

ECPS6005 - COGNITION IN ACTION

DRUGS AND COGNITION

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EFFECTS OF DRUGS ON COGNITION



- Need to consider:
 - Legal drugs (e.g., caffeine & alcohol)
 - Prescription medication
 - Illegal drugs (e.g., ecstasy)
- Need to consider whether drugs influence whole cognition or specific cognitive functions differently:
 - E.g., perception, attention, decision making, memory

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EFFECTS OF DRUGS ON COGNITION

- Takagi et al. (2014): investigated effects of inhalants and cannabis on cognition.
 - Ps 13-24 years - self-report history of drug use
 - Go/No Go test, and Stroop measured
 - Inhalant users (spray paint) performed worse than controls
 - Also heavy, regular use associated with more incorrect responses
- However, Ps reported using other drugs, not focused on in study.



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COCAINE AND COGNITION

- Results in broad cognitive impairments, including:
 - Basic cognitive functions (attention and working memory)
 - Complex abilities (executive functions, social cognition, decision-making)
- Vonmoos et al. (2013): 30% of dependent and 12% of recreational users displayed clinically relevant global cognitive impairment
 - Dependent users show strongest deficit in WM and executive functions
 - Recreational users display strongest effect in attention and memory

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REAL-WORLD APPLICATION

- Driving:
 - Drugs commonly linked to impaired driving:
 - Cannabinoids (marijuana)
 - Depressants: hypnotics, sedatives, antihistamine
 - Stimulants: cocaine, meth
 - Narcotic analgesics: morphine, codeine

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REAL-WORLD APPLICATION

■ Effects of Drugs on Driving:

Reaction time
Insufficient response

Perception
90% of info is visual, glare resistance, recovery, dark/light adaptation, dynamic visual acuity

Judgement
Risk reduction, avoidance of potential hazards, anticipation, risk-taking behaviour, inattention, decreased fear, exhilaration, loss of control

Coordination
Effects on nerves/muscles: steering, breaking, accelerating

Tracking
Staying in lane, maintaining suitable distance

Attention
Divided, not focused, time-shared task with high demand and info processing

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REAL-WORLD APPLICATION

Effects of Drugs on Driving:

Cannabis

Slows reactions, affects concentration and reduces ability to steer

Cocaine

Causes erratic behaviour; reduces concentration, can lead to sleepiness after initial resistance to tiredness

Ecstasy

Causes adrenaline surge giving driver feeling of over-confidence

LSD

Vehicle speeds and movement are difficult to judge, causes hallucinations, results in confusion

Heroin

Slows reaction, blurs vision, makes driver feel drowsy/confused

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RESEARCH IN PRACTICAL SETTINGS

- SDT in driving:
 - Relates to the identification of sudden hazards
 - Considers external and internal influences of driver
- Drugs affect signal detection: both ability of sensory information to be registered and cognitive aspects of decision making.
- But difficulty examining effect in real-world.
 - Ethics!

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RESEARCH IN PRACTICAL SETTINGS

- Li et al. (2016): investigated effects of alcohol on driving performance in simulator.
- Fifty-two Ps in double-blind test divided into groups:
 - Alcohol and no-alcohol (placebo).
- Results: the higher the levels of alcohol in the bloodstream, the longer it took to react to brake to avoid a hazard.
- However, study lacks ecological validity and issues with familiarity of simulator layout added.



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RESEARCH IN PRACTICAL SETTINGS

- How can research examine effects of drugs in real-world in ethical manner?
 - E.g., Ford developed drug driving suit – simulates effects of drugs on driving:
 - Although cognition is not focus, physical aspects influencing cognition are captured:
 - Visual impairment glasses to interfere with perception
 - Arm and leg weights to reduce reaction times
 - Headphones playing random sounds to cause confusion

Link to Ford's Drug driving suit video: <https://www.youtube.com/watch?v=UriQNCIS83E>

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CONDUCTING DRUG AND COGNITION RESEARCH

- Drugs can induce physiological and psychological effects
 - Even having knowledge of taking a drug could influence thought processing and behaviour/action, etc.
- Use balanced placebo design (BPD; Rosenow & Marlatt, 1981) to allow clear differentiation between placebo and physiological effects.
 - Four test conditions: (1) told drug-consume drug, (2) told drug-consume placebo, (3) told placebo-consume drug, (4) told placebo-consumed placebo.
- Physiologically alcohol has been found to increase instances of inattention blindness (Clifasefi et al., 2006), working memory processes (Benson, et al., 2019), performance judgements (Tiplady et al., 2004) and other cognitive functions.
- Psychological response to belief one has consumed alcohol affects social behaviours, with no impact on cognitive functions (Aseffi & Garry, 2003).

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IS HORSE RIDING MORE DANGEROUS THAN TAKING ECSTASY?

EVALUATING EVIDENCE OF WHETHER HALLUCINOGENIC DRUGS SHOULD BE USED FOR THERAPEUTIC PURPOSES.

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PROFESSOR DAVID NUTT:



- British psychiatrist and neuropsychopharmacologist.
- Fiercely campaigned for drug law changes to allow researchers to examine effects of hallucinogens.
- Appointed chairman of UK government Advisory Council on Misuse of Drugs (ACMD) in January 2008.
- Continually clashed with ministers on drug classifications.
- 2009: published editorial in *Journal of Psychopharmacology*, comparing risks of horse riding as more dangerous than risks of taking ecstasy.
- Lecture suggesting alcohol/tobacco more harmful than LSD, ecstasy, or cannabis.
- By end of 2009 he was dismissed by Home secretary.

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HALLUCINOGENS...

- What are they?
 - Diverse group of perception altering drugs (inc. thoughts, emotions, feelings, and consciousness).
- Where do they come from?
 - Plants/mushrooms (or their extracts). Also, human-made.
- Cause hallucinations or experiences that appear real but are not.
 - Used for centuries in religious and sacred rituals.

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COMMON EXAMPLES INCLUDE...

***D*-lysergic acid diethylamide (LSD):**

- mood-changing chemical
- Clear/white odourless material
- made from lysergic acid
- found in fungus grown on rye
- Acid, Blotter, Dots



Ayahuasca:

- tea from Amazonian plants containing *dimethyltryptamine* (DMT): mind-altering ingredient.
- Hoasca, Aya, & Yagé



MDMA/Ecstasy:

- synthetic drug: alters mood/perception
- produces feelings of increased energy, pleasure, emotion, distorted sensory and time perception.
- popular in nightclub scene and "raves"



Psilocybin:

- From mushrooms found in tropical & subtropical regions of South America, Mexico, and US.
- Magic Mushrooms, Purple Passion, Shrooms.



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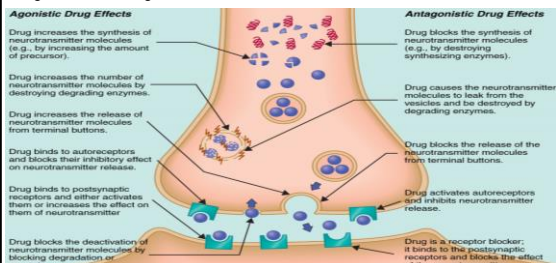
DANGERS OF HALLUCINOGENS

- **LSD:** Unpredictable – users experience “bad trips”, including:
 - Experience of psychotic “breakdown”
 - Changes in body temperature, blood pressure/heart rate
 - Loss of appetite, sleeplessness, dry mouth and tremors
 - Impairs distance perception (crossing road made difficult)
 - Negative flashbacks
 - Severe depression
 - Perceptual deficits
 - Loss of understanding
 - Feelings of intense fear and paranoia (Parrott et al.).

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LSD

- Binds to Serotonin receptors but nature of neurochemical changes is unclear: Agonistic vs. Antagonistic effect



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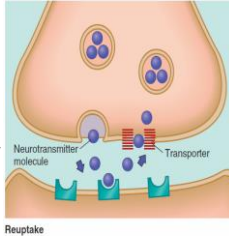
DANGERS OF HALLUCINOGENS

- **Ecstasy:**
 - changes in sleep (McCann et al. 2007; Jones et al. 2008),
 - reduced immunocompetence (Connor 2004),
 - altered pain thresholds (O'Regan & Clow 2004),
 - depression & forms of psychiatric distress (Schifano 2000; Soar et al. 2001),
 - occupational problems (Topp et al. 1999),
 - neurohormonal changes (Parrott 2009),
 - reduced happiness and greater everyday stress (Scholey et al. 2011).
- Inexperienced therapists unable to deal with drug-induced reaction (Greer & Tolbert, 1986).
- Appetite problems and food cravings – link to serotonin (Schifano, 2000)
- Lack of energy, irritability, brooding, and bad dreams (Liechti et al., 2001).
- Memory and higher-order cognitive deficits (e.g., Fox et al. 2001; 2002; Parrott et al. 2001; Parrott et al. 2004; Rodgers et al. 2003; 2006; Wareing et al. 2000).

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ECSTASY

- Induces neurotransmitter activation across neural pathways, e.g., serotonin, dopamine, noradrenaline, and others (Green et al. 2003).
- Impairs serotonergic function by blocking re-uptake.
- Impairs executive function, inhibitory control, and decision making (as shown by cortex and limbic functional brain scan abnormalities)



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THE BRAIN ON LSD

- First images of brain on LSD released by researchers (2016)
- Carhart-Harris: on LSD, scans suggest volunteers were “seeing with their eyes shut”, though images they reported were from imaginations rather than real world
- Scans revealed loss of connections between parahippocampus and retrosplenial cortex.
- HOWEVER – What is the main issue with brain imaging studies?

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ASSESSING THE EFFECTS OF HALLUCINOGENS

- Some critics say one of the main issues with conclusions drawn from assessing effects of hallucinogens is most research has been conducted with recreational drug users.
- What confounding factors should be considered here?



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LSD AND COGNITION

- Research has returned to examining **healthy volunteers**.
- Porkony et al. (2020): LSD on **specific cognitive domains** using standardised neuropsychological tests had not been studied.
 - Acute effects of LSD alone and in combination with ketanserin on cognition
 - Double-blind, randomised, placebo-controlled, within-subject design (25 Ps)
 - Tasks: Executive functions, cognitive flexibility, spatial working memory, and risk-based decision-making examined by the Intra/Extra-Dimensional shift task (IED), Spatial Working Memory task (SWM), and Cambridge Gambling Task (CGT) of the Cambridge Neuropsychological Test Automated Battery.
 - Results: Compared to placebo, LSD significantly impaired executive functions, cognitive flexibility, and working memory on the IED and SWM, but not quality of decision-making and risk taking on the CGT.

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CONDUCTING DRUG AND COGNITION RESEARCH WITH HEALTHY VOLUNTEERS

- In groups think about the following issues/concerns with conducting drug and cognition research with healthy volunteers:
 - Practical
 - Methodological
 - Ethical
 - Long-term effects

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