Emerging Adult Justice Project

Hot and Cold Cognition:

Understanding Emerging Adults' Cognitive Reasoning

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Neuroscience research has revealed that the development of cognitive reasoning is more complex than previously understood. Decision-making is executed through two independent neural pathways, often referred to as "hot and cold cognition," and these pathways develop at separate rates during the life course. Understanding the differences and importance of these two types of cognition is essential to creating practices and policies in the justice system that will be fair, effective, and developmentally appropriate.

"Cold cognition" is non-emotional information processing and reasoning. A person uses cold cognition to plan their schedule, consider the consequences of their actions, and evaluate different approaches to a problem. "Hot cognition" is decision-making in an emotionally charged situation that can result in an outcome with a high risk or a high reward. Humans shift between these forms of cognition depending on their surrounding environment, physical and mental disposition,[1] and learned coping mechanisms to high-stress events.[2]

Emerging adults, generally defined as 18- to 25-year-olds,[3] have a greater tendency to take risks in a state of hot cognition compared to fully grown adults.[4] This age group is in a critical developmental period,[5] transitioning from adolescence into mature adulthood. The prefrontal cortex, the area of the frontal lobe that executes cognitive control, continues developing into the late twenties.[6] The region of the prefrontal cortex that moderates behavior in an emotional state tends to develop later in the life course than the area that makes decisions in non-emotional states.[7] Thus, during an emotionally charged event, an emerging adult's underdeveloped prefrontal cortex is less able to resist immediate rewards.[8] Emerging adults' motivation to seek rewards drives them to take impulsive actions,[9] especially in the presence of peers.[10]

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The Distinction Between Hot and Cold Cognition

Brain science shows that different neural pathways are activated when a person uses hot cognition or cold cognition.

When a person perceives their surrounding environment to be low stress, their brain engages in **cold cognition**, activating the dorsolateral prefrontal cortex for decision-making.[11] The dorsolateral prefrontal cortex, which tends to develop at about age 15,[12] controls the functions of planning and abstract, logical reasoning. For example, a 20-year-old, in a calm, relaxed state, decides to write out a strict diet plan to lose weight over the upcoming month—their dorsolateral prefrontal cortex is activated.

Hot cognition activates the orbitofrontal cortex,[13] a region of the prefrontal lobe that responds to high-stress events and inhibits impulsive decisions.[14] The orbitofrontal cortex tends to develop later in the lifespan than the dorsolateral prefrontal cortex that guides cold cognition. Once the orbitofrontal cortex has developed after puberty, typically around the late twenties,[15] a person's cognitive control system can more effectively regulate emotions, manage stress, and withstand peer pressure.[16]

In the same example, a 20-year-old is on a diet but their friends insist that they have cake at a party. Under peer influence, this young person will likely be in a state of hot cognition. This emerging adult will have a hard time resisting the cake because their social-emotional system is wired towards sensation seeking and high rewards. In this situation, the rewards are the acceptance of their peers and the delicious cake.

Emerging Adults Under Hot Cognition

The maturity gap between the neural pathways executing hot and cold cognition explain why emerging adults often have the intellectual capabilities of fully grown adults[17] but struggle with the brain functions that operate under hot cognition—emotion regulation, stress management, and behavioral control.[18] Emerging adults who experienced trauma or brain injury may take even longer to master decision-making in hot cognition states, as trauma can interfere with and prolong the development of the prefrontal cortex.[19]

Emerging adults experience hot cognition differently than fully grown adults. They are more likely to interpret an event as high stress[20] and be impulsive in an emotional state,[21] as shown by the high rates of substance abuse, automobile crashes, and crime[22] among this age cohort. While emerging adults are generally able to comprehend the negative consequences of risk-taking,[23] their premature cognitive control system tends to drive them towards engaging in dangerous behavior.[24] As a person ages, their brain is more capable of resisting instant gratification in emotionally charged situations.[25]

The presence of peers significantly increases young people's risk taking because social acceptance serves as a high potential reward.[26] For example, emerging adults have the cognitive abilities to pass a driving test but are more likely to drive recklessly if their friends are observing them.[27] Under peer influence, emerging adults' decision-making is guided by hot cognition[28]— shown by the increased activity of the orbitofrontal cortex[29]— and they are likely to rely on underdeveloped cognitive control systems that lead to the prioritization of sensation-seeking over minimizing risk.[30]

Considering Development of Hot and Cold Cognition in Public Policy

The age difference between the development of hot and cold cognition has recently been considered in legislative reform efforts. For example, studies showing that logical reasoning matures by age 15[31] have led to support for lowering the age of voting eligibility from age 18 to ages 16 or 17.[32] At the same time, the research revealing that emotion regulation and impulse control under hot cognition develops into the late twenties,[33] has influenced lawmakers' understanding of youths' criminal culpability[34] and has generated debates about better ways to respond to emerging adults who become involved in the justice system. A growing number of states – California, Colorado, Connecticut, Illinois, Massachusetts and Nebraska – have all considered raising the age of juvenile jurisdiction above the 18th birthday to include emerging adults. One state, Vermont, has already passed such legislation, with gradual implementation to be completed in July 2022.[35] The implications of the research revealing the maturity gap between hot and cold cognition are important to consider when creating developmentally appropriate public policy.

	Hot Cognition	**Cold** Cognition
Approximate age of development	Late twenties	Age 15
Type of circumstance that activates this state	Emotionally charged, with an outcome of high risk or high reward	Non-emotional
Brain region activated	Orbitofrontal Cortex	Dorsolateral Cortex
Brain function under this cognitive state	Emotion regulation, stress management, and behavioral control	Planning and abstract reasoning
Examples of decision-making in this state	Resisting peer pressure; delaying gratification	Planning a schedule; developing strategies to approach a problem

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