Cannabis - memory

The influence of Cannabis on the process of memory, a clinicians perspective.

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Memory is a process that results in a relatively permanent change in behavior. It is never directly observed and is always inferred.

The acute effects of cannabis on memory have been well documented, especially on the short-term/working memory. Residual effects on memory impairment beyond the period of acute intoxication, although clinically important, have received little attention.

Clinical psychologists and psychiatrists report that patients with a pattern of chronic cannabis use complain that they do not remember their teenage years well, and have a feeling of emptiness when they think back to the time when they were cannabis users.

In my thesis (1995), I match the scientific studies concerning aspects of the memory processes in relation to cannabis use, in order to achieve a better understanding of the influence on the memory processes. The outcome of this matching will be discussed in the context of Tulving's theory of memory and consciousness, and its implication for clinical practice.

Tulving, a Canadian cognitive psychologist and memory expert (1984) propose that it is possible for the memory function to consist of multiple systems with similar functions, and it is also possible for us to have separate long-term memory functions. This supports the stance of a holistic functional perspective on a processing level, which take in to consideration that if one aspect is disrupted it affects the whole process.

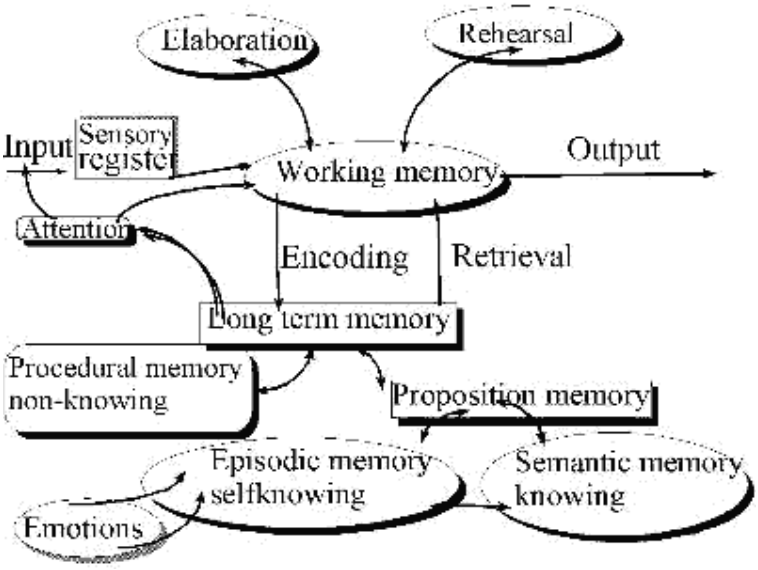
The aspects are :

- Motivation
- Attention
- Sensory register
- Pattern recognition
- Short-term/Working memory
- Repetition
- Elaboration
- Encoding
- Long-term memory Proposition; episodic and semantic memory,

Procedure, and

Prospective memory

- Retrieval
- Recognition



This illustration is a holistic functional description of how I picture our memory system. It could be extended, but my intention is only to give a depiction of the complexity of the memory system and to stress that it is a process.

This model will serve as a background and structure for my presentation of a clinician's perspective.

Observations and reports

show that long-term users display the following weaknesses: problems in remembering meetings, estimation of the passage of time, maintaining the theme of a story, problems in recollection of the past.

In a study (1993), described in my thesis, concerning the differences between a person's way of thinking as a cannabis user and as a former cannabis user, the subjects reported in regards to memory functions:

As a cannabis user

- The memory isn't very clear so I get mixed up.
- I was only aware of the present.
- Poor access to memories.
- **You have experienced a lot during this 10 years, but everything is lost.**
- You could not trace back in your memory to remember where you had put things.
- You loose the main theme in discussions.

As a nonuser

- I can bring information with me back home and sit down and think it over.
- It's easier to maintain the main theme in a discussion and not lose track all the time.
- I can easily remember where I've put things and what I did last week.
- **I can remember events for a long time.**
- I remember what to do, and I can be there in time.

Results from scientific studies

Many of the observed memory deficits could be attributed to **attentional dysfunction** in the form of reduced attention due to competition by intrusion of irrelevant associations. The inability to focus attention and to reject irrelevant information is interpreted as reflecting long-term changes.

Intrusion errors are one of the most robust phenomena of cannabis-induced memory deficits in tasks of both recall and recognition.

There are no published studies available on the **Sensory register.**

Pattern recognition is the process by which meaning is derived and it is the read-off process of the sensory register. Cannabis users generate significantly more intrusion errors than nonusers, and impairments become more apparent in users as the interference conditions increase.

Several studies indicate, as a consequence of the chronic influence, a low level of **motivation**.

The users have a decreased ability of **elaboration**, a process by which information to be remembered is linked or related to information already known. In chronic cannabis users, intrusion errors constitute the introduction of extraneous items, word associations, or new material during the free recall of words, or the identification of false or previously unseen items in recognition.

Short-term/working memory is a cognitive conceptual system, which not only stores information, but also serves as work space for processes like rehearsal, elaboration, encoding, retrieval, and decision making.

The results indicate that any cognitive deficits due to cannabis may be selective to specific aspects of short-term processes. Limited capacity and work space for the temporary storage and processing of information coming from sensory input or from long term memory and suggested the carry-over effects from cannabis may occur whenever the working memory is presented with more information than it is able to process, which is reflected by a decreased rCBF-level. The dysfunctional process may interfere with one's sense of continuity during ongoing events which is an essential element in time perception.

Beyond a possible defect in memorizing capacity, chronic use of cannabis interferes with the transfer of information from short-term to long-term storage **(encoding)**.

Long-term memory is the concept which represents the vast store of knowledge we have about the world. The studies indicate that chronic users have problems in recollection of the past.

My conclusion, so far, is that cannabis interferes on a level of processing information, which will affect the specific aspect, which at the time of examination is sensitive to lack of capacity and if one element is disrupted it will affect the whole process.

Tulving proposes that:

At one level there is *a procedure memory,* i.e. executing a skill. It is characterized by the absence of thought. There are no reports of a shift in physically-oriented, non mental functions, among cannabis users,

and at one level a *propositional memory*, a set of psychological processes underlying the use of knowledge. This type of memory can than be subdivided into two separate systems or classes.

The semantic memory represents generic knowledge, like to name two cars of Swedish origin, and

the episodic memory, which requires the additional capability of acquisition and retention of knowledge about personally experienced events and their temporal relations in subjective time and the ability to mentally "travel back" in time, that is, being aware of one's identity and existence in a subjective time span that extends from the past through the present into the future.

The episodic memory can be viewed as a subsystem of the semantic memory.

The three memory systems are characterized by different kinds of consciousness.

Procedural memory is associated with non-knowing (anoetic) consciousness,

semantic memory with knowing (noetic) consciousness, and

episodic memory with self-knowing (autoetic) consciousness.

The consequences of the cannabis use on the process of consciousness

It is reasonable to assume that a drug-related memory develops during cannabis use and that this first affects the episodic memory. The utilization of information in episodic memory is critically dependent for its success on restoration, at the time of attempted retrieval, of the pharmacological state in which the information was originally acquired. During the acute intoxication the user will encode his experiences, colored by the cannabis induced enhanced subjective perception, into the episodic memory.

Failures to demonstrate state dependence are restricted to situations in which utilization of stored information is tested in a present of discretely identifiable retrieval cues (recognition), success, to situations in which retrieval occurs in the absence of any observable reminders (retrieval).

In treatment terms this means that the therapist needs a set of questions and statements that help the patient in recognizing. The effectivity of the cue is dependent on the associative strength and encoding specificity.

The pharmacological intoxication may thus be seen as a context, a distinct node, in which the event was memorized.

The influence on encoding and retrieval from episodic memory may be one cause to why cannabis is not attractive as a drug for women. Women have compared to men a more differentiated process of encoding.

It appears that a semantic drug-dependent memory is established much later and only after a substantial amount of cannabis has been consumed, but of course this occurs indirectly earlier due to the cooperation between the two kinds of memories.

We can assume that it is the drug-related memory that controls the attention and the meaning of the information.

It is suggested that cannabis affects both the input processes, which involves the hippocampus (cognitive process: psychomotility), and the output process, which involves dorsolateral functions (cognitive processes: logical-analytic and analytic-synthetic abilities). While we know that disturbances in one component of the cognitive system will affect other components, it is obvious that even recreational use of cannabis will have influence on the memory system.

Experimental or recreational use (short-term), the cognitive input process will be affected:

- Which will cause a disturbance in concentration, attention, and storing and elaborating information.
- The individual will experience enhanced subjective perception, later stored in the episodic memory.

Long-term use, in addition the cognitive output process will be affected:

Which may impair the ability to efficiently process complex information.

With an inability to make plans, difficulties in temporal integration of the behavior, hardly any self criticism, apathy, listless.

Table 1.

	Recreational use		Chronic use
	Light use	**Moderate use**	**Heavy use**
	2-3 tms/m - 4-6 tms/w		
Input process	X	X -> Y	Y
Output process	Z	Z -> K	K

Let me explain **table 1**.

X= The acute intoxication experienced in comparison to the persons normal state of consciousness.

Z= After the acute intoxication a period of being passive and blunt will follow. If he smokes again within a period of six weeks or less, these aftereffects will last longer.

Y= The user will gradually adjust to a new mental set, which will be a new normal state of consciousness. The significance of the acute intoxication will then be experienced in comparison to this altered state of consciousness.

K= The influence of the chronic use affects the cognitive processes in such a way that you can't question or criticize your behavior and will therefore be unable to change it if necessary. The acute state of intoxication will then be experienced in relation to the effect of the chronic influence (passive and blunt).

Therapeutic steps:

At X and Z, information and counseling.

At X->Y and Z->K, the measures taken are dependent on the level of the cognitive dysfunction, from counseling to a treatment program.

At Y and K a treatment program with a cognitive approach is applicable.

It is a problem that there is no neuropsychological tool to assess the emerging cognitive impairment, and to provide an answer to the question "When may a cognitive ability be considered impaired?".

A beginner or recreational user will get a random focus of attention, which results in scant memories. In the course of use and time, the cognitive dysfunction will become more apparent. Problems with processing incoming information and storing it in episodic and later in semantic memory will increase.

Semantic memory is not affected in early stages of chronic use, which makes it possible to study and take an exam.

Moderate use of cannabis, in an early phase (once a week), will not prohibit a person from, e.g. learning a profession, but this person may have difficulties in consolidating subjective experiences from different situations, which in turn will lead to feelings like boredom and a difficulty in understanding the purpose of a task. In order to relax or to cope with feelings of boredom, he will smoke more often. He will lose control of the use, the amount of cannabis used, will increase. The inability of the episodic memory to produce adequate information creates disruption in self- knowledge, and later, deficiencies in knowledge of how to handle new situations.

Heavy use affects the cognitive processes in such a way that you can't question or criticize your behavior and will therefore be unable to change it if necessary. Information stored in episodic memory will be state dependent. Thus, heavy users smoke cannabis in order to achieve a sense of being "normal".

It is apparent that not all individuals are affected equally by prolonged exposure to cannabis.

For those who are dysfunctional, there is a need to develop appropriate treatment programs which should incorporate:

- the subtle impairments in cognition within their agenda and work towards their resolution.
- the possibility of long-lasting cognitive deficits that affect both the performance of complex tasks and the ability to learn.
- A focus directly on use itself and, at the same time, help to improve the accompanying deficits in competence. Attempts aimed only at reducing intensive use without simultaneously addressing the need to build competence skills and motivation will have limited impact on the underlying conditions.
- A built-in flexibility to offer care to patients of all ages.
- A help to critical examination of the drug-related episodic memory. It is first after cessation of use that the user will notice that his subjective history is embedded in fog, and an emerging feeling of being nobody.
- Strategies to enhance self-esteem that is not based on a drug-related episodic memory.
- A set of adequate questions to enhance the recognition factor. The effectivity of the cue is dependent on the associative strength and encoding specificity.

- That the patient is tutored to **notice** what is happening; to **compare** with earlier experiences; and to **reflect** and **consider** a relevant topic of a discussion. This will improve the process of comprehension and manageability.

Finally, I am well aware of the immense diversity of influence cannabis has on memory functions in humans, and I would like to emphasize that the picture here presented represents my view as a clinical psychologist on the cannabis issue. I do not claim that this is a complete or definitive depiction. However, it may fill in some more pieces of the seemingly infinite puzzle.

Reference :

Lundqvist Thomas, Cognitive dysfunctions in chronic cannabis users observed during treatment, an integrative approach, Almqvist & Wiksell International, Stockholm Sweden, 1995.