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Fuzzy Trace Theory and Medical Decisions by Minors: Differences in Reasoning between Adolescents and Adults

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Standard models of adolescent risk taking posit that the cognitive abilities of adolescents and adults are equivalent, and that increases in risk taking that occur during adolescence are the result of socioemotional differences in impulsivity, sensation seeking, and lack of self-control. Fuzzy-trace theory incorporates these socioemotional differences. However, it predicts that there are also cognitive differences between adolescents and adults, specifically that there are developmental increases in gist-based intuition that reflects understanding. Gist understanding, as opposed to verbatim-based analysis, generally has been hypothesized to have a protective effect on risk taking in adolescence. Gist understanding is also an essential element of informed consent regarding risks in medical decision-making. Evidence thus supports the argument that adolescents' status as mature minors should be treated as an exception rather than a presumption, because accuracy in verbatim analysis is not mature gist understanding. Use of the exception should be accompanied by medical experts' input on the bottom-line gist of risks involved in treatment.

Keywords: *adolescence, fuzzy-trace theory, informed decision-making, medical consent, risk communication, risk taking*

I. INTRODUCTION

The mature minor exception allows adolescents under the age of 18 to make medical decisions and consent to procedures with equivalent authority of an adult (Al-Samsam, 2008). Although this was originally conceived to

be applied in emergency situations in which parents are not available, it has evolved to represent a blanket exception for those over the age of 14, so long as the benefits outweigh the risks and the adolescent is not otherwise deemed intellectually incapable (Wilkins, 1975). This expansion of rights has been used for easier access to abortion and contraceptives without parental consent, as well as the access to treatment for sexually transmitted infections (STIs), addictions, mental health problems and prenatal care (McNamara, 1974; Pilpel, 1972). On occasion, this expanded legal standing of minors has been used to justify treatment refusal (Kuther, 2003, Derish and Heuvel, 2000).

Based on traditional considerations of parental authority over minor children, it might be presumed that parents should be involved, at least to some degree, when minors consent to treatment. However, children sometimes suffer violence from their parents for sexual transgressions, and there has been speculation that parents might have a conflict of interest in treating their children. One example of the latter concerns infertility that can result from cancer treatments: A parent may select fertility treatment on behalf of a minor child out of a perception that future childbearing should occur for the sake of the family (Nisker, Baylis, and McLeod, 2006). Regardless of conflicts of interest (which have not been demonstrated), parents' concerns are more likely to encompass long-term considerations than are adolescents', such as infertility (Reyna and Farley, 2006). That is, planning for future health and well-being are generally not as salient in the mind of the adolescent patient. Treatment decisions that entail immediately unpleasant consequences, including pain, nausea, and hair loss, are likely to be unduly weighted relative to long-term consequences. One important question, then, is whether adolescents can fully appreciate the tradeoffs between short-term unpleasant or socially embarrassing side effects as opposed to long-term health consequences and quality of life.

Consider the real-life example of an adolescent girl who was warned that drinking alcohol would reduce the potency of her chemotherapy treatment for cancer. Once in remission, she subsequently attended college, decided to drink, and her cancer recurred. Was such a risky decision to drink a rational tradeoff between immediate social benefits versus uncertain long-term health consequences, or was the choice to drink the result of an immature brain, which continues to develop through the early 20's (Casey, Getz, and Galvan, 2008; Steinberg, 2008)? Socioemotional and cognitive developmental differences between adolescents and adults that are predicted to influence such risky decisions are discussed below.

Another crucial consideration regarding the mature minor exception is whether adolescents have equivalent cognitive abilities compared with adults, specifically whether they are developmentally competent enough to make decisions about risks such as those often present in medical decision-making. To evaluate these questions, we briefly describe the standard view

of adolescent decision-making—in which reason is disrupted by "dumb" emotionality—by documenting some of the behavioral and neuroscientific evidence that identifies differences between adolescent and adult decision-making (Reyna and Rivers, 2008). This evidence will include developmental changes in sensation seeking, self-control, impulsivity, and emotional responses. We then describe how fuzzy trace theory (FTT) integrates the evidence for these differences while simultaneously predicting developmental differences in cognitive ability—specifically in reliance on gist representations and processing that reflect understanding—which have been associated with health-protective effects (e.g., Mills, Reyna, and Estrada, 2008; Reyna et al., 2011). An alternative definition of "informed consent" as delineated by FTT is also discussed, for which the gist processing that is relied on in adulthood is essential (Reyna, 2008; Reyna and Hamilton, 2001). We conclude that circumstances in which adolescents are equivalent to consenting adults are unusual and discuss implications for the mature minor distinction.

II. STANDARD MODELS

Many theories that have historically dominated the literature on adult decision-making—including the theory of reasoned action, theory of planned behavior, health belief model, and prospect theory—are broadly consistent with an expected value framework. Specifically, they posit that individuals multiplicatively weigh risks and rewards (Reyna and Farley, 2006). According to some developmental theorists, the basic building blocks of cognition that are used to weigh risks and rewards are in place by adolescence (e.g., Steinberg, 2008). In fact, basic rules of logic and probability are generally understood at an early age in development, well before adolescence (Reyna and Brainerd, 1994). Thus, the premature conclusion has been reached that "the logical reasoning and basic information-processing abilities of 16-year-olds are comparable to those of adults" (Steinberg, 2008, 80).

Nevertheless, risk taking increases in adolescence, which must be accounted for by developmental theory (Romer, 2003). For example, adolescents would be expected to be more likely than adults to elect risky surgery if it promised greater potential benefits relative to medical management. To take another example, adolescents are less likely than adults to adhere to medical regimens, such as taking anti-rejection drugs for organ transplants, a risky decision that can be fatal (Diaz-Gonzalez de Ferris, 2011). In socio-emotional developmental approaches, these differences between adolescent and adult risk taking are explained by differences in sensation seeking, self-control, impulsivity, emotionality, and future orientation (e.g., Figner et al., 2009). According to these approaches, adolescents have the same decisional capacity as adults, but they are sensation seekers, cannot control their impulses, let emotions cloud judgment, and do not plan or focus on the

future. At the level of the brain, two broad neural circuits are used to describe these tendencies. One system involves increases in arousal mechanisms that occur during adolescence, and the other system involves increases in self-control that are not yet complete until adulthood. The arousal mechanisms include dopaminergic circuits related to reward processing and emotion, and the increases in self-control include the development and integration of cortical control mechanisms, which are associated with delay of gratification (Reyna, Chapman, Dougherty, and Confrey, 2012; Somerville, Jones, and Casey, 2010).

Specifically, sensation seeking has been extensively studied as an individual difference (Zuckerman, 1994), defined as "a need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences" (Zuckerman, 1979, 11). Sensation seeking appears to be curvilinearly related to age from childhood to adulthood rising to a peak in adolescence, followed by a decline (Arnett, 1992; Romer and Hennessy, 2007; Steinberg et al., 2008). This relationship between sensation seeking and age has been related to neurobiological changes that occur during adolescence, such as an increase in dopaminergic innervation in the prefrontal cortex during adolescence (Rosenberg and Lewis, 1995), as well as an increase in the magnitude of nucleus accumbens response in adolescents compared with adults while participating in a task with manipulated reward values (Galvan et al., 2006). These changes are assumed to have an effect of heightening reward salience by making the experience of potentially rewarding stimuli more rewarding (but see Bjork, Lynne-Landsman, Siroccoa, and Boyce, 2012). The hypothesized effect on risk taking is that adolescents perceive rewards associated with taking risks to be particularly great, which can result in unhealthy decisions.

Other neurobiological changes occur during adolescence as well, such as in the networks relied on for the encoding of social and emotional information (Nelson, Leibenluft, McClure, and Pine, 2005). These regions associated with social stimuli (e.g., social acceptance from peers) significantly overlap with the regions associated with nonsocial reward magnitude and salience (Steinberg, 2008). The potential consequence of losing one's hair due to chemotherapy, for example, can bring dramatic social consequences for an adolescent, which can then be amplified by the adolescent's neurobiological response.

Adolescents have also not yet completed the process of neurobiological changes that are associated with delay of gratification and self-control. The tendency to weigh immediate rewards more highly than delayed rewards is referred to as temporal discounting, and is a stable characteristic and predictor in adult decision-making (Kirby, 2009). Note that temporal discounting, discounting future rewards, is distinct from risk preference, preferring risky options that offer greater rewards. The extent of temporal discounting has been associated (inversely) with many healthy and otherwise socially

desirable outcomes, such as higher educational attainment (Metcalfe and Mischel, 1999; Reyna and Farley, 2006). However, as previously alluded to, the ability of an individual to delay gratification—that is, to less steeply discount future rewards—varies with age. A drop in delay discount rates can be found between the ages of 20 and 30, before remaining relatively stable (Green et al., 1996). Note that this standard view makes it difficult to localize why an adolescent might reject chemotherapy, which could be due to discounting the future, hypersensitivity to social rewards, or some other combination of socioemotional factors.

The preceding evidence fits into a framework in which adolescents have similar basic cognitive capacities, compared with adults, although they do not use this reasoning as a result of immature cognitive control systems that fail to inhibit impulsive, sensation-seeking behaviors. Although these differences seem to exist between adolescents and adults, the story told by this explanation is seriously incomplete, because it ignores cognitive changes that occur between adolescence and adulthood—specifically, the meaningful, intuitive understanding associated with gist representations—that are specifically predicted by FTT. Moreover, research suggests that these cognitive changes account for unique variance in predicting risk taking, beyond socioemotional factors (Mills et al., 2008; Reyna et al., 2011; Reyna and Farley, 2006).

III. FTT'S INTEGRATION OF SOCIOEMOTIONAL DIFFERENCES

FTT is a comprehensive theory of reasoning, judgment, and decision-making that integrates the prior standard reactive model with documented cognitive developmental differences to explain risk taking behavior in adolescents. FTT is grounded in research on how people represent, retrieve, and process information, with specific attention to how these processes change with development and with social context (Reyna and Brainerd, 2011). According to FTT, deliberative, analytic reasoning and impulsive reactivity are distinct routes to risk taking, and, surprisingly, the former accounts for a great deal of risk taking in adolescence (Reyna and Farley, 2006). Moreover, gist-based intuition rather than deliberative, analytic reasoning characterizes advanced reasoning, such as that of experts (Reyna et al., 2011; Reyna and Lloyd, 2006). Thus, adolescents are not just more emotional and impulsive than adults; their understanding of the gist of such decisions is not mature. More specifically, adult decisions more heavily rely on intuitive, bottom-line gist representations. Prior to the acquisition of such insight, adolescent processing of risky decision-making resembles solving a mathematics problem (although naturally no explicit calculation occurs). Considering again the previous example of the adolescent chemotherapy patient who decided to consume alcohol despite the accurate perception that it would reduce the

effectiveness of the treatment, one might argue that she was merely trading off the relative risks and rewards: the pleasure of fitting in socially by drinking compared with the reduction in treatment effectiveness. In contrast, according to FTT, mature understanding of the gist of this situation would be a rejection of the standard model of trading off (e.g., trading off social benefits against survival); such compensatory reasoning would indicate a fundamental failure of insight (despite full knowledge of the facts) that survival trumps everything.

FTT describes the social cognitive processes at work in adolescent decision-making, while also integrating the evidence from the standard model. FTT differs from this standard model of risk taking in that *impulsivity* is distinguished from *intuition* (Reyna, 2013). Impulsivity is a failure of self-control or inhibition, a separate concept in FTT (Reyna and Mills, 2007). Intuition is a mostly unconscious, parallel, impressionistic kind of reasoning that operates on gist representations. Information is encoded along a hierarchy of precision varying from gist to verbatim representations to support intuition and analysis, respectively.

Verbatim representations are the encoding of low-level details, including numerical information and precise wording. *Gist* representations preserve meaning, that is, patterns, inferences, and themes (Reyna and Brainerd, 2011). Although the gist-verbatim distinction originated in psycholinguistics, the idea that these are independent memory representations was developed in FTT; this idea has been tested as it applies to representations of words, sentences, numbers, pictures, and events. Numerical representations, in particular, are critical to the understanding of how adults and adolescents process risk and make decisions (Reyna et al., 2009). For example, an individual might be required to choose between two treatment options, which carry with them a 6% and 18% chance of severe side effects, respectively. The information can be encoded with an exact verbatim representation (i.e., the exact values of 6% and 18% associated with each treatment), with an ordinal gist representation (i.e., "the second treatment is riskier"), or with a categorical representation (i.e., "both treatments carry some risk").

Gist and verbatim representations are encoded, stored, and retrieved roughly in parallel independently (Reyna and Kiernan, 1994). This assumption explains many paradoxical effects, including that people respond in contradictory ways to questions about their memory for the same information. Crucially, for decision-making, note that the gist of information is an *interpretation* that extracts the important nub of information, such as whether a medication is safe or risky or whether the risk is low or high. Gist, because it reflects meaning, depends on content and context. For example, returning to our example of side effects, an 18% risk of a heart attack is pretty high, whereas an 18% risk of catching a cold is pretty low. Adults have a fuzzy processing preference, meaning that they use the simplest gist they can to make decisions. Adolescents, in contrast, are more likely to focus on

more precise representations toward the verbatim end of the gist-verbatim continuum. Thus, adults and adolescents reason in qualitatively different ways, which implies that minors will not base their "consent" on the same processes as adults.

It should be noted that although processing and reasoning with gist representations is often quick, unconscious, and automatic, it differs from other dual-process accounts of reasoning (e.g., the standard model described above), in that intuitive gist processing is distinct from the impulsive and emotional reactivity that also happens to be quick and automatic. FTT takes a nuanced approach to the incorporation of emotion in reasoning (Rivers, Reyna, and Mills, 2008). In particular, emotional valence (positive vs. negative affective content) is often a basic feature of gist representations. Another aspect of emotion is one's level of arousal, which interferes more with verbatim processing than with gist processing (because gist representations are more resistant to interference). Many treatment decisions are accompanied by a high level of arousal—such as being informed that you have cancer. Therefore, FTT predicts that arousal that accompanies medical decisions will be more impairing for adolescents than adults, because of the nature of their information processing. If an adolescent is generally less likely to be using stored gist representations, the revelation of a grim diagnosis is more likely to result in confusion of the verbatim information they receive regarding details about treatment options, risks, and prognoses.

IV. FTT'S PREDICTIONS OF DEVELOPMENTAL DIFFERENCES

Research on FTT has shown that adult decision-makers tend to rely on the simplest gist representation for any task, and that this reliance emerges with age from childhood to adulthood (e.g., Reyna and Brainerd, 2011). Because, as previously mentioned, gists can be encoded on a hierarchy ranging from the simplest categorical distinction (e.g., "some risk" vs. "no risk"), through ordinal distinctions (e.g., "more risk" vs. "less risk"), and on through more finely grained distinctions (e.g., "18% chance of side effects"), this means that if making a decision requires only the simplest categorical distinction, only that categorical gist will be employed by a mature adult. This principle can be illustrated with the common risky choice framing task. In this task, originally proposed by Tversky and Kahneman (1981), one group of subjects chooses between two options to treat 600 people at risk of a disease: a sure option in which 200 will be saved, or a risky option in which all 600 will be saved with a one-third probability (and two-thirds probability none saved). In the loss frame version of the same decision, another group chooses between 400 dying for sure versus a two-thirds probability that all 600 die (and a one-third probability that none die). The common effect found with this and similar problems is that people change their answers

from mostly risk avoiding to mostly risk seeking, based on whether the options are described in terms of lives saved or lives lost, even with mathematically identical options.

The explanation for this effect as posited by FTT is that, first, individuals simultaneously encode both the verbatim and gist representations from the problem. In the lives-saved frame, for example, the verbatim representations would be the exact values such as *600*, *200*, and *two-thirds*, and the gist representations would be the categorical options of *some lives saved* versus *some lives saved or no lives saved* (Reyna et al., 2011). When making a decision, the simplest gist necessary is employed. People then retrieve relevant social and moral values, such as values about saving lives, which support selection of *some lives saved* over the possibility of *no lives saved*. In the lives-lost frame in which the simplest gist distinction is encoded as *some die* versus *some die or no one dies*, the preference is reversed, because the applicable value is none dying is better than some dying. This explanation was validated through experiments that varied how the risky option was expressed (Kühberger and Tanner, 2010). This example also illustrates the role that emotion plays in advanced cognition, as previously explored (Rivers, Reyna, and Mills, 2008). One's emotional reactions to the options that emphasize death and survival are critical to how the options are encoded and thus relied on to make a decision. The ability to see this critical meaning in choices in which life and death are possible outcomes is particularly relevant to granting exceptions to mature minors allowing them to make medical decisions for themselves, as adolescents do not process this gist in the same way that adults do.

This developmental difference in reliance on gist has been found both with laboratory tasks such as the framing problem described above, as well as with real-world risk taking. For example, in the framing task, level of reliance on gist representations (e.g., "save lives whenever possible") versus trading off risk and reward (e.g., selecting options that are the reverse of the standard framing effect when rewards are higher in the risky option) has been assessed by measuring the extent to which the individual displayed standard framing (risk avoidance for gains and risk seeking for losses) or reverse framing (the opposite preferences; Reyna et al., 2011). Compared with adults, for example, preschoolers do not show the common framing effect and treat gain and loss frames equally; young adolescents (fifth-graders) display the opposite effect (reverse-framing) when differences between rewards are large (Reyna and Ellis, 1994). Older adolescents also displayed reverse-framing when potential gains from taking a risk were high, which implies less reliance on the simple gists that are used to produce the common framing effect in adults, and more verbatim-based, quantitative reasoning (Reyna et al., 2011).

The results from framing studies such as these provide analogous predictions for medical contexts. Referring back to the example of a decision

between a risky surgery with greater potential benefit versus conservative medical management, this is a frequent scenario for adults in medical contexts. For example, adults may wait to have knee surgery if they can get around pretty well, despite the upside potential of surgery to achieve greater mobility (but surgery has a risk of death or complications). The sure option of medical management involves maintaining the status quo (e.g., pain management) versus an option that requires substantial risk in order to potentially see greater benefit through surgery. Adolescents, however, would be more inclined to select surgery—trading off this benefit of surgery with the risks that are inherent in the surgery. Note that, in the standard view, adolescents ignore or underweight risks. According to FTT, adolescents weigh risks, but benefits often outweigh risks.

Alternately, consider the example of the decision whether to amputate a limb in the face of potential infection, complication, or even death if the limb is kept. This could easily be seen as a loss-frame scenario, in which a sure loss of a limb is compared with the risky option of possibly worse, but less likely outcomes. Adults in this case might delay the amputation and take the risk, whereas adolescents would be more inclined than adults to reverse-frame and amputate (accepting a sure loss). The increasing reliance on gist processing that occurs with age is broadly consistent with neurobiological evidence of development that occurs between adolescence and adulthood. First among the categories of evidence is the well-documented pruning of unused synapses over the course of adolescence, resulting in a significant reduction in gray matter (Chick and Reyna, 2012; Giedd et al., 2012). This pruning is accompanied by increased speed and efficiency of information transfer, in conjunction with increases in myelination (white matter) that insulates the remaining synaptic connections. Neurobiological differences were also found between adolescents and adults in a study in which participants were asked to respond to questions such as "Is it a good idea to set your hair on fire?" (Baird and Fugelsang, 2004, Reyna and Farley, 2006). Although adolescents and adults all fortunately tended to say "no" to such questions, adolescents took longer, and neuroimaging data demonstrated that this delay was correlated with activation in brain areas associated with deliberation (e.g., dorsolateral prefrontal cortex), which were more active in adolescents. Adults, contrarily, demonstrated activation in areas associated with imagery (fusiform gyrus) and gut responses (insula). This finding can be applied to the previous example of an adolescent girl undergoing chemotherapy and subsequently deciding to drink, even though it would reduce effectiveness. Although mature adults with a gist understanding of what is at stake would have an immediate, categorical response to not reducing the effectiveness of the treatment, adolescents would be predicted to take the time to deliberate and trade-off the risks and benefits—a rational tradeoff according to standard economic models but an irrational response according to fuzzy-trace theory (Reyna and Farley, 2006). Ironically, therefore,

adolescents seem more rational and logical than adults, but that mode of thought signals immature judgment in situations in which tradeoffs are unhealthy (e.g., risking HIV because the probability of transmission is low).

V. GIST AND RISK IN INFORMED CONSENT

One of the other major differences between FTT and the standard model of adolescent reasoning is that reliance on gist processing can have a protective effect, and that the deliberative analysis that is the ideal of the standard dual-process models can backfire. However, in order for this protective effect to exist, an individual must first encode an advanced gist that reflects an accurate and healthy understanding of the situation, and subsequently the individual must retrieve and process that gist at the moment of deciding.

The accurate encoding of advanced gists, especially in medical or health-related domains, is not without challenges. As has been previously discovered, it is quite possible for people to understand every word they read and still understand and retain almost none of it because they fail to understand its gist. This was illustrated in a classic study in which participants read a brief set of instructions, with or without the additional context that the instructions were specifically about how to do laundry (Bransford and Johnson, 1972). Without the context given in the title, the meaning was obscure, and participants recalled very little about the instructions compared with being given the context of washing laundry. FTT built directly on such psycholinguistic evidence; this effect was a failure to comprehend the gist of the instructions. A parallel experience can occur during the process of informed consent; patients may read the document they must sign that grants consent and acknowledges risks, but without the additional context, such as pertinent medical knowledge that is not included in the consent document, they retain or understand very little of it (Reyna and Hamilton, 2001). Without this understanding of the procedure to which the patient is consenting—the gist of the procedure and risks—then consent to the procedure is not informed, according to FTT.

The successful encoding of gist is also a critical element of informed consent in medical practice, in that the gist representations of numbers also represent an essential element of understanding the risks involved in consenting to medical procedures. Because informed consent requires patients to have an understanding of risks, questions such as whether the patient has an appropriate interpretation of risk magnitude are of critical import. Consider the example of consenting to a surgical procedure for which there is a 2% chance of serious complications (Reyna and Hamilton, 2001). A patient who recalled a risk of 0% would reflect closer verbatim accuracy than a patient who recalled a risk of 10%, although the former's report of the procedure entailing objectively no risk represents a fundamental misunderstanding compared with the latter patient. Given that patients should understand that the surgery

requires the undertaking of some risk, the patient that falsely understood the risk to be zero—an estimate that is gist-inconsistent with the true understanding—is in more egregious violation of informed consent than the patient who understood some risk. Because of developmental differences in gist processing, adults would be more likely to clearly appreciate the significance of this categorical contrast in safety versus risk, compared with adolescents.

As FTT predicts that adults will rely on the *least* precise gist representation in their hierarchy of encoded representations, this means that categorical (absolute) representations will be preferred to ordinal (relative) representations, if they both apply to the choice options. The relationship between such representations and actual risk taking was tested using two specific gist principles about risk, the absolute principle (i.e., "No risk is better than some risk") and the relative principle (i.e., "Less risk is better than more risk"; Mills, Reyna, and Estrada, 2008). If adolescents endorsed only the relative principle, they were more than twice as likely to have initiated sex (61% compared to 30%) than if they endorsed only the absolute principle (and endorsement of both or neither resulted in an intermediate level of sexual activity, 44% and 46%, respectively). As predicted by FTT, the absolute principle endorsement was negatively associated with sexual intentions and behavior, whereas endorsement of the relative principle was positively associated with sexual intentions and behavior. These and other results demonstrate that by making finer distinctions adolescents do not necessarily promote their own health, a result that is counter to assumptions of standard models of decision-making.

VI. CONCLUSIONS

Despite the fact that adolescents understand rules of logic and probability (Reyna and Brainerd, 1994), there are still significant differences between adolescent and adult cognition. Differences in emotional reactivity—emotional responsiveness and impulsivity—exist between adolescents and adults, and these differences have applications to medical scenarios. In particular, one should note that social rewards are more salient during adolescence than adulthood, which is an important consideration when faced with treatment options that include social consequences. Adolescents may be reluctant to seek treatments that would in some way single them out from their peer group, or otherwise reduce social benefits.

However, adolescents are also different from adults in their cognitive processing. Critically, adolescents have not developed the reliance on gist processing that adults tend to exhibit. This developmental difference can have broad implications for the comprehension of treatment options, such as understanding the risk of treatments, as well as retrieving categorical principles, such as "No risk is better than some risk." Lost in the details, adolescents can fail to fully appreciate the overarching gist that reducing

treatment effectiveness is an essential bottom line. Although adolescents are capable of encoding mathematical probabilities about risks and rewards (Reyna, Chapman, Dougherty, and Confrey, 2012), they still do not have the mature appreciation for the *meaning* of those risks and rewards, and their implications for their future adult lives (Partridge, 2010). Put another way, it could be said that some adolescents know "the price of everything but the value of nothing" (Hans and Reyna, 2011).

Generalizing complex principles of cognitive development to practical guidelines is challenging, and it is difficult to set a single standard of maturity in decision-making. For example, although most developmental studies tend to reveal declines in risky behavior after adolescence, a minority of individuals continues to demonstrate this behavior into adulthood, as is described as life-course-persistent rather than adolescent-limited anti-social behavior (Moffitt, 2003). One could easily conceive of adolescents who demonstrate more maturity than adults who fit this description or who otherwise think more literally (as in Asperger's Syndrome; see Reyna and Brainerd, 2011). The content and context of options also matter. Adolescents behave like adults do in framing scenarios when rewards from taking a risk are low. In relatively low-risk medical scenarios, such as consenting to general anesthesia, adolescents may demonstrate reasoning that is similar to adults.

However, given the necessity of the advanced cognitive reasoning that comes with adulthood—that is, a reliance on gist processing—and its role in both the risky choices necessary in medical decision-making and in informed consent, the argument from the research inspired by FTT is that the mature minor exception should remain an exception. Moreover, traditional measures of competence such as intelligence tests (e.g., Wechsler) that assess merely analytic reasoning ability are not suited to identify these critical differences of judgment between adolescent and adult cognition. If the exception is necessary for an emergency situation, the physician or medical experts involved should emphasize the bottom-line gist of risks involved during the process of consent or deciding on treatment options. To refer back to the examples above, an individual obtaining informed consent should clarify that there are in fact some risks (especially when their probability is nonnegligible) and what the risks mean in terms of quality of life. When a patient must decide between treatment options, emphasis should be placed on the meaningful differences between treatment options (such as the serious side effects that differ when the mortality rate is the same). Better still would be to obtain the service of a volunteer proxy consenting adult when available, so that someone acting on the child's behalf will be able to process and understand fully the risks being undertaken. Even in this case, however, these conclusions regarding the potential protective effect of gist understanding and its critical role in informed consent are still warranted, as many who make these decisions in unfamiliar medical contexts are novices, both adults and adolescents.

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