

Hazy memories

Citation for published version (APA):

Kloft, L. (2021). *Hazy memories: the impact of drugs on false memory formation from a legal-psycho pharmacological perspective*. [Doctoral Thesis, Maastricht University]. Gildeprint Drukkerijen. <https://doi.org/10.26481/dis.20210623lk>

Document status and date:

Published: 01/01/2021

DOI:

[10.26481/dis.20210623lk](https://doi.org/10.26481/dis.20210623lk)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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The findings in this thesis suggest that popular drugs such as cannabis and MDMA can impact false memory formation, and responding in memory tasks, in different ways. As these drugs are used by many people involved in crime (Evans et al., 2009) but also recreationally by the general population (Winstock, 2019), the findings can have wide societal impact and applied value for a range of target groups, including legal professionals (e.g., lawyers, judges, jurors, police), policy makers, scientists serving as expert witnesses, and clinicians and recreational users.

Potential Impact for Legal Practice, Policy Makers, and Expert Witnesses

The findings in this thesis are of notable legal relevance to all those who collect, use, and evaluate testimonies from eyewitnesses and suspects. In Chapter 2 it was demonstrated that the incidence of intoxication with alcohol, cannabis, and stimulants (e.g., ecstasy, cocaine) was especially high in violent crime cases. This implies that police officers, who are likely to be the first contact between an intoxicated crime-involved individual and the legal system, need to be equipped with appropriate methods of intoxication detection (e.g., formal training, biological detection methods) and be trained in handling (e.g., when and how to question) intoxicated witnesses, victims and suspects. Specifically, the information accumulated in Chapter 2 indicates that at mild to moderate levels of intoxication, alcohol-intoxicated individuals can still provide accurate information while intoxicated and the best strategy is to question them as soon as possible (Jores et al., 2019). At higher alcohol levels and after a delay however, chances of false memories are higher (Evans et al., 2019; van Oorsouw et al., 2019; van Oorsouw et al., 2015).

In contrast, when it comes to cannabis, the information described in Chapters 2-4 specifies that the risk for false memories is highest during acute cannabis intoxication. Therefore, we recommend that when witnesses, victims, and suspects are under the influence of cannabis, interviewing should be minimized to reduce the risk of false reporting that is induced by cannabis. Questioning should be postponed and, if needed, occur as soon as the person has sobered up to prevent memory decay due to time. However, a person under the influence of cannabis during an event, as well as sober-but-frequent cannabis users, might still show a yes-bias towards some new information later. Therefore, findings suggest that intoxicated individuals and potentially also regular cannabis consumers should be categorized as a vulnerable group, similar to child or elderly

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witnesses and suspects (e.g., Bull, 2010). This means that special procedural safeguards and best practice recommendations such as the use of skilled interviewing techniques (e.g., using validated tools such as the cognitive interview, Fisher & Geiselman, 1992) should be put in place to ensure that best evidence is achieved (i.e., maximizing accuracy and minimizing error, see Holliday et al., 2012).

The question regarding the reliability and validity of testimonies of intoxicated witnesses/victims/suspects is a relevant one for investigating officers, prosecuting attorneys, expert witnesses, and to judges or jurors ultimately determining a defendant's guilt. This thesis presents a first step to answer this question, and a first investigation into some of the detrimental memory effects of poorly studied but very commonly used drugs. The results presented here will eventually be integrated into the general scientific consensus, and this consensus can be used by expert witnesses to teach juries, legal professionals, and police about memory evidence in crimes that involved alcohol and other drug (AOD) intoxication. Chapter 2 specifically can be a useful resource for experts and legal professionals as it presents an extensive overview and converges findings of studies conducted with AOD in the domain of eyewitness and false memory. Information from Chapters 3, 4, and 6 showed that response bias might be a sensitive marker of drug impairment, and this knowledge could be applied to develop new objective tools to assess response bias in the context of drug use as part of forensic assessment (similar to e.g., Gudjonsson, 1997). This knowledge and general scientific consensus can be utilized by lawyers to defend their clients, by judges to evaluate the appropriateness and probative value of memory evidence, and by jurors to make informed decisions during the legal proceedings. This consensus can also be used to shape evidence-based recommendations to inform public policy and shape police protocols that are specifically designed to support memory functioning and to prevent its contamination. In turn, this increases the chance of obtaining reliable memory evidence, which contributes to the overarching goal in legal-psychological research: preventing miscarriages of justice by maximizing the number of perpetrators rightfully convicted and minimizing the number of innocent people wrongfully convicted.

Potential Impact for Clinicians

Knowledge on the acute, delayed, and long-term consequences of cannabis and MDMA is essential in the context of therapeutic use of these substances. Cannabis is often prescribed to be

used daily (e.g., Hazekamp & Heerdink, 2013), and MDMA-assisted psychotherapy for treatment of post-traumatic stress disorder will become a reality in the coming years (e.g., Mithoefer et al., 2019). Clinicians who are educated about the present findings can on the one hand take the potentially compromised reliability of memory responses by patients receiving these substances into account in their practice. Likewise, they can inform their patients of potentially unwanted side effects. Most important with regard to cannabis is that the risk of exhibiting spontaneous false memory errors, and the risk to go along with leading and non-leading questions is highest during acute cannabis influence. Clinicians should therefore minimize clinical interviews with patients who are under acute cannabis influence, in order to reduce the risk of obtaining unreliable and invalid information. Regular cannabis use however can also result in a general yes-saying bias potentially in the sober state. Clinicians should thus be critical and aware that such general yes-saying tendencies can occur in regular cannabis users. Specific to MDMA, the greatest worry seems to be an increased chance of forgetting events experienced during MDMA intoxication. Clinicians should be aware that patients might be prone to forgetting details from an MDMA-assisted therapy session, which could be counteracted by careful and extensive documentation of the session and later follow-ups, or even recording of sessions.

Potential Impact for Recreational Users

Knowledge on the potential acute, delayed, and long-term memory effects and cognitive consequences of cannabis and MDMA use is relevant to recreational users, who often seek out scientific knowledge to inform their use habits. Elevated tendency to forming false memories and to a yes-saying bias might be viewed as an unwanted side effect of acute or chronic cannabis use. Practically, it is recommended to avoid acute cannabis influence during situations where it is important that information is processed and remembered correctly; for example, when studying or when watching the news, where attention to nuanced details is needed. Misinformation can come in form of fake news (e.g., Murphy et al., 2019), and a higher yes-bias could encourage people to accept fake news that aligns with their current biases, prejudices and beliefs. Similarly, increased forgetting may be seen as an undesirable consequence of an MDMA experience. Recreational MDMA users should consider that certain events experienced during MDMA influence will not be remembered, and appropriate strategies to counteract this (e.g., video recordings, photos) can be chosen if this is desired.

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Current Impact

The current findings have been disseminated extensively among scientific audiences and the general public alike, an overview of which is included in the Output section below. The work has been presented at various international academic conferences across both the psychopharmacological and legal psychological fields. Findings have been communicated in lectures to students of various Bachelor and Master programs, and will be integrated as learning material in so-called *problems* in ongoing courses (e.g., of the Forensic Psychology M. Sc. Program) at Maastricht University in accordance with the *Problem-based Learning* system. Additionally, findings have been shared widely across popular social platforms (e.g., Twitter, ResearchGate, Reddit) and have been covered by newspapers from around the world. For example, the paper on cannabis and false memory (Chapter 4) has attained an Altmetric Attention Score of >500 (top 5%) and has widely attracted media attention from news channels and magazines from >20 different countries. Moreover, ample opportunities have been pursued to discuss the current research with the wider public through talks, demos, and podcasts, for example at scientific festivals (Pleasure, Arts, and Science festival, Pint of Science festival), invited talks (Rotterdam Psychedelic Collective, Aha! Event by New Scientist) and workshops on drugs and memory for public prosecutors in NL (invited by Openbaar Ministerie) and for federal police in Sydney, Australia. Similar efforts will be undertaken with the so far unpublished papers in Chapters 2, 5, and 6 to disseminate the findings among the scientific community as well as the general public. A follow-up episode about the MDMA project for the podcast “Drugs and their History in Society” for which I gave an interview earlier this year is already planned. Similarly, findings will be made available in other languages, for example via a blogpost for the German psychology magazine In-Mind as I have done in the past.

