Picture basketball coach Don Smith, who desperately needs at least a couple of outstanding free throw shooters. Coach Smith’s team has lost game after game in the waning seconds. That is because opposing teams easily regain possession of the ball by committing intentional fouls since they know that Smith’s players make few of their free throws. Coach Smith is pondering how to recruit a new player who has already demonstrated his proficiency at the line. He is also trying to figure out how to train a current player to elevate his free throw performance to the level of an expert. Related to this second approach, Coach Smith also has what some would call “scientific” concerns. He wonders why none of his players is already an excellent free throw shooter. What exactly is involved in foul shooting expertise? How does one normally develop the skill? Why is it that some players acquire the ability but others do not? Are there certain constitutional factors, physical or psychological, that limit a player’s potential at the free throw line? If so, what are they? And how can one detect them, so that resources are not wasted “trying to make a silk purse from a sow’s ear?”

Coach Smith’s situation is by no means unique. In some form or another, it is replicated in countless circumstances where the focus is on making decisions rather than shooting free throws. Thus, instead of Coach Smith, our protagonist might be the managing partner in a medical practice, where the need is for new staff physicians who make excellent treatment decisions for their patients. It could be the head of a marketing division who is recruiting brand managers, ones who will make choices that improve market share. It could be a police department official who wants to assure that the officers retained after their probationary periods make wise choices in the heat of the moment. In all these cases, the fundamental questions are similar:

- **Identification**: How can we find people with high degrees of decision-making expertise?
- **Explanation**: How can we explain the presence or absence of such expertise?
• Development: How can we develop this kind of expertise?

Our original aims for this chapter were to survey, analyze, and summarize what the decision-making literature has to offer for questions like those above, with a special emphasis on the explanation question. A portion of the literature does indeed directly address expertise, but it is small. Moreover, our examination of the literature forced us to conclude that most research explicitly focused on decision-making expertise is incapable of providing answers that satisfy all major constituencies. Put another way, scholarship on this variety of expertise appears to be much less well developed than one might like or expect, a perception that is not unique to us (cf. Phillips, Klein, & Sieck, 2004).

We therefore modified our aims. Thus, in the chapter, we first offer our analysis of significant impediments to progress in research on decision-making expertise. We then describe a means of overcoming those impediments, an overarching way of thinking about decision making that makes clearer what decision-making expertise must entail. In the context of describing that perspective, we interpret some of the few major conclusions from earlier studies on decision-making expertise that seem firmly defensible. We also identify findings about aspects of decision behavior that have implications for expertise, although this is usually unrecognized. The analysis also identifies specific questions whose answers derived in future work should significantly accelerate progress toward a deep understanding of decision-making expertise.

Decisions

It is obvious what a free throw is in a basketball game. But things are murkier in the case of decision making; there is not universal agreement about what constitutes a decision. The resulting fuzziness has been burdensome for decision scholarship generally and for studies on decision-making expertise in particular. Consider, for instance, the suggestion that scholarship on expertise in problem solving has been more productive than that on decision making (e.g., Orasanu & Connally, 1993). What can one make of such propositions if, as is often the case, decision making and problem solving are not clearly distinguished. (To anticipate, we view decision making as a special case of problem solving.)

To avoid such difficulties, it would help if investigators adhered consistently to a convention about what decisions are. Such a convention actually exists, although, as implied in the previous discussion, it is not universally followed. The convention is embodied in the following definition, which we assume for the remainder of the chapter (Yates, 2003, p. 24):

A “decision” is a commitment to a course of action that is intended to yield results that are satisfying for specified individuals.

There are several major decision varieties: “choices,” which entail the selection of a subset from a larger collection of discrete alternatives (e.g., a class of ten new graduate students from a pool of 100 applicants); “acceptances/rejections,” which are special cases of choices in which only one specific option (e.g., potential marriage partner) is acknowledged and must be accepted or not; “evaluations,” which are statements of worth that are backed up by commitments to act (e.g., a $50,000,000 binding bid on a house); and “constructions,” which are attempts to create ideal decision problem solutions given available resources (e.g., a department’s budget or a plan for fighting a fire).

The present definition is a synthesis of how the decision idea has been understood implicitly in most scholarship on decision making, for example, in psychology, education, marketing, politics, operations, and the military. Individual investigators are sometimes inconsistent and imprecise in their use of the word “decision.” But in our experience, when pressed, they almost never claim that the definition here differs significantly from how they understand the decision concept.
Several key features are packed into the decision definition:

- **Action**: Decisions ultimately are about people doing things — taking actions. Thus, when Jane Davis decides to purchase General Motors stock, the pertinent action is exchanging her money for GM shares.

- **Commitment**: Decisions need to be distinguished from the actions they implicate because, for instance, not all decisions are eventually executed. Hence, we recognize that a decision has been made as soon as there is a commitment to act in a particular way, as when Davis resolves to buy 100 GM shares.

- **Intention**: People cannot decide by accident, even though they sometimes decide haphazardly. That is, decision making is intentional behavior; it has a purpose. This is not to say, however, that unintended consequences do not sometimes (often?) occur or that deciders are always fully aware of how they arrive at their decisions, as when they decide according to "intuition."

- **Satisfying results**: Decision making is about achieving results that are experienced as satisfying (e.g., with high "utility"), not merely "correct" in some purely logical sense. The intentional character of decisions implicates their sought-after results (e.g., relief from arthritic pain in making a choice of medication). But other results that people care about are usually involved, too, ones recognized as "side effects" (e.g., liver damage from a medicine) or "process costs" (e.g., the time it takes to choose among alternative medications or the anxiety experienced when deliberating such choices).

- **Specified individuals**: People make decisions to serve the interests of particular individuals. Sometimes the targeted "beneficiary" is the decider alone, for example, when one is dining solo and choosing between the Szechuan chicken and the egg foo young. But at other times, the beneficiaries include others, for example, when a physician is choosing a pain reliever to prescribe for a particular patient. (The decider is nearly always among the intended beneficiaries of a decision, since people rarely seek to decide contrary to their own interests.) The specification of beneficiaries is critical, implicating what is arguably the single feature of decision problems that distinguishes them most sharply from more general problems — differences among people in the values they attach to decision results. The correct solution to an algebra problem is the correct solution for everybody. But, whereas Joe Payne regards the cobalt blue Phantom as the most beautiful car he has ever seen, Lew Walters sees it as "hideous" and therefore cringes at the mere idea of buying one. It is noteworthy that the implicit subjectivity represents a significant and challenging departure from most expertise scholarship, which prizes unambiguous performance criteria.

### Decision Quality and Decision-Making Expertise

Even more than for the decision concept itself, ambiguity about notions of decision quality and expertise is a major hindrance to scholarship on decision-making expertise. Here we describe common views and their difficulties and propose an escape route.

#### The Satisfying-Results Perspective

It is plain for all to see when a basketball player is an expert free throw shooter. A successful shot is one that goes through the hoop. And an expert shooter is one who makes a high percentage of successful shots, even when the game is in the balance and the tension is palpable. In principle, there is no reason that decision quality and, correspondingly, decision-making expertise could not be conceptualized the same way. Thus, recalling that the aim of any decision is results that satisfy particular people, from a
satisfying-results perspective, a "high-quality decision" is one that does indeed achieve such satisfying results. Consider a decision to prescribe Medication A over Medication B for Patient Lang. That would be the better decision if, taking pain relief, side effects, and all other results into account, Lang would, in fact, be more satisfied using Medication A. By extension, an "expert decider" is a person who tends to make high-quality decisions.

So, according to this statistical ("tends") satisfying-results viewpoint, Dr. Lincoln is a more expert prescription decider than Dr. Thomas if, typically, Lincoln's patients get prescriptions that leave them more satisfied, on the whole, than Thomas's patients, all else being the same.

The Coherence Perspective

Perhaps surprisingly, the pure satisfying-results perspective is unpopular in traditional decision scholarship. Indeed, authors often go out of their way to caution against it, as when Hammond, Keeney, and Raiffa (1999, p. 110) write: "Although many people judge the quality of their own and others' decisions by the quality of the consequences – by how things turn out – this is an erroneous view." Research on outcome bias mirrors that sentiment. As described by Baron and Hershey (1988, p. 570), people exhibit "outcome bias" when they "take outcomes into account in a way that is irrelevant to the true quality of the decision." Elsewhere in their article (p. 569), Baron and Hershey remark that "information that is available only after a decision is made is irrelevant to the quality of the decision," and presumably such information includes indications of decision results. There is good evidence that laypersons generally do conceive of decision quality in terms of outcomes, as implicated in the satisfying-results characterizations described here. Yates, Veinott, and Patalano (2003) asked people to bring to mind actual serious decisions of their own that they considered to have been "good" and "bad" ones. They then had those individuals explain why they put those decisions into the good and bad categories. By far, the most commonly cited reason for describing decisions as "good" (95% of the time) was that those decisions yielded desirable outcomes. Similarly, decisions classified as "bad" ones were described (86%) of the time) as having led to poor results.

Why have some scholars resisted people's apparently natural inclination to appraise decisions according to their outcomes? The main reason is the role of chance, as implicit in remarks by Ward Edwards (Edwards, Kiss, Majone, & Toda, 1984): "A good decision cannot guarantee a good outcome. All real decisions are made under uncertainty. A decision is therefore a bet, and evaluating it as good or not must depend on the stakes and the odds, not on the outcome" (p. 7). Writers often emphasize that the results of almost every decision-driven action depend at least partly on events outside the decider's control and awareness. Moreover, those events might well be beyond anyone's anticipation. Thus, in this view, it would be unfair and dysfunctional to castigate Dr. Lincoln for deciding to prescribe a medicine for Patient Lang that brings about a life-threatening but extremely rare allergic reaction.

So how do scholars antagonistic to the results perspective propose that people should appraise decisions (and, implicitly, decision-making expertise)? Apparently, they should do so according to the logical coherence of the procedures employed in making those decisions. Procedures are "logically coherent" if they do not contradict themselves or, equivalently, do not allow the decider to be self-contradictory in particular ways (cf. Yates, 1997, Chapters 5 and 9). As an extremely simple example, suppose that Jane says that she never wants to violate the transitivity principle, which says that, if A is preferred to B and B is preferred to C, then A must be preferred to C. Nevertheless, Jane likes Apartment 1 more than Apartment 2, Apartment 2 more than Apartment 3, but Apartment 3 more than Apartment 1. She is being logically incoherent.

In a perhaps extreme version of the coherence perspective, Edwards (Edwards, Kiss, Majone, & Toda, 1984) contended that the sole criterion for decision quality should be
whether the process used to arrive at a decision mimics the maximization of expected utility: “No principle other than maximizing SEU deserves a moment’s consideration” (p. 7). And in numerous laboratory studies of decision-making where the uncertainty is not explicitly acknowledged (e.g., Payne, Bettman, & Johnson, 1988), the coherence standard is often taken to be equivalence to additive utility or value maximization. Such expertise yardsticks are, incidentally, the ones implicit in several well-known decision-analytic methodologies. That is, the promise is that deciders (or, more importantly, their beneficiaries) would be well served by realizing such standards (e.g., Morris, 1977).

Implications for Expertise Questions

The satisfying results and the coherence perspectives are clearly different. This therefore poses a dilemma for addressing the expertise questions articulated at the outset of this chapter, most obviously the identification question. Suppose that one needs to identify expert deciders, for example, to hire them or to study them. The alternative perspectives suggest two different ways of doing that, and there is every reason to expect that those approaches would sometimes lead to different conclusions about who is actually an expert. Which conclusions would be right?

Interestingly, in terms of what happens in real life, this obvious question is actually moot. It is undoubtedly true that people commonly believe that some deciders – including professionals of various kinds – are either more or less expert than others. And those people almost certainly act on these beliefs, for example, in choosing to hire the services of individuals regarded as more expert than their peers. How do those beliefs arise and how are they justified? We are unaware of anyone pointedly trying to appraise expertise in terms of coherence. Nor have we seen full-fledged, legitimate attempts to assess decision-making expertise according to satisfying results in the kinds of complex, real-life situations for which people typically seek expertise. A key reason is statistical. It is nearly impossible for people to defend statements like “Decider A’s tendency for producing decisions with satisfying results is better than Decider B’s” on the basis of large samples of observed cases. Instead, indications are that, when expertise beliefs are at all based on observations of results, those beliefs rest on fewer observations than statistical principles would demand. By default, then, the beliefs must be driven by other considerations.

An example: Extensive research has shown that people’s judgment behavior is susceptible to strong primacy effects and that, under particular conditions, these effects result from “attention decrement” (e.g., Yates & Curley, 1986). Thus, people are inclined to observe a small number of cases, draw a conclusion on the basis of those cases, and then simply stop paying attention to pertinent facts that present themselves later. This phenomenon is plausibly related to the one Tversky and Kahneman (1971) dubbed “the belief in the law of small numbers,” which suggests that people feel that attending to further cases beyond the first few is unnecessary as well as burdensome. In the present instance, these mechanisms suggest that our presumptions about a decider’s expertise are dictated by the first few decisions we happen to associate with that person. If those decisions turn out well, we apply the label “expert.” But if they turn out badly, the decider might well be called “inept.” And that opinion is cast in stone since its underpinnings will not be revisited. It is worth noting that these effects implicate the sense in which the “outcome bias” label is sometimes justified. A process-control engineer would never dismiss a single product defect as irrelevant to conclusions about the quality of the manufacturing process that produced it. In the same way, it is unreasonable to say that people should ignore the results of a single decision when trying to infer the decider’s expertise. The notion of “bias” enters the picture only when, in violation of principles like the law of large numbers, people use nothing more than a single case to draw definitive conclusions about long-term tendencies (Caplan, Posner,
& Cheney, 1991, provide a compelling illustration).

There are indications that beliefs about decision-making expertise are in large measure social constructions, too. In research on decision-making expertise, some investigators consider as experts individuals who have extensive experience, training, and/or professional and social standing, for example, practicing clinicians (Meehl, 1959) or senior military personnel (Tolcott, Marvin, & Lehner, 1989). In part, this practice seems to reflect a tendency to infer decision-making expertise from subject-matter expertise (e.g., the ability to recite standard psychiatric diagnostic categories). This is not unreasonable to the extent that subject-matter expertise is necessary for decision-making expertise, which it doubt often is. For instance, it would be impossible for a layperson who knows nothing about the law to consistently make decent legal decisions on behalf of clients. Nevertheless, equating decision-making and subject-matter expertise effectively assumes that there is no such thing as decision-making expertise per se. This also implies that studies of expert deciders in one arena (e.g., law) offer no insight for decision-making expertise elsewhere (e.g., medicine); generalizability is nil.

Other researchers operationally define expertise according to consensus among peers (Shanteau, 1992). Thus, “experts” are people who already-acknowledged experts say are experts. Of course, this begs the question of how such self-sustaining impressions of expertise arise initially. As suggested earlier, these impressions plausibly are based at least partly on outcome observations, even if minimally. But they are also probably affected by such validity-vulnerable factors as personal style, which charlatans can easily “fake.” Shanteau (1992, p. 257) put it nicely: “In short, to be accepted as an expert, it is necessary to act like one.” This involves things like exhibiting self-confidence (bluster?) as well as good communication and persuasion skills. This conclusion agrees with the data of Yates, Price, Lee, and Ramirez (1996). These investigators found that many of their partici-pants inferred consulting candidates’ expertise at probability judgment according to their inclination to report extreme, that is, highly confident, opinions. They also found that many individuals demand that potential consultants be able to convincingly explain and justify their assessments; prospective principals give short shrift to empirical evidence of consultants’ accuracy.

One worrisome possibility that the present analysis suggests is that our assumptions about who is or is not a decision-making expert might not be as good as we hope. (This is not to say that they are, in fact, erroneous, only that we do not know.) To the extent that this is true, we are not enjoying as many benefits of decision-making expertise as we might. There are troublesome research implications, too, concerning the decision-making expertise explanation and development questions. Some research designs for approaching such questions are predicated on identifying and studying large numbers of documented expert and non-expert deciders. Those designs are precluded if certification is suspect, as it seems to be. Prospects for those designs are also compromised by sample size restrictions. Studies of decision-making expertise are conspicuous for their small sample sizes, which causes some observers to not take the research seriously. Consider, for instance, the six empirical expertise studies reported in the important collection edited by Zambok and Klein (1997). The median number of participants in those studies, ones considered experts and otherwise, was only 20.5. One likely reason for such small numbers is the difficulty of finding and persuading busy experts to participate in research. All in all, it is clear that a good alternative to current perspectives and practices is essential. We now sketch what seems to be such an alternative.

The Process-Decomposition Perspective

In the process-decomposition perspective, the overall process of making a decision is partitioned into elements. If each element is executed well, this should contribute significantly to the adequacy of the
resulting decision. (This is withstand the real likelihood of the kinds of interactions emphasized in complex systems research, e.g., Sterman, 2002.) Ideally, there should be empirical evidence that, statistically, successful execution of an element does indeed increase the odds of decisions with satisfying outcomes. The process-decomposition perspective shares common ground with both the coherence and the satisfying-results perspectives. The standard coherence perspective focuses on just a couple of elements in normal decision processes. In that sense, it can be seen as a limited, special case of the process-decomposition perspective. No one claims that coherence harms the odds of good decision outcomes. Nevertheless, there have never been convincing demonstrations that coherence is sufficient to increase those odds substantially, which is what everyone wants decisions to do. Like the satisfying-results perspective, the process-decomposition perspective insists on efficacy demonstrations, even if they are only indirect or logical rather than empirical. It differs most sharply from the former point of view in its practicality. As we have seen, it is exceedingly difficult to appraise and study individuals' overall decision-making expertise. But it is often feasible to isolate and examine how people deal with specific process elements.

Decision processes can be decomposed into component processes in numerous different ways. But the particular decomposition to which we turn next has several attractions. Perhaps the most compelling, for present purposes, is that it is comprehensive. That is, it appears to encompass a great many of the activities implicated in virtually any decision situation. Thus, the following key inference makes sense: If a decider were to perform well on each element represented in the decomposition, we would be justified in expecting true decision-making expertise, even in the satisfying-results sense. Moreover, studies of such dimensional performance are directly informative about explanation and development questions regarding decision-making expertise. After all, if a decider is poor at some particular decision process element, this is itself a partial explanation of that individual's lack of overall decision-making proficiency. It also points to very specific things one can do to improve expertise, in the spirit of the "deliberate-practice" approach (Ericsson, Krampe, & Tesch-Römer, 1993).

Decision Processes as Cardinal Decision Issue Resolution

Decision-related writings in myriad fields (e.g., psychology, health care, management, finance, engineering, law, operations, anthropology, counseling, politics, and marketing) as well as analyses of hundreds of incidents indicate that a limited number of fundamental questions arise repeatedly in real-life decision problems. That is why the term "cardinal decision issues" is used to describe them (see Yates, 2003, for a more complete treatment of the "cardinal decision issue perspective"). In some instances, the issues go unrecognized by deciders themselves and thus are resolved by default, by whatever happens to be "natural" in the given situation. For instance, as we shall see, one cardinal issue concerns detecting that there is a decision problem in the first place. Suppose, say, driver James Lawson never senses growing deterioration in his car’s transmission. Then he naturally makes no deliberate decision about how to deal with the impending disaster, and one day his car simply refuses to move. Regardless of their recognition, the cardinal issues are indeed somehow settled during the course of any decision episode. It therefore proves useful to characterize "decision processes" themselves as the means by which the various cardinal issues are addressed for the decision problem at hand.

There are ten cardinal issues, which are numbered for easy reference: 1) need, 2) mode, 3) investment, 4) options, 5) possibilities, 6) judgment, 7) value, 8) trade-offs, 9) acceptability, and 10) implementation. Detailed statements and illustrations of the issues appear below. But at this stage it is useful to put them in the context of the "big picture" of Figure 24.1, where the issues...
are listed in the "Decision Processes" box. A tour of that big picture is useful.

Figure 24.1 mimics the kind of chart often sketched in root-cause analyses (see Robitaille, 2004). It starts with "Beneficiary Satisfaction" since that is the "point" of decision-making. We are ultimately interested in understanding (and sometimes influencing) contributors that, in cascade fashion, feed into that construct. The analysis acknowledges that, although decisions affect people's satisfaction with the results that ensue after a decision is made, so do "Other Contributors," factors unrelated to the decision. The decision is depicted as following from how the decider deals with each of the cardinal issues, "Decision Processes" as "Cardinal Issue Resolution."

Observe that the issues are grouped into categories that roughly correspond to when the issues arise in the typical decision episode. At the "core" of the overall decision process are the options, possibilities, judgment, value, and tradeoffs issues, matters that have received the most attention in decision research. But before those issues arise, usually the decider attends to several "preliminaries," the resolution of the need, mode, and investment issues, concerning matters such as the resources assigned to the decision task. Ordinarily, deciders have reached their decisions (saying, for example, "So this is what we are going to do") once they have resolved the tradeoffs issue. In the "aftermath," often before anything else occurs, the acceptability and implementation issues take center stage, for example, how various other parties feel about how the decision was made. It is important to acknowledge that the stated order is indeed "rough." In real-life decision episodes, deciders often tentatively resolve issues but then revisit them later after confronting other issues (hence the double-headed arrows). Suppose, for example, that apartment seeker Linda Mathers, in addressing the options issue, identifies two possible places to rent. Later, in dealing with the tradeoffs issue, she realizes that picking Apartment A over Apartment B requires sacrifices that are too painful, and vice versa. She therefore returns to the options issue, attempting to find a third option that obviates such sacrifices.

The bottom portion of Figure 24.1 acknowledges that a decider's decision processes derive from a host of other, sometimes "deep," contributors that are important to
understand in their own right, for example, unique personal experiences, constitutional factors such as inherited dispositions or abilities, training, and culturally transmitted local customs. The dotted arrow leading from “Beneficiary Satisfaction” to these contributors highlights the expectation that decision results—particularly bad results—are likely to instigate adjustments in how a decider does things, in a feedback loop.

Here we sketch and briefly illustrate the issues, with each articulated in the voice of deciders confronted with it. We also identify and discuss the implications of key expertise-significant ideas and findings associated with those issues. In addition, we identify specific and important addressable gaps in current understanding.

**Issue 1 – Need:** “Why are we (not) deciding anything at all?” The need issue is about whether and how decision problems are recognized at the outset. Suppose that a problem goes unacknowledged. Then necessarily there is no decision of any kind, and default consequences occur, a particular variety of “blindsideing.” We already saw one illustration, the one in which driver Lawson was oblivious to the deteriorating transmission in his car.

Vigilance is one task that deciders sometimes take to address the need issue. This is the sustained attempt to monitor for signals of threats and opportunities that warrant serious efforts to decide what, if anything, to do about them, as in the control room of a power plant. Over the past 50+ years, researchers have learned much about human vigilance, for example, how surprisingly rapidly it degrades (Howe, Warm, & Dember, 1995). Almost all vigilance research has examined the effects on performance of various aspects of the situation, not why one person might more successfully monitor signals than others. But some recent findings have identified various correlates of vigilance expertise. For instance, Rose, Murphy, Byard, and Nikzad (2002) found that false alarms in a vigilance task were associated with the Big Five dimensions of extraversion and conscientiousness. And Helton, Dember, Warm, and Matthews (1999) observed that pessimists (vs. optimists) exhibited especially rapid vigilance declines. Results such as these suggest a side of expertise that is seldom discussed in any context—personality. That is, experts might perform particular tasks exceptionally well not (solely) because of cognitive capabilities but (also) because of temperament.

How well a decider maintains vigilance when actually trying is one thing. Whether the decider happens to notice good reasons for initiating decision-making efforts in the midst of performing other tasks is quite another, and arguably a more significant one. Consider, for instance, noticing subtle hints of customer taste changes in the normal course of commerce. We are unaware of research that has addressed differences in deciders’ inclinations for doing this, which should be an important aspect of decision-making expertise. There is only a hint from the ancillary literature on problem finding and creativity that suggests the potential fruitfulness of decision-expertise scholarship on the problem. Rostan (1994) found that a significant distinction between “acclaimed” and merely “competent” artists and scientists was that, in an unstructured task, the former spent significantly more of their time finding problems.

**Issue 2 – Mode:** “Who (or what) will make this decision, and how will they approach that task?” Decision modes are qualitatively distinct approaches to deciding. The concern is with who decides and how those individuals address the various other cardinal issues that will be resolved in arriving at a decision. The mode issue per se is about how it is determined which of those modes is applied to the decision problem at hand.

A major part of the “who” mode distinction concerns whether and to whom people with the authority for making a decision defer at least part of their work to others, agents or consultants. “Agents” are parties (including possibly devices such as computers) who are granted the power to make a decision however they see fit, for example, a subordinate asked to make all hires in a particular unit. “Consultants” are parties who provide input to a decision
procedure but who do not make the final decision, for example, a computer program that searches for and ranks job candidates but does not actually determine who gets a job. No decider can possibly have the substantive expertise required to make every kind of decision ideally. Thus, it seems apparent that deciders who are good at determining when there are significant advantages of using agents and consultants for particular purposes have an edge. That is, their expertise at the “who” side of the mode issue should pay off. There is consistent evidence that people generally have extraordinary confidence in the quality of their own decisions and that this confidence increases under particular conditions, for example, when they explain their decisions (e.g., Sieck & Yates, 1997). To the extent that this amounts to overconfidence, this suggests that people generally defer to agents and consultants less often than they should. But if our earlier conclusions about the difficulty of assessing true decision-making expertise are correct, figuring out to whom one should defer is a formidable task. We are unaware of research that has even tried to identify, explain, or develop expertise on decision work deferral.

The “how” side of the mode issue is about the nuts and bolts of how deciders (as well as consultants) carry out their work. Several broad categories of possibilities are recognized, including (but not limited to) analytic, rule-based, automatic, and intuitive decision-making. The “analytic” label describes the broad category in which the decider effortfully seeks to figure out what action makes sense to do in a given decision situation. That mode is presumed to be necessary when the situation is unfamiliar. Most traditional decision scholarship (e.g., utility theory) addresses this mode. In “rule-based” decision-making, the decider applies rules of the following form: If Conditions C hold, then take Action A. Such rules are ubiquitous in business and medicine (e.g., “If the patient displays signs and symptoms X, Y, and Z, then treat as follows….”). “Automatic” decision making is such that, if the decider recognizes particular conditions (and not necessarily consciously), then a particular action spontaneously emerges, with negligible effort, control, and self-insight. This mode is common in high-speed, frequently repeated situations, for example, operating a vehicle or playing a sport such as basketball. “Intuitive” decision making is said to occur when the decider selects a course of action on the basis of considerations (“feelings”) that the decider cannot articulate, perhaps because of fundamental weaknesses in the linkages between cognitive and affective psychological processes (Sadler-Smith & Shefy, 2004).

“How” decision modes differ most obviously in their efficiency. Deliberately pondering what to do, as in analytic decision-making, obviously takes far more time than deciding via any of the other modes. And, to the degree that a good decision maker is efficient, the application of various “how” modes is a significant dimension of decision-making expertise. Moreover, to the extent that expertise tends to (imperfectly) increase with experience, we should expect an association between mode use and measures of decision-making expertise beyond efficiency. Such associations have indeed been inferred. Probably the best-known example is embodied in research related to Klein’s (1993) recognition-primed decision (RPD) model (see Ross et al., Chapter 23). Such work has repeatedly demonstrated that rule-based decision making is extremely common among highly experienced, recognized experts such as fireground commanders. Unfortunately, there is not yet a body of research that systematically addresses identification, explanation, and development questions as they apply to individual differences in expertise at shifting among “how” modes.

**Issue 3 – Investment:** “What kinds and amounts of resources will be invested in the process of making this decision?” The investment issue is about how and how well it is determined whether the “investment” of resources in the process of making a given decision is extensive or minimal, and in which particular resource categories. As implied in the mode issue discussion, if
two deciders are otherwise equivalent, it clearly makes sense to say that the one who routinely expends fewer resources is more expert. As also suggested in that previous discussion, one means for minimizing decision-making costs — as yet unstudied systematically — is deliberate, strategic reliance on “cheap” modes such as rule-based and intuitive decision making.

Conceivably, deciders who require little time to decide do so because decision chores demand little of the mental resources they have available, compared to what others bring to the table. Such a possibility has been given little credence in view of results like those of Chase and Simon (1973), who compared the memory performance of chess masters and less-expert players. There was no indication that masters had generally superior pure memory skills. Instead, the inference drawn from such work is that experts are especially good at organizing or “chunking” pertinent information, which can facilitate effective memory performance in appropriate circumstances. Results like these as well as more recent research on the long-term working-memory concept (Ericsson & Kintsch, 1995) suggest a minimal role for capacity variations in explaining expertise, decision making and otherwise. But other research has been more favorable to the capacity view, finding reliable connections between performance on decision-related tasks, on the one hand, and measures of working-memory capacity (Dougherty & Hunter, 2003) and general cognitive facility (West & Stanovich, 2003), on the other.

**Issue 4 — Options:** “What are the different actions we could potentially take to deal with this problem we have?” If a decider never recognizes a certain alternative, then clearly the decider cannot commit to that alternative. Thus, the leaders of Ace Products cannot choose to market — or not market — Product C if that prospect never reaches their attention. The options issue is about how people come to “see,” if not create, prospective solutions to their decision problems. It is essential to recognize that expert management of the options issue is not about increasing the number of alternatives considered, a false assumption that many people make. The ideal “option consideration set” for a given problem consists of only a single alternative — the best one. Recognizing others is wasteful, requiring the decider to expend precious resources vetting alternatives that ultimately will (or should) be rejected. But recent work has demonstrated that the deliberation of large consideration sets can do more than simply waste time. It can also exact significant psychological costs, such as turmoil over the possibility of failing to pick the very best alternative (e.g., Schwartz et al., 2002).

There has been surprisingly little research that directly implicates expertise with respect to the options issue. One of the few decision articles on the subject was by Dougherty and Hunter (2003), who found that working-memory capacity was reliably related to the number of alternatives individuals could recall in a laboratory decision task. The creativity literature is the major non-decision literature most directly relevant to option-issue expertise since, by definition, highly creative individuals are especially good at crafting new and useful alternatives. Assuming their validity, creativity measures should be helpful in identifying this particular variety of decision-making expertise. So should measures of personality characteristics, such as openness to experience, that have been shown to be associated with creativity (e.g., Wolfradt & Pretz, 2001). Unfortunately, there is little in the literature immediately informative on the explanation and development expertise questions, for example, about where creativity originates, how creative people go about their work, or how their practices can be cultivated in others. Nevertheless, some possibilities seem implicit in other research. For instance, numerous studies have shown that creativity is enhanced by positive emotion (Fredrickson, 1998). This suggests that creative individuals might achieve some of their advantage by strategically arranging their work environments to exploit phenomena such as the creativity-emotion linkage.
**Issue 5 – Possibilities:** “What are the various things that could potentially happen if we took that action – things they care about?” This issue implicates another form of blindsiding, well illustrated by an actual case involving a popular assistant school superintendent. Only by accident was she discovered to have falsified her credentials (including degrees) when she was hired years earlier. The officials responsible for her appointment were stunned, saying things like: “It simply never occurred to us that she might not be who she said she was.” More generally, the possibilities issue is about recognizing outcomes of prospective actions that are capable of occurring and which, if they did, would matter greatly. Note that the concern is not with whether those outcomes would occur, only whether they could. Thus, in the superintendent case, if the mere possibility of false credentials had come to mind, the deciders might well have made routine checks that would have precluded an embarrassing appointment.

Clearly, a truly expert decider would be good at anticipating possibilities. Yet, the possibilities issue as such has gone largely untouched in decision research. Nevertheless, work framed in other ways arguably has implications for it. This includes research demonstrating people’s difficulty even imagining the sometimes bizarre behaviors of common real-life nonlinear systems (Sterman, 2002). It also includes scholarship on stress. Numerous studies have shown that acute stress narrows the scope of attention. Thus, stress should induce the neglect of possibilities. But a decider who is stress resistant should be immune to such effects. This suggests that stress resistance should facilitate the handling of the possibilities issue and, thus, decision-making expertise, particularly in high-stress environments. There have been no direct tests of this proposition yet. But there are data consistent with it, such as indications that individuals who self-select and succeed in becoming air traffic controllers tend to be more stress resistant than other people (see the review by Yates, Klatzky, & Young, 1995).

**Issue 6 – Judgment:** “Which of the things that they care about actually would happen if we took that action?” Usually, this issue logically and temporally follows the possibilities issue. After the decider recognizes (accurately or otherwise) that some decision-relevant event can happen, the next task is judging whether it would happen. A “judgment” is an opinion as to what was, is, or will be the state of some decision-relevant aspect of the world. Accordingly, a judgment is “accurate” to the degree that there is a correspondence between that judgment and the actual pertinent state. Clearly, judgments and decisions are distinct, but equally clearly, judgment accuracy imposes an upper bound on decision quality. Many considerations go into crafting a bid on a business contract. But the eventual deal cannot possibly be fully satisfactory if it is predicated on false expectations about what the other party would do during the contract’s life.

Much research that has been described as concerning decision making has really been about judgment. Consider, for instance, Shanteau’s (1992) remarks on the “good decision performance” of weather forecasters, who actually make predictions of weather events rather than make decisions predicated on such predictions. Making the judgment-versus-decision distinction is useful for several reasons, including the fact that decision problems demand the consideration of much more than judgment problems. At the same time, however, as we shall see, judgments of various kinds assume roles in the resolution of several other cardinal decision issues beyond the judgment issue per se.

Partly because its adequacy is often easy to evaluate and analyze, judgment is the aspect of decision behavior that has been studied more extensively than any other. And the most consistent expertise conclusion has been this: Subject matter experts often exhibit much worse judgment accuracy than most people expect. Meehl (1959), for instance, found that clinical psychologists’ diagnoses based on MMPI scores were less accurate than those derived from simple linear combinations of those scores. There have been many similar demonstrations since
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then. One of the most recent was Önkal-Atay, Yates, Şimge-Mugan, and Özlin's (2003) finding that, although professionals were generally more accurate at predicting foreign exchange rates than amateurs, in many individual comparisons, the opposite was true.

Several contributors to such occurrences have been hypothesized and, in some cases, documented. Some amount to artifacts of the testing conditions, for example, as in studies showing that auditors are minimally susceptible to known biases when making judgments in familiar professional contexts (Smith & Kida, 1991). Other contributors are apparently "real," including the fact that humans, unlike computers, necessarily cannot perfectly reliably execute any intended judgment policy (e.g., Dawes & Corrigan, 1974). An especially powerful contributor seems to lie in the very character of human judgment. Yates (1990) observed that there are two classes of judgment processes, formalistic and substantive. Formalistic procedures are similar to the application of rules such as those in probability theory or regression analysis. Significantly, such rules are indifferent to the content of judgment problems. Quite the opposite is true of substantive procedures, which entail the person attempting to envision how "nature" literally would (or would not) create the event in question. Pennington and Hastie's (1988) story model of juror decision making is a good illustration. In that model, jurors judge the likelihood of a defendant's guilt by how easily evidence fits into a narrative whereby the defendant committed the crime in question. The mental simulation process in Klein's (1993) RPD model is another illustrative substantive procedure. There are many indications in the literature that, as Yates (1990, pp. 209–210) argued, people resort to formalistic procedures only when they cannot use substantive ones, which are much more natural.

By definition, subject-matter experts know more than other people about the substance of a given area. This implies that they are also especially likely to apply substantive procedures when arriving at their judgments. Johnson's (1988) protocol data provide direct evidence for this expectation. Substantive procedures are a powerful but risky tool. The character of people's personal theories about how events (e.g., criminal acts) literally occur has little if any place for uncertainty, which should encourage overconfidence. Such theories also tend to be convoluted, since they seek to account for every local nuance in the abundant and interpretable information experts see. As Camerer and Johnson (1991) argued, this feature should manifest itself in configurality equivalent to interaction terms in statistical models, terms that tend to be unpredictable. This can actually harm the accuracy of experts' judgments by making them "noisy," laden with what amounts to random error, a phenomenon observed by Yates, McDaniel, and Brown (1991) in securities forecasting. A significant challenge for future research is the development of human-device systems that take effective account of the documented peculiarities as well as the complementary strengths of human experts and judgment algorithms.

Issue 7 - Value: "How much would they really care - positively or negatively - if that in fact happened?" The value issue is a special case of the judgment issue, albeit an exceptionally important special case. That is because it centers on what makes decision problems so distinctive and difficult - individual differences in what people like and dislike. In order for a decider to pursue actions that promise outcomes that the intended beneficiaries find satisfying - the goal of any decision-making effort - the decider must know those persons' tastes. That is, an expert decider must be outstanding at making judgments for which the target is how people feel about things. For instance, an expert designer, buyer, or casting director must be excellent at anticipating how much the typical potential customer would like or dislike any given "product."

There is extraordinary interest in the value issue these days in decision research, under the rubric of hedonic forecasting. Specifically, the concern is with the consistent errors people tend to make when trying
to predict their own feelings about future occurrences, for example, winning a lottery, suffering paraplegia, or getting promoted (Loewenstein & Schakade, 1999). Unfortunately, there has been much less interest and systematic study of expertise in anticipating people's values, particularly other people's values. Nevertheless, work to date suggests that subject-matter experts are not always as good at the value issue as one might expect or hope. Consider the study by Wilson et al. (1997), involving interns and attending physicians caring for elderly patients. Only 4% of the interns knew their patients more than seven days, whereas almost half the attending physicians had known their patients more than six months. Nevertheless, the attending physicians (despite their confidence) were no more accurate than the interns at predicting patients' preferences for end-of-life care (e.g., lifelong tube feeding). Determining why accuracy sometimes fails to improve with experience is an important task on the research agenda. Part of the problem is likely to reside in the lack of attention and feedback.

**Issue 8 - Tradeoffs:** "All of our prospective actions have both strengths and weaknesses. So how should we make the tradeoffs that are required to settle on the action we will actually pursue?" This issue concerns the fact that in virtually all decision situations, deciders eventually arrive at this reality: Every alternative has drawbacks. Investing a company's funds in a new, untested product could provide unprecedented profits. On the other hand, it could also push the company into bankruptcy. To reach a decision, the company's leaders must trade off the prospect of great profit against the risk of ruin. Mainstream decision scholarship historically has been preoccupied with the tradeoffs issue. Expected utility theory, the undisputed point of reference for the field, is at heart about the trading off of outcome value and uncertainty (Yates, 1990, Chapter 9). Multiatribute utility theory and its variants seek to explain or guide the trading off of values for some outcomes against those for others (Keeney & Raiffa, 1976). And the discounted cash-flow rules at the core of so many finance tools prescribe how to trade off outcome value against time (Higgins, 1998).

Behavioral decision research has been dominated by questions about deviations of people's actual decision behavior from what is predicted or prescribed by rules like the expected utility, additive utility, and discounting models. It is therefore perhaps surprising that there is virtually no literature on individual differences in adherence to those standards. And, accordingly, there has been virtually no discussion of expertise with respect to tradeoffs. This probably reflects an overly narrow conception of how deciders tend to deal with tradeoffs in real life. The dominant models just described presume a static, "pick among these" stance by the decider. Yet, there is evidence that a major tactic deciders use is, in effect, transforming tradeoffs problems into options problems (cf. Shafir, Simonson, & Tversky, 1993). Specifically, deciders sometimes seek to avoid having to make an onerous tradeoff altogether by finding or creating a new alternative that makes it unnecessary. Thus, instead of simply choosing between putting a new, untested product on the market and forgetting about it, a company's deciders might seek other alternatives, such as sharing the product's risk with a partner. Indeed, this approach seemed quite evident to Shapira (1995) in his study of risk taking among top executives. The executives appeared to believe that a major feature of managerial expertise was the ability to restructure risky alternatives such that they were less hazardous to one's company.

**Issue 9 - Acceptability:** "How can we get them to agree to this decision and this decision procedure?" In perhaps most of the situations where decision-making expertise matters, the decider is not a free agent. Instead, the decider must contend with the sentiments of many different people concerning two things, what is decided as well as how it is decided, the province of the acceptability issue.

Negotiations are the most familiar context where the acceptability issue figures significantly. Unless both parties accept a given proposal, there is no deal. Many
Deals fall through not only or even mainly because of the material aspects of a proposal but because of the character of the deliberations (e.g., the parties’ perceptions of one another’s integrity or respectfulness). Negotiation research and teaching are vibrant enterprises these days (cf. Thompson & Leonardelli, 2004). This is likely tied to the immediacy, transparency, and obvious importance of negotiator effectiveness. As soon as a negotiation is over, each party seems clearly better or worse off than before, and apparently because of the negotiators’ skills or lack thereof. We are unaware of extensive research on negotiator expertise per se. But there are certainly popular assumptions that some negotiators (e.g., those entrusted with negotiating hostage releases) are more expert than others. And there is considerable work pointing toward negotiator behaviors or characteristics associated with their effectiveness and hence expertise, for example, their creativity (Kurtzberg, 1998).

The acceptability issue assumes significance beyond the realm of formal negotiations. Striking illustrations have played themselves out in courtrooms. American automakers have lost several major lawsuits because they mishandled the acceptability issue in design decisions. In one prominent case, jurors were repelled by testimony that the decision to limit costs on certain features rested partly on a decision analysis in which a dollar figure (based on actuarial records) was attached to lives that might be lost in accidents linked to those features. The jurors responded by forcing the company to pay billions in punitive damages (Fix, 1999). Such examples dramatically demonstrate the importance of expertise with respect to the acceptability issue. Unfortunately, there appear to have been no systematic efforts to identify and understand such expertise.

**Issue 10 – Implementation:** “That’s what we decided to do. Now, how can we get it done, or can we get it done, after all?” This final cardinal issue arises in decision situations where the selected alternative entails a nontrivial “project” that must be executed as opposed to a single action that is virtually synonymous with the decision itself (e.g., purchasing a shirt). What sometimes occurs is that the project proves to be difficult or even impossible to actually perform. A good example is a company that agrees to generous pension payments to its workers but ultimately discovers, years later, that it cannot afford those payments.

Disasters with respect to the implementation issue generally result from the mishandling of one or more of the other cardinal issues. For instance, in the pension illustration, the deciders plausibly did a poor job with the judgment and options issues, failing to anticipate increased employee longevity or to create contract options containing contingencies that take such increases into account. There has been little systematic research aimed at understanding how people, experts or otherwise, address the implementation issue, although this is changing (e.g., Dholakia & Bagozzi, 2002). But arguably relevant scholarship framed differently has existed for some time. This includes work highlighting cultural differences in priorities assigned to the issue. For instance, numerous Japanese businesses appear to have deliberately chosen to emphasize ease of decision implementation over decision-making speed (cf. Liker, 2004).

**Closing Remarks**

This review, built on the component analysis afforded by the cardinal issue perspective, has cited numerous results suggesting specific behaviors that plausibly contribute to decision-making expertise. Nevertheless, the review has also made it painfully obvious how much remains unknown about such behaviors. It also made clear how difficult it would be for any one person to consistently demonstrate excellence in resolving every one of the cardinal issues for any class of decision problem. This makes one suspect that true, across-the-board decision-making expertise is exceedingly rare. Yet, the present analysis is optimistic in that it points
toward concrete and manageable questions for future fundamental as well as developmental research, including efforts to create collectives and human-device systems that decide with undeniable proficiency.

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Footnote

1. Confusingly, the term "judgment" is sometimes applied to evaluation decisions in the literature, as when authors distinguish "judgment" and "choice" (e.g., Montgomery, Selart, Gärling, & Lindberg, 1994). The present use of the expression is older, more firmly established, and hence preferred.

References


