

QUESTIONS ABOUT APPLYING TECHNIQUES FROM OLDER SCIENCES TO PSYCHOLOGY

Thus far, we have talked about the value of using an important tool: the scientific method. Specifically, we have emphasized that psychology, like other sciences, should collect objective evidence, make verifiable statements, be explicit, and be public.

We are not saying, however, that psychology should use the same equipment and techniques as other sciences. Obviously, what you study affects how you study it. Thus, the biologist, the astronomer, and the chemist all use different equipment and techniques. Clearly, live subjects (rats, pigeons, humans, etc.) cannot be studied the same way molecules are studied.

To appreciate how sensitive research psychologists are to the unique challenges and responsibilities involved in studying the behavior of living things, let us see how a research psychologist would react if someone ignored those challenges and responsibilities. For instance, suppose that a novice investigator tried to model his psychological research after the following chemistry experiment:

A chemist has two test tubes. Both test tubes contain a group of hydrogen and oxygen molecules. She leaves the first test tube alone. She heats the second over a flame. She observes that water forms only in the second test tube. Because there was only one difference between the two test tubes (the flame), she concludes that the flame caused the group of molecules in the second test tube to behave differently than the molecules in the first tube. She then concludes that heat always causes hydrogen and oxygen to combine.

Instead of filling two test tubes with hydrogen and oxygen, the novice investigator fills two rooms with both men and women. He treats both groups identically, except that he makes the second group's room ten degrees warmer than the first group's room. He then compares the behavior of the two groups and observes more "aggression" in the second room. Consequently, he concludes that "feeling warmer" makes people more "aggressive."

Because of the vast differences between humans and molecules, an experienced research psychologist would have four sets of very serious questions about the novice investigator's study. The first three deal with the validity of the novice investigator's conclusions: (1) Did the treatment manipulation really *cause* the differences in *behavior*?; (2) Did the investigator really measure and manipulate the variables he thought he did? (Did the manipulation make subjects feel warmer and did the subjects' behavior really reflect aggression?); and (3) Would the results *generalize* to other settings and subjects? The fourth, and final, set of concerns is the most serious: Was it ethical to perform the study?

INTERNAL VALIDITY QUESTIONS: DID THE TREATMENT CAUSE A CHANGE IN BEHAVIOR?

The first set of questions deals with the study's *internal validity*: the degree to which the study demonstrates that the treatment *caused* a change in behavior. If the study clearly

establishes that putting the subjects into different rooms *caused* the warm-room group to behave differently from the normal-room group, the study has internal validity. If something other than being in different rooms is causing the groups to differ, then the study does not have internal validity.

For the chemist, establishing internal validity is fairly simple. If the flame condition yields water and the no-flame condition does not, the flame manipulation must be responsible. The chemist does not have to worry that the oxygen molecules in one tube were more likely to combine with hydrogen than were the molecules in the other tube. Since all oxygen molecules are basically alike, she knows she would have gotten the same results if he had applied the flame to the second tube rather than to the first. Similarly, since oxygen molecules in the well-controlled laboratory tend to stay the same, the chemist does not have to worry about treating both tubes identically. For example, she could do the no-flame part of the study in the morning and do the flame part of the study at night. She can be confident that her results will not be affected by time of day because laboratory oxygen in the morning behaves just like laboratory oxygen at any other time.

In psychological research, on the other hand, it is not easy to determine whether a *treatment* is the *cause* of an *effect*. In this study, for example, the warm-room group may have naturally been more aggressive than the normal-room group. Since we do not know that the groups were the same at the start of the study, finding a difference between the groups at the end of the study is not conclusive that the room manipulation caused the groups to differ. Furthermore, even if the groups were initially equivalent, they may not be equivalent at the time of testing. For example, suppose the novice happens to test the normal-room group in the morning and the warm-room group in the evening. In this case, many events completely unrelated to the room manipulation might cause the warm-room subjects to behave differently from the normal-room subjects. For example, during the afternoon or early evening, the warm-room group may have had a few drinks or learned of some act of terrorism. Although these events have nothing to do with the room manipulation, they might affect the subjects' behavior.

To reiterate, if we cannot be sure that the *manipulation* is *the one and only* systematic difference between our subjects, we cannot determine that the manipulation is the cause of an effect (see figure 1.2). That is, if we cannot be sure that the groups were the same except that they were placed in different rooms, we cannot conclude that being in the different rooms caused the difference in their behavior.

CONSTRUCT VALIDITY QUESTIONS: WHAT DOES SUBJECTS' BEHAVIOR REALLY MEAN? WHAT DOES THE TREATMENT REALLY MANIPULATE?

In the example, the novice carelessly assumed that the room manipulation *caused* the subjects to behave differently. However, that was not the only questionable assumption he made. Unfortunately, he also presumed the manipulation made warm-room subjects "feel warm" and he had accurately measured "aggression."

The professional researcher would point out the novice did not see subjects "feel warm" or "be aggressive." The novice manipulated the physical environment by raising

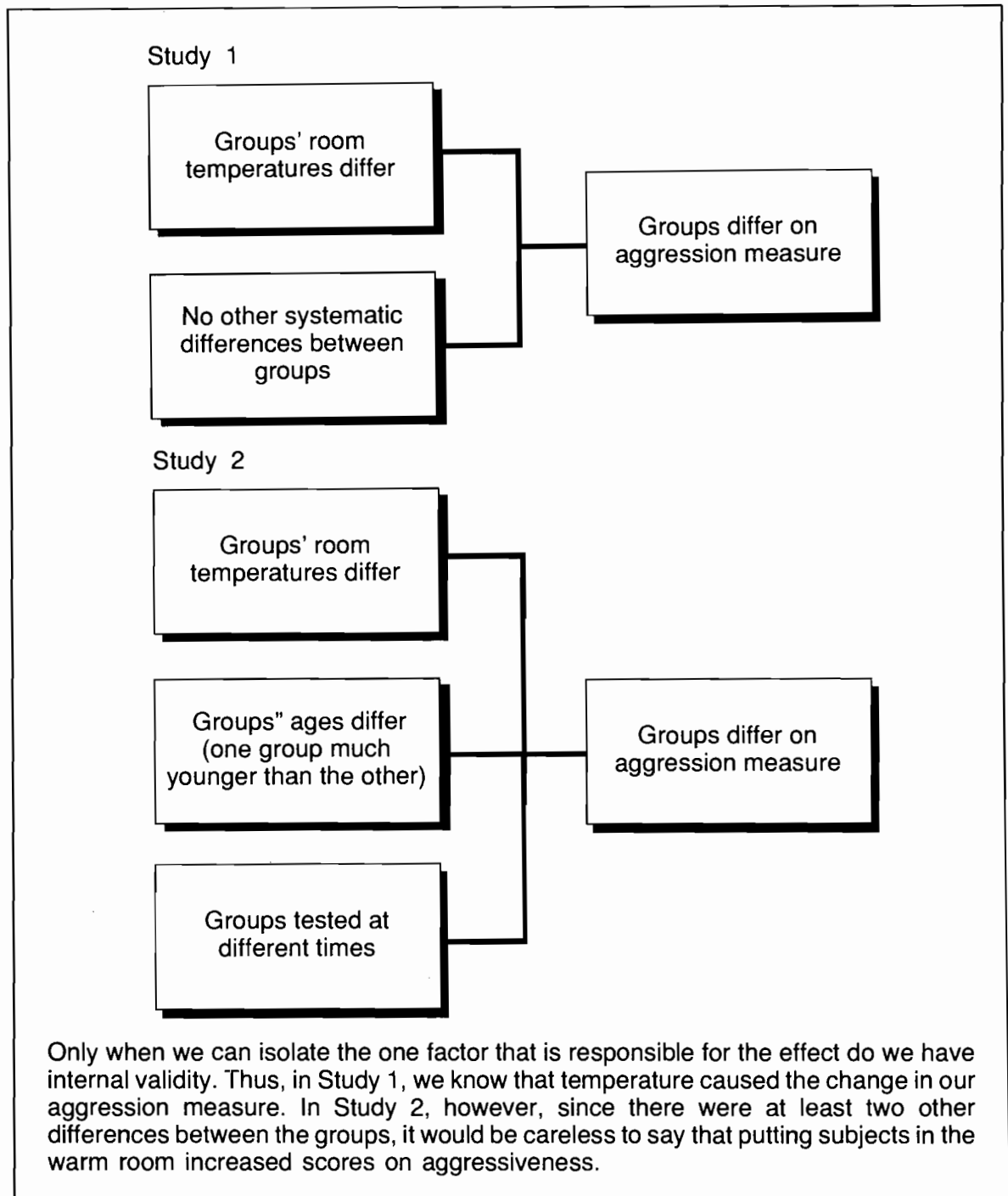


FIGURE 1.2: The Challenge of Establishing Internal Validity

the thermostat and observed behaviors, but the novice did not directly manipulate or directly observe subjects' psychological states. Yet, the novice is talking about psychological states. He is labelling his room manipulation as a manipulation of "feeling warm" and he is labelling subjects' behavior as "aggressive." How can he justify using those arbitrary labels?

The novice might respond that most scientists go beyond talking about the procedures they use. That is, scientists' conclusions do not deal with the actual actions they performed, but with the underlying variables that they manipulated. For example, the chemist's conclusions would not deal with the effects of "a lit bunsen burner," but rather would deal with the effects of the underlying variable—heat.

The researcher would point out that the leap from assuming that the bunsen burner manipulates the heat of the molecules in the test tube is relatively safe and short. It is unlikely the burner has any other effects. The molecules do not notice the flame's color, are not irked or terrified by its intensity, do not care if it discolors the test tube, and do not smell it. Manipulating the temperature of molecules is clearly simpler than manipulating how people feel. Furthermore, the chemist makes virtually no inference when it comes to observing the results of the reaction: Water is easy to observe and measure. In contrast, it is difficult to accurately measure "aggression."

In short, the research psychologist realizes that measuring and manipulating people's thoughts, feelings, and behaviors is much more difficult than measuring and manipulating the behavior of molecules. If you are not careful, going from objective, observable, physical concepts to inferring invisible, subjective, psychological concepts may involve jumping to conclusions. For instance, some people are quick to infer that a person who works slowly is unintelligent. Others are quick to infer that such a person is lazy. However, the individual may be cautious, new to the task, or ill. Because the possibility of error is so great, psychologists are extremely cautious about inferring private mental states from publicly observable behavior. Therefore, the research psychologist would question the temperature study's *construct validity*: the degree to which the study measures and manipulates the *underlying concepts* the researcher claims. The research psychologist would have four major reasons to doubt that the novice's aggression study had adequate construct validity.

First, turning up the thermostat is not necessarily a "pure" manipulation of room temperature, much less of "feeling warm." For example, turning up the thermostat in the "warm" room might also decrease the room's air quality (if the heater's filters were dirty) or make the room noisier (if the heater's belts or fans were noisy). Thus, the room manipulation might be a temperature manipulation, a noise manipulation, *and* an air quality manipulation.

Second, even if the researcher has a pure manipulation of heat, the researcher does not necessarily have a pure manipulation of "feeling warm." That is, unlike molecules, subjects may interpret the research situation or manipulation differently from how the researcher intended. Consequently, the subjects may not *feel warm* in the "warm" room. For example, they may take off jackets and sweaters to cool off or they may find the room's temperature "comfortable." But even if the novice investigator did make the warm-room subjects feel warm, he may also have made them frustrated about being unable to open the windows to cool off the room or he may have made subjects angry with him for being so inconsiderate as to put them in such an uncomfortable room. Thus, in addition to being a manipulation of temperature, the treatment may have had other side effects, such as being a manipulation of frustration or anger.

Third, unlike molecules, people know they are in a research project and may act

accordingly. In the novice's study, warm-room subjects may realize that they have been deliberately placed in an abnormally warm room and then given a questionnaire that asks them how aggressive they feel. If they like the investigator, they may *act* aggressive for the researcher's benefit. The investigator may misinterpret or mislabel this acting as genuine aggression.

Fourth, unlike the amount of water produced by a chemical reaction, psychological concepts such as aggression are abstract, invisible, and therefore impossible to measure directly. We can only indirectly assess inner reality from clues we find in outer reality. Guessing what is on the inside from the outside, like guessing what is inside a package, is a gamble. Because there is no direct pipeline to the mind, subjects' behaviors and reactions may not be correctly labelled. For example, the novice investigator may have misinterpreted "kidding around" and attention-getting behaviors as aggression. The novice may have misinterpreted physiological changes (sweating, flushed face) as signs of anger rather than merely the body's automatic reaction to being warm.

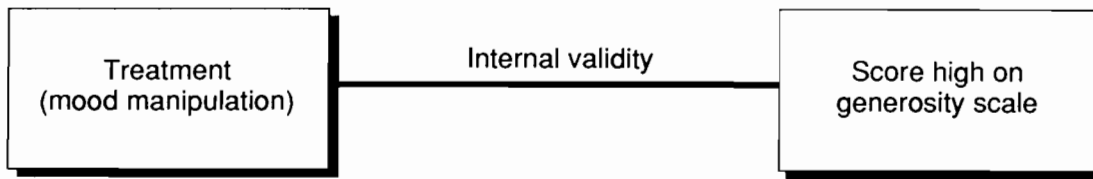
In conclusion, our novice wants internal and construct validity (see figure 1.3). With only internal validity, he would be limited to concluding that "turning up the thermostat *causes* a difference in how people fill in circles on a multiple-choice answer sheet." With only construct validity, he would be limited to concluding that "members of the group who felt warm were more aggressive, but the aggression could be due to many factors unrelated to feeling warm, such as the possibility that people in the group who felt warm were naturally more aggressive than those in the other group."

EXTERNAL VALIDITY QUESTIONS: CAN THE RESULTS BE GENERALIZED TO OTHER SETTINGS, SUBJECTS, AND TIMES?

Even if the novice actually manipulated "feeling warm" and measured aggression (construct validity) and established that results in this particular study were due to the treatment (internal validity), the experienced researcher would still question the study's *external validity*: the degree to which the results could be *generalized* to different subjects, settings, or times (see figure 1.4 and table 1.3). There are at least two reasons to question the aggression study's external validity.

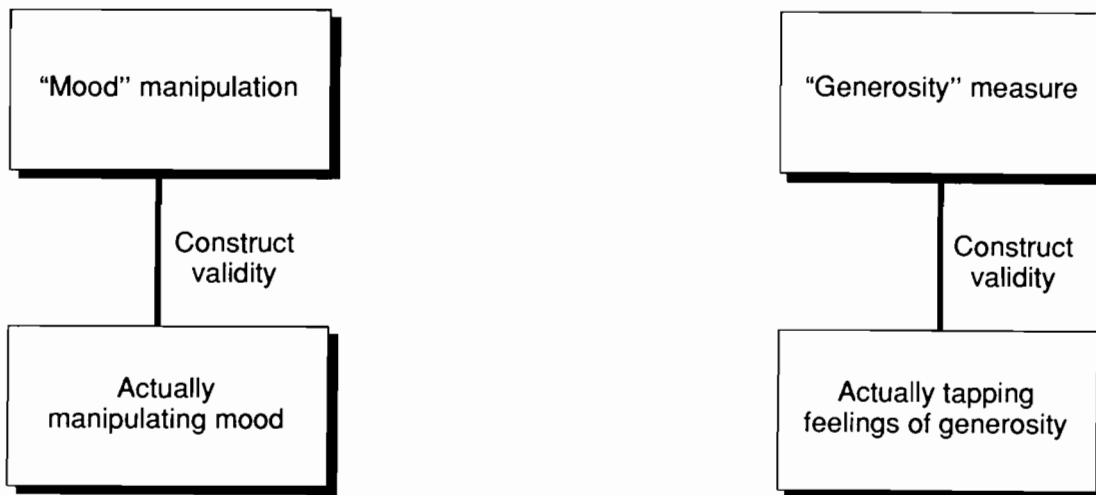
First, since people differ, a result that occurs with one group of people might not occur with a different group of people. The novice investigator might have obtained different results had he studied all female groups instead of mixed-sex groups, if he had studied Soviet sixth-graders instead of midwestern college students, if he had studied people used to working in very warm conditions, or if he had studied less aggressive individuals.

Second, since people's behavior may change depending on the situation, the results might not hold in another setting. For instance, suppose the novice investigator used a very sterile laboratory setting to eliminate the effects of non-treatment factors. By isolating the treatment factor, the novice may have succeeded in establishing internal validity. However, results obtained under such controlled situations may not generalize to more

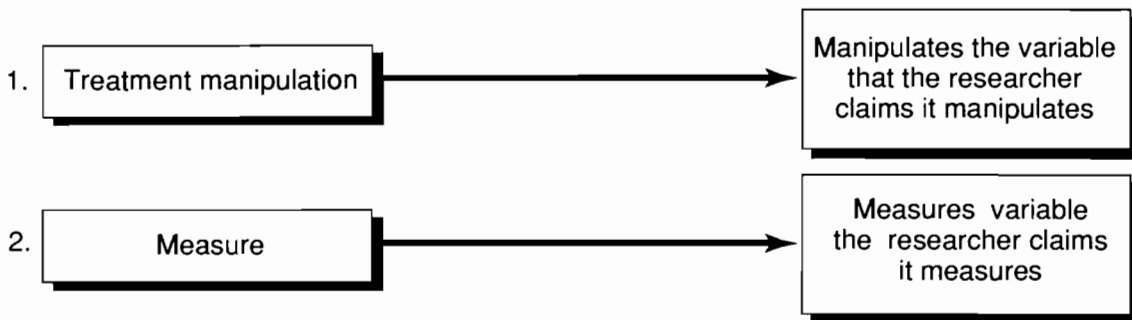


A researcher may know that a “mood manipulation” caused people to score higher on a “generosity” measure. That is, the research has internal validity.

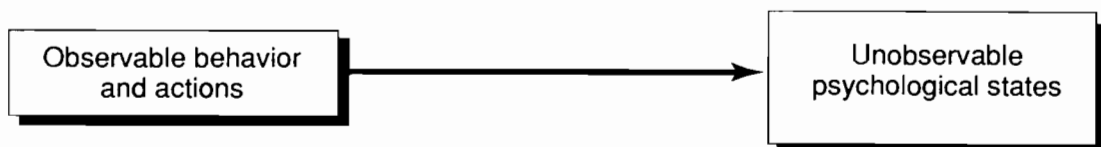
However, the researcher may not want to stop at saying that the manipulation had an effect on the measure. Instead, the researcher may want to say that happiness causes people to feel generous. To make such a statement, the researcher needs to establish that the manipulation of happiness actually increases happiness and that the generosity measure actually measures feelings of generosity. In other words, on top of internal validity, the researcher needs to also establish construct validity.



In general terms, the researcher needs to establish at least two links that are vital to construct validity:



In this case, the researcher is trying to establish a link between



Clearly, the researcher’s inferences about subjects’ invisible mental states may be wrong. For example, the “mood manipulation” might not really succeed in making subjects feel happy. Or, the “generosity measure” may really be tapping willingness to conform.

FIGURE 1.3: The Challenge of Establishing Construct Validity

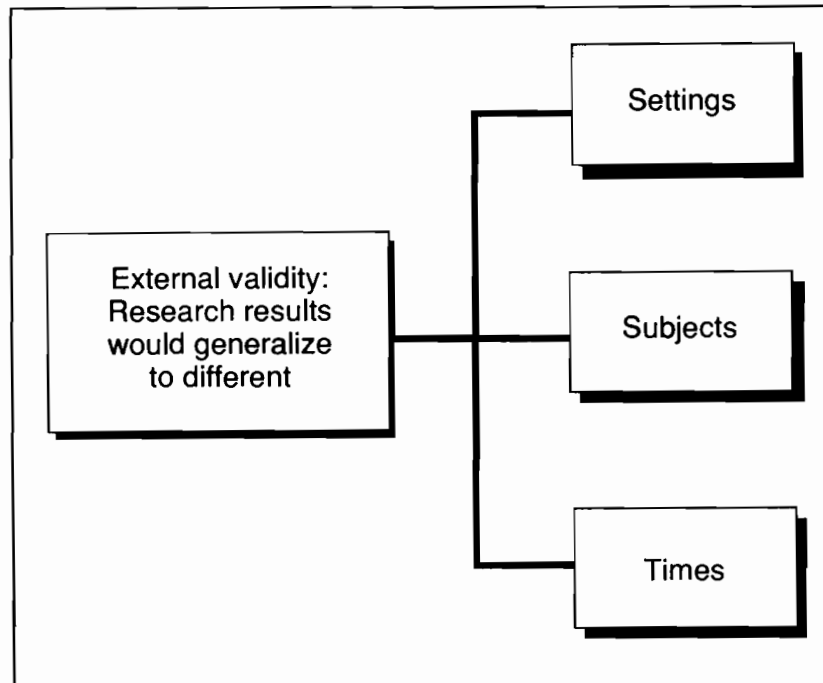


FIGURE 1.4: External Validity

complex situations, such as the work place or the home where other factors, such as frustration and pressure, come into play.

In short, even if temperature increased aggression in this particular lab with this particular group of subjects at this particular time, the experienced researcher would not automatically assume that temperature would have the same effect in future studies conducted with different subjects in different settings. To maximize external validity, the experienced researcher might repeat the study using different types of subjects and different situations.

Table 1.3 Common Threats to the Three Kinds of Validity

TYPE OF VALIDITY	DEFINITION	MAJOR SOURCES OF PROBLEMS
Construct validity	Manipulating and measuring psychological states researcher claims to be measuring	Faulty measures, resulting in mislabelling or misinterpreting behavior
Internal validity	Determining cause-effect relationship between manipulation and behavior <i>in</i> a given study	Allowing factors other than the manipulation to vary (treatment and no-treatment groups differ before study begins)
External validity	Producing results that can be generalized <i>outside</i> the study to other situations and subjects	Artificial situations, unusual subject population

ETHICAL QUESTIONS: SHOULD THE STUDY BE CONDUCTED?

The novice's failure to take into account the fact that humans are more complex and individualized than molecules seriously threatened the validity of his study. Although those were important differences to overlook, the student also overlooked the two most important differences between molecules and humans: (1) Molecules do not have rights, whereas humans do; and (2) Chemists have no responsibility for the welfare of molecules involved in their studies, but psychologists have a responsibility for the welfare of their subjects. Therefore, in the researcher's mind, the most important question about the study is whether it should have been done. This question is so important that no professional researcher would do a study without first determining whether the study should be conducted as well as considering how ethical concerns could be addressed.

In deciding whether the subjects' rights had been protected and whether the novice investigator had lived up to his responsibilities, the experienced researcher would consult the *Ethical Principles in the Conduct of Research with Human Participants*, published by the American Psychological Association (1990). (These principles are summarized in appendix A.)

The principles state that participants have the right to know what will happen in the study, the right to refuse to be in the study, and the right to anonymity. According to these principles, the novice should have told participants the study would involve sitting in a warm room with a group of people. Knowing what the study was about, participants should have freely volunteered to be in the study. Once in the study, they should have been told they could quit the study at any point and do so without being penalized. Furthermore, the novice should have taken extensive precautions to ensure that no one other than the investigator found out how each subject behaved during the study.

The ethical principles not only discuss subjects' rights, but also discuss investigators' responsibilities (see table 1.4). According to the APA's ethical principles, the investigator is responsible for behaving in an ethical manner and, under some circumstances, may be responsible for ensuring that others also behave ethically. For example, if the novice had others working on the aggression study, those people would be responsible for their own conduct, but the novice would also be responsible for their conduct. In other words, if the people working with or for the investigator behaved unethically, the novice could not avoid responsibility by saying that he personally did not misbehave or that he did not know what the others were doing.

Furthermore, the investigator should try to anticipate all possible risks to subjects and protect subjects from these risks. In this study he should have taken steps to prevent subjects from suffering due to heat (heart attack, heat stroke) or aggression (hurt nose, hurt feelings, hurt relationships).

Yet taking preventative measures is not enough. The investigator should also try to find out if anyone has been harmed. The investigator cannot merely assume that no one has been harmed. Instead, he should have actively looked for evidence of harm. He should have probed subjects to find out if anything unpleasant had happened to them. Of course, if he detected harm, he should have tried to undo that harm.

Table 1.4 Selected Ethical Principles

1. Subjects should volunteer to be in the study.
 2. Subjects should have a general idea of what will happen to them if they choose to be in the study. In addition, they should be well informed about anything that they might perceive as unpleasant. That is, they should know about anything that might cause them to decide not to participate.
 3. Subjects should know that they can quit the study at any point.
 4. Subjects have the right to anonymity.
 5. Investigators should keep subjects' responses confidential.
 6. Investigators should make sure all subordinates behave ethically.
 7. Investigators should try to anticipate all possible risks to subjects and take steps to prevent these potential problems from occurring.
 8. Investigators should probe subjects for signs of harm and take steps to undo any harm detected.
 9. Investigators should explain the purpose of the study and answer any questions subjects may have.
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Finally, after subjects finished participating, the investigator should explain the study to them. Educating subjects about the study is the least an investigator can do to compensate subjects for their participation. Furthermore, telling subjects about the study may help subjects by assuring them that their reactions are not unusual. For example, subjects might think they were anti-social or highly aggressive unless they were told the study was designed to make them act and feel that way.

Unfortunately, the professional researcher cannot determine the novice's study was ethical simply by observing that the investigator followed a few simple rules. Instead, as the first sentence of the *Principles* states, "The decision to undertake research rests upon a considered judgment by the individual psychologist about how to *best contribute to psychological science and human welfare*" (italicizing added).

The first sentence of the *Principles* has two important implications. First, it implies that even if none of the principles were compromised, the study would still be unethical if the study were unlikely to contribute to psychological science and human welfare. Second, it implies that the investigator could compromise some of these principles and still be ethical if the expected benefits of the study would compensate for those compromises. Consequently, an important step in determining whether the study was ethical is determining the likelihood that the study would lead to human betterment.

The experienced researcher would determine whether the study might lead to human betterment by evaluating the importance of the research question and by determining how well the study could answer that question by evaluating the proposed study's internal, external, and construct validity. Unfortunately, determining the value of the research question is highly subjective. One person may find the idea very interesting, another may find it extremely dull. In the aggression study, the novice may believe that determining the relationship between temperature and aggression is extremely valuable

and might lead to ways of preventing riots. Others, however, may disagree. A novice investigator should always consult and defer to a higher authority's opinion. ***Never conduct a study without approval from your professor!***

To further complicate the problem of assessing the potential value of a piece of research, no one knows what the investigator will discover. A study that looks promising may discover nothing. On the other hand, many scientific studies designed to answer one question have ended up answering a very important but unrelated question (Burke, 1985; Coile & Miller, 1984). Because it is so hard to judge the value of a research question, the experienced researcher would probably acknowledge that the novice's research question has some merit.

The only way the experienced researcher would consider the research question totally worthless was if he discovered that the research question had already been answered. For example, suppose there was an abundance of research on aggression and temperature, including several studies identical to our novice's study. Suppose further that the novice would not have done his study if he had known about this published research. In other words, the only reason the novice performed the study was because he failed to do a proper literature review. Under these circumstances, the experienced researcher would consider the novice's study unethical. No investigator has the right to put subjects at any risk, no matter how small, if the study has no chance of contributing to human betterment.

As you can see, outside of showing that previous research has already answered the question, judging the quality of a research question is difficult. Therefore, to estimate the potential value of the novice's study, the professional research psychologist would put less emphasis on his subjective impression of the importance of the research question and put more emphasis on the more objective judgment of how well the study would answer the research question. That is, he would ask whether the study would provide valid data. Of course, he would not consider the study worthless if it failed to have high levels of all forms of validity (see table 1.5). Few studies even attempt to have all three validities. However, in this particular study, he would demand a reasonable level of internal validity.

After carefully considering the potential value of the novice's study, the professional research psychologist would again consider the potential risks to subjects. If the benefits outweighed the risks (the ends justified the means), he would believe that conducting the study was ethical.

To reiterate, the psychological researcher's most important concerns about the aggression study are ethical concerns. Indeed, since ethical concerns include concerns about validity and since the goal of research is human betterment, one could argue that ethical concerns are the competent researcher's only concerns.

But what if the study had used animals instead of human subjects? In that case, some might think the psychologist would not have been concerned about ethics. Nothing could be further from the truth. Psychologists have always been concerned about the ethics of animal research, and, in recent years, animal rights have received more attention from the APA than human rights. If the aggression study had used animals as subjects, the experienced researcher would have consulted APA's *Ethical Principles for the Care and Use of Animals* (1989), summarized in appendix A.

Table 1.5 Valid Conclusions Can be Made Without Having All Forms of Validity

CONSTRUCT VALIDITY	INTERNAL VALIDITY	EXTERNAL VALIDITY	CONCLUSIONS
Yes	Yes	Yes	Increasing temperature caused increased aggression and this finding would generalize to other settings and subjects.
Yes	Yes	No	Increasing temperature caused increased aggression. However, this finding probably does <i>not generalize</i> to many other situations or subjects.
Yes	No	Not applicable	The warm-room group was more aggressive, but the investigator failed to establish that the groups were equally aggressive before the study started. Therefore, we cannot say that temperature <i>caused</i> aggressiveness.
No	Yes	Yes	Putting subjects in the warm room caused them to behave differently than putting subjects in the normal room. However, we cannot say the warm room caused <i>aggressiveness</i> , possibly because we have a <i>poor measure</i> of aggression.

ISSUES RESEARCHERS FACE: CONCLUSIONS

Professional research psychologists must be aware of the responsibilities and challenges of studying human and animal behavior. In other chapters we will discuss the wide range of methods psychologists use to meet these challenges and responsibilities. Investigators may use a single subject or thousands of subjects, human subjects or animal subjects, laboratory studies or field studies, experiments or surveys, depending on ethical considerations, the type of validity the researcher is after, and the research problem.

WHY SHOULD YOU KNOW ABOUT RESEARCH?

Thus far, we have explained why professional psychologists are interested in scientific research. Psychologists see research as a useful tool to obtain answers to their questions. But why should you know about this tool?

TO UNDERSTAND PSYCHOLOGY

The classic answer is that you cannot really understand psychology, the *science* of behavior, unless you understand its methods. Without understanding psychology's scientific aspects, you may know some psychological facts and theories, but you will not understand the basis for those facts and theories. Thus, to major in psychology without knowing about research would be like buying a car without looking at the engine or a house without inspecting the foundation. Furthermore, as a young science, psychology does not have as much technology as some other sciences have. Consequently, in some complex, applied situations, the most useful thing psychology can offer is not a pre-packaged answer to the problem based on established facts, but rather its method of getting answers to problems (Levy-Leboyer, 1988).

TO CONVINC OTHERS THAT PSYCHOLOGY IS A LEGITIMATE SCIENTIFIC FIELD

Although you are keenly aware of the fact that psychology is a science, not everyone accepts this fact. Many psychology majors report that their peers majoring in physical sciences look down on them as being less than "real scientists." Even non-science majors express doubts about psychology's scientific merit and are consequently less likely to trust its findings.

To illustrate the value of being able to convince people that a field is indeed a science, contrast the credibility of physics with that of psychology. Because physics is considered "real science," people will accept any statement a physics major makes about the physical world. The physicist has little fear of being contradicted, even when making statements that run counter to everyone's perceptions, such as: the earth, rather than standing still, is spinning at thousands of miles per hour; heavy objects fall at the same rate as light-weight objects; a solid steel wall has billions of holes in it; or the sun does not set, it stays still while the earth revolves. Psychologists, on the other hand, know that virtually any statement they make will be contested if it does not perfectly coincide with people's perceptions (Stanovich, 1990). Specifically, people's reactions to counterintuitive findings often follow this pattern: "Who says? . . . Psychology? That's not a science, that's their opinion. I don't agree with that at all. They're wrong." From people's reactions, one might suppose psychologists get together at conventions to decide what fable about human behavior they are going to fabricate this year.

If you are going to defend the validity of the psychological statements you make, you need to be able to explain to people why psychology is a science. Otherwise, your credibility, as well as that of your field, will suffer.

SO YOU CAN READ RESEARCH

Not only will knowing about research help you to motivate others to take advantage of psychological knowledge, but it also will help you become more able to take advantage of such knowledge. Specifically, knowing about research will allow you to tap the most

recent psychological discoveries about whatever problem interests you. For instance, you may want to know something about the latest treatment for depression, the causes of shyness, factors that lead to better relationships, or new tips for improving work-place morale. If you need the most up-to-date information, if you want to draw your own conclusions, or if you want to look at everything that is known about a particular problem, you need to read research. You cannot rely on reading *about* research in textbooks, magazines, or newspapers. Textbooks will only give you sketchy summaries of the few out-of-date studies selected by the textbooks' authors. Magazine and newspaper articles, on the other hand, may talk about up-to-date research, but these reports may not correctly represent what really happened. A knowledge of research terminology and logic will allow you to bypass second-hand accounts of research. Instead, you will be able to read original research for yourself and come to your own conclusions.

SO YOU CAN EVALUATE RESEARCH

If you understand research, you will not only be able to get recent, first-hand information, but you will also be in a position to critically evaluate that information. You may also be able to critically evaluate many second-hand reports of research in magazines and newspapers.¹ Thus, you will be able to take full advantage of the knowledge that psychologists are giving away, knowledge that is available to you for free in libraries, in newspapers, and on television. Your critical abilities will also enable you to judge how much weight you should place on a particular research finding—a very useful skill, especially when you encounter two conflicting research findings.

TO PROTECT YOURSELF FROM QUACKS

Perhaps more important than encountering conflicting research findings is the problem of identifying quacks. The lack of restrictions on free speech protects quacks, just as the lack of the Food and Drug Administration protected “snake oil” salespeople in the old days. Back then, patent medicine vendors could sell the public anything, even pills that contained tapeworm segments. Today, “experts” are free to go on talk shows and push “psychological tapeworms.” Common “psychological tapeworms” include unproven and sometimes dangerous tips on how to lose weight, quit smoking, discipline children, and solve relationship problems. Unfortunately, without some training in research, it is hard to distinguish which free information is useful and which is worthless or even dangerous.

TO BE A BETTER THINKER

Not only can understanding the scientific approach improve your access to psychological knowledge, but it can also improve your thinking. As you will discover, science is an

¹Assuming, of course, that the articles provide you with enough information about the study's methodology, if they do not, you will have to go to the original scientific publication.

elaboration of everyday thinking. The skills you learn in this course—problem-solving skills, decision-making skills, how to look for objective information, and being able to judge and interpret information—are transferable to real life. Consequently, the same scientific thinking skills you will learn in this book are also taught in books that purport to raise your practical intelligence (e.g., Lewis & Greene, 1982). Furthermore, those same skills are measured by some tests of “practical intelligence” (Frederikson, 1986) and are necessary for understanding certain real life situations (Lehman, Lempert, & Nisbett, 1988). Finally, Lehman, Lempert, and Nisbett’s (1988) research suggests that learning about research methodology in psychology transfers to understanding real life applications of methodological principles better than does learning about other sciences, such as chemistry or medicine (see figure 1.5).

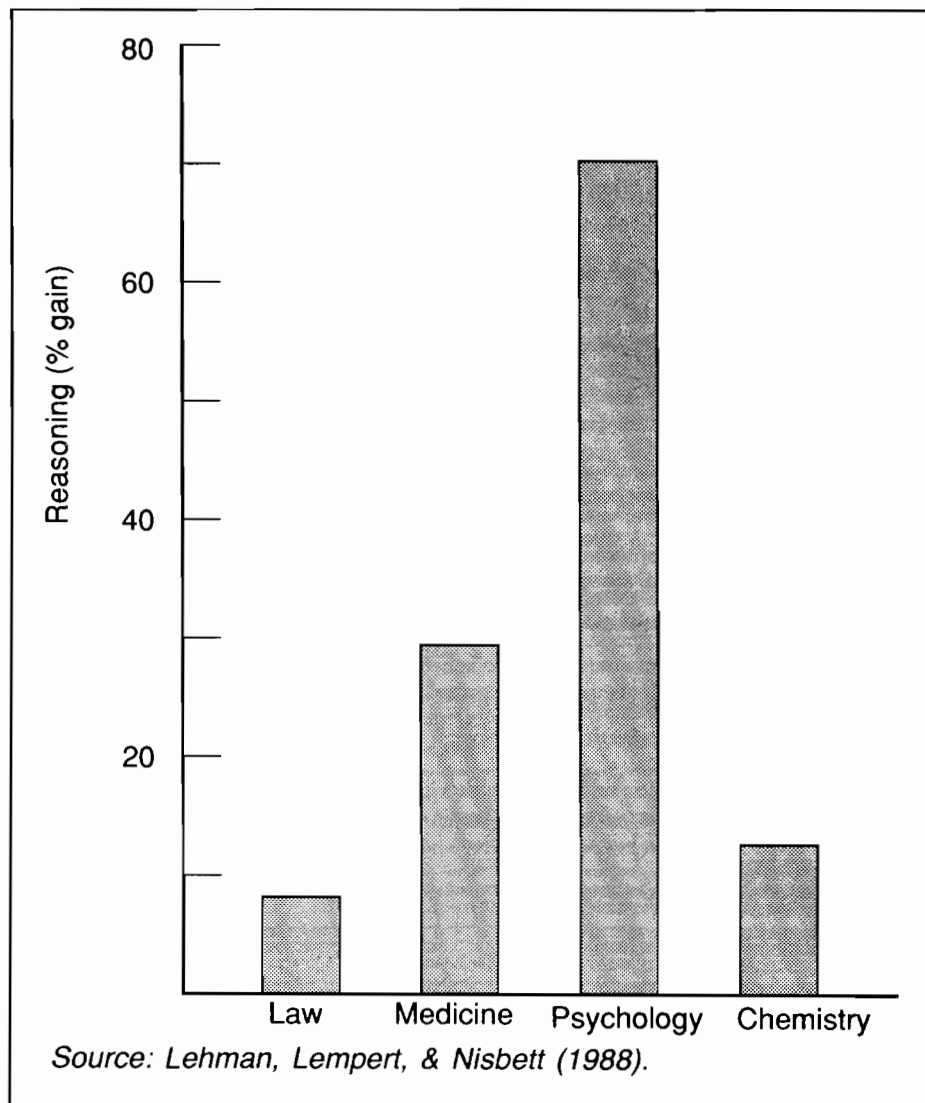


FIGURE 1.5: Changes in Reasoning Ability Scores as a Function of Program of Study

TO BE “SCIENTIFICALLY LITERATE”

Another reason students take a psychological research methods course is that it is a relatively easy way to learn about how science works. Intelligent people are supposed to be able to profit from experience, and in today’s world, many of our experiences are shaped by scientific and technological changes. Unfortunately, despite the scientific progress we have made and despite the fact that the results of science surround us, many people do not know how science works.

Many argue that this scientific illiteracy threatens our democracy—and they have a point. How can we make intelligent decisions about the so-called “greenhouse effect,” if we cannot properly interpret the data about global warming? We would like to rely on experts, but “experts” contradict each other on many important issues. Therefore, if we are going to make an informed decision about global warming, acid rain, whether drugs are the cause or a symptom of societal problems, the extent of the drug problem, the extent and nature of the homelessness problem, the extent of the AIDS problem, the effectiveness of a highly expensive heart operation, the effects of pornography, the inhibiting effects of capital punishment, the effects of sex education classes, or the psychological effects of a woman having an abortion, we need to know how to interpret scientific research.

Regrettably, it appears that many people are not scientifically literate. Most high school students (and some high-ranking politicians) believe in astrology. Furthermore, many astrology skeptics can easily be convinced to believe in it (Glick et al., 1989). In addition to astrology, other scientifically invalid procedures such as handwriting analysis, foot reflexology, and scientology also enjoy surprising popularity.

Against this backdrop, there is an amazing emphasis of hype over objective facts. Politicians, for example, often say, “We don’t need to do research on the problem, we know what we need to do” or “I don’t care what the research says, I feel . . .” Similarly, contrary to the scientific belief in research and openness, products that include “secret ingredients” or “mysterious secrets of Europe” are more appealing to many consumers than ones that were carefully tested in the open and proved to be effective.

With flagrant disregard for internal validity, people often make careless cause-effect statements. Leaders take credit for random or cyclical changes in the economy. Advertisers try to convince us that models are attractive because they use their products. Even people who are not trying to sell us products use very weak evidence. For example, *Sports Illustrated*, hyping the problem of youngsters wanting high-priced tennis shoes, presented the following evidence “proving” that teens are being killed for shoes: a young man was found dead, and his money, cocaine, and shoes had been stolen. Couldn’t it be that he was killed for the money, the drugs, or some other reason? Does it have to be the shoes alone?

With blatant disregard for internal, external, and construct validity, talk show hosts periodically parade a few people who claim “success” as a result of some dieting or parenting technique. Similarly, advertisers still successfully hawk products using testimonials from a few satisfied users and political leaders “prove” what our country needs by telling us stories about one or two individuals rather than boring us with facts.

Unfortunately, research shows that, to the naive, these nonscientific and often misleading techniques are extremely persuasive (Nisbett & Ross, 1980).

TO INCREASE YOUR MARKETABILITY

Besides making you a better citizen and consumer, knowing about research makes you a more employable individual. In today's information age, you probably will *not* be hired for what technical information you know because such information is quickly obsolete and will soon be available at the punch of a keystroke from a computer database. Instead, you probably will be hired for your ability to evaluate and create information. That is, as you will see in appendix D, you will be hired for your analytical abilities rather than your knowledge of facts. For example, even marketing majors are told that, at least for their first few years, their scientific skills, not their marketing intuition, is what will pave the way to future career success (Edwards, 1990). These same analytical skills will, of course, also be helpful if you plan to go to graduate school in business, law, medicine, or psychology.

SO YOU CAN DO YOUR OWN RESEARCH

To get into graduate school or enhance your marketability, you may do your own research. Or, you may do research as part of your job or graduate school experience. It seems that everyone is doing research these days. Movie moguls do research to decide whether the music, length, ending, and so forth are effective. As a result of such research, the ending for the movie *Fatal Attraction* was re-shot (at a cost of \$1.3 million). Some of our former students have been surprised that they ended up doing research to get government grants or get more staff for their social service agencies.

Beyond the employment angle, you may find that doing research is its own reward. Some students like research because it allows them to “do psychology” rather than read about it. Others enjoy the teamwork aspect of working with professors or other students. Still others enjoy the excitement of trying to get answers to questions about human behavior. Once you start an investigation into one of the many uncharted areas of the human psyche, we think you will understand what Carl Rogers (1985) meant when he said, “We need to sharpen our vision of what is possible . . . to that most fascinating of all enterprises: the unearthing, the discovery, the pursuit of significant new knowledge” (p. 1).

CONCLUDING REMARKS

In conclusion, no matter what you do in the future, a knowledge of scientific research will be useful (see table 1.6). The skills you learn will allow you to attack problems systematically, criticize data, and become a scientifically literate citizen or consumer—almost necessities in our science-dominated world.

Furthermore, you will need to read and evaluate the merit of specific psychological

Table 1.6 Nine Reasons to Understand Psychological Research Methods

1. To better understand psychology
 2. To convince others that psychology is a legitimate scientific field
 3. To keep up with recent discoveries by reading research
 4. To evaluate research claims
 5. To protect yourself from quacks and frauds
 6. To be a better thinker
 7. To be scientifically literate and thus a better educated citizen and consumer
 8. To improve your marketability
 9. To do your own research
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research findings. If you become a counseling psychologist, you will want to use the best, most up-to-date treatments with your clients. Partly for this reason, licensing exams for counseling psychologists include questions testing knowledge of research methods. If you become a manager, you will want to know the most effective management techniques. If you become a parent, you will want to evaluate the relative effectiveness of different child-rearing strategies. To get accurate answers in any of these areas, you will need to understand research. Unless you understand the research process, you will be limited by insufficient, out-of-date, or inaccurate information.

The reason *you* need to know about psychological research is, unlike other fields, psychological knowledge is not useful if only the experts have it. If only a few experts know how to design computer chips or drugs that stop illnesses, we can all benefit. The experts can apply the knowledge for us and businesses can make a profit mass-producing and marketing the technology. We do not have to understand or apply the technology, all we need to do is buy it. Furthermore, our ignorance should not hurt us because the government will usually protect us from defective products, such as computers that do not work or drugs that harm rather than help. Psychological technology, on the other hand, is not available in stores. If we are to benefit from psychological research, we usually have to find the research and apply the technology ourselves. Consequently, even seventeen years after psychologists have discovered proven ways of reducing prejudice and easing racial tensions, people are unaware of and fail to use these techniques (Aronson, 1990). Because advice is protected by laws that govern free speech, the government cannot protect you from bad advice. You are the only one who can protect yourself.

Of course, if you plan to pursue a career in psychology, the need to keep up with psychological research is even more important. Psychological knowledge is growing at such a rapid rate that much of what you know now will be obsolete in ten years (it's even worse in engineering where knowledge becomes obsolete in less than five years). Thus, a person graduating at age twenty-three could be hopelessly out-of-date by age thirty-three.

Last, but not least, knowing about research will give you the tools you need to find answers to your questions. By reading this book, you will learn how to generate research ideas, manipulate and measure variables, collect objective data, ensure validity,

choose the right design for your particular research question, treat subjects ethically, interpret your results, and communicate your findings. We hope you will use this knowledge to join the most fascinating quest of our time—exploring the human mind.

SUMMARY

1. Science seeks objective evidence and simple, general rules. Science is also skeptical, verifiable, creative, open-minded, explicit, public, and productive.
2. Psychology is a science.
3. Scientific research is a logical, proven, and ethical way of obtaining important information about human behavior.
4. Researchers want to conduct ethical research. Part of being ethical is ensuring that the research has some degree of validity.
5. If a study has internal validity, it establishes that a particular, observable, physical stimulus or manipulation **causes** a certain, observable response.
6. A study's external validity is the degree to which its findings can be generalized to other people, places, and times. Often, people question whether a result can be generalized to real world situations.
7. When investigators are studying the psychological states they claim to be studying, their research has construct validity.
8. Threats to construct validity include
 - a. poor measures of variables—for example, if researchers measure “sense of humor” by how funny subjects rate sexist cartoons, they may be measuring sexism rather than sense of humor;
 - b. treatments that do not succeed in doing what they claim to do—for example, if researchers tried to make subjects happy by having a mime play tricks on people, the “happiness” manipulation might really be an “irritation” manipulation; and
 - c. subjects figuring out how the researchers want them to behave and then acting that way.
9. Subjects in research studies have many rights, including the right to decide whether they want to be in the study, the right to privacy, and the right to learn what the study's purpose is.
10. No study should be done without doing a literature search first, and no student should conduct a study without the approval of a professor.
11. Skills learned in research design are transferable to real life.

KEY TERMS

construct validity
internal validity

external validity