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### **Cognitive Enhancement in Courts**

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### **Abstract and Keywords**

Human cognitive performance has crucial significance for legal process, often creating the difference between fair and unfair imprisonment. Lawyers, judges, and jurors need to follow long and complex arguments. They need to understand technical language. Jurors need to remember what happens during a long trial. The demands imposed on jurors in particular are sizeable and the cognitive challenges are discussed in this chapter. Jurors are often subjected to both tremendous decision complexity and tremendous evidence complexity. Some of these problems could be ameliorated if we can somehow enhance the cognitive capacities, including attention and memory, of various players in trials. There are multiple ways in which cognition can be improved either by external tools or by an increasing number of biomedical interventions that act directly on the brain. The article surveys a range of beneficial and detrimental effects that substances can have on cognition.

Keywords: cognitive performance, cognitive challenges, jurors, decision complexity, external tools

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HUMAN cognitive performance has crucial significance for legal process, often making the difference between fair and unfair imprisonment. Lawyers, judges, and jurors need to follow long and complex arguments. They need to understand technical language. They need to observe what happens during the trial.

Moreover, trials depend crucially on memory.<sup>1</sup> Eyewitnesses must remember what they saw. Expert witnesses must remember their fields and their data and analyses in this case. Lawyers must remember which points they and the other side made and what each of their witnesses is supposed to say. Judges must remember the law, including complex procedural rules. Jurors need to remember what happened during a long trial.

# Cognitive Challenges for Jurors

The demands imposed on jurors in particular are sizeable:

The rules and procedures used to govern the conduct of jury trials reflect a great deal of faith in jurors' ability to understand and retain information over long periods of time, often with much intervening information. Jurors are expected to operate as passive recipients of information presented by the parties, and generally are prohibited from taking notes, asking questions, or using other potentially memory-enhancing tools. In addition, little opportunity is provided for review or elaboration of the concepts presented. From this impoverished learning environment, jurors are expected to recall the evidence and testimony presented at trial, recall the judge's instructions about the law applicable to the case, and reach a rational conclusion regarding the proper verdict in the case. (Johnson 1993)

**(p. 274)** These memory demands likely affect real court cases. Johnson (1993) cites the experience of litigation consultants that test the comprehensibility and memorability of particular case presentations to surrogate jurors. These evaluations often find inaccurate recall of case information, especially in complex cases.

The legal process also assumes that jurors can accurately assess what they do and do not remember. However, in mock jury trials there was no link between how confident jurors were about their memory and their actual accuracy: the most confident (and hence most likely to sway uncertain fellow jurors) were not the most accurate. The same was true for individual estimates of memory for particular categories of evidence. The accuracy improved once the jurors answered questions about the evidence, suggesting that a proper jury deliberation can compensate for individual memory failure. Unfortunately this requires a careful review of all evidence, something that might be hard to achieve due to memory and communication limitations (Pritchard and Keenan 1999).

Jurors are often subjected to both tremendous decision complexity (because of intricate legal principles) and tremendous evidence complexity (because of high information load as well as low implicational clarity and comprehensibility). Lawyers sometimes intentionally obscure their opponents' points, such as by introducing red herrings or continuously objecting in order to break the flow of testimony. When asked, jurors report that increasing the quantity of information they have to consider decreases their ability to understand the issues and the confidence in their verdict (Heuer and Penrod 1994). Decisions of jurors in a simulated civil trial were affected by different levels of evidence complexity. In a high-information load situation, they attributed greater blameworthiness to the plaintiffs, contrary to the evidence, and were less able to distinguish between differently liable plaintiffs (Horowitz *et al.* 1996).

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In general, the psychology of decision making has found that decision quality decreases as information load increases (Hwang and Lin 1999). To handle the information load the subject typically uses heuristics to rapidly weed out possibilities (Payne 1976), a process that seems likely to introduce some biases.

Learning and memory are strongly affected by other psychological factors, such as emotions, stress, alertness, and attention. The court environment is often stressful for jurors (The National Center for State Courts 2002), and this stress will likely affect their cognition. Equally, monotony, lack of stimulation, and active participation can also produce inattention and sleepiness that interfere with learning the evidence. Gruesome evidence may also arouse emotion and thereby bias recall through an emotional von Restorff effect (von Restorff 1933; Bradley *et al.* 1992).

For a trial to be fair, the jury needs to remember the details of the case, as well as their instructions from the judge, and to deliberate until they reach a consensus based on this information without being biased. Cognitive limitations might preclude bringing accurate memories to the deliberation, and they might affect the impartiality of the deliberation and the fairness of the trial. In some cases, jurors are asked to disregard evidence, which requires an additional high degree of mental control.<sup>2</sup>

**(p. 275)** Sleepiness in the courtroom is another cognitive problem. Judicial sleepiness is not uncommon, but mistrials due to sleeping judges appear to be rare. In *White* 589F.2d 1283 1289 (5th Circuit, 1979), the presiding judge fell asleep during the defense counsel's opening statement, but there was no mistrial because there was no evidence of prejudice to the defendant's case. Nonetheless, such somnolence is increasingly disparaged by the public and the profession.

In many ways, the evidence from these cases suggests that judges are now held to a high standard similar to those in the trucking industry or hospital medical staff. While potential consequences of fall-asleep errors by truck drivers and hospital medical staff often involve death or serious injury, fall-asleep episodes by judges could possibly lead to serious consequences such as a wrong conviction or incorrect sentence (Grunstein and Banerjee 2007).

Jurors are even more prone to sleep. In a survey of juror delinquency, 562 judges (69%) reported cases over the previous 3 years where jurors had fallen asleep. This would correspond to 2300 cases, approximately 5-10% of all cases (King 1996). There were probably many more cases where jurors were sleepy, perhaps very sleepy, but did not actually fall asleep. However, the number of new trials actually granted due to juror misconduct (of any kind) was very low: 51 cases out of 26,000.

## Ways to Enhance Cognition

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Some of these problems could be ameliorated if we could somehow enhance the cognitive capacities, including attention and memory, of various players in trials. There are multiple ways in which cognition can be improved either by external tools or by an increasing number of biomedical interventions that act directly on the brain.

### External Tools

Memory and cognition in general are not strictly located solely within the brain: we often employ parts of the environment as extensions of the mind, and hence external tools can enhance or extend their abilities (Clark and Chalmers 1998; Dror and Harnad 2008). Typical examples include counting on fingers or adding on calculators. There are many more possibilities for jurors, some of which indicated in Table 17.1.

Some external tools that enhance cognition are simple and obvious. Exercise (which is, strictly speaking, not external) can enhance attention and memory. One might suggest that courts allow jurors (as well as witnesses, etc.) to go for a run or brisk walk occasionally during trials, when time permits. Requiring jurors to sit still for long periods can reduce memory and cognition in general.

Memory can also be enhanced by manipulating the environment. People tend to remember more and more accurately when they recall in the same circumstances as when they first experienced an event. Jurors then might recall more of the evidence in a long trial and might make fewer recall mistakes during their deliberations if they deliberate inside the courtroom where they heard the evidence. (p. 276)

Instructions and procedures can improve memory as well. These tools might include mnemonics or merely repetition of important information.

Table 17.1 External tools for cognitive enhancement in the courtroom

- 1.** Exercise and environment
- 2.** Instructions and procedures
- 3.** Note-taking:
  - a.** Improve memory by making notes and using them as memory cues
  - b.** Increasingly but not always allowed
  - c.** Concerns:
    - i.** Distract from testimony and observation
    - ii.** Overemphasize actually written information
    - iii.** Give literate people an advantage
- d.** Studies:

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- i. Likely improve recall of trial events
- ii. May be less effective with ambiguous information
- iii. Helps handle information load

#### 4. Access to transcripts and recordings:

- a. Less useful as memory cue

Taking notes is an obvious external memory enhancer. Note-taking by jurors used to be forbidden in most US jurisdictions, partly out of fear that jurors who took notes would gain inordinate dominance over illiterate jurors. Today, it is reportedly allowed in most but still not all jurisdictions. Note-taking can enhance memory both by the process of recording notes and by providing memory cues for later recall. Even doodling might act as an indirect memory enhancer by reducing boredom (Andrade 2009). Several studies have found that jurors taking notes recalled more trial events than non-note takers, and this might increase juror competence in some circumstances (Forsterlee *et al.* 1994; Rosenha *et al.* 1994; Forsterlee and Horowitz 1997). However, other field studies have questioned the improvement of recall of trial information (Heuer and Penrod 1988, 1989), especially when the evidence was ambiguous (Forsterlee and Horowitz 1997). Note-taking may help the jury confront higher information loads: in an experiment with 6- and 12-member mock juries note-taking reduced the tendency for the smaller (and likely more overloaded) juries to give too high compensatory awards in high-complexity situations (Horowitz and Bordens 2002).

Pre-existing knowledge tends to aid recall of related information by providing a framework for assimilating the new information. Careful pre-instruction assists with juror recall of evidence (Elwork *et al.* 1977; Kassin and Wrightsman 1979). Note-takers, while showing better memory than non-note-takers, performed even better in terms of decision making when given effective pre-instructions (Forsterlee and Horowitz 1997).

When memory fails, jurors can ask for access to transcripts and recordings. However, the ability to ask for transcripts is useful only if jurors remember enough to know which parts to ask for. Moreover, some courts surprisingly suggest that jurors should put less weight on the transcript than on their memories of what was said. Courts could more strongly encourage jurors to refer to official records by making access easier.

(p. 277) In these and other ways, courts could enhance juror memory and performance by the use of external tools. Each of these methods raises legal, moral, and practical issues that might preclude its use in actual trials. Still, the cost of refusing to use these tools will be decreased cognitive performance by jurors (and other legal actors).

## Biomedical Cognition Enhancement

Like external tools, biomedical cognitive enhancers could improve a wide variety of cognitive functions (Table 17.2):

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- Wakefulness: caffeine, modafinil, stimulants in general.
- Attention: methylphenidate (Ritalin<sup>®</sup>), nicotine.
- Memory encoding: glucose, cholinergic drugs (eg. donepezil, nicotine, physostigmine), levodopa, ampakines.
- Working memory: methylphenidate (Ritalin<sup>®</sup>), modafinil, dopaminergic drugs.
- Stress reduction: beta blockers (propranolol).
- Self-control: glucose.
- Executive inhibitory control: Modafinil.
- Empathy/prosocial behavior: oxytocin.

Some jurors already use some of these substances regularly. Glucose improves episodic memory and other cognitive abilities in middle-aged people, especially when the task is demanding (Riby *et al.* 2008). Many jurors use caffeine and nicotine while serving on a jury. Some take stronger energy drinks, such as 5-hour Energy™.

Other biomedical cognitive enhancers are used less often, but are still probably used by some jurors today. US sales of methylphenidate (Ritalin<sup>®</sup>) are growing so fast that many jury members probably already take it as a therapeutic medication. Cognitive enhancers are used deliberately by at least some professionals (Sahakian and Morein-Zamir 2007). Levodopa, a precursor to dopamine used in the treatment of Parkinson's disease, when given over 5 days improved learning of an artificial vocabulary in terms of speed of learning, correctness of answers (the effect was approximately 10% more correct responses in the levodopa condition). There was a decrease of false alarm responses (Knecht *et al.* 2004).

Much research has examined how to enhance sleep-deprived healthy subjects. Stimulants (modafinil, caffeine, and dextroamphetamine) improved general alertness, reaction speed, and other cognitive abilities, including the ability to discriminate and label complex emotional blends in pictures of faces (Huck *et al.* 2008). This ability can be crucial for assessing witnesses. However, modafinil and caffeine appear more efficacious for improving executive function (Wesensten *et al.* 2005). Modafinil is able to restore humor appreciation (a complex cognitive ability), unlike the other stimulants (Killgore *et al.* 2006). Modafinil also resulted in greater deliberation before making decisions than the use of amphetamines. Different stimulants are, thus, likely to have subtly different effects on cognitive subsystems (Killgore *et al.* 2009). In a court setting, the basic stimulant effect would allow jurors to remain awake and vigilant, while enhancing the higher cognitive abilities needed for making observations (p. 278) of subtle evidence (e.g. witness testimony), following lines of argument, and avoiding rash decisions during deliberation.

Table 17.2 Some cognition-affecting substances and court-relevant cognitive effects

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	<b>Positive cognitive effects</b>	<b>Negative cognitive effects</b>
Alcohol	Reduce persuasion? (Bostrom and White 1979)	Memory, attention, and wakefulness impairment, disinhibition (Weissenborn and Duka 2003)
Ampakines	Memory (Lynch 2002)	
Benzodiazepines	Stress reduction (Lydiard <i>et al.</i> 1988)	Memory impairment, alertness reduction (Gorissen <i>et al.</i> 1995; Stewart 2005)
Beta blockers	Stress reduction (Alexander <i>et al.</i> 2007)	Memory biasing (Callaway <i>et al.</i> 1991; Cahill and van Stegeren 2003)
Caffeine	Wakefulness (Smith 2002)	More easily persuaded? (Mintz and Mills 1971; Martin <i>et al.</i> 2005)
Cholinergic drugs (donepezil, physostigmine)	Memory (Furey <i>et al.</i> 2000; Barch 2004)	
Glucose	Memory (Riby <i>et al.</i> 2008), self-control (Gailliot <i>et al.</i> 2007)	
Marijuana	Stress reduction (Hart <i>et al.</i> 2001)	Premature responses, learning impairment, working memory impairment, possibly memory bias (Hart <i>et al.</i> 2001; Lundqvist 2005)
Methylphenidate (Ritalin®)	Planning, working memory (Elliott <i>et al.</i> 1997)	
Modafinil	Wakefulness (Baranski <i>et al.</i> 2004), working	

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	memory, decisionmaking, inhibitory control (Turner <i>et al.</i> 2003)	
Nicotine	Attention (Rezvani and Levin 2001; Newhouse <i>et al.</i> 2004)	Withdrawal distraction, reduced recall (Kelemen and Fulton 2008)
Stimulants	Wakefulness, some memory encoding, emotional discrimination (Barch 2004; Huck <i>et al.</i> 2008)	Impulsivity (Ramaekers and Kuypers 2006)

However, some biomedical cognitive enhancers have worrying side effects that could impair legal decision making. Propranolol, used for the treatment of hypertension, reduces anxiety in subjects forced to give a speech, so it might reduce anxiety and its effects in witnesses and jurors, but it was also found to impair recall of difficult (but not easy) words in anxious subjects (Hartley *et al.* 1983). Again, some enhancers might improve memory performance among the worst performers but reduce it among the top performers (Kukolja *et al.* 2009). Enhancer effects might, for example, be larger among older jurors, since they may be suffering from neuromodulatory deficits; but the same enhancers might have (p. 279) detrimental side effects on younger jurors. Each biomedical enhancer must be tested separately and carefully for its costs as well as benefits to cognitive capacity.

## The Ethics of Cognition Enhancement in Court

Should cognitive enhancers be allowed, made readily available, provided for free, encouraged, or required for jurors or other participants in the legal process? These moral and legal issues can be illuminated by comparing biomedical enhancers with note-taking. As we said, note-taking is allowed in most but not all jurisdictions. Where note-taking is not allowed, various objections are raised (though not based on empirical research) (Penrod and Heuer 1997). Only some of these objections apply to the use of cognitive enhancers:

- Note-taking is alleged to distract jurors.
  - No distraction occurs with the use of biomedical cognitive enhancers.
- Note-taking is assumed to consume too much trial time.

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- No trial time is taken by biomedical cognitive enhancers.
- Juror notes are often not accurate records of the trial.
  - Enhanced memories might be more accurate than non-enhanced memories, but accuracy is not guaranteed by any method.
- Juror notes might favor one side or the other. For example, notes tend to trail off, so the side that goes first might get an unfair advantage if notes are allowed.
  - Biomedical cognitive enhancers give no such advantage to the side that starts, and might even reduce an unfair disadvantage to the side that goes last by counteracting detrimental effects of exhaustion, impatience, and boredom.
- Note-takers might have undue influence over non-note takers.
  - Biomedically enhanced jurors might become over-confident, and jurors who are not biomedically enhanced might become over-deferential.

This brief comparison suggests that biomedical cognitive enhancers are no more questionable than note-taking, unless they lead to excessive confidence by users and/or excessive deference by non-users. Greater confidence of those who use biomedical cognitive enhancers might be justified by their greater cognitive abilities, but they might become even more confident than is warranted. In any case, these dangers should be taken seriously and tested empirically.

## Biasing Effects

There would be a strong reason to forbid the use of biomedical cognitive enhancers in courts if they biased judgment in some unfair way. Drugs can produce effects that are not strictly memory failures yet influence what is remembered and how deliberation is conducted.

(p. 280) Drugs can, for example, influence how easily jurors are swayed by persuasive communication. Caffeine appears to facilitate persuasion (Mintz and Mills 1971; Martin *et al.* 2005). In a double-blind test, moderate amounts of caffeine (3.5mg/kg) led to greater agreement with a counter-attitudinal message. The effect may be mediated by the increased arousal, attention, and information processing due to the drug, which facilitates systematic thinking about the message and hence being convinced by it. More persuasive arguments showed a stronger effect in the caffeine condition than in the non-caffeine condition, while less persuasive arguments had similarly low effect (Martin *et al.* 2005). Contrary to common belief, alcohol appears to have the opposite effect (Bostrom and White 1979). It is not clear, however, whether these effects carry over to conditions of lengthy cross-examination and opposing arguments, as in real trials.

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Some drugs can also affect memory in ways that might bias trials. The ability to recall information is influenced by the emotional valence and strength of the information at the time of encoding. Drugs may affect this. (Cahill and van Stegeren 2003) found a sex-related impairment of memory for emotional information by an adrenergic blockade. They gave test subjects the beta-blocker propranolol and showed them slides of an emotionally arousing story, afterwards asking central and peripheral questions. They found that in men the drug impaired memory for information central to the storyline but not peripheral details. Conversely, in women the effect was opposite: they recalled more of the central storyline and less of the peripheral details. These effects on emotional memory might be relevant to trials: trial testimony can have a strong emotional component, and recall of central and even peripheral details is relevant for making a correct decision.

Propranolol also affects how users deal with difficult memory tasks. In hypertensive patients given a memory task treatment with propranolol gave them a more conservative bias, that is, an increased tendency to answer “no” when uncertain about whether they recognized an item (Callaway *et al.* 1991). This effect appears similar to how depressed patients have a conservative bias in a word-recognition task, while manics have the opposite bias (i.e. more positives when uncertain) (Corwin *et al.* 1990). It is not implausible that this effect is mediated through noradrenergic mechanisms, making drugs that increase noradrenergic levels, such as amphetamine or atomoxetine, potential cognitive enhancers, have the positive biasing effect. Response bias effects may be relevant in juries, especially during deliberation. A conservative bias would generally favor the defense, whereas the opposite bias would favor the prosecution.

In conclusion, some drugs, such as propranolol, can bias judgment. Given that such beta-blockers are widely prescribed for cardiovascular disease and are used by many to relieve symptoms of stress (including reduction of stage-fright among music performers (Slomka 1992)), it is not unlikely that some jurors are using these drugs. These drugs may be used for medical or lifestyle reasons, but their potential biasing effects might be grounds to ban them from trials.

It is unlikely, however, that the use of cognition-affecting drugs would result in a mistrial. Defendants have a right to a competent and fair jury, which has led to concerns about juror drunkenness. In the US, 12 of the 562 judges surveyed in King (1996) reported jurors under the influence of drugs or alcohol. Over time the forms of juror drinking needed to grant a retrial has changed from a strict view in the 1800s to increasingly viewing it as a harmless form of misconduct, at least as long as it was the fault of the individual juror (King 1996). After investigations into the excessive use of drugs by a jury, the Supreme Court ruled,

The same policy considerations supported the Supreme Court’s decision in *Tanner v. United States* upholding the trial judge’s refusal to conduct an investigation into broad allegations that a jury “was on one big party” and numerous claims alleging jurors’ excessive use of (p. 281) alcohol and drugs. The Court rejected the defendant’s contention that substance abuse constituted an improper external

influence. According to the Court, “drugs or alcohol voluntarily ingested by a juror seems no more an ‘outside influence’ than a virus, poorly prepared food, or lack of sleep.” As an internal matter, ingestion of drugs and alcohol was within the rule prohibiting juror testimony to upset a verdict. (Gershman 2005)

If drunkenness and excessive use of illegal drugs is not enough to justify a mistrial, then it seems unlikely that the use of caffeine or propranolol would be enough for a mistrial, even if such enhancers did have some biasing effect.

## Policy Considerations

We have surveyed a range of beneficial and detrimental effects that substances can have on cognition. Some can adversely affect or bias deliberation, but their effects appear smaller than the biasing effects of jury deliberation itself (Sunstein 2006). Given the low requirements for juror competence, it is not consistent with current legal practice to ban such substances. Similarly, given the low bar required for juror competence, coupled with rights to control what goes into one’s body, courts could not legally require consumption of even clearly safe cognition enhancing drugs.

Even if courts neither ban nor require biomedical cognitive enhancers in trials, other steps could be taken. An increasing number of agents that affect cognition are clearly entering use. Courts and jurors should be aware of the effects of these substances on cognition. Better information about how to deliberate more effectively, including interventions and strategies, should be made available prior to the court process. Courts should also consider deployment of simple strategies, such as breaks and exercise, to improve juror performance.

As our range and knowledge of cognitive enhancers increases, some enhancers should be provided, as we now provide coffee, if they are safe and do not bias judgment. Substances like modafinil may well meet this criterion. Given the stakes, we have a moral imperative to investigate ways to utilize these new technologies to improve cognitive performance in the courtroom. Innocent people’s lives may well depend on them.

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### Notes:

(1) This is one reason why the statutes of limitations exist (Johnson 1993).

(2) In this chapter, we will not deal with the implications of inherent cognitive limitations of jurors due to low IQ or mental disorder. If there is a 10% chance of a mental disorder per juror, there is only a 28% chance that a random jury will be entirely free of mental disorder.

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