

The Effects of Psilocybin on Primary Process Content in Language

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Abstract. The hypothesis that psilocybin induces primary process thinking was assessed. On four separate occasions, a subject was asked to write before, during, and after the hallucinogenic experience induced by doses ranging between 80 and 200 $\mu\text{g/kg}$ of psilocybin. Texts produced at the drug peak contained significantly more primary process content and were significantly more stereotyped on several measures than those written before or after the drug peak.

The term drug 'trip' to describe the effects of psychotomimetic drugs may be seen as the usage of a spatial metaphor to describe what is really an alteration in state of consciousness, a 'movement' along the perception-hallucination continuum delineated by *Fischer* (1971). Some themes of the journey in literature can be interpreted in a similar light. *Martindale* (1974) has proposed that literary journeys to hell and other fabulous destinations are in fact extended metaphors describing alteration in state of consciousness. They are, in a sense, retrospective accounts of their own creation. This follows from the notion that the act of creation involves an initial stage of inspiration, wherein the creator undergoes an alteration in state of consciousness, and a subsequent stage of elaboration, wherein there is a return to a more normal state of consciousness (*Kris*, 1952).

One may ask whether the destinations of the drug 'trip' and the 'fabulous voyages' of literature are the same. That is, do they involve a movement to the same or a similar state of consciousness? There is some theoretical reason to believe that they might. Both *Fischer* (1971) and *Martindale* (1975b) have demonstrated that creativity is connected with changes in level of arousal. Psychotomimetic drugs, such as psilocybin, LSD, and mescaline raise level of

arousal. Several theorists (e.g., *Blum*, 1961; *Martindale*, 1975b) have proposed that arousal is connected with what *Freud* (1938) labelled primary process thinking. We may see the fundamental continuum of states of consciousness as ranging from secondary process (abstract, analytic, purposeful, reality-oriented) to primary process (concrete, free associative, drive-dominated, autistic) states. We assume that normal or secondary process states are based upon a medium or 'normal' level of cortical arousal. When arousal is increased or decreased, primary process thought results in connection with an altered state of consciousness.

Martindale (1975a) has developed a content analytic measure of primary process thinking presented later in this article. Using this measure, several studies (*Martindale*, 1974; *Martindale and Hasenfus*, 1975) have shown that primary process content rises to a peak and then declines across the course of narratives (such as *The Tibetan Book of the Dead*, Book VI of *The Aeneid*, and the first part of the *Divine Comedy*) that describe a journey to hell and a subsequent return.

The purpose of the study described in this paper was to investigate whether this same pattern would be found in verbal material of a subject across the course of experiences induced by psilocybin.

The volunteer subject used in this study, W.L., was a 28-year-old instructor of comparative literature at the time of his participation as a volunteer in psilocybin research. On a task tapping perceptual-behavioral stability or variability W.L. emerges as a 'variable' subject (*Landon and Fischer*, 1970; *Fischer and Landon*, 1972).

This task involves having a subject copy a standard 28-word passage several times and then computing the standard deviation on handwriting area. 'Variable' subjects – those who exhibit a large range of standard deviations – turn out to be those who are maximally susceptible to the effects of psychotomimetic drugs (*Fischer*, 1971). Variable subjects display significantly higher resting heart rates than do stable subjects. It is apparently this difference in arousal baseline level that is related to differential reactivity to hallucinogenic drugs. Under conditions of sensory attenuation stable subjects tend to maximize sensory input at drug peak while variable subjects tend to minimize it. Under these conditions the stable maximizers have no opportunity to maximize their optimal sensory input and hence will never be sure whether they have obtained a placebo or the drug. Variable minimizers, on the other hand, do not have to further minimize the already attenuated sensory input which prevails in the sensory attenuation chamber and, therefore, will have optimum conditions for an intense hallucinogenic drug experience (*Panton and Fischer*, 1973). These studies confirm in humans the experiments of *Bradley and Key* (1963) performed on a variety of animals. After 5 µg/kg of hallucinogenic drug, EEG activating effects were found to depend upon a minimum amount of stimulation.

Landon and Fischer (1970) compared a sample of W.L.'s non-drug prose with a sample of prose written while under the effects of an 80 $\mu\text{g/kg}$ dose of psilocybin. They found that the drug had effects on several linguistic dimensions: there was a movement toward the use of more concrete (as opposed to abstract) noun phrases; length of sentences, clauses, and T-units (independent clauses and subordinate clauses dependent upon them) decreased; use of subordination gave way to simple concatenation of clauses; and topical organization of subject matter broke down. In addition, standard deviations for most of these measures were appreciably smaller for drug than for control texts, indicating increased stereotypy of language produced under the influence of the drug. The findings of increased concreteness and of breakdown of syntactic and rhetorical integration are consistent with the hypothesis that the drug induces a primary process state. The findings of increased stereotypy are consistent with the idea that it induces heightened arousal.

Method

Texts

Texts were obtained during four separate sessions with the subject. Several months elapsed between each session. In each session, an attempt was made to obtain a sample of his writing during the three phases of the drug experience: the ascending branch (0–60 min after drug ingestion), the drug peak (60–120 min after ingestion), and the descending branch (over 120 min after ingestion). During the ascending branch, the drug has not yet fully taken effect, while during the descending branch its effects are wearing off. In several cases, not enough was written to allow meaningful analysis. At least 100 words of text are necessary for the methods to be expected to yield reliable results. Table I presents information on the texts obtained.

Table I. Dates of sessions, dosages of psilocybin, and number of words in textual samples

Date	Dosage $\mu\text{g/kg}$	Number of words in sample		
		ascending	peak	descending
February 7	160	—	387	256
April 5	80	306	609	—
June 25	80	328	220	286
October 24	200	—	664	—

During the sessions of April 5 and June 25, the subject was asked to recall and write about a previous 80 µg/kg psilocybin experience. In the February 7 session, he was asked to write in reply to the question, 'Who are you and on what spiritual voyage are you embarking?' In the October 24 session, he was asked to write about a woman with whom he was in love.

Content Analysis

Textual samples were keypunched and analyzed with the Regressive Imagery Dictionary (Martindale, 1975a). The Regressive Imagery Dictionary is a content analysis coding scheme implemented with a computer program called COUNT (Martindale, 1973a). COUNT accepts keypunched natural language texts and, after punctuation and suffix removal, looks up each text word in a dictionary that contains information as to which categories a list of up to 4,000 words is to be assigned. A running total of category occurrences is kept and the final output consists of a printout of the categories and the percentage of words in a document that were assigned to each category. The Regressive Imagery Dictionary contains 3,647 words assigned to 29 categories designed to measure primary process content. These categories were derived from the theoretical and empirical literature on regressive thought (Martindale, 1975a). The rationale behind the dictionary is that psychological processes operant at the time of a text's composition will be reflected in the content of the text. Thus, for example, the more primary process the thought involved in producing a text, the less abstract and the more drive- and sensation-oriented words it should contain.

The primary process categories and examples of the words in each are given in table II. The dictionary yields a measure, primary process, derived by summing the word-based percentage occurrence scores of the component categories.

Primary process words are listed under the summary categories Drive, Regressive Cognition, Defensive Symbolization, Sensation, and Icarian Imagery in table II. Primary process is measured by the percentage of words in a text that are classified into any of the primary process categories.

Martindale (1975a) reports detailed evidence concerning the reliability and validity of the Regressive Imagery Dictionary. Evidence for the construct validity of primary process as an index of regressive or dedifferentiated thought comes from a number of studies where the measure has behaved as theoretically predicted. Significantly more primary process content has been found in the poetry of poets exhibiting signs of psychopathology than in that of poets not exhibiting such signs (Martindale, 1975a) and in fantasy stories of creative as opposed to uncreative subjects (Hines and Martindale, 1973). Unpublished research by Martindale has revealed more primary process content in verbal products of schizophrenic and anxious subjects as compared with control subjects. Martindale (1976) in a cross-cultural study found, as predicted from the 'primitive mentality' hypothesis of Lévy-Bruhl (1966) and Werner (1948), that amount of primary process content in folktales is negatively correlated with degree of sociocultural complexity in preliterate societies. Finally, the measure has varied as predicted in several studies of historical change in the content of poetry (Martindale, 1973b, 1975a). Thus, the Regressive Imagery Dictionary does seem to yield a reliable and valid index of primary process or dedifferentiated thought in a variety of contexts.

Table II. Regressive imagery summary categories, categories, and examples of words in each category

Summary category Category	Example of words in category
<i>Drive</i>	
Oral	breast, drink, lip
Anal	sweat, rot, dirty
Sex	lover, kiss, naked
<i>Regressive cognition</i>	
Unknown	secret, strange, unknown
Timelessness	eternal, forever, immortal
Consciousness alteration	dream, sleep, wake
Brink-passage	road, wall, door
Narcissism (bodyparts)	eye, heart, hand
Concreteness (spatial references)	at, where, over
<i>Defensive symbolization</i>	
Passivity	die, lie, bed
Voyage	wander, desert, beyond
Random movement	wave, roll, spread
Diffusion	shade, shadow, cloud
Chaos	wild, crowd, ruin
<i>Sensation</i>	
General sensation	fair, charm, beauty
Touch	touch, thick, stroke
Taste	sweet, taste, bitter
Odor	breath, perfume, scent
Sound	hear, voice, sound
Vision	see, light, look
Cold	cold, winter, snow
Hard	rock, stone, hard
Soft	soft, gentle, tender
<i>Icarian imagery</i>	
Ascend	rise, fly, throw
Height	up, sky, high
Descend	fall, drop, sink
Depth	down, deep, beneath
Fire	sun, fire, flame
Water	sea, water, stream

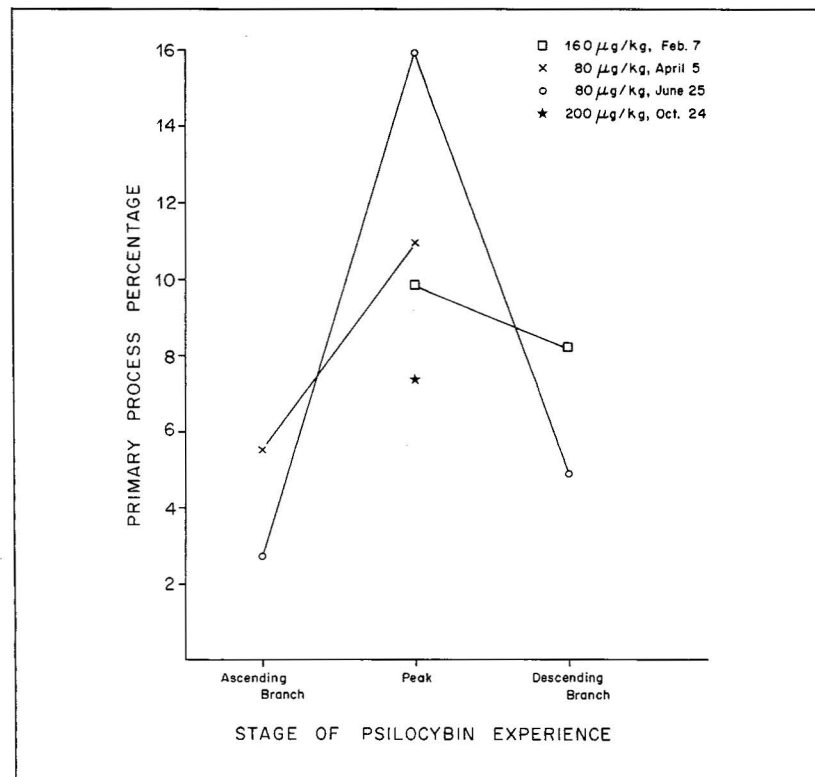


Fig. 1. Amount of primary process content in texts written during ascending branch, drug peak, and descending branch of psilocybin experiences.

Results

Figure 1 presents the results for primary process content. The hypothesis is supported by the results shown in the figure. The amount of primary process content is comparatively low in the ascending branch before the drug has taken effect. It rises to a peak at the peak of the drug experience and then declines during the descending branch as the effects of the drug diminish. In order to get some idea of the statistical significance of these changes, we used the *t* test to compare the four peak texts with the four non-peak texts from the ascending and descending branches. When this was done, it was found that the mean of the peak texts (11.02, *SD* = 3.59) is significantly larger than the mean of the non-

peak texts (5.35, SD = 2.25): $t = 2.68$, $p < 0.05$. Turning to the component subcategories of primary process, it was found that peak texts exhibit appreciably more content falling into the categories of Regressive Cognition — $t = 2.88$, $p < 0.05$ — and Icarian Imagery — $t = 2.71$, $p < 0.05$. No significant differences are found for the categories Drive, Sensation, and Defensive Symbolization.

The peak texts contain more words on average than the non-peak texts — 470 vs. 294 — and also slightly more sentences — 25 vs. 18 — but neither of these differences approaches significance. There is some evidence that the peak texts are more stereotyped in their content and style than the non-peak texts. Mean word length (in number of characters) for peak texts is 4.31 (SD = 0.21) and for non-peak texts is 4.55 (SD = 0.19) but this difference is not significant. However, if we compare the standard deviation of word length for the two types of texts we find a mean of 2.32 (SD = 0.13) for peak texts and of 2.70 (SD = 0.14) for non-peak texts, $t = -4.11$, $p < 0.01$. In other words, peak texts tend to employ words of the same length while non-peak texts are more variable in the lengths of words employed. Thus, peak texts are somewhat more repetitious. These findings of increased stereotypy are consistent with the findings of *Landon and Fischer* (1970) and also concur with the assumption that the peak texts are produced in a state of heightened arousal.

Conclusions

The results for changes in primary process content across the course of psilocybin experiences support the hypothesis that psilocybin induces primary process thinking. The pattern of an increase in primary process content from the ascending branch to the drug peak followed by a decrease during the descending branch is isomorphic with the pattern of primary process content found in literary narratives describing a journey to and return from hell or analogous fabulous destinations. This isomorphism lends some credence to the notion that such narratives may be in a sense symbolic accounts of alterations in state of consciousness similar to that induced by psilocybin.

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