to Talk the Talk and Walk the Walk

Introducing Social Research Methods: Essentials for Getting the Edge, First Edition. Janet M. Ruane.

FIRST TAKES

Be sure to take note of the following:
The "trouble" with science: "What we got here is failure to communicate" (*Cool Hand Luke*)

- Terms of endearment: variables, relationships, causal analysis, and more …
- Styles of research
  - Quantitative vs. qualitative
  - Inductive vs. deductive
- Goals of research
  - Descriptive
  - Exploratory
  - Explanatory
  - Evaluation
- Validity issues
  - Measurement
  - Internal
  - External

Science, who doesn't love it? Well, today it seems that more and more people are leaving the fan club. Back in the 1950s and 1960s, scientific advancement was a source of national pride as various countries around the world competed in the race to space or in the arena of medical research. But today, the love affair appears to be waning if it is not over. Between 1966 and 2012, the percentage of Americans reporting great confidence in men and women of science fell from 76% to 34% (Harding 2014). A 2013 *Huffington Post* poll found that only about one-third of Americans report having "a lot" of trust in the information they get from scientists (Swanson 2013). On the European stage, the BSE (mad cow disease) crisis of the late 1980s as well as the growing concern over the genetic modification of foods prompted the BBC to ask, in 2000, if science was to be trusted anymore. Since 2005, the EU has witnessed a double digit decline in Europeans general trust in science from 78% to 66% (Innovation Union Competitiveness Report 2011). The United States has seen similar divides between science and the public over genetically modified (GM) food. In 2015 the Pew Research Center reported that 87% of the American Association for the Advancement of Science (AAAS) scientists think GM food is safe as opposed to just 37% of the general public. In that same survey, Pew also found a possible explanation for this striking gap: 67% of the public thinks that scientists do not understand the health risks of GM food! And for their part, scientists today may be feeling the loss of love as well. Only 52% of AAAS scientists feel that it is generally a good time for science, down from 76% in the late 1970s (Funk 2015).

To be sure, it is not just the lack of good feelings we are currently witnessing. Instead, we see an alarming reversal where some people readily express their rejection of, or even contempt for, science. Witness, for instance, how during the 2012 US presidential election, almost all the Republican candidates tried their best to distance themselves from science. Or consider the persistent dismissal by so many people from around the world of the