Assessing Adolescent Decision-Making Competence

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Abstract

Behavioral decision research offers a general approach to studying cognitive aspects of decision making, as well as a platform for studying their interplay with social and affective processes. Applied to any decision, behavioral decision research involves three interrelated tasks: (a) *normative* analysis, identifying the expected impacts of possible choices; (b) *descriptive* study, characterizing how individuals view the decision, in terms comparable to the normative analysis; and (c) *prescriptive* interventions, helping people to bridge critical gaps in their understanding. Applied to adolescents' decisions, behavioral decision research provides analytical and empirical procedures for clarifying the challenges that young people face and their success in addressing them. It recognizes that competence varies by individual and by decision, leading to domain-specific policies and interventions, affording teens as much autonomy as they can manage.

Assessing Adolescent Decision-Making Competence

High stakes ride on society's ability to assess adolescents' decision-making competence [Fischhoff 2008]. If that competence is overestimated, then teens will face choices that are too difficult for them. If it is underestimated, then they will be kept from exercising warranted independence. If teens believe that the boundaries of their autonomy have been drawn wrongly, then they may feel unfairly restricted or unfairly left to fend for themselves.

Behavioral decision research offers a framework for studying decision-making competence, including methods for assessing it, theories for predicting it, and interventions for improving it [Fischhoff 2010; Fischhoff & Kadvany 2011; Hastie & Dawes 2002; Kahneman 2011; vonWinterfeldt & Edwards 1986; Yates 1989]. Behavioral decision research recognizes both individual and situational variability. A given decision might be harder for some people than for others. A given individual might find some decisions harder than others. That variability poses a challenge to teens, who must identify their personal "envelope of competence," circumscribing the decisions that they know how to make. It poses a challenge to adults, who must find the balance between affording teens too much freedom and too little.

Behavioral decision research cannot resolve such policy questions. It cannot say, for example, whether teens can make decisions about interpersonal violence well enough to be adjudicated as adults nor whether teens can make decisions about interpersonal intimacy well enough to assume control of various reproductive decisions. What the research can do is assess how likely teens are to make choices of varying soundness. Whether the benefits of autonomous decision making outweigh its risks is a political-ethical question, not a scientific one. What

research can do is to clarify the expected costs and benefits of letting teens make various choices.

A Normative Standard

Behavioral decision research's starting point is a *normative* analysis, describing a decision precisely enough to identify the choice that a *rational* actor would make. In this usage, "normative" refers to the procedural norms embodied in the axioms of decision theory. A famous mathematical proof showed that following these seemingly simple rules (e.g., transitivity) leads to choosing the option with the highest expected utility, given an individual's beliefs and values [vonNeumann & Morgenstern 1947]. Plous [1993] provides a brief introduction; Hastie & Dawes [2002], vonWinterfeldt & Edwards [1986], and Yates [1989] provide fuller ones.

From this perspective, *social norms* are among the things that people might value. A rational choice might reflect just social norms, if people care solely about what other people value. A rational choice might also let social norms be overridden by other concerns or balance conflicting social norms (e.g., those of peers and parents).

Behavioral decision research does not assume that people are rational. Nor does it assume that people must follow (or even know) the axioms, in order to make rational choices. Some decisions are easy enough that even casual analysis leads to the rational choice; some good choices are learned by trial and error. Nor does behavioral decision research assume that people always want to make rational choices. People may prefer to follow their emotions or inviolate moral principles. Nor does behavioral decision research assume that rational choices will also be *optimal* ones, in the sense of making the greatest expected contribution to people's wellbeing. If people misunderstand their circumstances or themselves, rational choices may not bring the best outcomes.

Normative analysis plays several roles in behavioral decision research. One is facilitating a precise definition of each decision, against which people's performance can be compared. That means identifying people's goals, their options for achieving those goals, and the events that determine the chances of each goal being achieved by each option.

A second role of normative analysis is organizing evidence. Any issue that decision makers might consider must find its way into the normative analysis. It must affect either the definitions of the choice options, the valuation of potential outcomes, or the probabilities of experiencing those outcomes.

The third role of normative analysis is keeping researchers from focusing too narrowly. For example, researchers concerned about a risk behavior (e.g., unprotected sex) naturally see its link to health risks (e.g., sexually transmitted infections), but might neglect teens' other goals (e.g., showing trust in a partner) or obstacles (e.g., sexual coercion). Normative analysis requires a comprehensive view.

Sometimes, quantitative normative analyses are needed (e.g., for assessing the impact of underestimating condom effectiveness by 10%). Often, though, qualitative analysis is enough to clarify the decision's structure, identify its critical beliefs and values, and suggest potential problems or interventions [Fischhoff 2005a; Fischhoff et al. 2006]. Once completed, the normative analysis structures the next steps in behavioral decision research: *descriptive* research, empirically assessing individuals' competence to make the choice, and *prescriptive* interventions,

attempting to increase that competence, by closing critical gaps between the normative ideal and the descriptive reality. The next sections consider research on three competencies: assessing beliefs, assessing values, and integrating beliefs and values.

Assessing Beliefs

When outcomes are certain, decision making is just about values: identifying the most attractive set of outcomes. When outcomes are uncertain, decision makers must predict the outcomes of possible actions. In order to be meaningful, those predictions must be sufficiently precise to be evaluated in the light of experience. That requires a clear description of the event being predicted [Beyth-Marom & Fischhoff 1997] and a numeric probability of its occurring.

Although people use verbal quantifiers (e.g., likely, rarely), in everyday speech, their meaning can vary widely across people and situations [Budescu & Wallsten 1995; Schwarz 1999]. Thus, "likely drug side effect" may connote a different probability than "likely Stanley Cup winner." Although eliciting numeric values solves this problem, some researchers believe that it is too demanding for respondents. However, even imperfect measures can be useful, if their strengths and weaknesses are understood. Fortunately, the research on probability elicitation is very extensive, providing guidance on responsible usage [O'Hagan et al. 2006]. Results include:

a) Numeric probability judgments can be as reliable and acceptable as verbal ones. Woloshin et al. [1998] found this pattern when comparing judgments of medical events, elicited with two verbal scales and two numeric scales, each of which had equally spaced options from 0% to 100%, with one expanding the 0-1% range with log values from 1/100 to 1/1,000,000 (under a cartoon magnifying glass).
b) People often prefer to provide verbal judgments, but to receive quantitative ones. Receiving quantitative estimates provides useful information, while producing them requires greater effort and accountability [Erev & Cohen 1990].
c) Absolute values of numeric judgments can vary widely with response mode, while relative values are fairly invariant. For example, absolute values have been found to vary when using odds or probabilities, probabilities or relative frequencies, and individual items or grouped ones [Gilovich et al. 2003; Poulton 1994].
d) Some numeric values are treated specially. For example, people seldom use fractional values [Poulton 1989], a pattern that motivated the log part of Woloshin et al.'s log-linear scale. When uncertain what to say, people sometimes say "50" in the sense of "50-50," a vague, non-zero value, rather than a specific numeric probability [Bruine de Bruin et al. 2000].
e) Probability judgments can be deliberately biased, unless honest responses are requested and rewarded. For example, Christensen-Szalanski and Bushyhead [1993] found physicians overestimating the probability of pneumonia, fearing that low-probability cases would be ignored. Forecasters sometimes overstate precipitation probabilities, in order to reduce users' chance of being caught in the rain [Lichtenstein et al. 1982].
f) Probability judgments for knowing the answer to a question are modestly correlated with the probability of being correct [Lichtenstein et al. 1982; Yates 1989].

g) People differ in their ability to use probabilities, an ability that correlates with performance on other tasks and with life events that might reflect decision-making competence [Parker & Fischhoff 2005; Table 4 below; Bruine de Bruin et al. 2007].

Like much psychological research, these studies mostly involve people of at least college age. Jacobs and Klaczynski [2005] offer a collection of articles regarding developmental differences in decision-making processes, while Furby & Beyth-Marom [1992] and Reyna & Farley [2006] offer integrative essays. Perhaps a fair summary of the research is that, by mid adolescence, most individuals have approximately adults' imperfect cognitive skills. Of course, having skills is necessary, but not sufficient for relying on them. Nor does it guarantee having the domain-specific knowledge needed to make informed choices [Fischhoff 2008].

Fischhoff et al. [2000] analyzed the construct validity of numeric probability judgments made by a nationally representative sample of 15 and 16-years olds, in the 1997 National Longitudinal Study of Youth (NLSY97). The analyses found, among other things, that teens use the full range of probability values, almost always give 100% for eating pizza in the next year (on a warm-up question), show no individual-difference tendency to give high or low values, and sometimes seem to say "50" in the "50-50" sense. These teens' probability judgments correlate sensibly with their answers to related questions on other NLSY97 modules (created by other researchers). For example, females who reported being sexually active also gave higher probabilities for getting pregnant in the next year and for having a baby by age 20; males showed similar correlations for making someone pregnant and for becoming a father. Teens reporting neighborhood gang activity gave higher probabilities for being arrested in the next year and for dying in the next year or by age 20. Thus, these teens seemed both sensitive to factors affecting their futures and able to express that knowledge in numeric probabilities.

The greater one's faith in a research method, the more seriously one can take the data it produces. For example, the log-linear scale that Woloshin et al. [1998] evaluated was first used by Quadrel et al. [1993], in a study whose results challenged the conventional wisdom that adolescents have a unique sense of invulnerability. Recognizing the extra burden borne by methods producing unexpected results, Quadrel et al. [1993] examined some aspects of construct validity, finding sensible (and similar) usage by teens and adults. Confidence in their results is strengthened by Woloshin et al.'s study and by studies using other methods that also found no unique teen sense of invulnerability [Millstein & Halpern-Felsher 2002].

That confidence is also strengthened by the NLSY97 finding that adolescents exaggerate their probability of dying soon. This extreme expression of vulnerability appears in the final two rows of Table 1, which shows the 12 NLSY97 questions whose predictive validity could be evaluated, with data from subsequent waves. Teens' median mortality judgments were 10%, for events with a tiny statistical probability (0.08%/year). Mean judgments were higher (about 20%), "inflated" by many 50s, some apparently expressing epistemic uncertainty, rather than numeric probabilities. Although non-numeric 50s are inappropriate responses, they still provide insight into teens' thinking, meaning perhaps, "I don't know if I'll live or die" or "I don't want to think about it."

Table 1's other rows show that teens' probability judgments are significantly correlated with these events' probabilities of occurring, as revealed in subsequent waves of the survey (e.g., teens who gave a higher probability for being in regular school a year hence were also

more likely to be there). Teens' mean probability judgment sometimes approximates the observed rate (row 2), sometimes is optimistic (rows 1, 3, 4), sometimes is pessimistic (rows 9, 10), and sometimes has an unclear bias, depending on what teens value (rows 5-8). Because Table 1's occurrence rates reflect self-reports, teens' probability judgments are evaluated in terms of how they interpreted the events.

Table 1 evaluates teens' probability judgments in terms of *correspondence* tests, comparing them to *external* real-world events. Those judgments can be also subjected to *coherence* tests, examining their *internal* consistency, as defined by probability theory [Fischhoff & Beyth-Marom 1983]. Coherence tests include whether the probabilities assigned to an event and its complement sum to 1.0 and whether the probability for an event is strictly greater than that for a subset. Teens' probability judgments often show coherence [Parker & Fischhoff 2005], but not with Table 1's mortality judgments. There, most teens gave the same probability for dying in the next year and by age 20 (a period of 4.5 years, on average). When the two values differed, one third of teens gave a *lower* probability to the longer period [Fischhoff et al. 2000]. Thus, mortality judgments are anomalous in both correspondence and coherence terms, suggesting that many teens lack the competence here that they show for other probability judgments.

Table 1. Predictive validity and accuracy of adolescents' expectations in NLSY97.

What is the percent chance that you will..	N	Correlation (γ) with outcome	Mean response (1997)	Observed outcome rate
1. Be a student in a regular school a year from now?	3160	.64***	92.5%	79.6%
2. Have received a high school diploma by the time you turn 20?	3077	.60***	94.5%	92.0%
3. If you are in school a year from now, … work for pay more than 20 hours a week?	2492	.29***	57.7%	27.2%
4. If you are not in school a year from now, … work for pay more than 20 hours a week?	610	.31***	80.5%	43.9%
5. Become pregnant within 1 year from now? (female)	844	.37***	8.9%	20.1%
6. Get someone pregnant within the next year? (male)	1553	.35***	9.4%	7.9%
7. Become the parent of a baby sometime between now and when you turn 20? (female)	1368	.38***	16.0%	25.7%

Table 1 (contd.)

What is the percent chance that you will..	N	Correlation (γ) with outcome	Mean response (1997)	Observed outcome rate
8. Become the parent of a baby sometime between now and when you turn 20? (male)	1356	.27***	19.1%	13.4%
9. Be arrested, whether rightly or wrongly, at least once in the next year?	3141	.41***	10.3%	8.2%
10. Serve time in jail or prison between now and when you turn 20?	3300	.39***	5.4%	2.8%
11. Die from any cause (crime, illness, accident, and so on) in the next year?	3165	n.s.	18.7%	0.1%
12. Die from any cause (crime, illness, accident, and so on) between now and when you turn 20?	3169	n.s.	20.3%	0.5%

*** p<.001; n.s.=not significant

Source: Fischhoff et al. (2010) Note: Complex skip patterns account for the different Ns.

Assessing Values

Behavioral decision research has two complementary approaches to assessing the values that individuals hope to realize when making decisions [Fischhoff 1991, 2005a; Lichtenstein & Slovic 2006]. One approach, rooted in psychophysics, assumes that people know roughly what they want, regarding any question put to them. The second approach, rooted in decision analysis, assumes that people may lack that knowledge, forcing them to derive specific preferences from potentially relevant basic values.

When people have well-articulated preferences, the two approaches converge. People know what they want and express those desires, whenever they are asked clear questions. The approaches diverge, when people lack stable preferences. Perhaps they have not given the topic much thought; perhaps they cannot reconcile conflicting values. In such cases, they don't know what they want, leaving them looking for clues and susceptible to manipulation by how questions are posed. As a result, their expressed values are *labile*, subject to *framing* or *context* effects [Fischhoff 2005a; Kahneman & Tversky 2000; Lichtenstein & Slovic 2006; Schwarz 1999].

As an extreme example, consider someone diagnosed with a brain tumor, who must choose between palliative care and aggressive treatment that is equally likely to lengthen or shorten her life. Over time, she might derive specific preferences from her basic values. Or, she might never know what tradeoffs to make between pain and hope. Or, she might shift between positions, depending on how she feels at the moment. In such cases, the psychophysics approach to eliciting values makes little sense. Why ask people what they want, when they don't know?

The alternative value elicitation approach, that of decision analysis, seeks to help people reflect on what they might want [vonWinterfeldt & Edwards 1986], by presenting a balanced set of potentially relevant perspectives, as identified in the normative analysis. When successful, decision analytic value elicitation deepens people's understanding. However, it can also bias their thinking, if the set of perspectives is not systematically developed and fairly presented [Fischhoff 1991]. Related procedures, facing similar risks, include motivational interviews [Rollnick & Miller 1995] and deliberative polling [Fishkin 1997]. Both methods also have prescriptive goals: the former hopes that individual reflection will uncover a latent desire for healthy change; the latter hopes that group reflection will uncover latent agreement about public policies.

The values elicited by decision analysis approaches should predict the ones that people express in their lives, when those lives present similarly balanced perspectives. Psychophysics approaches should predict real-life behavior, when lives present the same incomplete set of perspectives as the research question. Comparing the perspectives presented by researchers and by life means looking for regularities, such as how young men shape the values salient to young women in sexual situations, how young men shape the values salient to other young men in conflict situations, and how advertisers shape the values salient to as many people as they can. Some regularities occur naturally; others come from training that makes specific values salient. Pledges (for abstinence, diet, non-violence, etc.) attempt to do that, by making internal cues stronger than external ones.

Value judgments are subject to the same two kinds of performance standard as probability judgments. *Correspondence* tests ask whether people accept externally prescribed values, such as social norms. *Coherence* tests ask whether people's values are internally consistent, across

choices. If a value represents an unambiguous, inviolate principle, then the two tests converge. For example, people opposed to abortion should condemn it in all cases. In more complex situations, though, the tests require normative analyses, showing the roles that specific values play in specific choices. For example, the importance of any value depends on how the decision options vary in that respect. For example, it is not inconsistent to pay attention to money when the options have different monetary outcomes, but to ignore money when the options have similar monetary outcomes. Conversely, ignoring money in the latter case would not represent anti-materialist virtue.

Asking people about specific values can present cognitively challenging tasks, just like asking about specific probabilities. Some of the most demanding tasks ask for values needed by regulatory analyses, such as pricing health services [Tengs & Wallace 2000] or environmental damages [Mitchell & Carson 1989]. For example, "Would you be willing to pay $10/month for a special treatment that would relieve the breathing difficulty due to low level ozone from emissions?") The debate over these tasks raises essential questions regarding the nature of value elicitation [Fischhoff & Manski 1999].

Although teens rarely participate in policy-related studies, they are often asked questions analogous to one policy concern: How much to discount future outcomes. Economists ask questions like, "How many dollars would you need one year from now, in order to forgo $100 today?" They would like to use the discount rates implied by the answers in cost-benefit analyses. Unfortunately, those answers vary widely.

Frederick et al. [2002] argued that this variation reflects not just differences in how people value future outcomes, but also differences in how they interpret the questions. Although superficially simple, such questions leave potentially critical details unstated. As a result, respondents must read between the lines in order to complete the task. If they make different inferences about missing details, then they are answering different questions.

Frederick et al. proposed that how people value a future outcome could depend on the seven factors in Table 2. The first is how much they care about the future per se (the usual notion of temporal discounting). Subsequent rows capture other possible reasons for caring less about future outcomes: (2) People are uncertain about getting those outcomes (e.g., because they will have died). (3) People expect the outcome to be worse for reasons not in the description (e.g., the promised produce will be more poorly manufactured). (4) People expect to change in ways that diminish how much they will enjoy the outcome (e.g., losing their sweet tooth). (5) People see a psychological cost to waiting. (6) People will have less time to reminisce about the outcome after getting it. (7) People expect their other assets to change in ways that reduce the outcome's values (e.g., already having similar goods).

Analogous issues could arise when teens consider the relative value of, say, smoking today and enjoying better future health. Teens might care less about their future selves (row 1). However, they also might not expect to live that long, for reasons unrelated to smoking (row 2). Or, teens may expect a future world so degraded that all pleasures are diminished (row 3). And so on. Existing research provides a priori grounds for evaluating these options. For example, exaggerated mortality judgments (Table 1) lend credibility to row 2's concerns. However, without well-specified tasks, teens' values can be misunderstood, such as thinking that teens do not care about the future, when they actually do not expect to live to enjoy it.

Table 2 Possible Reasons for Evaluating Goods Differently at Different Times

MODEL	CORRESPONDING DESCRIPTION IN WORDS
DU (time preference only)	Future utility should be discounted because we should care about the later parts of our life (for some, unexplained reason)
DU + probability	Future utility should be weighted by the probability that the consequence that gives rise to the utility will actually occur
DU + changes in objective consequence	The objective properties of some coarsely defined consequence may depend on the time at which it occurs
DU + changes in utility function	The subjective utility associated with a particular objective consequence may change over time
DU + utility from anticipation	The utility at a given moment may be influenced by the anticipation of future utility.
DU + utility from memory	The utility at a given moment may be influenced by the recollection of past utility.
DU + opportunity cost	Utility depends on the current consumption level, and the potential consumption level depends on current income & past investment.

Source: Frederick, Loewenstein & O'Donoghue (2002).

Assessing Decision-Making Processes

Experimental researchers have shown great ingenuity in creating tasks that distinguish among the various rules that people might use, when integrating their beliefs and values (e.g., Weber, 1994; Yates, 1989). Real-world decisions rarely allow the control possible with these artificial tasks. Fortuitously, for predicting behavior, such control is often unnecessary. Many different simple linear (weighted-sum) models can predict many behaviors, about equally well [Goldberg 1968; Dawes & Corrigan 1974].

The model-building process is straightforward: Take variables that people consider when making a decision (or variables correlated with those variables), standardize them, give them the correct sign (indicating whether they favor a particular choice), and add. The resulting score will predict individuals' propensity to make the focal choice. Expect correlations around 0.3. Weighting the variables can sometimes improve predictions. However, robust weights are hard to find. Regression weights are often unstable because of multicollinearity. Importance weights elicited with rating scales depend on people's limited powers of introspection [Ericsson & Simon 1994]. As a result, the best research strategy may be to use unit weights (± 1). In addition to its simplicity, that strategy keeps researchers from wasting their time, fruitlessly interpreting meaningless variations in weights [Camerer 1980; Hastie & Dawes 2002].

Because of these problems with weights, simple linear models provide limited insight into decision-making processes. As a result, when behavioral decision researchers want to explain

(as opposed to predict) behavior, they typically focus on identifying choice rules that people find intuitively appealing. They are particularly interested in rules that violate the normative axioms. Such violations can be revealing about thought processes (which have survived despite being “irrational”), decision-making environments (which are forgiving of such violations), and interventions (which are needed for unforgiving environments).

As an example of such a violation, although decision theory requires evaluating all decision options, people often focus on just one. That leaves the expected outcomes of other options less clear than if they were examined equally well [Beyth-Marom et al. 1993]. A corollary bias is insensitivity to the *opportunity costs* of choosing a focal option, namely, the other ways to invest those resources. A related corollary is undue commitment to *sunk costs*, resources already invested in an option. Normatively speaking, previous investments should be ignored, when evaluating future investments. However, people are reluctant just to look ahead, especially when that means realizing losses [Arkes & Blumer 1985; Kahneman & Tversky 2000].

Table 3 shows the types of options revealed, when teens described seven recent decisions about specific topics (school, free time, clothing, friendships, health, money, and parents), two recent hard decisions and one pending hard decision. Although the descriptions were often detailed, they typically focused on statements of resolve, like "eat more healthfully" and "stop blaming others." In effect, these decisions re-evaluate a single option, chosen previously, without stating any alternative options. Explicit alternatives were also absent from the next largest category, decisions about whether to do something (e.g., smoke cigarettes). Roughly equal numbers of decisions had two distinct options (e.g., whether to go to school or hang out with friends) or a set of identifiable options (e.g., which class to take, what to wear, with whom to have lunch). Few decisions involved "designing" options (e.g., how to spend free time, what to do about having fought with a friend).

Most of these decisions involved concrete, one-time choices. The main exceptions were the recent decisions about health and money, which often involved policies of some breadth (e.g., what kind of diet or spending pattern to adopt). It is not hard to imagine general policy choices in the other areas (e.g., how to spend free time, how to manage homework, how to keep parents happy). However, teens rarely described them. Although hard decisions provide an opportunity to reflect on big issues, these teens did not report seizing it.

These patterns were echoed in another study, asking young women to describe decisions about sexual activities. Their descriptions were so narrowly focused as to be barely decisions at all. In response, Downs et al. [2004] developed an interactive DVD, hoping to reduce sexually transmitted infections (STIs) by helping young women to see that they had decisions to make. One element of that empowerment was affording cognitive mastery of the domain, by providing decision-relevant information in compact, comprehensible form. A second element was helping users identify decision-making opportunities, by interrupting video narratives in which young men pressed young women for sex, then asking users “What would you do?” A third element was eliciting cognitive rehearsal of refusal strategies, followed by an actress modeling refusal [Bandura 2000]. In a randomized control trial, the intervention outperformed an “ideal usual care” condition (with equal exposure to commercially available materials matched for topic), in terms of attitudes, knowledge, self-reported behavior, and sexual health. A replication is currently in the field, with 3000 young women receiving the intervention under normal clinical conditions.

Decision theory focuses on evaluating options and is mute regarding their creation. Indeed, it has been criticized for not empowering people to create (or demand) better options [Fischhoff 1992; O'Brien 2000]. In order to create options, people need to understand the processes that affect important outcomes. Downs et al. [2004] used a *mental models* approach to teach teens about the factors affecting STI risks, focusing on commonly misunderstood facts relevant to formulating decision options (e.g., how risks mount up through repeated exposure, how hard it is for partners to self-diagnose STIs). The mental models approach creates a formal model, summarizing the science regarding the processes shaping key outcomes. Semi-structured, open-ended interviews elicit beliefs on these topics, in their intuitive formulation. These serve as the basis for ecologically valid knowledge tests and interventions. The approach has been applied to informing decisions about many different risks [Fischhoff 2005b; Morgan et al. 2001].

Table 3 Option Structures in Teens' Open-Ended Decision Descriptions

Decision	Structure					
	To Do X	Whether To Do	Two Choices	Finite Choices	What To Do About	Missing[a]
Recent Decisions						
School	36.2%	29.0%	13.0%	13.0%	2.9%	5.8%
Free Time	31.9	18.8	17.3	20.3	4.3	7.2
Clothing	30.4	10.1	11.5	31.9	2.9	13.0
Peers	47.8	24.6	10.1	5.8	4.3	7.2
Health	55.0	20.2	1.4	2.9	2.9	17.4
Money	52.2	11.6	10.1	4.3	10.1	11.6
Parents	30.4	23.2	18.9	4.3	8.7	14.5
Hard Decisions						
First Past	39.1	33.3	20.2	-	5.8	1.4
Second Past	20.2	44.9	18.8	5.8	4.3	5.8
Current	2.9	44.9	23.2	13.0	13.0	2.9

[a]Includes cases where respondents produced no answer or an uncodable one, or where the question was not asked due to a procedural error. These three cases constituted 27%, 51%, and 21% of missing responses, respectively.
Source: Fischhoff (1996)

Cognition in Decision Making

Behavioral decision research attempts to treat cognitive aspects of decision making in a comprehensive, coherent way. Its normative analyses summarize what is known about the options, the probabilities of achieving valued outcomes, and those outcomes' relative importance. Descriptive analyses characterize decision makers' current beliefs in terms of deviations from the normative analysis. Prescriptive interventions try to bridge the gap between normative ideal and the descriptive reality.

The norms in these normative analyses are typically those of Bayesian decision theory [Edwards et al. 1963; Fischhoff & Beyth-Marom 1983]. Studies showing non-normative behavior have prompted proposals for revising decision theory, so as to fit human intuitions better, as well as proposals that respect the decision theory norms, but study when less rigorous thinking will suffice [Lopes 1987; Reyna & Farley 2006; Shafer & Tversky 1985; Simon 1957]. The *Journal of Risk and Uncertainty* is one good place to follow this work.

Getting the cognitive part right is necessary, but not sufficient, for a full account of decision making, which also must accommodate social, emotional, and developmental factors [Fischhoff et al. 1998]. Behavioral decision research asks how these factors relate to the normative analyses that define sound decision making, the descriptive accounts that evaluate people's competence, or the prescriptive interventions that try to enhance it.

Social factors fit readily into normative accounts. If people care about social norms, then the expected costs and benefits of complying with them are treated like other outcomes. If social pressures affect how an option is implemented (e.g., if friends might not let friends drive drunk), then that becomes another source of uncertainty when predicting outcomes. If social pressure becomes social coercion, then some actions might become impossible. Descriptive accounts can assess people's awareness of these social effects. Prescriptive interventions can seek to improve people's awareness or change the reality (e.g., Downs et al. 2004).

Emotional effects can also fit into normative analyses, as valued outcomes (e.g., if people want to be angry or sad or happy). They can be captured in descriptive accounts in terms of their effects on each aspect of decision making (defining options, predicting events, determining personal values, integrating beliefs and values). Prescriptive interventions can help people manage their emotions, either by pre-selecting actions (in unemotional conditions) or choosing how to feel (e.g., anger management).

Cognitive appraisal theory [Lerner & Keltner 2001] offers one such account, predicting the effects of specific emotions on specific judgments. For example, it predicts that anger encourages attributing problems to individuals (rather than to situations) and increases the perceived probability of overcoming problems. Lerner et al. [2003] and Small et al. [2006] demonstrate these effects with terror-related judgments, also finding that nationally representative samples of adults and adolescents responded similarly. Because the study elicited numeric probabilities for well-defined events, it was possible to evaluate the size of emotion effects (as well as their accuracy, given subsequent experience) [Fischhoff et al. 2005]. Over eight events, respondents in an induced anger condition were about 5% more optimistic than respondents in an induced fear condition.

The impact of an effect of that size depends on the decision. A close decision might be sensitive to a 5% shift; a more clear-cut decision might not. Some observers have argued that the close decision to go to war in Iraq was tipped by anger for some people and by fear for others. The wisdom of emotional effects depends on the validity of the cues that emotions provide (e.g., do they overcome unwanted numbing? are they manipulated by others?) [Finucane et al. 2000; Slovic et al. 2005].

Cognitions can also affect emotions. For example, teens who see a 20% chance of dying in the next year (or think 50-50) might feel frustrated enough to act out or to disassociate themselves from long-term future outcomes (as in row 2, Table 2). The article reporting these exaggerated mortality judgments concludes by speculating that teens take "risks, in part, because they underestimate what is at stake, as a result of overestimating the risk of dying. That is, they take risks not just because of an exaggerated feeling that they are not going to die, but also because of an exaggerated feeling that they are not going to live." [Fischhoff et al. 2000, p. 200].

More generally, any cognitive process that undermines effective decision making may increase the roles of social and emotional factors. For example, Table 3 shows teens considering reduced sets of options. An overly narrow focus could keep teens from identifying good choices or from finding any acceptable choices. As a result, they may drift toward points where choices must be made – perhaps into situations where social and emotional concerns overwhelm cognitive ones. The cognitive rehearsal intervention used by Downs et al. [2004] sought to help young women make decisions prior to experiencing the passion and coercion of intimate encounters.

Thus, teens competent in cognitive aspects of decision making should make better decisions, not only because they can execute those cognitive elements better, but also because cognition gets them further, when making decisions. Table 4 presents results from a study of how cognitive decision-making competencies fit into young people's lives. It shows correlations with an individual-difference measure of decision-making competence (DMC) extracted from a factor analysis of performance on eight tasks, representing basic decision-making skills (e.g., assessing probabilities, applying decision rules). Respondents were 110 18-19 year old males, who, at age 10, had entered a longitudinal study at the Center for Education and Drug Abuse Research (Ralph Tarter, PI), returning every year or two for a day or two of testing, thereby creating an extensive battery of potentially related measures. DMC scores showed good test-retest reliability, as did scores on a version adapted for adults [Bruine de Bruin et al. 2007].

The first section shows that DMC scores were correlated with standard measures of verbal and fluid intelligence (Vocabulary and ECF, respectively). The second section shows positive correlations between DMC and "constructive" cognitive styles; these correlations generally remained after partialing out the two intelligence measures, indicating that DMC is independently related to these ways of thinking about the world. The third section shows that DMC is negatively related to several important risk behaviors; again, beyond correlations with intelligence. The fourth section shows that DMC is higher for teens coming from low-risk (LAR) families, higher SES families, and more positive peer environments. (The negative correlation with social support seemed to reflect low DMC teens' more frequent gang membership). As discussed by Parker & Fischhoff [2005], these results support the construct validity of DMC as a measure of decision-making skills that both cause and reflect important aspects of teens' lives. For example, teens with higher DMC seem to come from families that might both model and reward good decision making.

Table 4: Correlations between Decision-Making Competence (DMC) and Other Variables

DMC Correlated with	Pearson r	Semi-partial Correlation, Controlling for		
		Vocabulary	ECF	Vocabulary & ECF
Cognitive ability				
Vocabulary	.50	-	.28	-
ECF	.48	.26	-	-
Overall*	p < .0001	p = .0009	p = .0008	-
Cognitive style				
Polarized thinking	-.34	-.20	-.24	-.19
Self consciousness	.20	.14[b]	.05	.11
Self monitoring	.24	.29[b]	.30[b]	.32
Behavioral coping	.32	.27[a]	.28[a]	.26
Overall	p < .0001	p < .0001	p < .0001	p < .0001
Risk behavior				
Antisocial disorders	-.19	-.18[b]	-.05	-.09
Externalizing behavior	-.32	-.28[b]	-.18	-.20
Delinquency	-.29	-.28[b]	-.18	-.21
ln(lifetime # of drinks)	-.18	-.22[b]	-.15	-.18
ln(lifetime marijuana use)	-.25	-.30[b]	-.20	-.25
ln(# times had sex)	-.24	-.30[b]	-.21	-.27
ln(# sexual partners)	-.30	-.33[b]	-.29[a]	-.31
Overall	p = .0004	p = .0002	p = .009	p = .002
Social and family influences				
Risk status (HAR=1; LAR=0)	-.35	-.27	-.23	-.21
SES	.35	.20	.21	.15
Social support	-.30	-.21	-.23	-.19
Positive peer environment	.33	.35[b]	.32[a]	.35
Overall	p = .0002	p = .002	p = .006	p = .007

** Overall p-values were computed using Strube's (1985) method for combining significance levels from non-independent hypothesis tests. All reported ps are one-sided. A conservative Bonferroni correction on the 57 tests presented here and another table showing comparable correlations with the eight individual DMC tasks converts an individual $\alpha = .05$ into $\alpha = .0009$. Approximate cutoffs for individual zero-order correlations are r = .16, p < .05; r = .22, p < .01; r = .29, p < .001. For a semi-partial correlation, approximate cutoffs are r = .18, p < .05; r = .25, p < .01; r = .32, p < .001.*

[a] *Test A rejects the one-mediator null hypothesis.*

[b] *Test B rejects the one-mediator null hypothesis.*

Abbreviations: ECF=executive cognitive function; SES=socio-economic status; HAR=high risk family; LAR=low risk family
Source: Parker & Fischhoff (2005)

Conclusion

Cognition, like emotional and social processes, is, arguably, part of most decisions and all of none. Behavioral decision research provides an integrated approach to studying cognitive aspects of decision making that also accommodates research on non-cognitive aspects. It provides ways to analyze decisions, identify potential problems, and assess the importance of those threats. Its commitment to detail should reduce the risk of simplistic diagnoses. For example, when assessing teens' impulsivity, it encourages considering all the reasons in Table 2, lest one confuse inability to exercise control and choosing to discount future options.

A question that occupies many people concerned about teens' welfare is, "Does information work?" as a way to improve teens' decision making. From a behavioral decision research perspective, there can be no simple answer. In some situations, people would not change their choices, whatever (truthful) information they received. In those cases, information has "worked," leading them to stable decisions [Reyna & Farley 2006]. Those choices might not please people who disapproved of the values that those decisions embodied; however, the problem would not be how people used information. Stable choices might not even please the people making them, if they wished that they had better options (e.g., those unable to stop smoking or escape abusive relationships).

Information interventions reveal nothing about their recipients' decision-making competence unless they address critical gaps between recipients' information priorities, as identified by normative analyses, and current beliefs, as identified by descriptive studies. Interventions also reveal little, unless performed to professional standards. That means keeping those critical facts from being buried in irrelevant information, including critical facts that recipients already know. That means taking advantage of research into how people process such information and conducting rigorous pretests [Fischhoff et al. 2011].

Unless information interventions are tested fairly, their recipients may be blamed unfairly – for ignoring messages that deserved to be ignored, because their content was irrelevant, cluttered, incomprehensible, etc. Unfairly criticizing teens' competence can unfairly undermine their social standing. For example, a pundit recently chose to spin adolescent research as proving "We're perceivers first, not deciders." [Brooks 2007] Any sweeping generalization diminishes the humanity of the individuals being depicted so formulaically. This particular generalization undermines any attempt to inform teens (e.g., sex education, over-the-counter labels on Plan B, driver education). Its acceptance would decrease the risk of holding teens responsible for decisions that they lack the competence to make, while increasing the risk of denying them choices that they could handle, were they properly informed.

If one succumbed to the temptation to make sweeping generalizations, but based them on detailed examination of specific decisions, one might conclude that teens do surprisingly well, given the difficulty of the decisions facing them (e.g., intimacy, friendship, drugs, careers, identity, money, appearance). These decisions often pose hard tradeoffs, have unpredictable effects, require mastery of unfamiliar facts, and lack trustworthy information sources. The number of poor decisions that teens make reflects not just their abilities, but also the number and nature of their challenges. Excellent third basemen still make a lot of errors at the "hot corner," relative to other field positions.

Behavioral decision research's normative, descriptive, and prescriptive research provide an integrated structure for accomplishing tasks addressed by anyone concerned about teens: identifying the critical issues in teens' choices, assessing their current understanding, and helping them do better. It takes advantage of research into cognitive decision-making processes, while clarifying their interface with affective and social processes. It encourages the nuanced assessment of competence that teens deserve.

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Questions to Consider for Discussion

1. How do we think about acceptable risks to young people, considering the need to balance their needs for growth and protection? How do we translate those standards into providing sound environments for young people?

2. How do we resist describing young people in terms of sweeping generalizations (e.g., "the adolescent brain") that undermine respect for the complexity of the situations that they face and their own decision-making processes?

3. How do we help young people to decision-making skills, along with justified feelings of self-efficacy?

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