



Development and Decision Making in Adolescence

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Risk and Rationality in Adolescent Decision Making

Implications for Theory,
Practice, and Public Policy

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Psychological Science in the Public Interest, 7, 1-44.

PSPI CONTENTS:

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Special Issue: Current Theories of Risk and Rational Decision Making



“Just as memory problems are a hallmark of aging (and so it is natural to study memory processes in aging), problems with risk-taking are characteristic of adolescence, and thus it is natural to study these problems in adolescence. One might say that adolescents are the ‘*Drosophila*’ of risk-taking research because they are such a natural preparation for understanding this fundamentally human phenomenon.”

(Reyna & Rivers, 2008; p. 2)

Developmental Review

Volume 28 March 2008

- n Fischhoff, B. Assessing adolescent decision-making competence.
- n Gerrard, M., Gibbons, F. X., Houlihan, A. E., Stock, M. L., & Pomery, E. A. A dual-process approach to health risk decision-making: The prototype–willingness model.
- n Casey, B. J., Getz, S., & Galvan, A. The adolescent brain.
- n Steinberg, L. A social neuroscience perspective on adolescent risk-taking.
- n Rivers, S. E., Reyna, V. F., & Mills, B. A. Risk taking under the influence: A fuzzy-trace theory of emotion in adolescence.
- n Sunstein, C. R. Adolescent risk-taking and social meaning: A commentary.



Background

Metaphors of Mind

- n Classic View: Mind is computer
 - n Best decision makers process more information, more precisely (quantitatively)
 - n *Compute* the decision by estimating risks precisely and weighing consequences
 - n Trade off risks and rewards (balance scale)
 - n Developmental *increase* in computation



Classic View: Theories

- n Expected Utility and Variants (risk vs. reward)
 - n Prospect Theory
 - n Behavioral Decision Making Framework
- n Theory of Reasoned Action/Planned Behavior and Variants
 - n Adds social norms, self-efficacy, and perceived control to risk vs. reward
 - n Health Belief Model
 - n Prototype/Willingness Theory

Evidence For Classic View, But...

- n Do perceptions of risks and benefits predict risk taking behavior and intentions?
- n Meta-analyses confirmed:
 - n Theory of *Reasoned* Action: 38% of variance
 - n Others
- n But what about *adolescents*?
 - n Surely not *reasoned, planned, or intentional*...
 - n Emotion, reward sensitivity, and impulsivity
 - n Evidence for steady age decline in impulsivity (PFC)
 - § But not the *only* factors promoting risk taking
 - n *Also*--developmental differences in decision processing

Evidence Against Classic View

- n Empirical support, but contradictions
 - n More *intuitive* as get older (Reyna & Ellis, 1994)
 - n Risk perception-behavior relations *reverse* under specific conditions (Mills et al., 2008)
- n New Approaches
 - n Fuzzy-trace theory
 - n Developmental approach: How decision processes *change* from childhood to adolescence to adulthood

Fuzzy-Trace Theory: Risky Decision-Making Develops

§ Knowledge

§ Having knowledge: Education and experience

§ Representation: Gist and Verbatim

§ How perceive (understand) situation

§ Retrieval: Knowledge and Attitudes

§ How access what you know when you need to

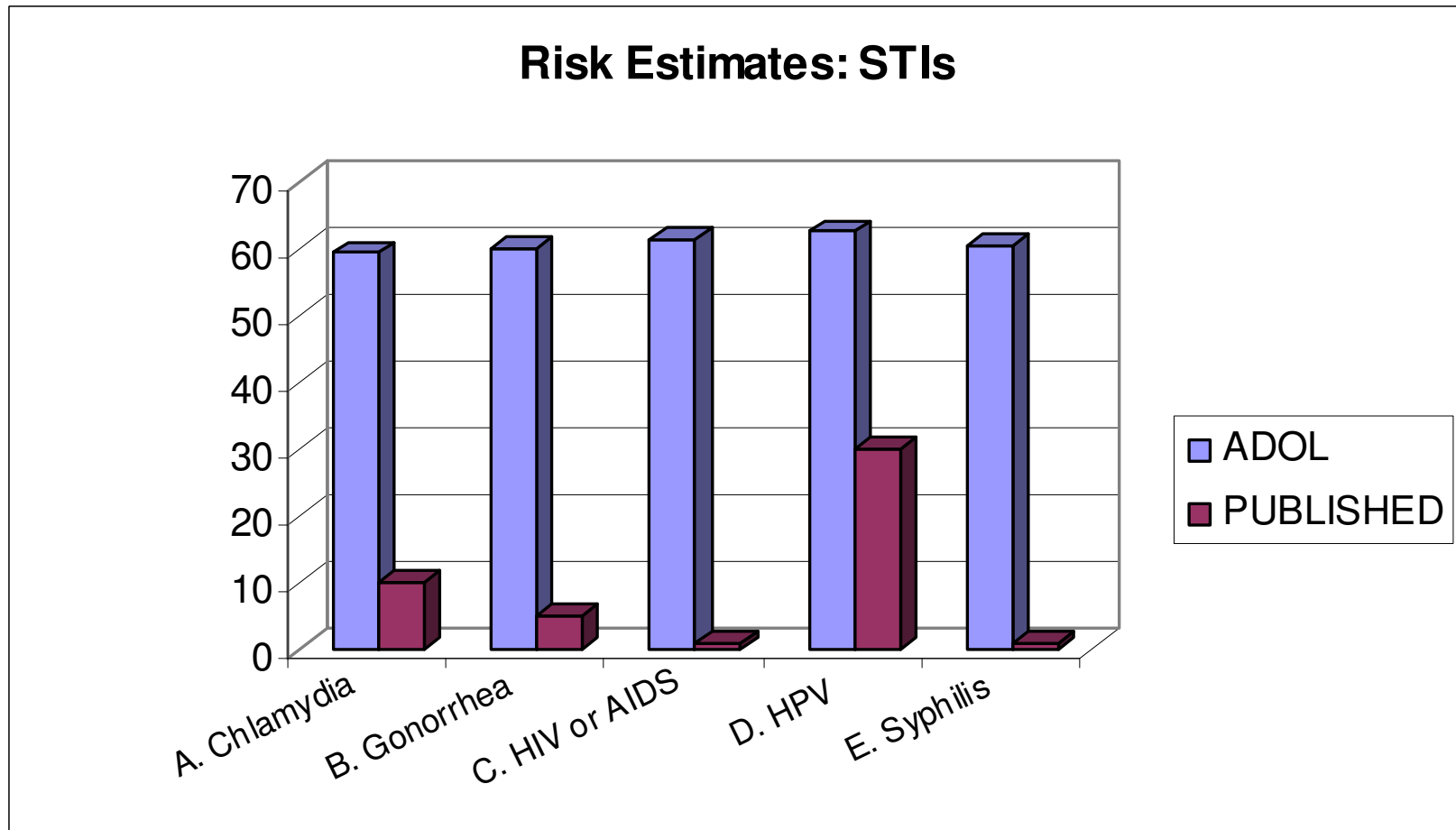
§ Processing

§ How put together what you perceive with what you retrieve to make decision



Knowledge

Knowledge of STI Risks



Risks *Overestimated*

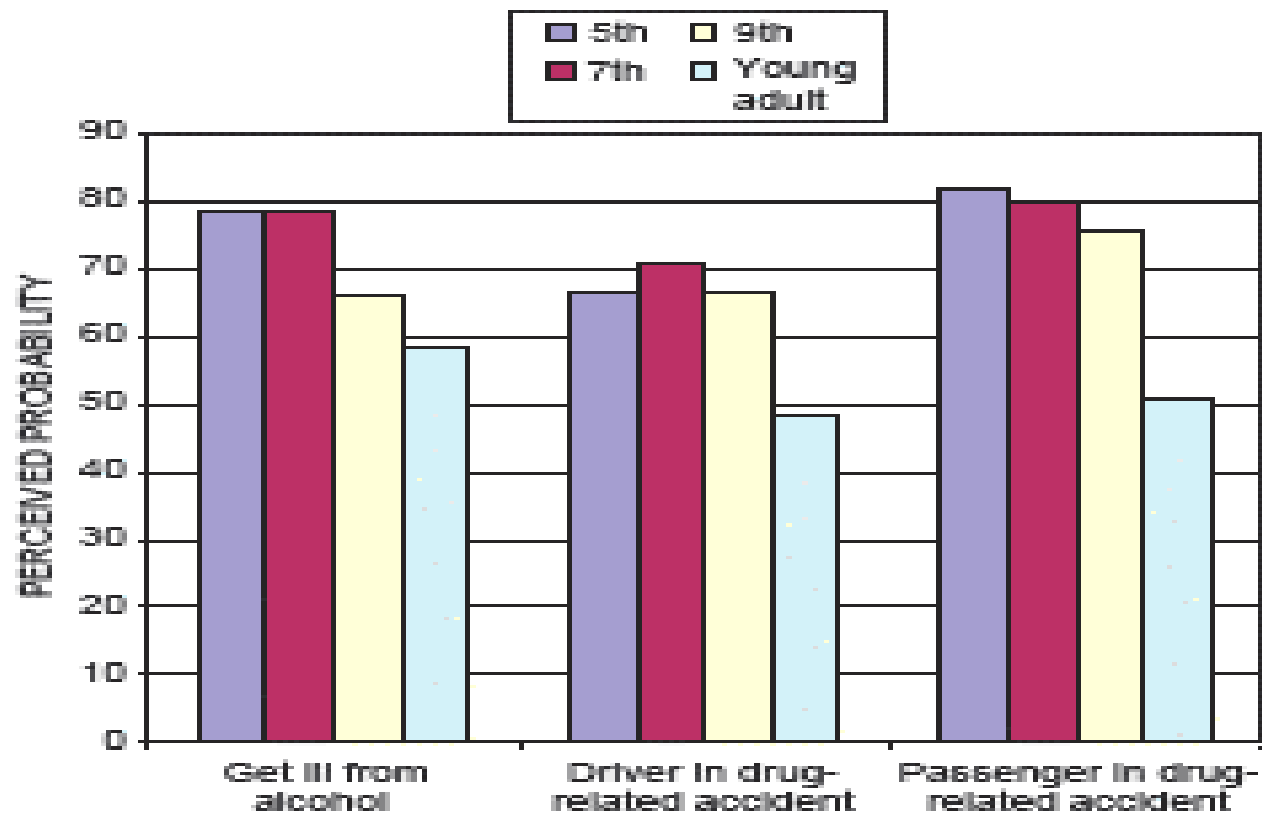
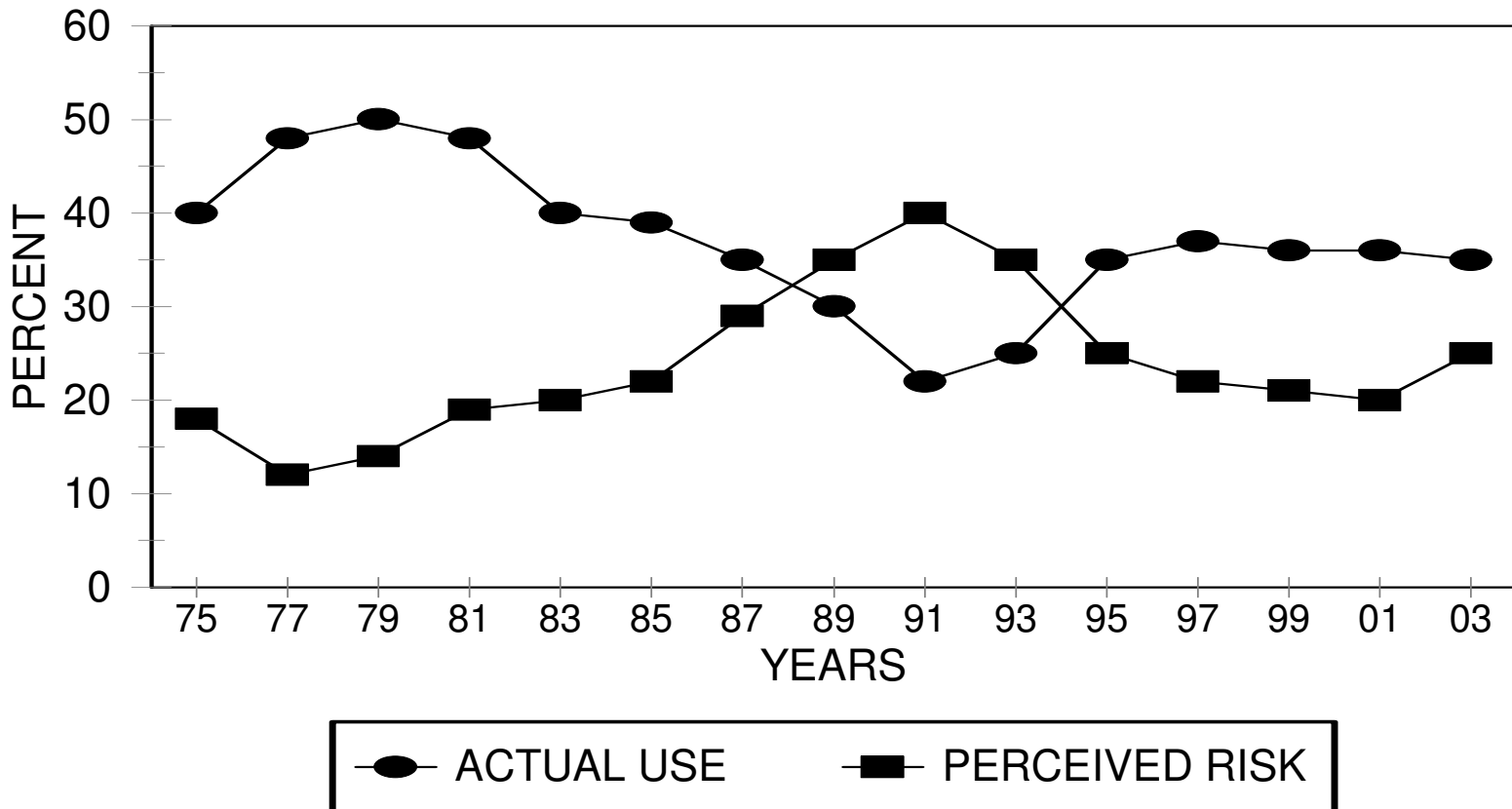


Fig. 11. Perceived probability of getting ill from alcohol, being the driver in a drug-related accident, and being the passenger in a drug-related accident for 5th, 7th, and 9th graders and a comparison group of young adults (based on Millstein & Halpern-Felsher, 2002a).

Perceived Risk Predicts Behavior: 12th graders Marijuana



Reyna & Farley (2006) Review

- n Risk taking predicted by adolescents' perceptions of risks and benefits
- n Important risks (e.g., HIV from unprotected sex; lung cancer from smoking) are *overestimated*
 - n Do not believe invulnerable: Myth
- n Benefits loom larger than risks
- n Risks sometimes positively, sometimes negatively related to risk-taking behavior

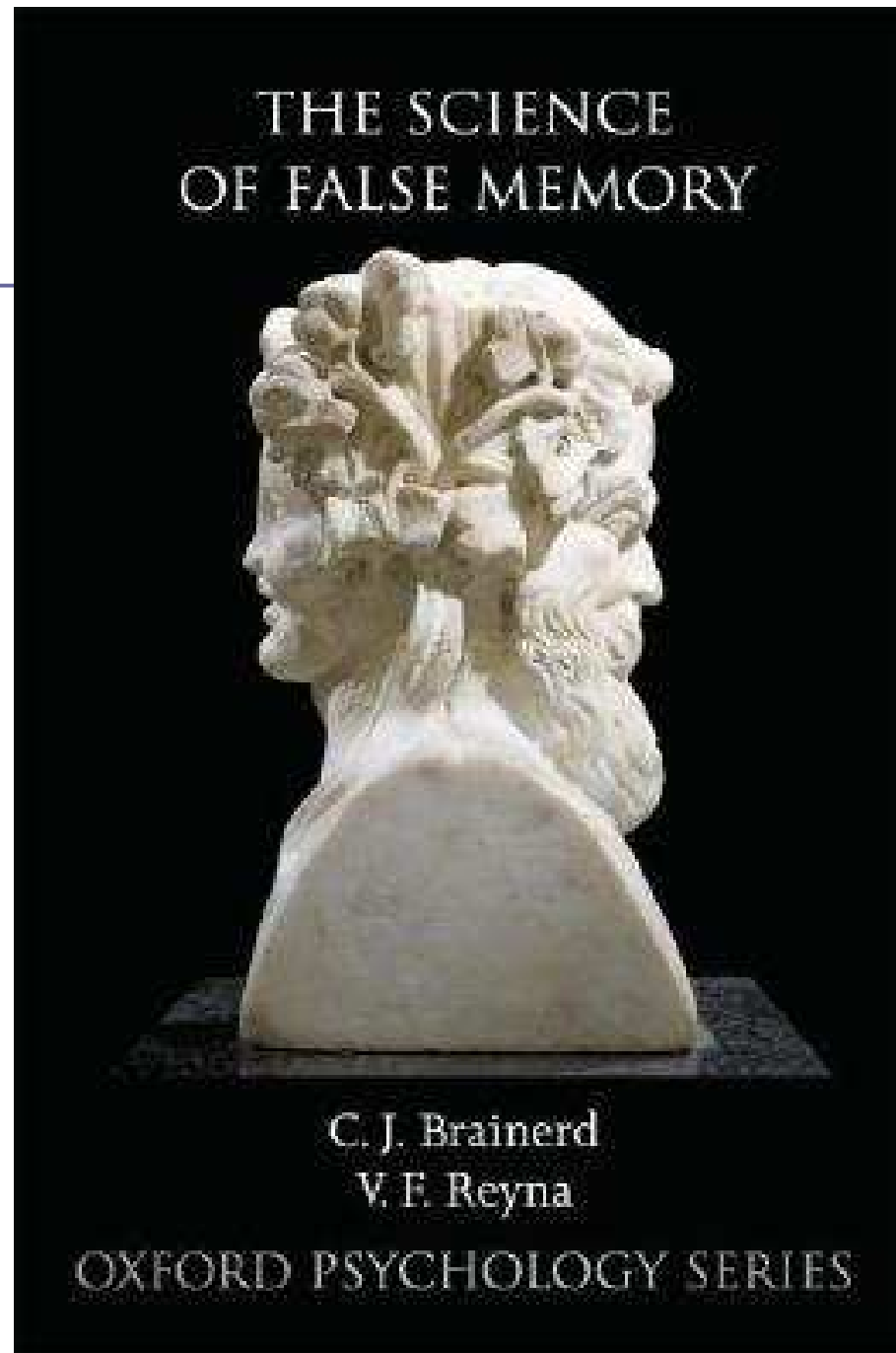


Representation

Representation

- n Encode *independent* gist and verbatim representations of experience into memory
- n Gist reflects *meaning* of experience
 - n Emotion, culture, social address, world view, education, development
- n Verbatim reflects surface form: Literal
- n Adults rely mainly on *gist* in decision making

Verbatim



Gist

Gist: *Meaning of Risk*

- n Relative to 46% (initial estimate), 13% feels low
 - n But same 13% rated as high in a no-initial-estimate group
- n 12% high relative to 4%
 - n But same 12% low relative to 20% (women vs. men)
- n 0% vs. 1% is large
 - n But 1% vs. 2% is small

Example Scenario

Sonya is 17 and a junior in high school. She has been sexually active with many partners in her life and has never used condoms in any of her relationships. Sonya met Juan at Homecoming last fall and they have been a couple ever since. Juan has never had sex before. At a party on Saturday night...

Response Scales

Benefits

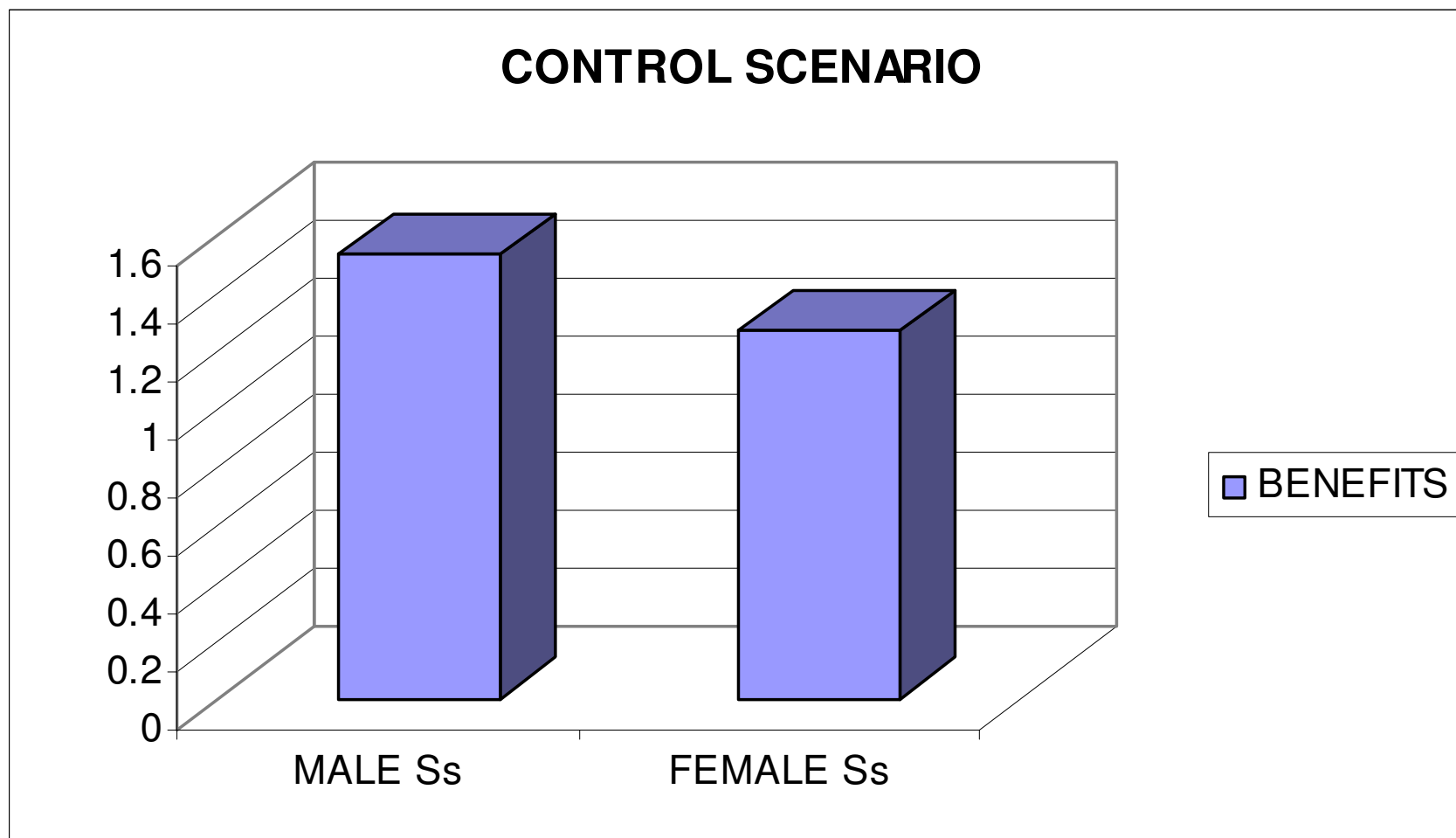
n None = 0; Small = 1; Medium = 2; Large = 3

Risks

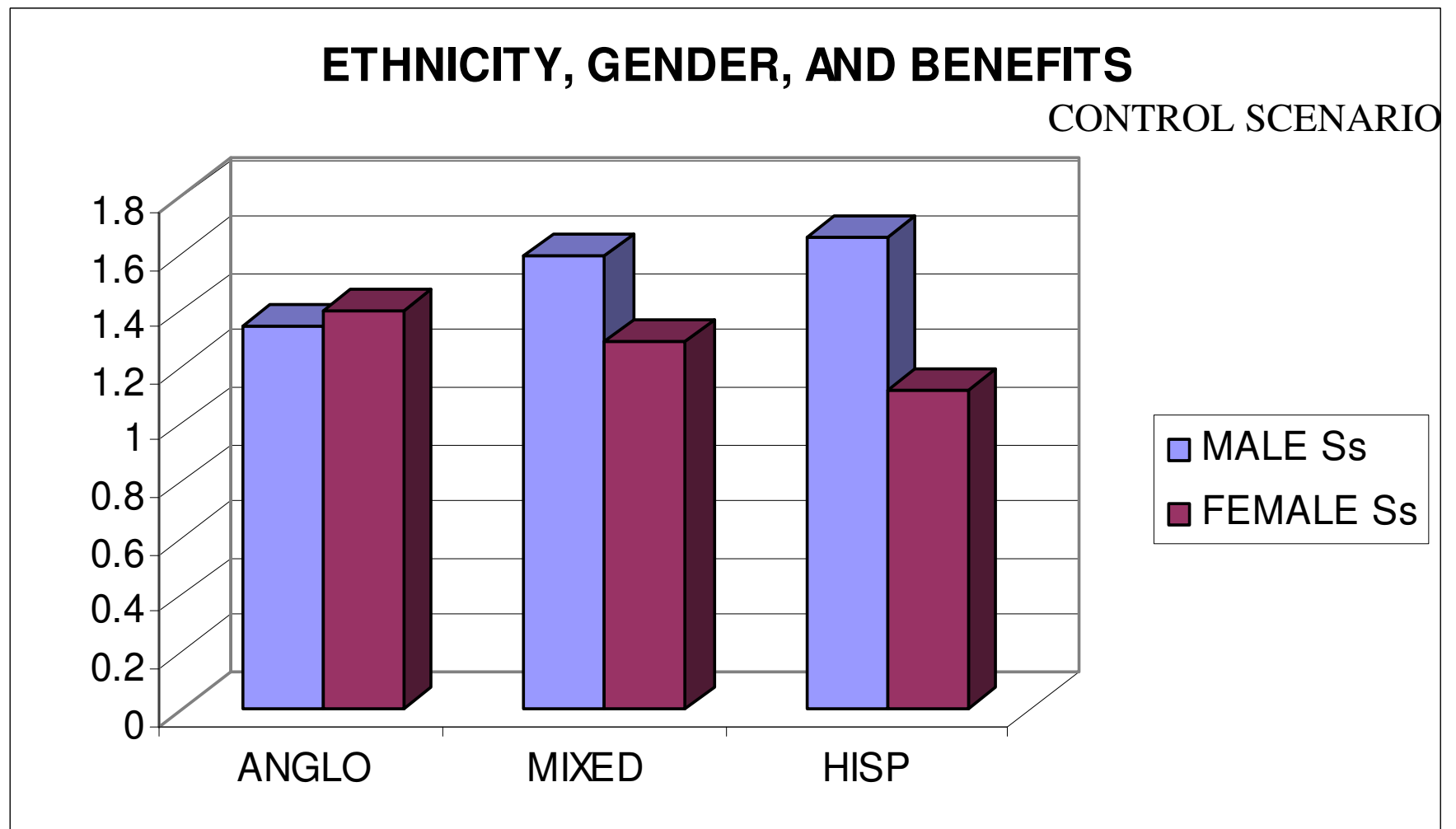
n None = 0; Low = 1; Medium = 2; High = 3

Subjects checked off verbal label, not numbers

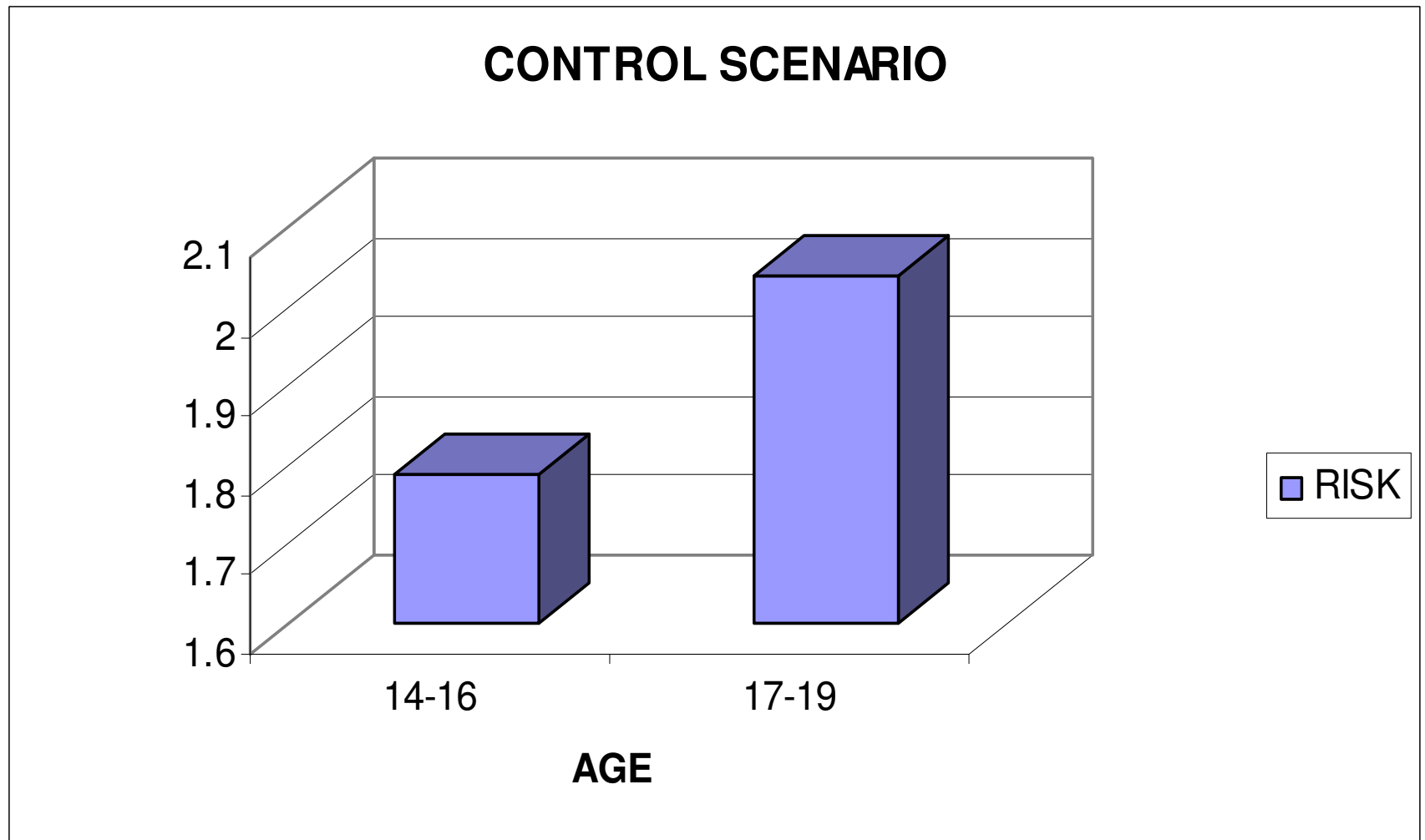
Gender Affects Gist: Benefits



Ethnicity Affects Gist: Benefits



Risk Perception Increases With Age

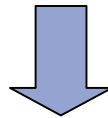




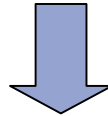
Retrieval

Retrieval Cues for Different Representations (Mills et al., 2008)

n Changing the cue (e.g., the question, the memory probe)



n Changes the memory representation retrieved



n Changes the answer to the question

n Dual processes in risky decision making

Fuzzy-Trace Theory Predictions

- n Questions as cues: Verbatim or Gist
- n Response specificity: Verbatim or Gist

- n Verbatim-analytic processing:
 - Positive (reflective) relation
- n Gist-intuitive processing:
 - Negative (protective) relation

- n Predictions apply *within* subjects

Verbatim-Analytic Processing: Recollection of True Memories

- n True memories of having engaged (or not) in risk behavior
- n Retrieve memories of acts of unprotected sex
 - risk rated as high
- n Retrieve memories of lonely Saturday nights
 - risk rated as low
- n Specific cues or quantitative response formats: Perceived risk **reflects** behavior

Gist-Based Intuitive Processing

- n Cues to global attitudes
 - n Catastrophic consequences
 - Global risk avoidance
 - n Ignores magnitude of potential benefits
- n More gist-based (simple, categorical) thinking, more risk avoidance
- n Global, gist cues or qualitative response formats: Perceived risk is **protective**

Method

- n 596 students aged 14-17 years ($M = 15.5$, $SD = 1.0$) from high schools in Arizona, Texas, and New York
- n 47% Caucasian, 17% Hispanic, 25% African American, and 11% “other”
- n 57% female
- n 41% sexually active

Specific Risks Scale: Verbatim

- n I am likely to have HIV/AIDS by age 25.
- n I am likely to have HIV/AIDS in the next 6 months.
- n I am likely to have a STD by age 25.
- n I am likely to have a STD in the next 6 months.
- n I am likely to get (a girl) pregnant in the next 6 months.
 - n *Strongly disagree to strongly agree (5-point scales)*
 - n $\alpha = .81$

STD Chances: Verbatim

- n What are the chances that you have a sexually transmitted disease?
- n On a 0-100 scale
 - n 0= no chance at all,
 - n 50 = as likely as not,
 - n 100 = absolutely sure

Categorical Thinking about Risk: Gist

- n If you keep having unprotected sex, risks will add up, and you will get pregnant.
- n Even low risks add up to 100% if you keep doing it.
- n It only takes once to get pregnant or to get an STD.
- n Once you have HIV/AIDS, there is no second chance.
 - n *Plus 5 other items*
 - n *Strongly disagree to strongly agree (5-point scales)*
 - n $\alpha = .75$

Gist Principles Scale

- n Avoid risk
- n Better to be safe than sorry
- n Better to focus on school than have sex
- n Better to wait than to have sex when you are not ready
- n Better to not have sex than hurt my parents/family
- n I have a responsibility to my partner to not put him/her at risk
- n I have a responsibility to God to wait to have sex
- n Have fun (sex) while you can (reverse scored)
- n Having sex is better than losing a relationship (reverse scored)
- n Having sex is worth risking pregnancy (reverse scored)
 - n *Plus 4 other items*
 - n *Endorse or not (check all that apply)*
 - n $\alpha = .82$

Global Risks: Gist

n Overall, for YOU which of the following best describes the RISKS of having sex?

Check one: **Low, medium, high**

Risk Perception Variables

- n Categorical Thinking about Risk: Gist
 - n 9-item scale
- n Gist Principles of Risk Avoidance
 - n 15-item scale of gist-based values/principles related to sexual choice (number endorsed)
- n Global Risk: Gist
 - n 1 item: low, medium, high
- n Specific Risks: Verbatim
 - n 5-item scale
- n Specific Risk of STDs: Verbatim
 - n 1 item: 0-100 scale

Risk Taking Measures

n Sexual Behavior (dichotomous)

n Ever had sex: Yes or No

n Sexual Behavioral Intentions

n 5-item scale ($\alpha = .91$)

§ Do you think you will have sex (or have sex again) before:

§ ...you turn 20?

§ ...you are in a serious relationship or in love?

§ ...you are finished with high school?

§ ...during the next year?

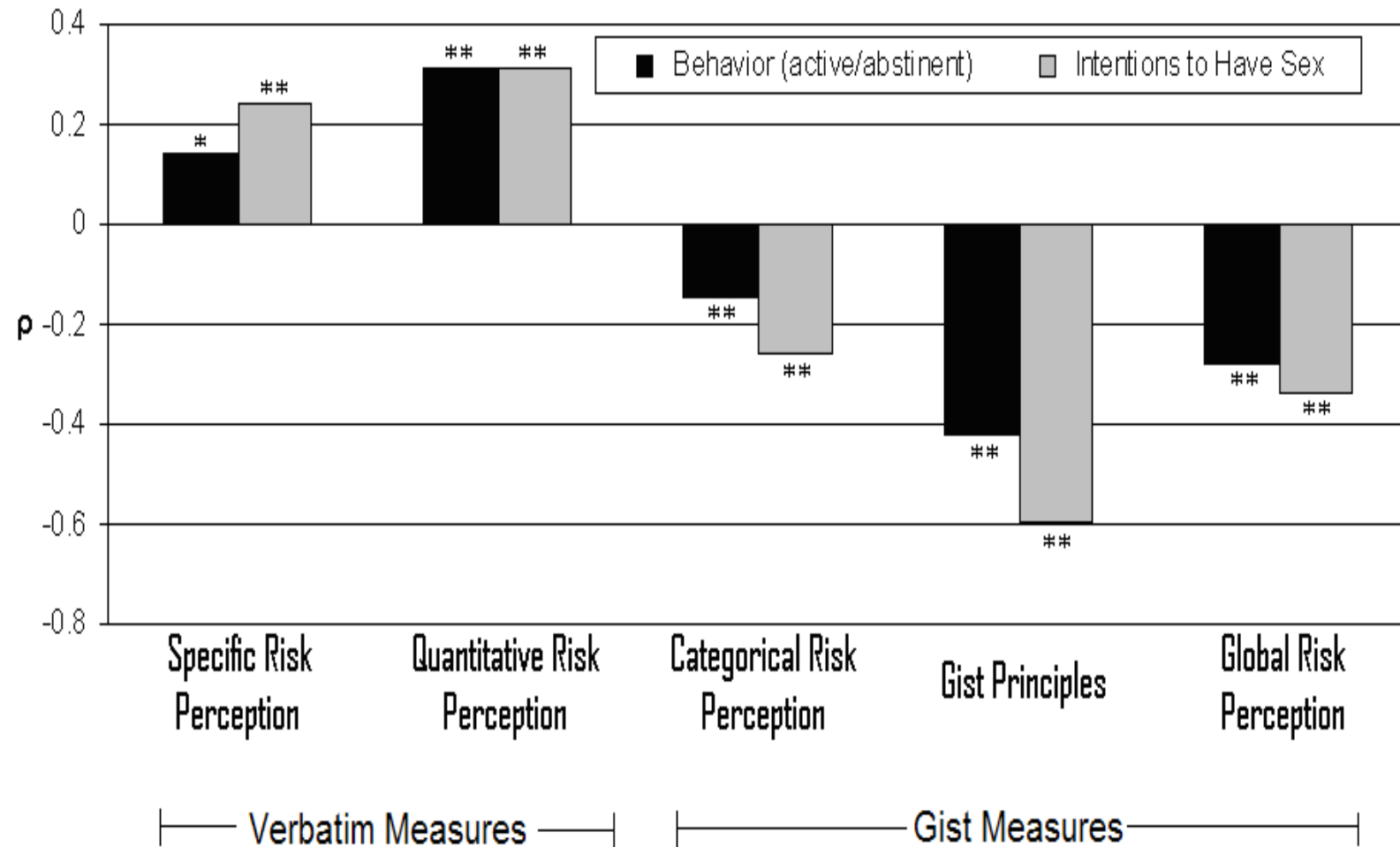
§ ...you are married?

§ *Strongly disagree to strongly agree (5-point scales)*

Predictions: Sexual Risk Taking

- n Adolescents in transition: Verbatim analysis *and* gist-based processing of risk and reward
- n If gist processing increases with maturity and experience and...
- n If risk avoidance function of gist processing
 - n Risk preference declines in framing tasks, despite rewards.
 - n As mature, avoid trading off risks and rewards when outcome catastrophic
 - n Russian roulette
- n Then less risk taking for gist processors

Risk Perception and Risk Taking: Dual Processes



Summary: Retrieval Cues for Verbatim vs. Gist Risk Perceptions

- n Positive and negative correlations between risk perception and risk taking
 - n Within same individuals
 - n Rated themselves as high for specific risk scale, perceived their global risk as low (and vice versa)
 - n Realized at risk when specific cues to behavior
 - n Denied at risk when cues tapped global attitudes
- n Not age artifact
 - n Not that younger have less sex and also have simpler cognitions
 - n Older more likely to endorse simple gist

Fuzzy-Trace Theory: Intuition

n New View: Intuition not computation

n Best decision makers use simple *gist*

n Avoid trading off, increasingly as mature and gain experience

n Adolescent risk taking: Russian roulette is “worth it”



Development



Gist-based intuition is advanced.

Development of framing effects and other biases in childhood.

Framing Task (Reyna & Ellis, 1994)

n Gain:

n A. Win 1 prize for sure

n B. Spin and either win 2 prizes or no prizes.

n Loss: Get 2 prizes.

n A. Lose 1 prize for sure

n B. Spin and either lose 2 prizes or lose no prizes.

Intuitive Gist-Based Processing Increases with Age

- § Preschool: No framing effect
 - § Trade off risk and reward
 - § 2 dimensions: Quantitative
- § Childhood: Reverse Framing
 - § Reward
 - § 1 dimension: Quantitative
- § Adolescence: Standard Framing
 - § *Qualitative* reasoning favored by adults for small rewards
 - § More quantitative when rewards large
- § More gist-based with age

Intuitive Processing Increases, Despite Analytic Competence

Biases increased

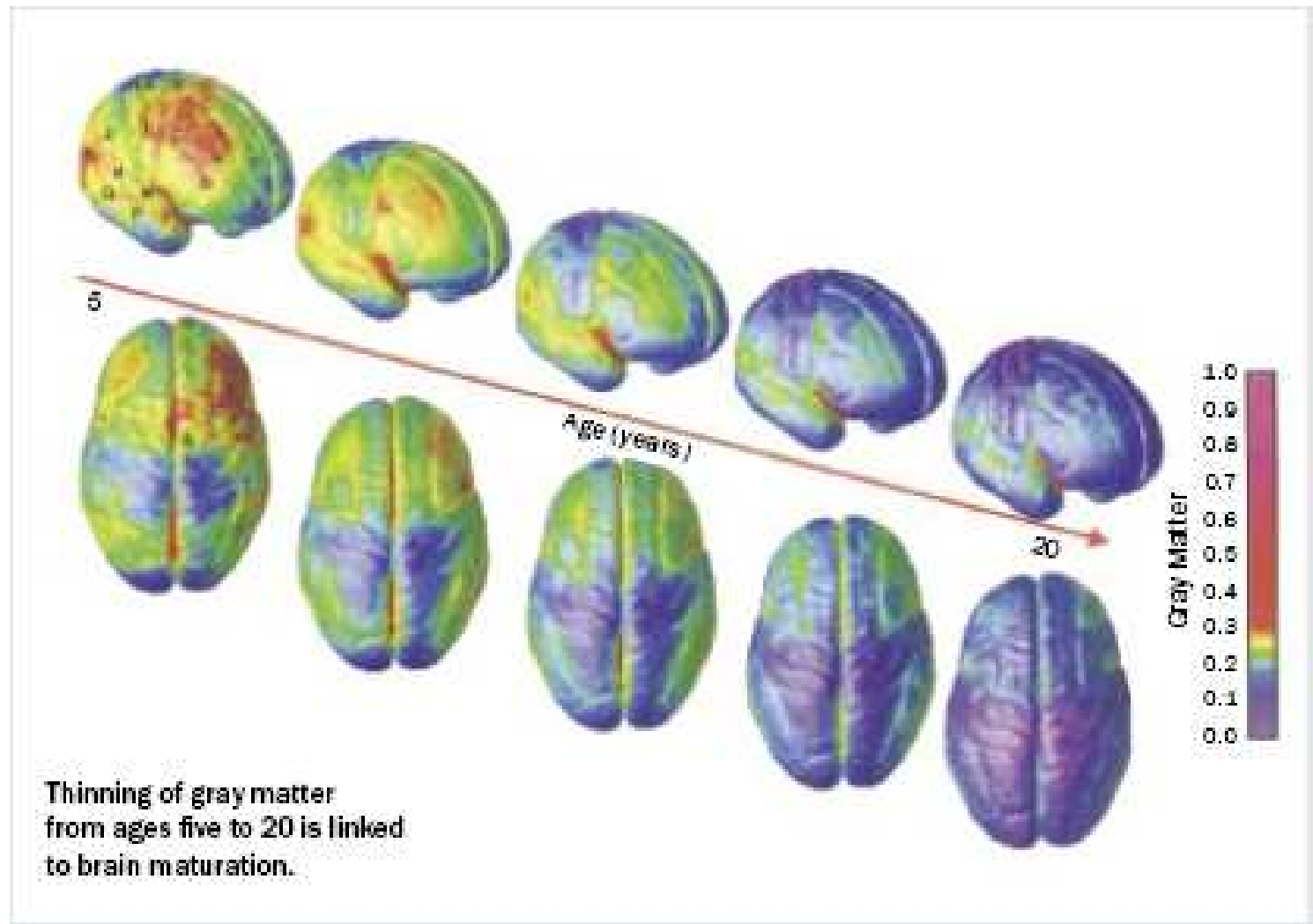
- n Jacobs & Potenza (1991)--representativeness
- n Reyna & Brainerd (1994)--probability
- n Davidson (1991)--multiattribute
- n Davidson (1995)--conjunction fallacy
- n Markovits & Dumas (1999)--transitivity bias
 - n Length vs. friendship
- n And others...



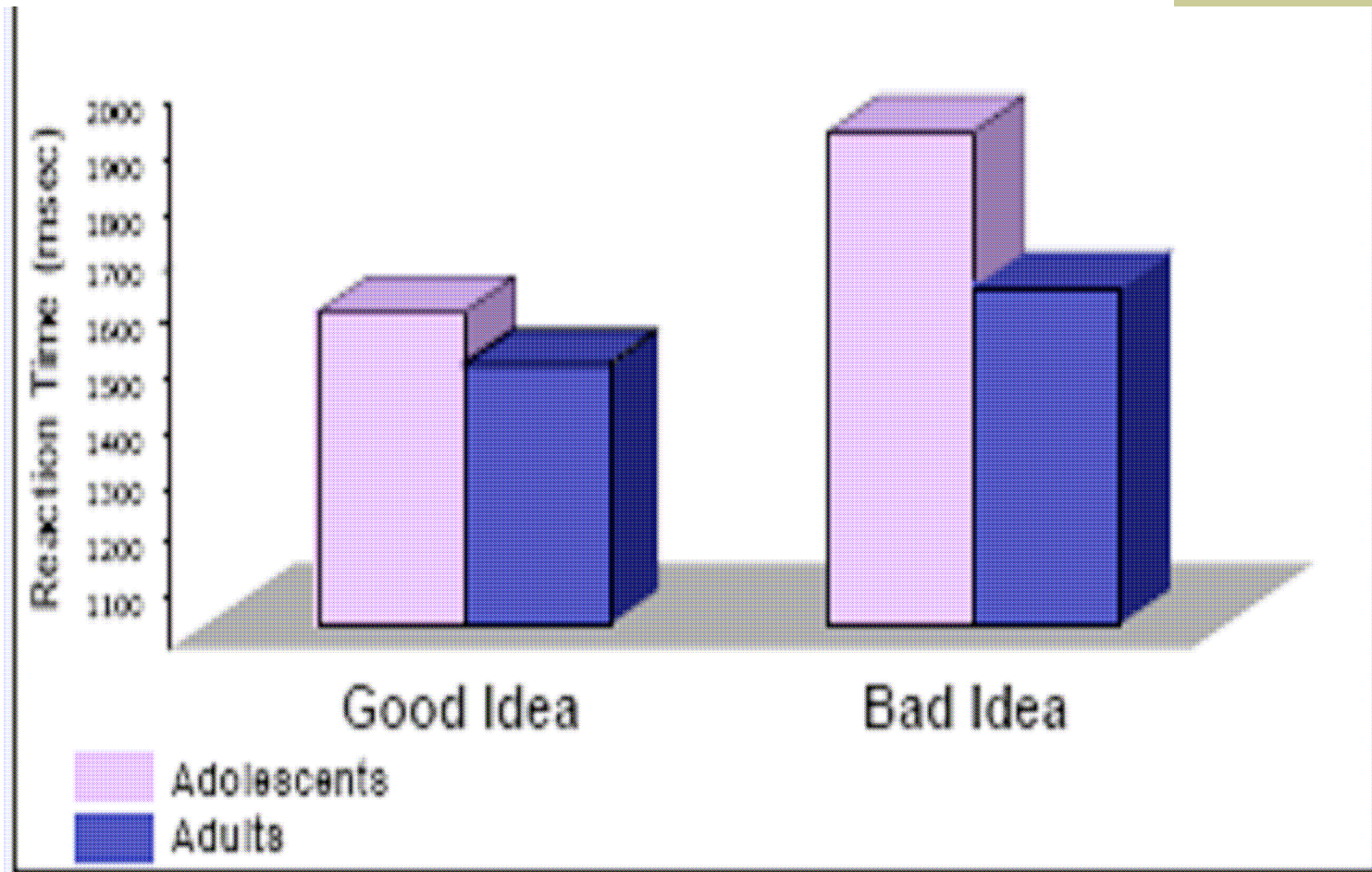
Gist-based intuition is advanced.

Neurological development: Analysis to gut-level gist.

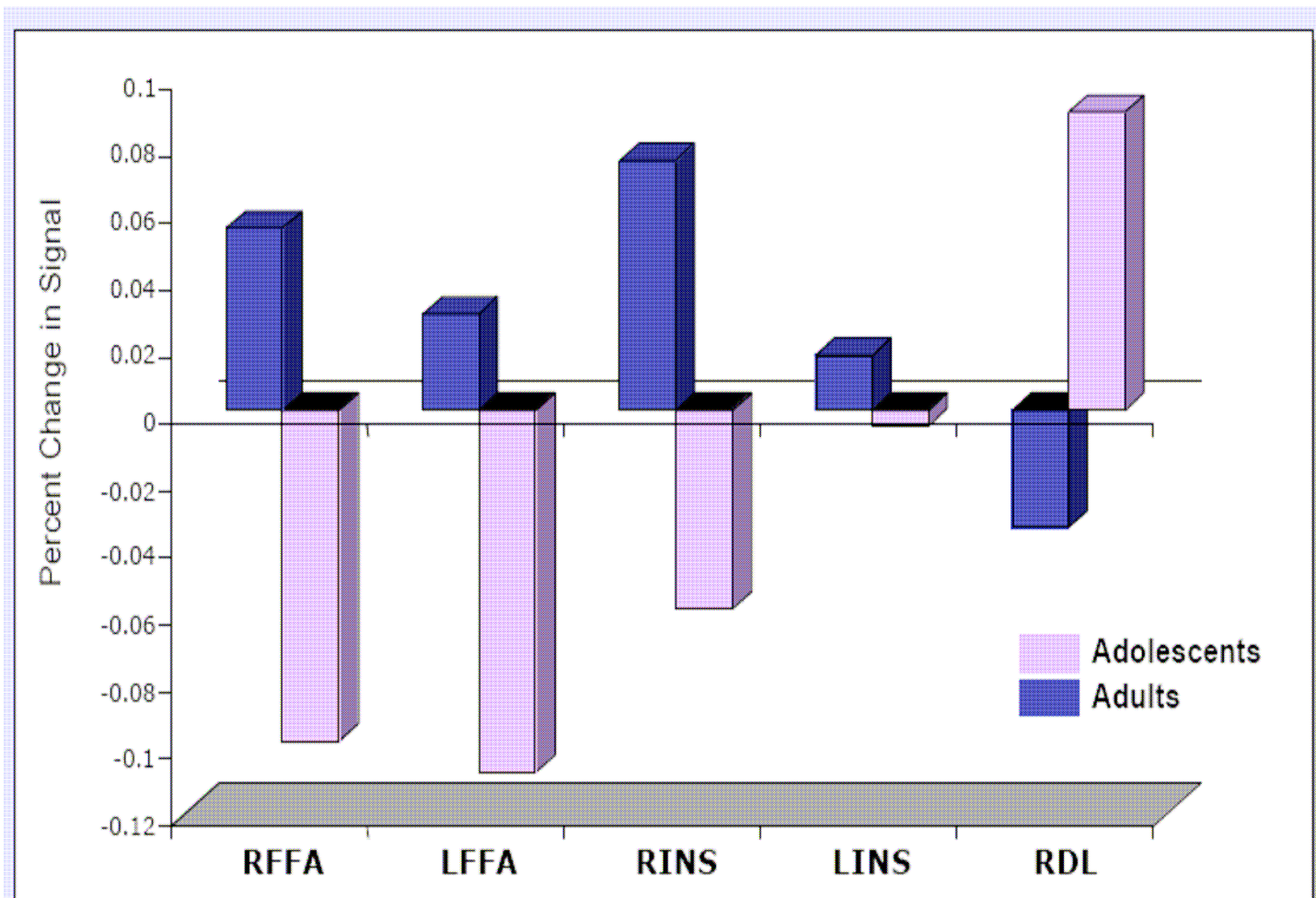
Thinning of Gray Matter: Less is More



Images, Insula vs. Effortful Reasoning



Images, Insula vs. Effortful Reasoning



Imaging Results Support Developmental Predictions

- n Adult brain: *Pruning*, not more connections
- n Adolescents: *More* deliberation, effortful reasoning about risky decisions (swim with sharks)
 - n Baird & Fugelsang, 2004; Baird, Fugelsang, & Bennett, 2005)

Deliberation: Sexual Risk Taking

n Risks of Sex:

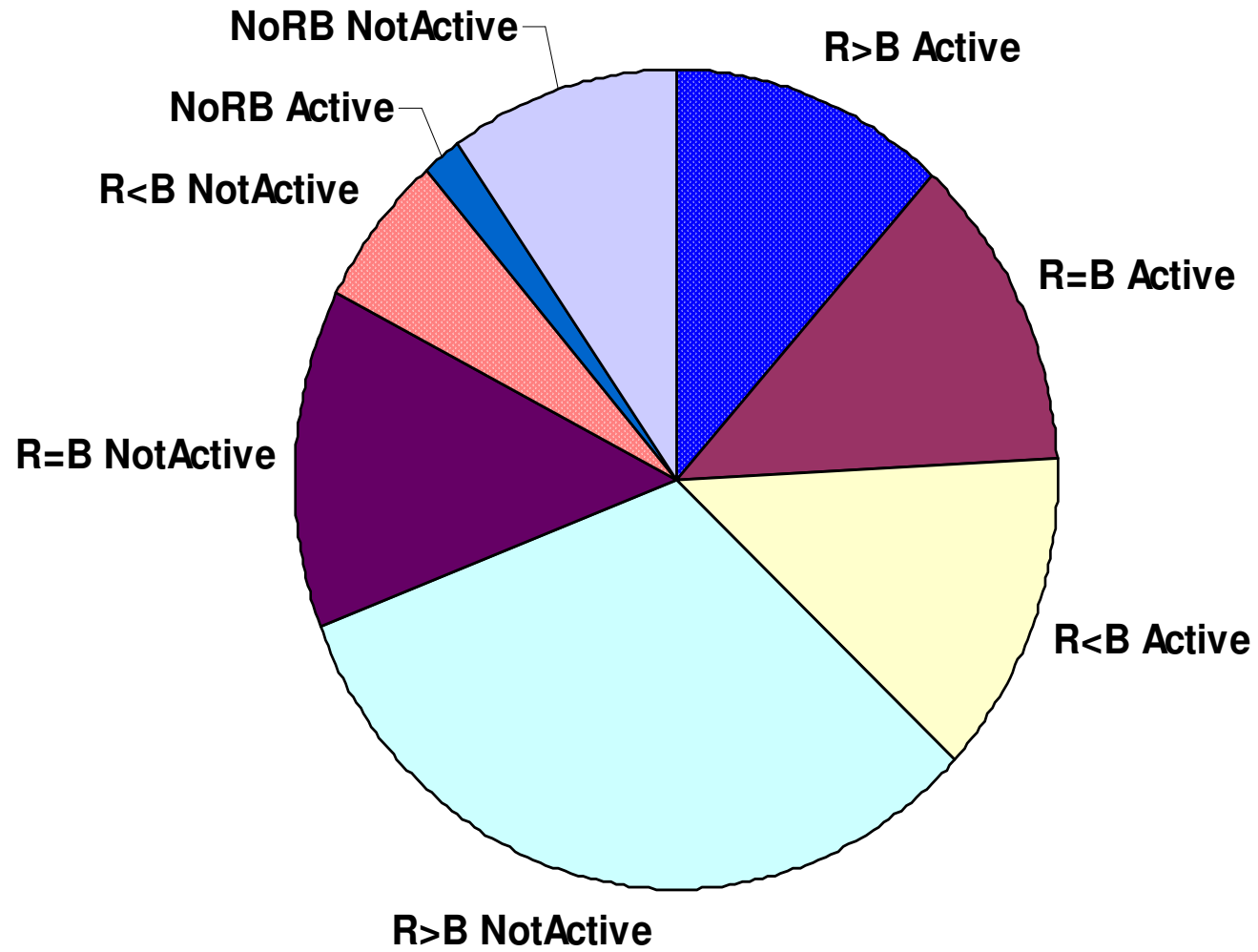
n None, Low, Medium, High (check one)

n Benefits of Sex

n None, Low, Medium, High (check one)

n Significant predictors of behavior and behavioral intentions

Intentionality



Absolute vs. Relative Gist Endorsement

- n Absolute: No risk is better than some risk.
- n Relative: Less risk is better than more risk.

Absolute vs. Relative

- n Further evidence that qualitative processing promotes risk avoidance
 - n Endorsement patterns of risk principles:
 - n Relative – Yes, Absolute – No: 61% sexually active
 - n Relative – Yes, Absolute – Yes: 44% sexually active
 - n Relative – No, Absolute – No: 46% sexually active
 - n Relative – No, Absolute – Yes: 30% sexually active
 - n Finer grained distinctions Increased risk taking

How Think *and* Opportunity

- n If risk overestimated, risk perception increases, and risk taking decreases in lab tasks in adolescence, why *more* real-life risk-taking?
- n Still *calculating* risks
 - n Promotes risk taking
 - n Risks are rare and benefits are large
- n More unsupervised time: Opportunity

Why is gist-based intuition protective?

- n Dual processes
 - n Gist: qualitative thinking based on simple gist representations, such as “avoid risk of HIV”
 - n Verbatim: quantitative trading off of risks and benefits
- n Trading off - Increased risk taking because trading off risks and benefits often objectively favors risk taking
 - n Especially for single acts as opposed to many acts
 - n Global risk avoidance ignores the magnitude of potential benefits and, thus, is protective
- n Supported by laboratory research (Reyna & Ellis, 1994) and studies of real-life risk taking (Reyna & Farley, 2006).

Factors in Risky Decision Making: Each Develops

n **Knowledge**

- n Overestimate important risks
 - n Problem for traditional programs to reduce risk

n **Representation** (gist = meaning)

- n Even when decision involves numbers (framing), not about numbers--about simple meaning

n **Retrieval:** Varying cues in questions (verbatim or gist), protective or reflective judgments can be elicited in the same person, related in opposite ways to risky behavior

n **Adolescent Development**

- n Avoid unhealthy risks by relying on gist-based intuition
- n Many calculate and take risks intentionally, not impulsively

Gist is Advanced

- n Framing effects due to categorical gist, and such effects emerge with development
 - n Other JDM effects emerge with development
 - n Related to real-life risk taking
- n Adolescents who avoid risk think more categorically and endorse simple gist principles
- n Recent randomized clinical trial showed that gist-enhanced intervention reduced sexual behavior and intentions better than standard interventions—endured after 12 months

Adolescent Risky Decision Making

- § Risky deliberator for whom benefits loom large, but also...
- § Risky reactor (emotion, impulse)
- § Gist-based risk avoider (less analysis, less risk taking)

Counterintuitive Conclusions

- n Despite conventional wisdom, adolescents do not perceive themselves to be invulnerable, and perceived vulnerability declines with increasing age;
- n Although the object of many interventions is to enhance the accuracy of risk perceptions, adolescents typically overestimate important risks, such as HIV and lung cancer;
- n Despite increasing competence in reasoning, some biases in judgment and decision making grow with age, producing more “irrational” decision making in classic view
 - n Occurs because of a known developmental increase in gist processing with age.

Implications

- n Traditional interventions stressing accurate risk perceptions are apt to be ineffective or backfire because young people already feel vulnerable and overestimate their risk.
- n Experience is not a good teacher for younger adolescents, because they learn little from negative outcomes (favoring effective deterrents, such as monitoring and supervision).
- n Novel interventions that discourage deliberate weighing of risks and benefits by adolescents are more effective and enduring.
 - n Mature adults intuitively grasp the gists of risky situations, retrieve appropriate risk-avoidant values, and never proceed down the slippery slope of actually contemplating tradeoffs between risks and benefits.



Recommendations

1. Reduce risk through higher drinking ages, eliminating or lowering the number of peers in automobiles, and avoiding exposure to potentially addictive substances (*not* exposing minors to alcohol to teach them to drink responsibly).
2. Develop psychometric instruments...
3. Develop reasoned arguments and facts-based interventions for risky deliberators.
Reducing perceived benefits of risky behaviors (and increasing benefits of alternative behaviors).
For younger adolescents, highlighting short-term costs and benefits.
4. Identify factors that move adolescents away from considering the degree of risk and the amount of benefit in risky behaviors toward categorical avoidance of major risks.

5. Monitor and supervise younger adolescents.

Rather than rely on reasoned choices, remove opportunity (e.g., occupy time with positive activities).

6. Seek practical self-binding strategies (avoiding situations that elicit temptation or require behavioral inhibition).

7. Encourage development of positive prototypes (gists) or images using visual depictions, films, novels, serial dramas and other emotionally evocative media.

8. Emphasize understanding of risk, deriving the gist or bottom line of messages that will endure in memory longer than verbatim facts.

Harmful consequences may not be understood because young people lack relevant experience; develop intuitive understanding.

9. Do not assume that adolescents think that they are immortal.

On the contrary, provide concrete actions that they feel capable of taking that will reduce their risk. Teach self-efficacy, help them practice skills, and show them how they can control specific risk factors.

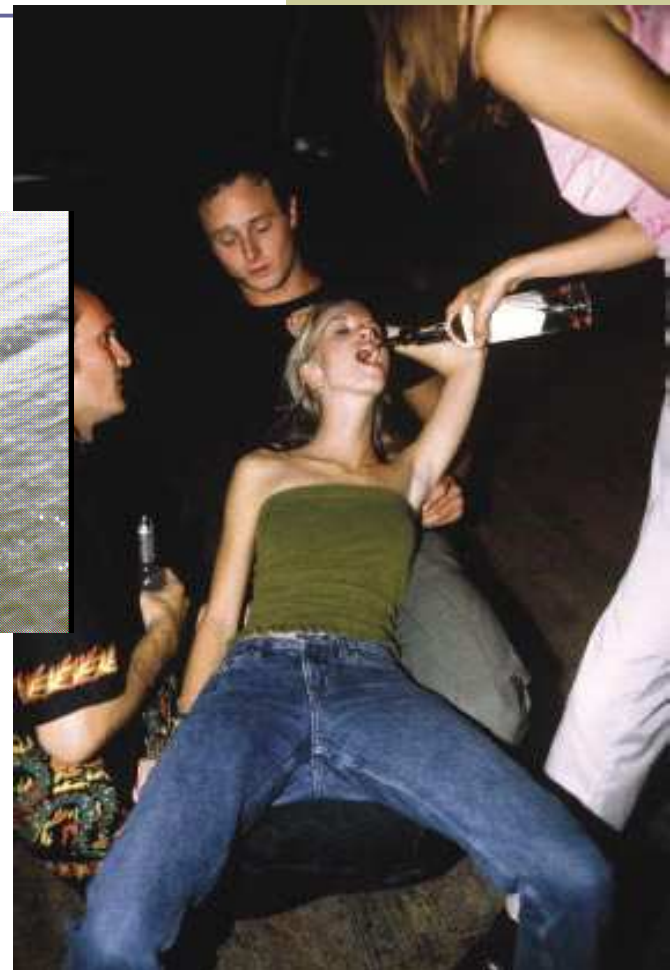
10. Provide frequent reminders of relevant knowledge and risk-avoidant values.

Even medical experts fail to retrieve what they know about STDs without cues.

11. Provide practice at recognizing cues in the environment that signal possible danger before it is too late to act.

12. Treat comorbid conditions, such as depression.

Is the teen brain too RATIONAL?



http://www.psychologicalscience.org/pdf/pspi/pspi7_1.pdf

Thank you!

n NIH

n NSF

n Laboratory for Rational Decision Making