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Risk-Taking

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A number of factors can influence an individual's propensity to take risks. In particular, developmental differences in reward sensitivity (attraction to money, food, and other rewards), self-control, and mental representation (the mental *picture* or interpretation) of choices have each been shown to explain greater susceptibility to risk-taking. *Developmental differences* refer to how people change with age from infancy to old age. This entry will explain how understanding each of these factors (and developmental trends in each of them) can help to explain changes in risk-taking that occur across the life span. This entry first defines key terms relating to risk-taking and then goes on to describe developmental trends in risk-taking and how these trends are explained by the leading psychological theories of risk-taking.

Defining Risk and Risk-Taking

There are distinctions between how laypeople describe a risk and how economists and psychologists think about risk. People who do not study risk may associate risk negatively with feelings of dread or positively by seeing it as an obstacle to overcome. Psychologists define risk-taking as engaging in behaviors that have a possible negative outcome, for example, drinking and driving, which can lead to arrest or a car accident. Economists define risk-taking as choosing options with more variance, for example, choosing to flip a coin with a 50% chance of winning US$200 (otherwise nothing) rather than accepting a sure win of US$100. The outcomes *vary* when a coin is flipped many times, but a sure thing does not vary. Psychologists and economists agree that people often take risks to obtain positive outcomes (gains) or to avoid negative outcomes (losses). Risks are not to be confused with related concepts such as *ambiguity*, an incomplete knowledge of probabilities. For gains such as winning money, most adults prefer to avoid taking a risk, and they prefer known risks over ambiguous risks, all else being equal.

The number of outcomes can influence how risky a situation is. For example, a scenario with three different potential outcomes of varying probabilities would be defined as riskier than a scenario with a 50/50 likelihood of two outcomes. Two people may behave differently in response to the same risky scenario due to a multitude of factors. Moreover, both *risk perception* and *risk preference* change across development. *Risk perception* is how people subjectively perceive the magnitude and the characteristics of a risk, whereas *reward sensitivity* refers to how attracted people are to a reward. Risk perception and reward sensitivity affect *risk preference*, the tendency to be risk-seeking (one who generally seeks out risks) or risk-averse (one who generally avoids risks).

Developmental Trends in Risk-Taking

Reward sensitivity, risk perceptions, and risk-taking preferences change across the life span. The most real-life risk-taking occurs during adolescence and young adulthood. Adolescents and young adults tend, more than do older adults or children, to engage in risky behaviors such as drug abuse, careless driving, criminal behavior, and unprotected sex. However, it is possible that adolescents simply take more risks than children due to an increased opportunity to take risks during this period rather than an increased preference for risk. Age differences in risk-taking in the laboratory and the real world do not always follow the same age pattern. One reason for this is that risk-taking in the real world is influenced by the opportunity to take risks as well as risk preferences. As children mature and enter adolescence, their actions are less likely to be supervised by parents or other caregivers, such as teachers. This autonomy coincides with increased physical and cognitive capabilities as

well as legal freedoms gained during adolescence. Because of the increased opportunity for risk in adolescence and other confounding factors influencing real-life behaviors, it is important to rely on controlled laboratory tasks and neurobiological evidence to fully understand factors influencing risk-taking across the life span.

Laboratory tasks have shown that young children, such as preschoolers, combine magnitudes and probabilities while processing risks. In fact, as early as at the age of 5, children perform crude mental estimations of the *expected value* (EV) of different choice options. These estimations are based on internal calculations of (a) the likelihood of the outcomes and (b) the magnitude of the gains and/or losses. These crude, unconscious estimates often roughly resemble the actual EVs of the choices, which are calculated by multiplying each possible outcome by the probability of that outcome occurring and adding the products. For example, imagine a scenario in which someone could either (a) win US$50 for sure or (b) take a gamble with a 50% chance of winning US$200 and a 50% chance of winning nothing. The EV of the first option would take into account the reward (US$50) and the probability (100% or 1.00) as follows: US$50 × 1.00 = US$50. Following suit, the second option would be: US$200 × .50 + US$0 × .50 = US$100, yielding a larger EV.

Children favor choices with a larger EV, although they may make mistakes in estimation, resulting in an increase in risk-taking when the EV of the risky option exceeds that of the sure option. Although adults are also more likely to choose options yielding a larger EV, they tend to trade-off rewards and probabilities in a qualitative fashion: When faced with particularly unpleasant outcomes, such as large financial losses or serious health repercussions, adults may choose options involving smaller EVs and less serious consequences. To them, the chance of experiencing a catastrophic outcome, no matter how improbable, is not worth the prospect of obtaining a larger reward. Similarly, older adults show a notable decrease in risk-taking: They often avoid taking risks, instead choosing safe options yielding a smaller EV.

One specific laboratory task that is important in understanding risk preference is the risky choice framing task. In this task, participants choose between a sure option and a gamble of equal EV, meaning the long-term average outcome of both choices are the same (e.g., gaining US$50 for sure or a 50% chance of winning US$100 and a 50% chance of winning nothing). The tasks participants are given vary superficially depending on whether they are framed as a gain or a loss. For example, in the gain frame, a participant would choose between gaining US$50 for sure and a 50% chance of gaining US$100, and in the loss frame, a participant would be given US$100 and would choose between losing US$50 for sure or a 50% chance of losing nothing. Despite these options being the same, adults change their preferences from risk aversion in the gain frame to risk-taking in the loss frame. This is known as the *standard framing effect*.

Surprisingly, children and adolescents are less susceptible to this inconsistency in preference, evidenced by smaller framing effects than adults. Children are less biased by descriptions of the same outcomes as gains versus losses. Young children treat choices involving gains and losses equivalently when weighing a safe option against a risky gamble, such as a coin flip. However, older children and adolescents react differently depending on whether they are facing potential losses or gains. Older children and adolescents sometimes favor sure losses over the possibility of losing less and high-reward gambles over guaranteed gains. For example, they favor a gamble yielding 90 prizes over a sure gain of 30 prizes. However, they are less willing to gamble for three prizes when the sure gain would fetch one prize, despite the ratio of rewards between gambles and sure gains remaining the same in both choice sets (3:1). Thus, the magnitudes of rewards matter, especially when they differ

across options by a great amount. Seeking risks to secure larger potential gains becomes less likely with maturity.

The Role of Experience

Because many real-world decisions are dynamic and involve changing information, scientists and researchers have also attempted to study how experience and feedback influence risk-taking behavior across different age groups. With the ability to learn from experience developing well into adulthood, children and younger adolescents have been shown to take comparable or higher levels of risks than older adolescents, and more risks than adults, when facing experience- or learning-based tasks: Although adults factor past knowledge about risks into their behavior, children encounter difficulties when they have to retrieve information about probabilities and outcomes from their own memory in experience-based tasks instead of description-based tasks. After encountering losses, children are less likely to change their risk-taking behavior, resulting in more disadvantageous choices.

In a similar vein, adolescents take more risks compared to younger adults when feedback for rewards or losses is immediate rather than delayed. This pattern has been explained as being due to the emotions that are elicited from receiving this feedback and the inability of adolescents, but not adults, to control such emotions. However, these results might be due to differences in memory for outcomes. Older adults' memories also differ from those of younger adults. Older adults take more risks in tasks where learning from experience should lead to participants favoring risk avoidance. Older adults also take fewer risks in experience-based tasks where learning from experience should lead to an increase in risk-seeking. Together, these results suggest that older decision makers experience a reduced learning ability, which in turn impacts their risk-taking behavior—although their underlying preferences have not changed appreciably.

Neurobiology of Risk-Taking

From a neurobiological perspective, researchers have been able to identify areas of the brain implicated in risk-taking that change with development. When compared with adults, children and adolescents have less-developed prefrontal cortices, the cortex associated with high-level information processing and cognitive control. In children, this deficit in cognitive control has been linked to difficulties making plans, pursuing long-term goals, anticipating consequences, and suppressing impulses. Although adolescents have more developed prefrontal cortices than children, systems in the brain focused on rewards, such as the dopaminergic reward system, and areas in the brain related to affective processes, such as the nucleus accumbens, mature faster than the prefrontal cortex. This creates a critical imbalance in the adolescent brain: Adolescents are less able to exhibit the necessary control needed to mitigate some of the effects that social factors (such as peer pressure), emotional factors (such as excitement), and magnitudes of rewards can have on decision processes. Other major cognitive changes seen in adolescence include the increase in inhibition and the rise and subsequent fall of sensation-seeking tendencies.

The aging brain, in turn, is characterized by marked decline both in the ventromedial prefrontal cortex (e.g., decision-making) and the hippocampus (e.g., memory) as well as in the dopaminergic pathways. As a result, the ability to learn or remember rote information from experience is lower for older adults, which can affect risk-taking. However, recent research has shown that the ability to remember the gist of experience (e.g., a surgical procedure involves a risk of death from the anesthesia) is preserved in old age in contrast to the ability to

remember verbatim details (e.g., a surgical procedure involves a 2% risk of death from the anesthesia). Although the verbatim details are a quantitative value, the gist (or bottom-line meaning) is that there is a categorical possibility of a dire result. Wiser decision-making has been linked to using gist rather than verbatim memories.

Explaining Risk-Taking Across the Life Span: Dominant Theories

Early accounts of risk-taking relied on expected utility theory, which holds that the most desirable course of action is to choose options with the highest overall expected utility—the option with the highest value to that individual—regardless of risk. Expected utility theory can explain why people who choose a sure option over a risky gamble of higher EV can be considered rational decision makers. However, expected utility theory cannot explain many of the findings in the risk-taking literature—such as the inconsistency in risk preference shown in risky choice-framing problems.

More recent theories of risk-taking build on expected utility theory in explaining risk-taking across the life span. These theories differ in their approach to understanding risk-taking—largely focusing on either social and emotional factors or cognitive factors. One theory that focuses mainly on cognitive factors is prospect theory, the theory in which outcomes in framing problems are coded as gains or losses relative to a reference point. In the gain frame, the value function is concave, and participants are more likely to choose the sure option. In the loss frame, the value function is convex, and people are more likely to choose the risky option.

One theory that focuses mainly on social and emotional factors is imbalance theory, based on a traditional dual-process approach, distinguishing between slow controlled thinking (Type 2 thinking) and fast impulsive thinking (Type 1 thinking). According to neurodevelopmental imbalance models of risk-taking, risk-taking (particularly in adolescents) is considered to be caused by hyperresponsiveness to rewards. Because the brain regions and functions that govern *hot* Type 1 thinking develop faster than *cold* Type 2 regions, adolescents have a tendency to rely on Type 1 thinking. This theory can explain the increase in real-life risk-taking that occurs in adolescents. However, these models do not fully account for all risk-taking behaviors over the life span. For example, these theories do not explain the fact that risk preferences in the framing task are more consistent in adolescents than adults. In addition, they do not explain the fact that trading off risk and reward in a quantitative way has been shown to lead to increased risk-taking in adolescence. These limitations do not mean that the theory should be discarded entirely, but that it does require modification.

Fuzzy trace theory (FTT) expands on previous theories of risk-taking, explaining the roles of *hot* and *cold* thinking but also adding an additional component—cognitive representation. FTT posits that when a person makes a decision, two forms of mental representation (gist and verbatim) will be interpreted and stored simultaneously, though separately. The gist is recognized as the qualitative, bottom-line meaning, whereas the verbatim constitutes the details. Gist is not extracted from verbatim representations—they are separate and independent ways of remembering and thinking. Reliance on gist representations is posited to be developmentally advanced and increases with age and experience. By including this additional component, FTT can explain findings that traditional dual process theories cannot. For example, FTT predicts and explains the fact that risk preferences are more consistent in adolescents than adults. Because adolescents are relying more on precise and literal verbatim thinking, we expect their risk-taking preferences to be more consistent and less influenced by context. By recognizing the role of gist representations, FTT can also explain

the fact that adolescents may appear more logical but also take more risks; specifically, adolescents take risks based on a kind of rough EV and thus many engage in a risky activity where potential benefits are high, even if serious negative consequences could occur. Adults instead rely more on gist principles such as "it only takes one instance of unprotected sex to contract HIV."

Considering both real-life risk-taking and risk-taking in laboratory tasks, theories of risk-taking make it possible to gain a better understanding of risk-taking and its development across the life span. Research has shown that a number of factors are important in explaining risk-taking across the life span, encompassing important cognitive, emotional, and social factors. Ultimately, research in risk-taking yields not only a stronger theoretical understanding of decision-making but an overall healthier approach to considering risks. Therefore, programs to help adolescents and adults make better decisions about risk have been effective when they have incorporated scientific evidence.

See also Adolescence; Adult Development; Decision-Making; Reasoning; Reward Sensitivity; Risk and Protective Factors

- risk-taking
- risk taking
- risk
- expected utility
- expected utility theory
- risk perception
- risk behaviors

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Further Readings

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