The Nature of Performance Deficit under Secobarbital and Chlorpromazine in the Monkey
A Behavioral and EEG Study*

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Abstract. The effects of secobarbital and chlorpromazine were studied in monkeys trained on a continuous, rapidly presented successive discrimination task. The subjects were implanted with epidural electrodes to monitor EEG during drug-induced impairment of performance. The analysis was focussed on the phase of drug effect during which both drugs induced intermittent lapses of responding.

EEG and behavioral analysis of events following stimulus onset lead to the conclusion that the mechanism of error occurrence is different under the two drugs. The effect of secobarbital was prominent both in correct and incorrect trials; input, integration and output processes seemed to be functional but slowed down. This was inferred from the presence of EEG arousal, late or abortive motor responses (in the case of errors) and prolonged reaction time of correct responses. In contrast to this general, even effect, CPZ affected the performance in an “all-or-none” fashion. Periods of normal functioning (i.e., correct responses with moderately increased average reaction time) alternated with complete absence of responsiveness including the EEG arousal reaction. These findings support the view that secobarbital suppresses the behavior by affecting the level of wakefulness and thus impairing the functional condition of the whole central nervous system; chlorpromazine on the other hand exerts its effect by selectively blocking input processes subserving the EEG and behavioral arousal.

Key words: Arousal Reaction — Secobarbital — Chlorpromazine — EEG — Monkey.

In both human and animal studies (Mirsky and Cardon, 1961; Kornetsky and Bain, 1965; Mirsky and Bloch, 1967; Bakay Pragay and Mirsky, 1967) it has been shown that moderate doses of chlorpromazine (CPZ) typically induce intermittent lapses of responding, so-called omission errors (OE), in a continuous, rapidly presented discrimination task (the Continuous Performance Test = CPT). On the other hand, fast-

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acting barbiturates like pentobarbital and secobarbital, in non-hypnotic
doses, typically induce erroneous choices, so-called commission errors
(Kornetsky and Bain, 1965; Bakay Pragay and Mirsky, 1967). However,
 omission errors occur also with secobarbital (SECO), although only as
 transient phenomena, most probably in the ascending and descending
 phase of the effect of a hypnotic dose (Mirsky and Bakay Pragay, 1970).

The two drugs also appear rather dissimilar when examined with
electrophysiological techniques (Brazier, 1954; Killam and Killam, 1958;
Bradley, 1958; Bakay Pragay and Mirsky, 1967; Mirsky and Bakay
Pragay, 1970). The question arises as to whether their electrographic
(and other) characteristics differ, as well, under conditions when they
produce apparently similar behavioral deficits, i.e., intermittent OE’s.

This study was designed in accordance with the view of Mirsky and
Van Buren (1965) that performance on the CPT may be separated into
input-integration-output events; and furthermore, that the various
components may be differentially affected by different experimental
variables. The several measures that were employed (EEG activation,
reaction time, the presence of subthreshold responses, etc.) attempted to
dissect out the various components of the performance as influenced by
SECO and CPZ.

**Methods**

*Subjects; Experimental Situation.* The four Ss were mature female *Macaca
mulatta* monkeys trained to perform the CPT for shock avoidance. (Two of the
animals had been trained to perform other tasks as well and all were used in several
studies involving administration of SECO and CPZ.) During the experimental tests
the animals were kept in a standard restraining chair. They wore a tightly fitted
jacket which served two purposes. It protected the devices attached to their arm
and tail and forced the Ss to use the right hand to perform the required response.
In two animals an additional restraining device was applied to prevent excessive
head movement.

During the experiments, a movement detector\(^1\) was attached to the right upper
arm of the Ss to pick up manipulandum-approaching movement. The general
behavior was observed through a TV monitor.

*Surgery.* The animals were also implanted with chronic cortical and subcortical
electrodes. In two Ss, the cortical electrodes consisted of stainless steel machine
screws of 3—4 mm diameter; in two Ss stainless steel ball-electrodes were used.
They were placed on the dura, in pairs, bilaterally, symmetrically over the frontal,
sensory-motor and occipital cortices. Approximately 1 cm separated the centers of
a pair of screw electrodes. This constituted a bipolar cortical placement. After the
operation, the animals were rehearsed on the CPT until they regained the preopera-
tive level.

*The Task.* The monkey version of the CPT is a rapidly presented successive color
discrimination task, similar to that used by Mirsky and Bloch (1967). In the present
case, however, a combined manipulandum-discriminandum was used. This was a

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1 Grass Model SPA 1 single plane accelerometer designed to measure Parkinsonian
tremor.