BYU
BRIGHAM YOUNG
UNIVERSITY

Harold B. Lee Library
Interlibrary Loan
Copy Center

For Ariel Receipt Problems:
Phone: 801-422-8648
Fax: 801-422-0464
Ariel: 128.187.229.251
Email: barbara_allred@byu.edu

Ariel Problem Report

If you have experienced a problem in the delivery of the requested item, please contact us within **Five Business Days** with the following information:

ILL#: _____
Your OCLC Symbol: _____
Date of Receipt: _____
Please specify if:
_____ Pages were Missing – pp._____ to _____
_____ Edges were Cut Off – pp._____ to _____
_____ Illegible Copy – Resend entire item
_____ Wrong Article Sent
_____ Other (Explain): _____

7 Do Lawyers Reason Differently From Psychologists? A Comparative Design for Studying Expertise

Eric Amsel*
Rosanna Langer**
and Lynn Loutzenhiser***
University of Saskatchewan

Legal reasoning has a logic of its own.

—E. H. Levi (1949)

Lawyers are experts in solving complex problems in their domain of expertise. For example, how a case ought to be presented, a contract drawn up, and when and when not to go to court are types of problems best left to lawyers who are trained to deal with them. Generally speaking, people appreciate the value of legal expertise. Very few people hire a psychologist to solve their legal problems or a lawyer to solve their psychological problems, although, as any good episode of "L.A. Law" suggests, people sometimes confuse their psychological problems with their legal ones. Such confusions of problem-states notwithstanding, people see both lawyers and psychologists as equipped to solve different problems by virtue of their training and experience.

This basic insight is not challenged, or even addressed, in this chapter. We address a different question: Does the training and experience of lawyers equip them to solve the same problem differently than experts in other professions? This may not be the theoretical focus that the reader expected. However, we believe that this question better addresses the central issue of this book: How are complex problems solved, and what are the underlying principles and mechanisms of such problem-solving skills? By examining whether lawyers and other groups of novices and experts solve the same problems differently, we can begin

*Now at the Department of Psychology, Vassar College.
**Faculty of Law, University of Saskatchewan.
***Now at the Department of Psychology, University of Guelph.

to say something about the existence of a uniquely legal style of reasoning and problem solving. A unique legal style of reasoning has been written about (Golding, 1984; Levi, 1949) and presented in popular culture in such films as *The Paper Chase,* but does it really exist? In this chapter, we compare and contrast problem-solving processes among lawyers, psychologists, and professionally novice adults. In particular, we examine theoretically and empirically the processes of causal reasoning among members of these groups. We start by outlining a comparative design for studying expertise and reviewing relevant research. Then, we review the theoretical literative on goals, structures, and processes of causal reasoning in legal and psychological contexts, and in everyday contexts. On the basis of the review, we present two studies evaluating the claim that lawyers' organization of causal inference rules is different than psychologists' and novice adults'.

Central to our position is the claim that the traditional manner of studying expertise cannot answer the question of the existence of a uniquely legal style of reasoning. In the traditional design, the cognitive processes used to solve problems unique to the expert's domain are isolated, categorized, and compared to the processes of novices (cf. Chi, Glaser, & Rees, 1982, on physics problem solving). The same traditional research design has been used on legal practitioners, focusing on novices' and experts' reasoning on tasks unique to the job descriptions of members of the legal profession; for example, sentencing (Lawrence, 1988), reading case law (Lundeberg, 1987), and legal argumentation (Hofer, 1987). Such an analysis tells us how to solve those problems uniquely faced by legal practitioners, but it tells us less about "legal reasoning" and more about "reasoning on legal tasks" than we prefer.

A Comparative Design for Studying Legal Reasoning

We believe that the best approach for studying the existence of a legal style of reasoning is to examine whether such a style is distinguishable from other styles of reasoning. For example, lawyers can be compared with psychologists, who are trained in a "social-scientific" style of reasoning. We call this a "comparative design for studying expertise" because the traditional comparison between the task performance of an expert and a novice group is augmented by comparisons between the different expert groups. These comparisons address the question of the specific influence of the experts' training and experience on their task performance, permitting a distinction between the expert groups. For example, a finding that the expert groups perform differently from each other on a task, and that each performs differently still from the novice group, suggests that task performance is influenced uniquely by the training and experience of each expert group. This, in turn, suggests that the training and experience led to different styles of reasoning. In summary, the choice of the comparative or traditional design for studying expertise ought to be based on whether one's interest is in isolating characteristics of a style of reasoning (e.g., legal reason-

ing), or in isolating expert strategies for solving a type of problem (e.g., legal problems).

A comparative design like that described was used in a study by Lehman, Lempert, and Nisbett (1988). They examined the effects of graduate training in law, psychology, medicine, and chemistry on such inference skills as statistical, conditional, and causal reasoning about everyday events. In both cross-sectional and longitudinal analyses, they found that graduate training in psychology and medicine enhances performance on all the reasoning tasks; training in law enhances performance only on the conditional reasoning task; and training in chemistry enhances performance on none of the tasks.

The findings were taken by Lehman et al. to support the claim that there are domain-general "pragmatic" reasoning schemas (Cheng & Holyoak, 1985). Domain-general reasoning schemas are defined by inference rules that are applied to various content domains (Cheng & Holyoak, 1985). Pragmatic reasoning schemas refer to how such rules are mentally represented and activated. The rules are not thought to be represented as a logical structure or activated by conditions that are independent of the subjects' goals; rather, pragmatic reasoning schemas "capture regularities among problem goals and among event relationships that people encounter in their everyday life" (Lehman et al., 1988, p. 432). The pattern of performance is explained by students' differential practice in the use of pragmatic reasoning schemas (contractual schemas, causal schemas, and statistical rules) as a function of professional or graduate school. The use of all these rules is practiced in the course of training in the probabilistic sciences of medicine and psychology; practice in the use of contractual schemas occurs during training in the nonscience of law; and no practice in the use of pragmatic inference rules takes place during training in the deterministic science of chemistry.

Alternative Interpretations

The Lehman et al. findings appear to cast doubt on the existence of a uniquely legal style of reasoning. They argue that professionals improve upon and generalize to everyday problems those pragmatic reasoning schemas that will help them in solving problems specific to their profession: Lawyers and psychologists reason no differently than would otherwise be expected because of the kind of tasks that they reason about. Our problem with the "inferential practice" explanation of the different patterns of improvement among the students centers on the finding of differential improvements of law and psychology students in causal reasoning. Only psychology and medical students' causal reasoning scores improved over the course of graduate education, presumably because they, and not law and chemistry students, exercise causal inference schemas in the course of graduate education.

This explanation conflicts with our understanding of the professional duties of lawyers, which include engaging in causal inquiry. Causal inquiry refers to the

processes for establishing the existence of causal connections. In their classic book on causation in the law, Hart and Honore (1985) argue that for legal liability in civil trials, "causal connection is often a necessary element in responsibility and sometimes sufficient" (p. xxxv). The amount of legal scholarship devoted to the topic of causation rivals that of social-scientific scholarship. For example, just as a recent volume of *Child Development* is devoted to the topic of causation (Volume 58,1, 1987, which is devoted to causal modeling), so is one recent edition of the *Chicago-Kent Law Review* (Volume 63,3, 1987, which is devoted to causation in the law of torts). Moreover, the topic of causation is almost as inevitable a topic in first year law courses (particularly in torts) as it is in first year graduate courses in methodology and statistics. We shall wait until later to go into further detail about the similarities and differences in the process of causal inquiry in law and psychology. For now, we want to impress upon the reader that the issue of causation is as central a topic in law (Hart & Honore, 1985) and legal education as it is in psychology (Cook & Campbell, 1979, 1986) and in graduate education in the social sciences. Yet, in contrast to the theoretical and pedagogical importance of causation in law and psychology, Lehman et al.'s "differential practice" explanation suggests that only graduate education in psychology or medicine provides sufficient practice to improve students' causal reasoning performance.

Our problem with Lehman et al.'s explanation lies with the insensitivity of their causal reasoning task. Perhaps if the causal reasoning task were improved, psychology and law students would show a pattern of improvement over graduate training consonant with our argument of the theoretical and pedogogical centrality of the topic of causation in law and psychology. Like Lehman et al., we believe that there are empirical and theoretical reasons for believing that causal reasoning is a good candidate for being the quintessential domain-general reasoning process. Empirically, systematic causal inference strategies have been demonstrated among infants (Leslie, 1987), preschoolers (Bullock, Gelman, & Baillargeon, 1982; Shultz, 1982), and adults (Kelley, 1967). Theoretically, the existence of domain-general causal inference strategies is acknowledged even by theorists who otherwise seek to explain all of cognitive development in terms of changes in domain-specific cognitive processes (Carey, 1985a, 1985b).

In the Lehman et al. task, subjects read stories that presented a causal relation between events, and were instructed to criticize the existence of the causal relation based on the presence of confounded variables. For example, the task assessed subjects' ability to apply control group concepts and the principle of self-selection. Thus, the task actually measures subjects' ability to inhibit making causal inferences, given certain conditions, rather than measuring the process by which such inferences are made. There is evidence that children become better at inhibiting causal inferences in the presence of confounding variables, although even adults are not particularly adept at it (Kuhn, Amsel, & O'Loughlin, 1988). Moreover, practice in solving "confounded causation" problems has been shown

to be helpful, but not for all subjects (Kuhn & Phelps, 1982; Schauble, 1990). These findings suggest that the skills for inhibiting invalid causal inferences are not particularly central in children's or novice adults' causal reasoning. It would seem that the Lehman et al. causal reasoning task assesses only a subset of inference rules used by children and novice adults in reasoning about causation. This leaves open the question of how children and novice adults engage in causal inquiries, and how professional training alters this process.

THE NATURE OF LEGAL, PSYCHOLOGICAL AND "EVERYDAY" CAUSAL INQUIRIES

The differences between lawyers', psychologists', and novice adults' causal inquiries are examined by comparing and contrasting theoretical discussions of and empirical research on the process of legal, psychological, and everyday causal inquiry. For example, there may be differences between lawyers, psychologists, and novices in what causal information is acquired, how the information is acquired, and when the inquiry is initiated. To examine such differences we distinguish three psychologically relevant aspects of a causal inquiry: its goals, its structures, and its processes. By the goals of a causal inquiry we are referring to the use of the causal knowledge that is enabled by the inquiry. The structure of a causal inquiry refers to its procedural characteristics as they are constrained by the inquirer or the task. The process of a causal inquiry refers to the inferential and information-gathering procedures available for conducting the inquiry. Unless otherwise stated, the comparison we make is between scientific and legal causal inquiries. However, to limit the discussion at particular points, we examine causal inquiry in the "softer" side of psychology, particularly social psychology, and in civil law or Torts, particularly harm-causing.

Goals

The knowledge gathered by everyday causal inquiries can serve a variety of purposes. Weiner (1985) found that adults spontaneously engage in causal inquiries when they are confronted with unexpected results or when they don't attain desired goals. Besides explaining the unexplained or unexpected, everyday causal inquiries serve as one basis for assessing blame and responsibility by adults and children (Fincham & Jaspers, 1980; Shaver, 1985; Shultz & Schleifer, 1983; Shultz, Wright, & Schleifer, 1986; Wollert & Rowley, 1987).

The dual goals of explanation and the attribution of blame and responsibility are central not only in everyday causal inquiries but also in the distinction between psychological and legal causal inquiries. According to a number of legal scholars, the goals of explanation and the attribution of blame or responsibility require different types of causal inquiry. Hart and Honore (1985) distinguish

between causal inquiries in which explanation is the goal and those in which the attribution of blame or responsibility is the goal. They claim that

> after it is clearly understood how some harm happened, the courts have, because of the form of legal rules, to determine whether such harm can be attributed to the defendant's action as its consequence, or whether he can properly be said to have caused it. (p. 24)

According to this traditional legal view, the explanation of the occurrence of a harm is only one step in the process; the second step involves assessing the defendant's role in causing the harm on the basis of legal policy. Hart and Honore label the two steps as *explanatory* and *attributive contexts*. Discussing these two kinds of causal inquiries in law, Strachan (1970) writes:

> There are, of course, two distinct causal problems. The first is concerned with whether there is a causal relationship between the defendant's conduct and the plaintiff's injury. . . . If the first of these questions is answered affirmatively the second inquiry arises as to whether the injury incurred was sufficiently proximate to the defendant's negligent action for liability to be imposed. The first question therefore is basically one which is divorced from matters of legal policy and turns on a question of 'pure' causation, while the second is intimately concerned with policy considerations of where and to what extent liability should lie. The distinction broadly corresponds to what Hart and Honore have called the 'explanatory' context, . . . and the 'attributive' inquiry . . . American legal terminology expresses this 'bifurcation of causal questions' as a distinction between causation-in-fact and causation-in-law. (p. 286)

The separation between causation-in-fact and causation-in-law amounts to a separation between fact-based causal inquiry and a policy-based inquiry. Weinrib (1975) clarifies the rationale for the distinction:

> Inherent in the division of cause into factual causation and proximate causation is the belief that the ascertainment of facts should be distinguished from elucidation of values. The former task requires the adducing of evidence, whereas the latter involves decisions of policy, usually expressed in terms of reasonable forseeability, as to whether certain interests have been or should be placed within the law's protective sphere. (p. 529)

The separation of fact from value in a two-staged legal inquiry is not universally accepted by legal scholars, some of whom argue that no separation is necessary (e.g., Epstein, 1973; Calabresi, 1975; although see Borgo, 1979) and others who argue for a third stage (e.g., Wright, 1985a). But, even if we ignore the issues of proximate causation (causation-in-law) and limit the discussion to explanatory causal inquiries (causation-in-fact), legal and scientific causal inquiries nonetheless continue to have different goals. Specifically, Williams (1961)

notes that causal generalizations are a central concern in scientific but not factual legal causal inquiries:

> For the scientist, the notion of causation involves the idea that the same effect can be repeated by reproducing the cause. In other words, the scientist is concerned with causal generalizations. But in historical and legal statements this notion of generalization and reproducibility hardly figures at all. (p. 66)

Williams' argument is that the goal of legal and historical causal inquiries is the generation of singular causal statements (e.g., "c causes e"; where c and e refer to unique events or states). However, in scientific causal inquiries the goal is to generate general causal statements (e.g., "C's cause E's"; where C and E refer to classes of events or states) required for causal prediction and control.

A slightly different view of the role of generalizations in legal causal inquiries is presented by Hart and Honore (1985). They claim that causal generalizations do constitute a part of the background of causal statements in attributive contexts to the extent that a reliance on general knowledge is exhibited. That is, the general causal statement is implicit in singular causal statements. However, they claim that this implicit relation is not true of all types of singular causal statements. The two main types of causal statements are distinguished according to whether a causal statement refers to: a) an event caused by a physical event, human action or a complex set of conditions; or b) a certain human relationship or interpersonal transaction. The central notion of this second type of statement is that the first person's words or actions constitute the reason or part of the reason why the second acted as he did. They argue that no appeal to generalizations is required for the defense of this latter statement, and that generalizations are no part of the implicit meaning of such a statement.

Yet a third position on the role of causal generalizations in legal contexts is presented by Mackie (1980), who contends, "No specific generalization needs be known in advance to support the interpretation of an observed sequence as causal; all that is required is the assumption that what happened is an instance of some regularity" (p. 79). His claim is that causal generalizations play some role in all legal contexts, "if only to aid in the exclusion of irrelevancies" (p. 122). Jensen (1957), like Mackie, argues that causal generalizations are part of causal inquiries in law. He suggests that relevant causal factors are derived from causal laws or probability rules, but that this derivation is overlooked because causal inquiry in law is not concerned with making predictions as to future occurrences:

> The law is not concerned, in negligence cases, with predicting and controlling accidents: it is concerned with the question whether a particular occurrence was the cause of a certain accident. The relevant causal factors are probably derived from common-sense causal generalizations or probability rules, e.g., if a driver turns around to chat with those at the back of his car he will have an accident. Not being

> concerned with prediction and control, lawyers do not bear in mind the causal laws from which their relevant causal factors have been derived. (p. 84)

Regardless of the precise role of generalizations in causal inquiries in law (if any), the consensus among theorists indicates that legal and scientific (e.g., psychological) causal inquiries have a different focus. Causal inquiries in law focus on the unique and specific content of a particular case, whereas a particular instance or case is only relevant in causal inquiries in science to the extent that it confirms the general causal law. Hart and Honore (1985) best characterized the difference in goals of explanatory causal inquiries in law and science. They wrote:

> The lawyer and the historian are both primarily concerned about *particulars,* to establish that on some particular occasion some particular occurrence was the effect or consequence of some other particular occurrence. . . . This characteristic concern with causation is . . . to *apply* generalizations which are already known or accepted as true and even platitudinous to particular concrete cases. . . . By contrast, in the experimental sciences . . . the focus of attention is the discovery of generalizations and the construction of theories. (Italics in the original, pp. 9–10)

The differences in goals between everyday, legal, and scientific causal inquiries appear to be a matter of emphasis: Everyday goals of explanation and attribution of responsibility become further differentiated and highly specialized in legal and scientific causal inquiries. Nonetheless, the goals of explanation and attribution of responsibility are so much part of everyday causal inquiries that children and adults have been characterized as intuitive scientists (Amsel, 1989; Ross, 1977) and intuitive lawyers (Fincham & Jaspers, 1980; Hamilton, 1980). That is, there remains a continuity between the goals of the intuitive psychologist/lawyer and the professional psychologist and lawyer.

Structure

Besides differences in goals, the structure of lawyers', psychologists', and novice adults' causal inquiries are different. The structure of an inquiry refers to constraints on its procedure due to characteristics of the inquirer or task. For example, one way in which the structure of legal and psychological inquiries differentially constrains lawyers and psychologists is that lawyers take a perspective on whether the defendant's action is or is not causal and find evidence in support of it; whereas psychologists, like other scientists, are ideally supposed to be objective, if not to seek evidence falsifying their causal hypotheses (Popper, 1965). That is, lawyers and psychologists are constrained by different sets of methodological prescriptions.

There are other differences between legal and scientific causal inquiries that

are more pertinent to the present discussion because they focus on constraints due to characteristics of the causal inquiry performed by lawyers and psychologists. For example, a factual causal inquiry in law is retrospective, being initiated to determine whether a particular event or act was the cause of an effect (damage or harm-doing) that has already occurred. Wright (1985a) notes that the characteristic specificity of a causal inquiry in law is made possible by the retrospective causal inquiry:

> The actual causation requirement invokes . . . a backward-looking, individualized and factual inquiry, which asks, ex-post, after the tortious conduct of the defendant has already occurred, whether the tortious (negligent, intentional, ultrahazardous) aspect of the defendant's conduct in fact contributed to a legally redressible injury to the plaintiff. (p. 437)

A causal inquiry in law is retrospective in two senses; not only has the event sequence already occurred (i.e., the inquiry is historically-oriented), but also the inquiry focuses on the cause of a given effect (i.e., the inference is from effect to cause or diagnostic). Hart and Honore (1985) note the diagnostic nature of legal inquiries, which they capture with the term *inquest:*

> It is, however, vital to see that logically the demands of the situation in which we ask for the cause of what has happened, and that in which we are concerned to predict are very different. In the first case it is an inquest that we are conducting. The 'effect' has happened: it is a particular puzzling or unusual occurrence, or divergence from the standard state or performance of something with whose ordinary states or modes of functioning we are familiar; and when we look for the cause of this, we are looking for something, usually earlier in time, which is abnormal or an interference. (p. 46)

Hart and Honore's characterization of a cause in legal inquiries as a particular puzzling or unusual occurrence suggests that the diagnostic nature of causal inquiries in law constrains the kinds of events that will be identified as causal. Moreover, the diagnostic nature of the inquiry permits an indefinitely long sequence to be evaluated, unless some criteria, legal or otherwise, are present for limiting the relevance to a particular case. This infinite sequence leading to an effect has been called "Adam-and-Eve-causation" (Williams, 1961). Cooper-Stephenson and Saunders (1981) note that the selection of the cause in retrospective legal inquiries is not completely arbitrary, or factual, but informed by legal policy.

In contrast to the retrospective nature of causal inquiry in law, causal inquiry in psychology is prospective. There are two senses to the prospective nature of the psychologist's causal inquiry. A psychological causal inquiry not only begins with predictions about the outcome of a future experiment (i.e., the inquiry is future-oriented), but it involves the manipulation of an independent variable—a

cause—in order to produce variation in a dependent variable—an effect (i.e., the inference is from cause to effect, or prognostic). The prognostic nature of causal inferences in psychology is due to the experimental and quasi-experimental requirement of manipulating the independent (treatment) variable. Philosophers such as Collingwood (1972) and von Wright (1971) claim that the locus of influence of human activity is central for understanding causation, a point that is extended by Cook and Campbell (1979, 1986) to include causal inquiries in psychology. They claim that underlying causal inferences in psychological research is the pragmatic notion that causation can be inferred when, by manipulating one factor, another factor is also manipulated. As evidence of their belief in the centrality of manipulation in causal inquiries in psychology, Cook and Campbell (1979, 1986) characterize the meaningfulness of a cause as related to its potential for manipulation:

> The paradigmatic assertion in causal relationships is that the manipulation of a cause will result in the manipulation of an effect. . . For many valid causal laws we may not in practice be able to manipulate the putative cause at will, if at all. This has grave consequences for our ability to test the law, but this does not negate its truthfulness. However, it does decrease the immediate practical importance of the law, for it suggests that the causal powers implicit in the law cannot be easily used to make desirable changes in persons or environments. . . . If we define the meaningfulness of causes in terms of their ability to create testable, dependable, and planned changes, then the most meaningful causes are those which can be deliberately manipulated. Such a concept of cause mirrors the unique feature of experimentation—the manipulation of putative causes. (p. 36)

Just as the diagnostic nature of legal causal inquiries constrains the kinds of events that lawyers entertain as causes, so it is in psychological causal inquiries: The prognostic nature of experimental inquiries constrains the kinds of events psychologists find as meaningful causes. Thus, the prospective/retrospective difference in legal and psychological causal inquiries is not trivial but rather reflects a significant constraint on the nature of the inquiry and the characteristics of the "cause" identified. Everyday causal inquiries have structural characteristics in common with both prospective psychological causal inquiry and retrospective legal causal inquiry. Some everyday inquiries are historically-oriented and diagnostic (e.g., determining who was the cause of the broken radio), and others are future-oriented and prognostic (e.g., determining if the placement of the radio will improve the quality of reception).

A more significant constraint on the process of everyday inquiries than their prospective or retrospective nature is the constraint due to children's and adults' cognitive systems. Lay adults' causal inquiries fail to measure up to models of how causal inquiries ought to proceed (c.f., Nisbett & Ross, 1980; Schustack, 1988; Kahneman, Slovic, & Tversky, 1982). For example, lay adults engage in limited searches of evidence (Shaklee & Fishoff, 1982), make inappropriate

causal inferences regarding evidence (Kuhn et al., 1988; Kahneman et al., 1982), and inadequately revise their prior causal beliefs on the basis of the evidence (Kuhn et al., 1988; Nisbett & Ross, 1980). Such findings have been interpreted as the consequence of a limited cognitive system; that is, people are generally thought to be "bounded" in their rationality (Fishoff, 1976; Simon, 1981). More recently, researchers have interpreted examples of cognitive "limitations" as the consequence of a pragmatically driven inference system. For example, Holland, Holyoak, Nisbett, and Thagrad (1987) have characterized people's rules of induction as being geared to the generation of accurate predictions of the aspect of the world that happens to be focused upon at the time. There is no spontaneous search for coherence other than a local one.

These findings portray the cognitive system of the inquirer as the major source of difference between the causal inquiries of legal and scientific professionals and nonprofessionals (although see Faust, 1984, for examples of limits on the cognitive system of scientists constraining their causal inquiries). However, there also appear to be sources of continuity between professional and nonprofessional causal inquiries. For example, rules of causal inference, such as covariation detection, counterfactual reasoning, sensitivity to and use of mechanism information, spatial-temporal contiguity, and similarity, appear to be available to and used by lay adults, lawyers, and psychologists (Cook & Campbell, 1979, 1986; Einhorn & Hogarth, 1986; Hart & Honore, 1985; Shultz, Fischer, Pratt, & Rulf, 1986; Wells, Taylor, & Turtle, 1987). The nature and use of these rules will be discussed more fully in the following section.

Processes

Given the differences between the goals and structures in lay adults', psychologists', and lawyers' causal inquiries, it is not surprising to find differences in the processes of such inquiries as well. By processes of causal inquiry we mean the inferential and data-gathering rules used to make causal judgments. We outline three kinds of inference rules, then discuss how the rules might be used and organized by novice adults, psychologists, and lawyers. The three rules are mechanism-based, covariation-based, and context-based.

Mechanism-based. One manner of making causal judgments is to assess whether a cause produces an effect through a mechanism. Use of such a rule has been demonstrated in children and adults (Bullock, 1985; Bullock et al., 1982; Koslowski & Okagaki, 1986; Shultz, 1982; Shultz & Kestenbaum, 1985; Shultz, Fischer, Pratt, & Rulf, 1986). For example, Shultz (1982, Experiment 1) presented preschoolers and adults with a candle that is blown out by one of two blowers that are directed at the candle. One blower is on and is producing a wind whereas the other is off and is producing no wind. Preschool children and adults overwhelmingly judged that the "on" blower was the cause of the candle going out,

demonstrating that even young children make causal judgments on the basis of mechanism information. Shultz (1979, 1983; Bindra, Clarke, & Shultz, 1983) has argued that causal judgments made on the basis of mechanism are irreducible to a logical form (e.g., logical necessity or sufficiency) or to probability calculus. Therefore, Mary's belief that her drinking coffee this morning caused her mental alertness because of the stimulant drug caffeine in the coffee may be consistent with, but can not be reduced to, the claim that drinking coffee is a logical condition of mental alertness or that drinking coffee is associated statistically with mental alertness.

Covariation-based. Another manner of making causal judgments is to assess whether a cause and an effect are associated statistically. This type of causal inference rule is available to children and adults in the form of covariation and other statistical rules (Einhorn & Hogarth, 1986; Kuhn et al., 1988; Shaklee & Tucker, 1980). Related to the use of covariation and statistical rules is classical attribution theory (Kelley, 1967). The central characteristic of the covariation-based causal inference rule is the use of prior association between the cause and effect as the basis for and justification of causal inferences. For example, Susan's belief that her drinking coffee this morning caused her mental alertness is justified by the association in the past between drinking coffee and mental alertness. Put schematically, "the belief that 'C causes E' is justified by the past association between C-type events and E-type events."

Context-based. A third manner of making causal judgments is to assess information from the causal context itself. Contextual information includes information about temporal contiguity, spatial contiguity, or similarity between events. Causal inference rules based on spatial and temporal contiguity and similarity between cause and effect events have been shown to be used by children and adults in making causal judgments (Sedlack & Kurtz, 1981; Shultz & Kestenbaum, 1985).

More recently, another kind of contextual rule, the counterfactual rule, has been demonstrated in adults (Tversky & Kahneman, 1982; Wells & Gavanski, 1989; Wells, Taylor, & Turtle, 1987). Counterfactual reasoning involves comparing an actual sequence of events leading to an effect to a hypothetical sequence undoing the effect. An actual event in the sequence leading to the effect is judged as causal if an imagined hypothetical sequence that does not include the target event "undoes" the effect. For example, Mary may give as evidence for her belief that her drinking coffee this morning caused her mental alertness the argument that she would not be so alert, had she not had the coffee. Although Mary may or may not know that coffee contains the stimulant drug caffeine and that there is a statistical association between coffee and mental alertness, her counterfactual argument does not directly mention or imply such knowledge.

This lack of a direct appeal to knowledge beyond the causal context makes counterfactual reasoning a context-based causal inference rule.

It has been shown that all three kinds of causal inference rules are used by adults. Some researchers have argued that the rules serve as "cues" to causality and so causal judgments are made by a weighting of information derived from use of multiple rules (Einhorn & Hogarth, 1986). Other researchers have argued that despite arguments to the contrary, all rules are variants of the same underlying statistical principle (Cheng & Novick, 1989). A third view is that each of the rules is psychologically unique and that there are organizing principles for selecting among rules (Shultz, Fischer, Pratt, & Rulf, 1986; Shultz & Kestenbaum, 1985). At present, this third approach seems to be the most promising because: a) it is the most consistent with the view of the cognitive system that is multi-ruled, pragmatically-driven, and capacity-limited (Holland et al., 1987); and b) the approach has been successfully applied in other content domains (Siegler & Shrager, 1984).

The primary organizing principle for selecting a causal inference strategy identified by Shultz is *fundamentality,* which is defined as the adaptational success of the rule in predicting true causes. According to Shultz, the mechanism-based rule is the most fundamental, meaning that mechanism is the primary source of information used to make causal inferences. If mechanism is unavailable, other rules are selected on the basis of the following four secondary principles: *salience* (the degree to which the relevant evidence for rule deployment is perceptible); *facility* (the relative ease with which the relevant information for rule deployment can be processed); *plausibility* (whether the deployed rule will generate a causal attribution that is consistent with imagined or hypothesized causal mechanisms); and *discriminability* (whether the rule selected will serve the goal of discriminating between the potential causes of interest).

Shultz's principles were derived from research on novice adults and children. It is our claim that, in contrast to novice adults, psychologists and lawyers would have a different hierarchy of causal inference rules. For example, among psychologists, covariation-based causal inference rules would seem as important as mechanism-based rules. Cook and Campbell (1979, 1986) described causal inference in psychology as requiring a combination of the covariation rule to reason about statistical evidence, and the mechanism rule to reason about various influences on the internal and external validity of an experiment.

Similarly, our argument is that, compared to novice adults and children, lawyers' causal inquiries seem to require an increased likelihood of use of context-based rules, particularly the counterfactual rule. In legal contexts, the "but-for" test is a counterfactually structured argument in which the necessity of the causal sequence is tested by "undoing" the outcome in a hypothetical sequence. The "but-for" factual causation test for the claim that "x caused y" amounts to acknowledging the truth of the proposition that "but for x, y would not have

occurred." For example, a homeowner would be held as the cause-in-fact for the visitor's injuries if, in the context, it can be reasonably concluded that "but for the homeowner's improper care for the staircase, the visitor would not have been injured."

However, there is disagreement regarding whether the "but-for" test can be used as the basis of both causal inclusion and exclusion. Weinrib (1975) contended that, although the overall cause-in-fact inquiry can be used to exclude potential defendants, the "but-for" test is one of inclusion only. The author first argued that the cause-in-fact inquiry functions to exclude defendants without having to decide if their conduct was culpable, but then went on to note that the "but-for" test is unable to exclude irrelevant causes; it operates only to include causal factors:

> If a function of cause-in-fact is to exclude whatever conduct is irrelevant to the plaintiff's inquiry, it is a function which the 'but-for' test is inherently incapable of performing. This test can operate as a criterion only of inclusion, not of exclusion; it can tell us whether the factor in question is a cause but it cannot determine that it is not a cause. (pp. 521–522)

Cooper-Stephenson and Saunders (1981), among other legal scholars, observed that the use of the counterfactual "but-for" as a test of exclusion can be problematic when applied in cases of concurrent or successive multiple causes (where each of two events, with other normal conditions, is sufficient for the effect). The problem in these and similar cases of causal overdetermination is that the "but-for" test cannot distinguish among sufficient causes. Thus it can be argued that each sufficient cause can elude the label of a "but-for" cause by conceding it to another event in the "but-for" test. (See Cooper-Stephenson & Saunders, 1981, pp. 653–654; Hart and Honore, 1985, pp. 122–128; Malone, 1956, pp. 88–90; Thompson, 1987, p. 482; Williams, 1961, p. 75; Wright, 1985b, pp. 1775–1777).

Attempts to remedy this situation have led to the addition of new legal tests of cause-in-fact or alterations of the "but-for" test. Nonetheless, it is clear from this discussion that the "fundamental" causal inference rule for the lawyer may well not be the mechanism rule, as Shultz claimed it is for professionally novice adults.

In summary, the process of causal inquiry for lawyers, psychologists, and novices would be different if they organize causal inference rules differently. To make this argument more concrete, imagine that David kicked a TV set and its picture became clear. Was David's kick a (factual) cause of the clear TV picture? One could justify the sequence of events leading from the kick to the clear picture as causal on the basis of a covariation argument (other times David kicked the TV its picture became clear), a counterfactual argument (if David had not kicked the TV, there would not have been a clear picture), or a mechanism argument

(David's kick rearranged loose wires to produce a clear picture). It is argued that these justification strategies are differentially adequate or convincing for lawyers, psychologists, and untrained adults. Untrained adults would be most convinced by mechanism, psychologists by mechanism and covariation, and lawyers by counterfactual as well as other arguments. This conceptualization of the difference between psychologists, lawyers, and novice adults in the organization of causal inference rules was tested in two experiments.

EXPERIMENTS

We carried out two studies based on the aforementioned discussion of differences in the goals, structures, and processes of psychologists', lawyers', and novice adults' causal inquiries. The studies examined whether the acquisition of expertise in law and psychology involves a characteristically different organization of novices' causal inference rules. Causal inference rules were assessed by subjects' preferred manner for justifying that an event is causally and not coincidentally related to an effect. The task parallels the kinds of situations argued in courts, discussed in journals, and overheard in college dormitories—a protagonist trying to convince an antagonist that a sequence of events is causally rather than coincidentally related.

Hypotheses

The hypothesis of a change with acquisition of expertise in the organization of causal inference rules was tested in four ways. First, causal inference rules were assessed in a comparative design, using a group of undergraduate "novices" and groups of experts in law and psychology. If there is a reorganization of causal rules, then there should be differences not only between undergraduates and lawyers and between undergraduates and psychologists in their organization of causal inference rules, but there should also be differences between lawyers and psychologists.

Second, a control group of professionals (police officers) was included. If there are differences in causal reasoning among novices, lawyers, and psychologists due to their professional training, then a control group of professionals who are not trained in law or the social sciences should reason like novices. Police officers served as a control group, because like social scientists, police officers evaluate evidence, and like lawyers they must have some understanding of the law. However, because police officers are not trained specifically in legal or social scientific reasoning, we predicted that their organization of causal inference rules would be similar to that of undergraduates.

Third, causal reasoning was assessed within and outside the lawyers' and psychologists' domains of expertise. Preferred causal justifications were exam-

ined in three content domains: a legal domain, a psychological domain, and an everyday domain. If there is a reorganization of lawyers' and psychologists' causal inference rules, and if the rules are general, then their manner of testing for causal relations should generalize to domains outside their domain of expertise.

Fourth, it is proposed that differences in the justification of sequences as causal and not merely coincidental reflect differences in the organization of causal inference rules. As such, professional differences in preferences for justifications should relate to differences in the processing of evidence and not merely to differences in the manner of expressing that a sequence of events is causal.

Study 1

In the first study, subjects read nine scenarios, each depicting a different causal relation. The scenario consisted of an initial sentence introducing a protagonist and describing an event sequence believed by the protagonist to be causal, followed by four *evidence sentences* about the event sequence in question. These four evidence sentences presented information about the situation prior to the presence of the cause, noting that the effect was also absent (contextual evidence), prior association of the cause and effect (past association evidence), other consequences of a plausible mechanism that links the putative cause and effect (mechanism evidence), and irrelevant evidence. The order of these four pieces of evidence was randomized across stories.

At the end of each causal scenario, we introduced an antagonist who believed that the event sequence, believed by the protagonist to be causal, is merely coincidental. Subjects then were presented with three *causal justification statements* that provided arguments against the protagonist's claim. The causal justification statements were designed on the basis of the three causal inference rules: counterfactual, covariation, and mechanism. The counterfactual causal justification statement was the claim that, had the cause been absent, then the effect would not have occurred (If C had not occurred, then E would not have occurred). The covariation causal justification statement was the claim that the cause and the effect covaried regularly (C is associated with E in the past), and the mechanism causal justification statement was the claim about how the cause produced the effect (C causes E through mechanism M). Subjects rated each causal justification statement as to how "convincing" it was (on a scale from one to five) as an argument against the antagonist's claim and in support of the protagonist's claim, selected the "most convincing" causal justification statement, and then rated each evidence sentence as to how relevant it was to their judgment of the most convincing statement. The nine scenarios presented causal relations in three domains—legal, scientific, and everyday—with three causal scenarios in each domain. Figure 7.1 presents an example of a causal inference item.

David, an avid sports fan, found a unique way of getting a clearer picture on his TV to watch the Grey Cup game. In telling a friend about this incident David points out that:

- He kicked the TV to get a clearer picture of the Curling and Hockey match.___
- The vertical and horizontal hold on the TV was stable after he kicked it.___
- David watches TV sports in the living room and sits on the couch.___
- He had a poor picture of the Grey Cup game until he kicked the TV.___

David thinks that the clearer picture of the Grey Cup game was caused by his kicking the TV. His friend thought that David's kicking his TV and the clearer picture of the Grey Cup game is just a coincidence.

Suppose you were asked to convince David's friend that a causal relation does indeed exist. Rate each of the following three statements, on a scale from 1-5, by how convincing it is of David's claim.

1	2	3	4	5
Not at all Convincing	**Somewhat Convincing**	**Moderately Convincing**	**Highly Convincing**	**Very Highly Convincing**

A If David had not kicked the TV, there would not have been a clearer picture.___

B David tends to get a clearer picture whenever he kicks the TV.___

C By kicking the TV, loose wires got jolted and so the picture got clearer. ___

Now that you have rated the above statements, choose the one (A, B, or C) that you find to be the most convincing. _____

Finally, rate each piece of information in the story, on a scale from 1-5, by how relevant it was in making the judgment of the most convincing statement.

1	2	3	4	5
Not at all Relevant	**Somewhat Relevant**	**Moderately Relevant**	**Highly Relevant**	**Very Highly Relevant**

FIG. 7.1. A causal reasoning task item (everyday domain).

There were four groups of subjects. The psychologist group was composed of psychology professors and Ph.D. students; the lawyer group of practicing lawyers and third-year law students; the police group of police officers; and the undergraduate group of students enrolled in first- and second-year psychology courses.

A pretest was conducted to determine whether the three causal justification statements given at the end of each scenario were equally supported by the evidence present in the scenario. This was to ensure that differences in the ratings of convincingness could be attributed to preferred ways of justifying a sequence of events as causal, and not to differences in the perceived support for the causal justification statements. Subjects in the pretest read 27 scenario/statement pairs (3 statements for each of the 9 scenarios) in random order and rated the statements for the degree to which they were supported by the evidence sentences in

the scenario. Analysis revealed that there were no differences in the support for the three causal statements overall or across domains.

The major hypothesis of the study, that novice adults (undergraduates and police officers) would be most convinced by mechanism, psychologists by mechanism and covariation, and lawyers by counterfactual as well as other causal justification statements, was tested with a 3 (domain) by 4 (profession) by 3 (statements) mixed-model, repeated-measures ANOVA on the frequency with which a statement was selected as the "most convincing." Figure 7.2 presents the mean number of times (out of 9) that each causal justification statement was judged to be the most convincing for each profession. The results revealed that: (a) the lawyers chose the counterfactual causal justification statement to be the most convincing significantly more often than any other group; and (b) the psychologists chose the covariation causal justification statement to be the most convincing more often than the lawyers and the undergraduates, but not more often than police officers. Domain had no effect, nor did it interact with profession in any analysis. This finding suggests that lawyers and psychologists were convinced by justifications (counterfactual and covariation respectively) that were infrequently found to be convincing by novice adults.

More generally, the data in Fig. 7.2 suggest that the undergraduates and police had a three-tier hierarchy of preferences for the causal justification statements. Both novice groups most frequently used the mechanism justification to justify causation, followed by, in order, the covariation and the counterfactual justifica-

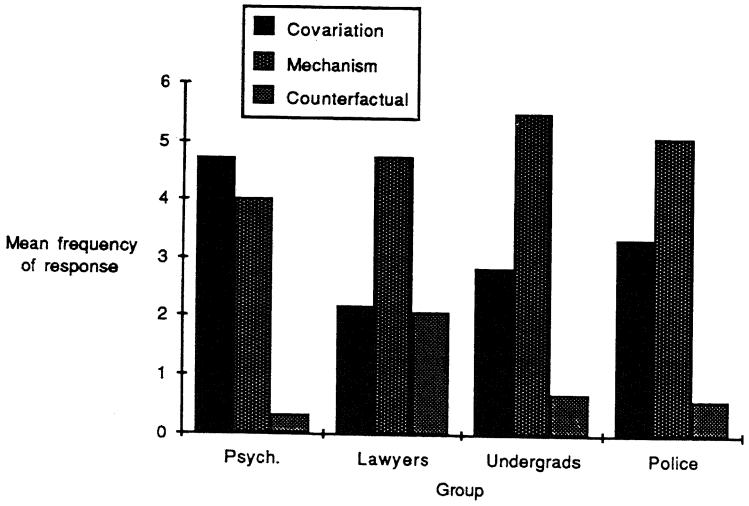

FIG. 7.2. Mean percent judgment across scenarios of the most convincing causal justification by group.

TABLE 7.1
Correlation coefficients between ratings of causal justifications and evidence sentences (the evidence sentence that is most highly correlated with a particular causal justification statement is in boldface).

Evidence Sentences	*Causal Justification Statements*		
	Counter-factual	*Covariation*	*Mechanism*
Contextual	**.32**	.52	.34
	$p < .01$[a]	$p < .001$	$p = .004$
Past Association	.30	**.68**	.28
	$p = .01$	**$p < .001$**	$p = .02$
Mechanism	.23	.42	**.63**
	$p = .057$	$p < .001$	**$p < .001$**
Irrelevant	.21	.08	.19
	$p = .09$	$p = .51$	$p = .11$

[a] 2-tailed tests.

tions. In contrast, the lawyers and psychologists had a two-tier hierarchy for justifying causal statements. The psychologists used the mechanism and the covariation causal justification statements equally frequently, followed by the counterfactual justification. The lawyers used the mechanism causal justification primarily, but secondarily used the covariation and the counterfactual justifications equally often. The interpretation of the data in terms of hierarchies of preferences for justifications confirmed the major hypothesis of the study that undergraduates and police professionals (adult novice groups) would have a similar organization of causal inference rules, but that their organization would be different from that of lawyers and psychologists, who in turn would differ in organization from each other.

To assess whether differences in ratings of justification statement convincingness reflected superficial linguistic or deeper information-processing differences, we examined Pearson product-moment correlations between convincingness ratings for the justification statements and relevance ratings for the evidence sentences (see Table 7.1). If differences in justification statement convincingness reflect linguistic preferences, then each causal justification statement should show the same pattern of correlation with the evidence sentences. Such a pattern of correlation would show that the variation in the convincingness ratings of each causal justification statement did not correspond to a unique pattern of ratings regarding the relevance of evidence sentences. On the other hand, if differences in justification statement convincingness reflect differences in how the evidence was processed, then each causal justification statement should

show a unique pattern of correlation with the evidence sentences. Such a pattern of correlation would show that the variation in the convincingness ratings of each justification statement corresponds to a unique pattern of ratings regarding the relevance of evidence sentences. The pattern of correlation coefficients between ratings of evidence sentences and each causal statement revealed that of all the evidence sentences: (a) the contextual evidence sentence was most strongly correlated with the counterfactual statement; (b) the past association evidence sentence was most strongly correlated with the covariation statement; and (c) the mechanism evidence sentence was most strongly correlated with the mechanistic statement. None of the correlations between the convincingness ratings of causal justification statements and the relevance ratings of the irrelevant evidence sentence were significant. These data suggest that the best predictor of the variation in justification convincingness was the relevance rating for the corresponding evidence sentence. The data support the hypothesis that variation in ratings of statement convincingness reflect differences in how the evidence was processed.

Study 2: Replication

If the data in Fig. 7.2 are best described as different hierarchical patterns of preferences for justification statements, then subjects' preference judgments should be transitive. That is, if undergraduates employ the predicted three-tier preference hierarchy for justifying a sequence of events as causal, then they should prefer the mechanism justification over the covariation justification, the mechanism justification over the counterfactual justification, and the covariation justification over the counterfactual justification. We carried out a second study to test whether lawyers', psychologists', and undergraduates' preference hierarchies for causal justification statements would generate predicted transitive judgments. Eight second- and third-year law students, eight second- and third-year MA psychology students (mean age of 27 years for both groups), and eight first- and second-year undergraduates (mean age 19 years) served as subjects. The replication study paralleled the first study except that there were four scenarios in each domain (pretested as in Study 1 and found to be adequate) and the scenarios were presented on a microcomputer. Each scenario was presented and then three pairs of causal justification statements were presented in random order (e.g., mechanism vs. covariation, mechanism vs. counterfactual, covariation vs. counterfactual). The subjects' task was to choose the more convincing statement in each pair.

Represented below are the eight possible patterns that could be generated from a subject's response on each of the three comparisons to a scenario (the symbol "M > Co" means that the mechanism justification is judged to be more convincing that the covariation justification):

	Comparison 1 M ? C	2 M ? Cf	3 Co ? Cf	
Pattern #		Transitive		Label
1	M > Co	M > Cf	Co > Cf	M > Co > Cf
2	M > Co	M > Cf	Cf > Co	M > Cf > Co
3	Co > M	M > Cf	Co > Cf	Co > M > Cf
4	Co > M	Cf > M	Co > Cf	Co > Cf > M
5	M > Co	Cf > M	Cf > Co	Cf > M > Co
6	Co > M	Cf > M	Cf > Co	Cf > Co > M
		Intransitive		
7	Co > M	M > Cf	Cf > Co	Intrans
8	M > Co	Cf > M	Co > Cf	Intrans

Response patterns 7 and 8 are intransitive, meaning that each causal justification statement is judged once to be more convincing than another. For the purpose of analyses, patterns 7 and 8 were collapsed and treated as a single pattern. The six transitive response patterns (patterns 1–6) reflect different transitive judgments regarding the causal justification statements. In each of the six transitive patterns, one causal justification statement is selected twice as being "more convincing," another statement is selected once, and a third statement is not selected at all. The label given to transitive response patterns 1 through 6 has the symbol for the twice-selected justification presented first, followed by the symbol for the once-selected justification, and then the symbol for the justification not selected. Subjects were assigned a response pattern for each of the 12 scenarios.

Over 90% of subjects' response patterns were intransitive, suggesting that their preferences for causal justification statements were hierarchically organized. If subjects were randomly responding, then 75% ($\frac{6}{8}$) of their response patterns would be transitive. The rest of the analysis was performed on the percentage of transitive response patterns subjects generated. Fig. 7.3 presents mean percentage of transitive response patterns generated for subjects in each group.

The percentage with which each of the six response patterns were generated was not the same. A 3 (Groups) by 3 (Domains) by 6 (Response Patterns) ANOVA on the percentage of response patterns subjects generated revealed a main effect of response pattern. There was neither a group by response pattern nor a group by domain by response pattern interaction effect. An analysis of the simple main effects revealed that each group differentially generated response patterns at a level that was significant or approached significance (Psychologists: $p = .066$, Lawyers: $p = .049$, Undergraduates: $p < .001$).

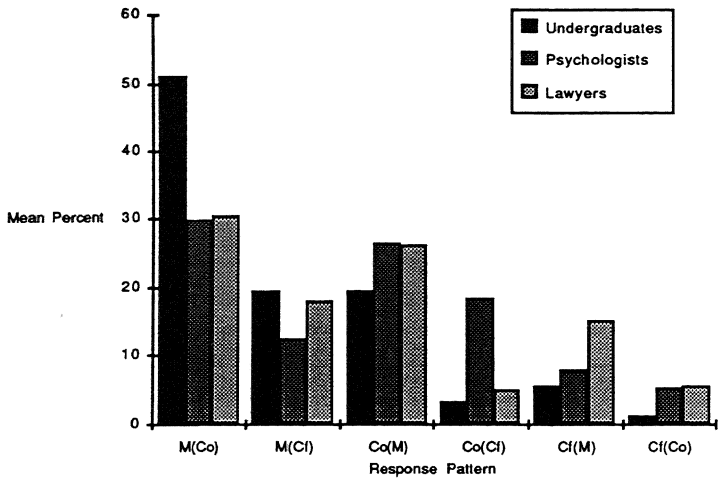

FIG. 7.3. Mean percent generation across scenarios of the six transitive response patterns by group.

We analyzed whether specific response patterns generated by subjects were consistent with their predicted preference hierarchy for causal justification statements. It was predicted that undergraduates would generate a higher percentage of response pattern 1 than any other pattern. In response pattern 1, mechanism is preferred over covariation, covariation over counterfactual, and mechanism over counterfactual. As predicted, *t*-test[1] comparisons demonstrated that the percentage of response pattern 1 was significantly higher than each of the other five transitive response patterns (all p's $< .01$). This supports the interpretation that undergraduates have primarily a three-tier hierarchy of preferences for causal justifications, with the mechanism justification being preferred over covariation, and covariation over the counterfactual justification.

Psychology students' preference hierarchy for causal justifications was predicted to be two-tier with the covariation and the mechanism causal justification statements equally preferred and both preferred over the counterfactual justification statement. The psychology students generated a higher percentage of pattern 1 than patterns 5 and 6 (all p's $< .05$). However, unlike the undergraduates, the psychology students' percentage of pattern 1 was not different from their percentage of patterns 2, 3 and 4. Patterns 1 and 2 are those in which the mechanism

[1]We used *t*-tests because we wanted a sensitive measure of the difference between the frequency with which various response patterns were generated, despite the fact that the multiple comparisons increase Type II error. Our justification for this choice lies in the fact that only a subset of significant differences could be reasonably interpreted as consistent with the predicted hierarchical pattern of preferences. Thus, although not an a priori use of *t*-tests, there was a strong constraint in interpreting the results.

justification is the most convincing, whereas patterns 3 and 4 are the ones in which the covariation justification statement is the most convincing. Thus, as argued above, and by Cook and Campbell (1979, 1986), the psychologists judged covariation and mechanism as an effective justification of causation.

Law students' preference hierarchy was predicted to be two-tier, with the mechanism justification preferred over the counterfactual and covariation justification statements, which would be equally preferred. The law students' percentage of response pattern 1 was higher than patterns 4 and 6 (all p's $< .05$), suggesting that, unlike both the undergraduate and psychology students, the law students' frequency of generating pattern 1 was not different from their frequencies of generating patterns 2, 3, and 5. Thus, as predicted above, the mechanism justification (patterns 1 and 2) was used more often than the covariation (pattern 3) and counterfactual (pattern 5) justifications. This finding suggests that law students sometimes found each of the three causal justifications to be effective in justifying a sequence of events as causal.

SUMMARY AND CONCLUSIONS

The two studies presented were designed to examine a basic question regarding legal reasoning: whether lawyers have a unique style of problem solving. Rejecting the traditional expertise literature as unhelpful, and motivated by results from Lehman et al., who showed that psychologists but not lawyers demonstrate superior causal reasoning performance over the course of professional training, we examined whether psychologists and lawyers engage in causal inquiries differently. A review of the goals, structures, and process of legal, psychological, and everyday causal inquiry suggested one psychologically relevant source of variance between the three groups: their organizations of causal inference rules. To measure differences in lawyers', psychologists', and adults' organization of causal inference rules, we examined preferences for arguments justifying a sequence of events as causal.

The results of the two studies can be summarized by examining the four hypotheses previously presented. First, in Study 1, lawyers judged counterfactual justifications as the "most convincing" more often than any other group, and psychologists judged covariation justifications as "most convincing" more often than lawyers and undergraduates. This finding confirmed the hypothesis that there are differences between undergraduates and lawyers, undergraduates and psychologists, and lawyers and psychologists, in use of causal inference rules.

Study 1 also demonstrated that the best predictor of variation in ratings of each justification statement convincingness was the relevance ranking of the corresponding evidence sentence. This finding supported the claim that differences in the use of causal justifications reflect differences in the processing of evidence, and not merely differences in the manner of expressing that a sequence

of events is causal. Moreover, there was no evidence in either study that the groups were differentially influenced by domain, suggesting that the causal hierarchies are domain-general.

Finally, the undergraduate and police groups (novice groups) had the same three-tier hierarchy of preferences for causal justifications, whereas the expert groups had different two-tier hierarchies, which was consistent with the claim that a control group of professionals, who are not trained in law or the social sciences, should reason like novices. The last finding was further confirmed by the subjects' preferences of response patterns in Study 2. The undergraduates preferred the response pattern in Study 2 that was the pattern identified in Study 1; they preferred (in order) the mechanism, covariation, and counterfactual justifications.

More generally, the results suggested that subjects' organization of causal inference rules was hierarchical in a manner consistent with Shultz (1982). Subjects' choices of convincing causal justifications could not be attributed to characteristics of the scenarios because pretesting insured that each causal justification was judged to be equally supported by the information in the scenarios. Thus, subjects' choices were preferences that we believe reflect the tendency to execute causal inference rules. However, the studies were not designed to test alternatives to Shultz's conceptualization (e.g., Cheng & Novick, 1989; Einhorn & Hogarth, 1986). Thus, we make no claim that the data support exclusively a hierarchical theory of the organization of causal inference rules. For one thing, the hierarchical organization may be adequate to explain the initial order of execution of causal inference rules. However, a complex causal problem may require the execution of multiple rules over time, and the search for consistency between inferences generated by different rules. Nonetheless, our data suggest that one principle of complex causal problem solving is that of the hierarchical organization of causal inference rules.

The results regarding the differences between the novice and expert groups' preferences for causal justifications are consistent with previous research on the novice-expert shift (cf., Chi et al., 1982). The hierarchies of lawyers and psychologists are more complex compared to that of undergraduate novices. Experts' hierarchies are more complex than novices' in that more kinds of causal justifications are seen as relevant by the experts and not by the novices, and the justifications are used in combination.

The results further suggest that lawyers' and psychologists' causal inference rules are organized differently. As discussed in the review of the goals, structures, and processes, the use of experiments as a basis of psychologists' goal of generating causal generalizations requires use of future-oriented and prognostic causal inference rules, which suggests a limited preference for context-based rules. Moreover, on the basis of Cook and Campbell's (1979, 1986) discussion of causal reasoning, it was predicted that the mechanism rule (to generate hypotheses and evaluate the internal and external validity of an experimental design)

and the covariation rule (to evaluate statistical evidence) would be preferred. Such an organization of causal inference rules was demonstrated in Studies 1 and 2. In contrast, lawyers' goal of making causal inferences about particular event sequences required use of past-oriented and diagnostic causal inference rules, which suggests an increased preference for the counterfactual rule. However, on the basis of discussion of the limits of the "but-for" test of causation-in-fact, it was predicted that the other rules would be used as well. Lawyers generated multiple hierarchies of causal inference rules in Studies 1 and 2, thus lending support to this hypothesis.

The difference in the organization of causal inference rules among lawyers and psychologists is directly relevant to Lehman et al.'s (1988) argument that psychologists but not lawyers exercise causal reasoning schemas during graduate education. The findings of this study suggest that the processes of training in law and psychology induce professional differences in causal reasoning. Thus, Lehman et al. found a change in psychologists' and not lawyers' causal reasoning performance over graduate school because their task assessed a manner of causal reasoning trained exclusively in the social sciences. However, the data confirm a central point of Lehman et al., that professional education can induce general changes in reasoning. Our argument for the role of training in professional differences in causal reasoning is based on the similarity between the two novice groups (undergraduates and police professionals) in Study 1, and the difference between the novice groups and each expert group in Studies 1 and 2.

Undergraduates who go on to study law or psychology are trained not merely in the content of a discipline, but in a manner of reasoning characteristic of that discipline. Cross-sectional and longitudinal analyses of students in professional schools is necessary before inferences can be drawn about the precise role of professional education on the induction of causal inference rules. For example, research could examine whether the induction of a professionally-consistent manner of causal reasoning is a direct or indirect result of instruction. Nonetheless, the finding of differences between lawyers, psychologists, and professionally novice adults in causal reasoning is one step in a line of research that could demonstrate the uniqueness of legal logic. Causal reasoning is one of many domain-general inference rules that may vary across profession. Further research comparing lawyers with a variety of professionals on a multitude of inference rules may yet support Levi's (1948) epigrammatic comment about the uniqueness of legal logic.

ACKNOWLEDGMENTS

The research reported in this chapter was carried out by the third author, supervised by the first. Support by a SSHRCC postdoctoral fellowship, a University of Saskatchewan president's NSERC, and a NSERC operating grant to the first

author is gratefully acknowledged. The authors would like to thank Judith Amsel, Jack Carroll, Michael Davidson, Peter Frensch, Leona Schauble, Bob Sternberg, and Ying Zhu for their help. Special appreciation is extended to Professor Lucinda Findley and the members of her Torts class (1986–1987) at the Yale Law School who allowed E.A. to audit.

REFERENCES

Amsel, E. (1989). *The development of scientific reasoning: Are children like scientists?* Unpublished manuscript, University of Saskatchewan.

Bindra, D., Clarke, K., & Shultz, T. R. (1980). Understanding predictive relations of necessity and sufficiency in formally equivalent "causal" and "logical" problems. *Journal of Experimental Psychology: General, 109,* 422–443.

Borgo, John. (1979). Causal paradigms in tort law. *Journal of Legal Studies, 8,* 419–455.

Bullock, M. (1985). Causal reasoning and developmental change over the preschool years. *Human Development, 29,* 169–191.

Bullock, M., Gelman, R., & Baillargeon, R. (1982). The development of causal reasoning. In W. Friedman (Ed.), *The developmental psychology of time* (pp. 209–254). New York: Academic Press.

Calabresi, G. (1975). Concerning cause and the law of torts: An essay for Harry Kalven, Jr. *University of Chicago Law Review, 43,* 69–101.

Carey, S. (1985a). *Conceptual change in childhood.* Cambridge, MA: MIT Press.

Carey, S. (1985b). Are children fundamentally different kinds of thinkers and reasoners than adults? In S. Chipman, J. Segal, & R. Glaser (Eds.), *Thinking and learning skills: Research and open questions* (Vol. 2, pp. 485–517). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cheng, P., & Holyoak, K. (1985). Pragmatic reasoning schemes. *Cognitive Psychology, 17,* 391–416.

Cheng, P., & Novick, L. (1989). *Covariation and pragmatics: A qualitative contrast model of causal induction.* Unpublished manuscript, UCLA.

Chi, M., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. J. Sternberg, (Ed.), *Advances in the psychology of human intelligence* (Vol. 1, pp. 7–75). Hillsdale, NJ: Lawrence Erlbaum Associates.

Collingwood, R. G. (1972). *Essay on metaphysics.* Chicago: Henry Regnery.

Cook, T., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings.* Chicago: Rand McNally.

Cook, T., & Campbell, D. T. (1986). The causal assumptions of quasi-experimental practice. *Synthese, 68,* 141–180.

Cooper-Stephenson, K., & Saunders, D. (1981). *Personal injury damages in Canada.* Toronto: Carswell.

Einhorn, H. J., & Hogarth, R. M. (1986). Judging probable cause. *Psychological Bulletin, 99,* 3–19.

Epstein, R. (1973). A theory of strict liability. *Journal of Legal Studies, 2,* 151–204.

Faust, D. (1984). *The limits of scientific reasoning.* Minneapolis, MN: University of Minnesota Press.

Fincham, F. D., & Jaspers, J. M. (1980). Attribution of responsibility: From man the scientist to man the lawyer. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 13, pp. 81–138). New York: Academic Press.

Fishoff, B. (1976). Attribution theory and judgments under uncertainty. In J. H. Harvey, W. J.

Ickes, & R. F. Kidd (Eds.), *New directions in attribution research* (Vol. 1, pp. 421–452). Hillsdale, NJ: Lawrence Erlbaum Associates.

Golding, M. P. (1984). *Legal reasoning*. New York: Alfred Knopf.

Hamilton, V. L. (1980). Intuitive psychologist or intuitive lawyer? Alternative model of the attribution process. *Journal of Personality and Social Psychology, 39,* 767–772.

Hart, H. L. A., & Honore, T. (1985). *Causation in the law* (2nd ed.). Oxford: Oxford University Press.

Hofer, P. J. (1987). *Cognitive strategies for interpreting law*. Unpublished doctoral dissertation, Johns Hopkins University, Baltimore.

Holland, J., Holyoak, K., Nisbett, R., & Thagrad, P. (1987). *Induction: Processes of inference, learning, and discovery*. Cambridge, MA: MIT Press.

Jensen, O. C. (1957). *The nature of legal argument*. Oxford: Basil Blackwell.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgments under uncertainty: Heuristics and biases*. New York: Cambridge University Press.

Kahneman, D., & Tversky, A. (1982). The simulation heuristic. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgments under uncertainty: Heuristics and biases* (pp. 201–210). New York: Cambridge University Press.

Kelley, H. H. (1967). Attribution theory in social psychology. In D. Levine (Ed.), *Nebraska symposium on motivation* (Vol. 15, pp. 192–238). Lincoln, NE: University of Nebraska Press.

Koslowski, B., & Okagaki, L. (1986). Non-Humian indices of causation in problem-solving situations: Causal mechanism, analogous effects, and the status of rival alternative accounts. *Child Development, 57,* 1100–1108.

Kuhn, D., Amsel, E., & O'Loughlin, M. (1988). *The development of scientific thinking skills*. Orlando, FL: Academic Press.

Kuhn, D., & Phelps, E. (1982). The development of problem-solving strategies. In H. Reese (Ed.), *Advances in child development and behavior* (Vol. 17, p. 5). New York: Academic Press.

Lawrence, J. A. (1988). Expertise on the bench: Modelling magistrates' judicial decision making. In M. T. Chi, R. Glaser, & M. J. Farr (Eds.), *The nature of expertise* (pp. 229–259). Hillsdale, NJ: Lawrence Erlbaum Associates.

Lehman, D., Lempert, R., & Nisbett, R. E. (1988). The effects of graduate training on reasoning: Formal discipline and thinking about everyday-life events. *American Psychologist, 43,* 431–442.

Leslie, A. M. (1987). Do six-month-old infants perceive causality? *Cognition, 25,* 265–288.

Levi, E. H. (1949). *An introduction to legal reasoning*. Chicago: University of Chicago Press.

Lundeberg, M. A. (1987). Metacognitive aspects of reading comprehension: Studying understanding in legal case analysis. *Reading Research Quarterly, 22,* 407–432.

Mackie, J. L. (1980). *The cement of the universe: A study of causation*. Oxford: Oxford University Press.

Malone, W. S. (1956). Ruminations on cause-in-fact. *Stanford Law Review, 9,* 60–99.

Nisbett, R., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment*. Englewood, NJ: Prentice-Hall.

Popper, K. (1965). *The logic of scientific discovery* (2nd ed.). New York: Harper & Row.

Ross, L. (1977). The intuitive scientist and his shortcomings: Distortions in the attribution process. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 10, pp. 173–220). New York: Academic Press.

Schauble, L. (1990). The role of prior knwoledge and strategies for generating evidence. *Journal of Experimental Child Psychology, 49,* 31–57.

Schustack, M. (1988). Thinking about causality. In R. J. Sternberg & E. E. Smith (Eds.), *The psychology of human thought*. New York: Cambridge University Press.

Sedlack, A., & Kurtz, S. (1981). A review of children's use of causal inference principles. *Child Development, 52,* 759–784.

Shaklee, H., & Tucker, D. (1980). A rule analysis of judgments of covariation between events. *Memory and Cognition, 8,* 459–467.

Shaklee, H., & Fishoff, B. (1982). Strategies of information search in causal analysis. *Memory and Cognition, 10,* 520–530.

Shaver, K. G. (1985). *The attribution of blame: Causality, responsibility, and blameworthiness.* New York: Springer-Verlag.

Shultz, T. R. (1979, July). *Causal and logical reasoning.* Paper presented at the International Congress of Psychology of the Child, Paris.

Shultz, T. R. (1982). Rules of causal attribution. *Monographs of the Society for Research in Child Development, 47,* (Serial No. 194).

Shultz, T. R. (1983, April). Causal and probablistic reasoning. In M. Bullock (Chair), *New directions in causal reasoning.* Symposium presented at the biennial meeting of the Society for Research in Child Development, Detroit.

Shultz, T. R., Fischer, G., Pratt, C., & Rulf, S. (1986). Selection of causal rules. *Child Development, 57,* 143–152.

Shultz, T. R., & Kestenbaum, M. (1985). Causal reasoning in children. In G. Whitehurst (Ed.), *Annals of child development* (Vol. 2, pp. 195–249). Greenwich, CT: JAI Press.

Shultz, T. R., & Schleifer, M. (1983). Towards a refinement of attribution concepts. In J. D. Jaspers, F. D. Fincham, & M. Hewstone (Eds.), *Attribution theory and research: Conceptual, developmental, and social dimensions* (pp. 37–62). London: Academic Press.

Shultz, T. R., Wright, K., & Schleifer, M. (1986). Assignment of moral responsibility and punishment. *Child Development, 57,* 177–184.

Siegler, R., & Shrager, J. (1984). Strategy choices in addition and subtraction: How do children know what to do? In C. Sophian (Ed.), *Origins of cognitive skills: The Eighteenth Annual Carnegie Symposium on Cognition* (pp. 229–293). Hillsdale, NJ: Lawrence Erlbaum Associates.

Simon, H. A. (1981). *The science of the artificial* (2nd ed). Cambridge, MA: MIT Press.

Strachan, D. M. A. (1970). The scope and application of the "but-for" causal test. *Modern Law Review, 33,* 386–395.

Thomson, J. J. (1987). Causality and rights. *Chicago-Kent Law Review, 63,* 471–496.

von Wright, G. H. (1971). *Explanation and understanding.* Ithaca, NY: Cornell University Press.

Weiner, B. (1985). "Spontaneous" causal thinking. *Psychological Bulletin, 97,* 74–84.

Weinrib, E. J. (1975). A step forward in factual causation. *Modern Law Review, 38,* 518–534.

Wells, G., & Gavanski, I. (1989). Mental simulation of causation. *Journal of Personality and Social Psychology, 56,* 161–169.

Wells, G., Taylor, B. R., & Turtle, J. W. (1987). The undoing of scenarios. *Journal of Personality and Social Psychology, 53,* 421–430.

Wollert, R., & Rowley, J. (1987). Concurrent and longitudinal patterns among sanctions, mood, and attributions. *Journal of Personality and Social Psychology, 53,* 608–613.

Williams, G. (1961). Causation in the law. *Cambridge Law Journal,* 62–85.

Wright, R. W. (1985a). Actual causation vs. probabilistic linkage: The bane of economic analysis. *Journal of Legal Studies, 14,* 435–456.

Wright, R. W. (1985b). Causation in tort law. *California Law Review, 73,* 1735–1828.

III NATURAL SCIENCES