

## Psilocybin's effects on cognition: Recent research and its implications for **enhancing creativity**

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Discussion of the article:

Spitzer M, Thimm M, Hermle L, Holzmann P, Kovar KA, Heimann H, Gouzoulis-Mayfrank E, Kischka U, Schneider F, (1996); Increased activation of indirect semantic associations under psilocybin. *Biol Psychiatry* 39:1055-1057.



THE "FIRST WAVE" of psychedelic research in the 1960's saw many attempts to understand the

mechanisms and effects of psychedelics. Looking back on this past research, one gets the idea that psychedelic substances were perhaps too complex for the scientific tools of the time. The current wave of psychedelic research therefore holds much promise. Since the 1960's, we have gained many sophisticated research tools. These tools include neuropsychological tests—simple, repetitive, game-like tasks—which can give valuable insight into how psychedelics affect the mind. Manfred Spitzer, M.D., Ph.D., and his colleagues (1996) recently published a fascinating report on the effects of psilocybin on one such neuropsychological test.

Spitzer's group orally administered 0.2 mg/kg body weight of psilocybin to eight male volunteers in a double-blind, placebo-controlled experiment. They then studied the effects of psilocybin in a word-recognition task. In this task, subjects identify whether a string of characters is a word or not. Past research has found that subjects can identify a word faster if the previous string of characters is a closely related word. For example, subjects can recognize the word "black" more quickly if it has been immediately preceded by the word "white." This effect is known as semantic priming. In normal subjects, semantic priming occurs only with closely related words. However, indirectly related words ("sweet" and "lemon," for example) produce semantic priming in thought-disordered schizophrenic subjects (Spitzer et al 1993a, 1993b).

### Semantic priming

The researchers found that psilocybin slowed the subjects' reaction times while at the same time producing a semantic priming effect for indirectly related words ("sweet" and "lemon"), similar to that seen in the schizophrenia research. The finding that psilocybin slowed reaction times was not unexpected; past

research with psychedelics has found the same effect. However, the finding that psilocybin produced indirect semantic priming is more interesting. In their discussion, the researchers point out that their findings are relevant to claims that psychedelics "enhance creativity" or "broaden consciousness."

Although most objective measures have failed to support these claims, our data suggest that the [hallucinogenic] agent in fact leads to an increased availability of remote associations and thereby may bring cognitive contents to mind that under normal circumstances remain

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nonactivated; however, the generally decreased psychological performance under hallucinogenic agents suggest that the increased indirect priming effect is due to a decreased capacity to use contextual information for the focusing of semantic processing. Hence, subjectively experienced increases in creativity as well as the broadening of consciousness have been found to parallel decreases in objective performance measures (p. 1056-1057).

Thus, the researchers suggest that psychedelics may in fact "broaden consciousness" by making remote mental associations more available. However, this involves a trade-off. Although remote mental associations are more available, subjects are less able to focus, which slows their reaction times.

#### **Semantic neural networks**

The researchers interpret their findings using a model which states that the brain contains semantic neural networks which can become activated by semantic information. The spread of this activation through the networks determines the amount of semantic priming that occurs in the word-recognition task. Activation spreads further and faster in thought-disordered schizophrenics and psilocybin users than in normal volunteers. One explanation for this unusual amount of activation is decreased efficiency in the cortex where semantic information is processed (Servan-Schreiber et al 1990, Cohen and Servan-Schreiber 1992, 1993). There is evidence that this inefficient processing is related to the decreased dopaminergic modulation. In support of this theory, the researchers have found that L-dopa, a precursor to dopamine, reduces the spread of activation and therefore reduces indirect semantic priming (Kischka et al 1995). In the context of this theory, psilocybin (which acts on the serotonin system) can be seen as increasing activation of semantic networks. Essentially, dopamine seems to have a focusing effect on activation of semantic networks while psilocybin has a defocusing effect.

#### **Word-recognition task**

The word-recognition task used by Spitzer's group is particularly interesting for a number of reasons. First, it allows researchers to test automatic rather than voluntary access to memory. Even when subjects cannot consciously recall previously viewed words (whether because of a drug or neurological disorder), the word-recognition task can demonstrate whether subjects can still automatically access that memory. In addition, the

task allows researchers to see how the focus of subjects' mental associations is changed by different pharmacological or psychological states. This aspect seems potentially promising for distinguishing between different types of memories. For example, in some situations, emotional words ("happy" and "sad") might be activated to a greater extent than words with little emotional content ("black" and "white").

**Spitzer and his colleagues have come closer to understanding the effects of psychedelics. As they point out in the conclusion of their paper, they have succeeded in using the results of a simple task to theorize connections between the subjective reports of psychedelic users, objective measures of psilocybin's effects, and underlying brain physiology. In the process they raised a number of productive leads for further research.**

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