

**The seven cognitive functions used for  
observation of cognitive behaviour in  
chronic cannabis users**

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**2004-11-16**

In this paper the cognitive processes, that constitutes the structure for the organization of the clinical observations made on chronic cannabis users, will be presented in a cognitive neuropsychological context.

Cognitive neuropsychology is concerned with patterns of cognitive performance in brain-damaged patients, and involves identifying those aspects of cognition which are intact or impaired. Such information can be useful for a number of different reasons. The first reason is that the cognitive performance of brain-damaged patients can be explained by theories within the cognitive psychology. Such theories specify the processes or mechanisms involved in normal cognitive functioning, and it should in principle be possible to account for many of the cognitive impairments of brain-damaged patients in terms of selective damage to some of those mechanisms.

The second reason is that it may be possible to use information from brain-damaged patients to reject theories proposed by cognitive psychologists, and to propose new theories of normal cognitive functioning. This is expressed by Ellis and Young (1988, p. 4), "The second aim of cognitive neuropsychology is largely responsible for the recent upsurge of interest in the approach. It is to draw conclusions about normal, intact cognitive processes from the patterns of impaired and intact capabilities seen in brain-injured patients. In pursuing this second aim, the cognitive neuropsychologist wishes to be in a position to assert that observed patterns of symptoms could not occur if the normal, intact cognitive system were not organised in a certain way".

Most cognitive neuropsychologists subscribe to the following assumptions (with the exception of the first one):

- X Most patients can be categorized in terms of syndromes, which are based on co-occurring sets of symptoms.
- X The cognitive system exhibits modularity, i.e. there are several relatively independent cognitive processors or modules, leaving the other intact.
- X There is a meaningful relationship between the organisation of the physical brain and that of the mind; this assumption is known as isomorphism.

Isomorphism 1. In mathematics, a formal point-by point relationship between two systems. 2. In Gestalt psychology, the hypothesis that there is such a relationship between excitatory fields in the cortex and conscious experience. Note that the correspondance here is not presumed to be between the physical stimulus and the brain but between the perception of the stimulus and the brain (The Penguin dictionary of psychology, London, 1985).

- X Investigation of cognition in brain-damaged patients can tell us much about cognitive processes in normal individuals; this important assumption is closely bound up with the other assumptions.

## **The prefrontal lobe function in a neuropsychological perspective**

A prefrontal lesion, especially lesions concerning dorsolateral and deeper structures will lead to cognitive dysfunction. There is consistent evidence that patients with these lesions have an inability to plan. This impairment is not obvious in normal profile testing.

Patient with a prefrontal dysfunction tend to hold on to one strategy (the original) in tests like Wisconsin card sorting test, and they show an inability to change strategy (perseveration) when the situation changes. Later on, this will be referred to as a function of Gestalt memory or of Holistic memory. This inflexibility causes problems in evaluating the demands of the situation. The patient is unable to control or judge the relevance of his/her own behaviour.

### **Disruption in the creating of a comprehensive view and perception**

The patient tends to perform isolated single actions, and s/he is unable to arrange them in a systematic program.

When a patient is to retell an anecdote he misses the point, and gets caught up in relatively uninteresting details. Proverbs will be difficult to understand, and the patient will only perceive the concrete content and not the abstract. The perception is also disrupted, which is important to note, since impairment of perception often depends on posterior lesions. It is important to remember that the prefrontal brain is involved in all kinds of complex behaviour.

If a patient is asked to interpret a comprehensive picture, he will only focus on a single detail and make hasty inferences about the meaning of the motive.

### **Inability to learn from mistakes made**

It is almost obligatory for patients to lack insight into their difficulties, with a lack of self-criticism being included. They may repeat mistakes several times, even after this is pointed out to them. Very often a patient can correctly repeat an instruction, but with no effect his/her behaviour. It is as if the patient has lost any ability to connect the spoken content with correct behaviour. Below, this is discussed as a *verbal ability* in a quality sense.

### **Planning and control**

The prefrontal cortex exerts control over behavioural expression and direction, such as avoiding all sorts of distraction. The individual continuously evaluates the result and decides whether it was sufficient and whether the behaviour is leading to what was decided upon. Naturally, this process is coloured by the limbic system. Thus, the purpose in social activity is always seen from an "egoistic" point of view. Behaviour supported by significant others are reinforced. The process of integration of inner and outer information is a crucial task for the prefrontal cortex. Later, this will be referred to as a *logical-analytic ability*.

### **Behavioural temporal coordination**

The prefrontal lobe is engaged in the temporal organization of behaviour, for the purpose of

attaining a goal. This is an aspect of planning. Each plan presumes a certain temporal arrangement. The different parts in the plan are only meaningful in a complete context, one that requires abstract thinking. Abstract thinking is a mental activity which is often taken as the hallmark of intellectual functions, alternating from a focus on a total problem to concentrating on its parts. The result of this process is a mental representation of the problem. Later on, this will be referred to as *an analytic-synthetic ability*.

There are both short-term, long-term, and parallel plans. It is the process underway in the prefrontal cortex that keeps the plans active, continuity in meaning and actuality. This is a temporal function, a result of *a short-term memory or working memory function*.

The processes in the prefrontal cortex make it possible for the normal individual not only to keep the behaviour in an acceptable format, but also help the individual understand events in the role as observer. The processes makes the individual inclined to interpret the behaviour (purpose and motive) of other people as well as inclined to look for intention and content in apparently senseless activity. Patients with a prefrontal dysfunction have problems with causality and with the interpretation of the behaviour of other people.

The PTO-cortex (parietal, temporal, and occipital lobes) is responsible for our ability to perceive all kinds of outer spatial concepts and relations. Later, this will be referred to as a *psychospatial ability*.

Whereas the specific function measured by IQ-tests can exhibit full capacity in an individual suffering from a prefrontal dysfunction, it is essential to assume that it's the processes behind the utilization of these that is crucial.

### **The logistic framework for the observations**

The descriptive structure for these observations consists of the same as those used by psychologists testing IQ profiles. These include: general verbal ability; logical-analytic ability (making accurate inferences); psychomotility (flexibility of thought); memory (short-term and long-term recall); analytic-synthetic (ability create an entity); psychospatial ability (perceiving environmental patterns), and gestalt memory. These psychological qualities are not independent of each other. On the contrary, the interaction among them is necessary. They are different aspects of one theme: cognitive control and management of behavioral patterns.

A framework is a general set of ideas which is drawn upon by theorists within a particular discipline. The important thing about frameworks is that they should be regarded as useful or not useful rather than correct or incorrect. the reason for this is that they consists of high-level assumptions that which cannot be tested directly at an experimental level (Andersson, 1983).

### **Verbal ability**

We have the ability to be familiar with many words, which is a semantic memory process

(quantitatively), associated with noetic (knowing) consciousness, and to express thoughts and feelings so that others understand the meaning of the communication. This implies that the words take on a qualitative sense for a person. This ability is dependent on access to the episodic memory and its correlate auto-noetic (self-knowing) consciousness and is influenced by emotions.

### **Logical-analytic ability**

We have the ability of logical reasoning, to critically examine what is being communicated, to use logical thought to correct errors and mistakes, to make logical analyses of one's and other's behaviour.

This ability is dependent on an appropriate process of elaboration.

The study of reasoning looks at how humans reach certain conclusions on the basis of either explicit or implicit premises. Reasoning and problem-solving are closely related topics in that both are concerned with aspects of what is normally called thinking. The focus, however, is on how a person goes about reaching a conclusion and evaluating whether a conclusion is valid or invalid.

There are two basic kinds of reasoning; *deductive*, which involves reaching a conclusion based upon assumptions that are known to be true, and *induction* is something that is likely to be true on the basis of past experience, but for which there is no guarantee of the absolute truth.

There are three kinds of deductive reasoning:

*Propositional*, if the car dealer doesn't lower the price, I can't buy the car. The car dealer doesn't lower the price, in that case I can't buy.

*Syllogism*, is a set of propositions that refer to the quantity of something such as some, all, none, or some not.

*Linear-order* problem sets up a relation among the propositions and requires that a person draws a conclusion about how items are related.

Braine's natural deduction theory (Braine, 1978) maintains that deductive reasoning is mediated by basic, abstract rules or schemata. The premises of an argument are comprehended and encoded into abstract schemata/rules from which inferences can be drawn. If this reasoning process does not deliver a straightforward conclusion then a set of nonlogical or quasi-logical rules determine the response made.

Cheng and Holyoak (1985) have contributed with their pragmatic reasoning schemata or rules, which are concrete in the sense of being sensitive to particular pragmatic classes of situations. One example is obligation schemata, which have been elaborated for situations in which one is obliged to do something; the rules in the schema take the form "if situation A arises then action C must be done".

## **Psychomotility (Flexibility of thought)**

This ability makes it possible for us to shift attention from one stimulus/task to another, to maintain a train of thought in a complex situation, to carry on a dialogue in conversation, see different sides of an issue, social situation, or problem, to establish an adequate focus of attention.

This process includes the ability to notice, compare, and consider.

## **Attention**

Attention is the process of allocating the resources or capacity to various inputs, and attention is important in determining which tasks are accomplished and how well they are performed, that is, the individual's ability to listen with his/her inner ear.

Attention can be divided into:

*focused attention*, both auditive and visual, which is like a spotlight with an adjustable beam, where there appears to be considerably more processing of visual stimuli falling within the beam of the spotlight than outside of it, and the spatial area encompassed by the beam varies widely as a function of the nature of the task (Eysenk, 1990, p.109).

*divided attention*, which process all of the input, and anything which minimizes interference between processes, or keeps them "further apart" will allow them to be dealt with more readily either separately or together.

## **Memory**

### **Working/Short-term memory**

Working/Short-term memory refers to an active system of memory in which information is assembled and organized prior to recall.

It: is a working space for several cognitive processes, gives us temporal integration, has an immediate function, enable us to read books with pleasure.

### **Long-term memory**

*Episodic Memory* refers to knowledge about episodes and events, and entails entities that are marked as happening at a particular time. It has a autobiographical flavour.

*Semantic memory* refers to our de-contextualised memory for facts about entities and to relations between entities in the world.

### **Analytic-synthetic ability**

This ability is based on a synthesis of the other six items and therefore dependent on their normal functioning. The result of this process is that which other people perceive as your identity and orientation in life. It makes it possible for us to form points of views, moral, set of values that constitute the self and to synthesize and see the whole.

## **Psychospatial ability**

Psychospatial ability makes it possible for us to locate oneself and function in the time and space continuum and to the read off of appropriate schemata

## **Gestalt memory (Holistic memory)**

Gestalt memory helps us to create patterns and pictures of what we see, to consolidate new schemata and to have a correct sense of direction.

## **Face recognition**

The most developed model of face recognition was proposed by Bruce & Young (1986). According to them there are major differences in the processing of familiar and unfamiliar faces. The recognition of familiar faces primarily depends upon structural encoding, face recognitions units, person identity nodes, and name generation, whereas the processing of unfamiliar faces involves structural encoding, expression analysis, facial speech analysis, and directed visual processing.

According to this model it is not unusual for the following to happen: if the appropriate face recognition unit is activated, but the person's identity is not, then there should be a feeling of familiarity coupled with the inability to think of any relevant information about them (e.g. where they have been seen before). Again according to the model, when we look at a familiar face, familiarity information from the face recognition unit should be accessed first, followed by information about the person from the person's identity node, followed by that person's name from the name generation component

In this paper a tentative structure for investigating the patterns of cognitive impairments shown by chronic users of cannabis was presented. These psychological qualities are necessary in structuring daily events.