A Neural Correlate of Consciousness Related to Repression

Howard Shevrin,* Jess H. Ghannam,³ and Benjamin Libet²

*Department of Psychiatry, University of Michigan Medical Center, Ann Arbor, Michigan; ³Department of Psychiatry, University of California at San Francisco, San Francisco, California; and ‡Institute of Neuroscience, University of California at Davis, Davis, California

In previous research Libet (1966) discovered that a critical time period for neural activation is necessary in order for a stimulus to become conscious. This necessary time period varies from subject to subject. In this current study, six subjects for whom the time for neural activation of consciousness had been previously determined were administered a battery of psychological tests on the basis of which ratings were made of degree of repressiveness. As hypothesized, repressive subjects had a longer critical time period for neural activation of consciousness, suggesting the possibility that this neurophysiological time factor is a necessary condition for the development of repression.

Key Words: neural activation; consciousness; unconscious processes; repression; neurophysiology; psychoanalysis; defenses; preconscious.

The existence of unconscious processes has been supported by a growing body of research based on behavioral and brain responses to subliminal stimuli (Shevrin & Fritzler, 1968; Shevrin, 1973; Shevrin, Williams, Marshall, Hertel, Bond, & Brakel, 1992; Wong, Shevrin, & Williams, 1994; Snodgrass, Shevrin, & Kopka, 1993; Wong, Bernat, Bunce, & Shevrin, 1997; Bernat, Shevrin, & Snodgrass, 2001; Bernat, Bunce, & Shevrin, 2001). Of equal relevance, other research has shown that cerebral activity in the form of readiness potentials precede the conscious intent to perform a motor act thus implicating unconscious processes in decision making (Libet, Gleason, Wright et al., 1983; Libet, 1985). Of particular relevance to the present report are a number of studies that have demonstrated a relationship between repressive personality style and diminished visual evoked potential responses to subliminal stimuli (Shevrin, Smith, & Fritzler, 1969; Shevrin, Smith, & Fritzler, 1970; Shevrin, 1973). In these studies it was reported that people characterized by a tendency to use repression responded with smaller evoked potentials to subliminal stimuli as well as giving significantly fewer verbal associations to the stimuli. In a more recent study, repressiveness was related to the presence of unconscious conflict reflected in differential brain responses to subliminal and supraliminal conflict-related words (Shevrin, Bond, Brakel, Hertel, & Williams, 1996).

There is, however, one significant limitation to these studies: subliminal stimuli are never in consciousness and thus investigations based on subliminal stimuli, although supporting the existence of unconscious processes, cannot clarify the role conscious-
ness itself plays in repression. We may now be in a position to address this question in the light of the discovery of a critical time period for neural activation necessary for a stimulus to become conscious (Libet, Alberts, Wright et al., 1964; Libet, 1973, 1978). These studies have reported that a person does not become conscious of a somatosensory stimulus until a certain period of central neural repetitive activations take place. This period may vary from 200 to 800 ms or more for different individuals. This new finding leads to a question we address in this report: Will people who have repressive personality styles and are given more often to repression than others require a longer time period of neural activation in order to develop a conscious experience of a stimulus?

SUBJECTS

In order to address this question we administered tests selected to assess personality style to six subjects (five men and one woman) whose neural time requirement for eliciting a conscious sensory experience had be previously determined (Libet, Alberts, Wright et al., 1964; Libet, 1966, 1973). The six subjects had undergone neurosurgical treatment for dyskinesias, mainly parkinsonism (Libet, Alberts, Wright et al., 1964; Libet, 1966). At the time of testing, the six subjects were 7 to 8 years beyond the operation during which this neural correlate for consciousness had been determined. The five men and one woman were selected because their neural correlates for consciousness extended across the full time range (200–750 ms.). The subjects were between 50 and 71 years of age, with a mean of 63. Three were high school graduates and three had college degrees (see Table 1).

All subjects appeared to be well compensated both physically and mentally at the time of testing and were capable of living alone or with a spouse. Their ages ranged from 50 to 71 with an average of 63. Appointments were arranged by phone. Subjects were seen in their own homes for approximately 3 h. Tests were administered by the first two authors. In view of the possibility of dementia in long-term parkinsonism, it was notable that all subjects appeared capable of responding to all instructions and performing adequately on all tests. One of the tests administered was the Vocabulary Subtest of the WAIS, considered to be a good estimate of overall intelligence. Scores ranged from 8 to 17 with a mean of 12, considerably above the average of 10. As a group these subjects functioned at the superior intelligence level and were unlikely to be suffering from dementia of any severity.

DETERMINING CRITICAL TIME PERIOD FOR CONSCIOUSNESS

At some point during surgery the primary somatosensory area on the postcentral gyrus was localized with an exploring stimulating electrode. The cortical area selected elicited a sensation that referred to some portion of the contralateral hand or, less commonly, of the wrist or forearm. In establishing the stimulus parameters of significance to conscious sensory responses, it was found that pulses with the weakest or liminal effective intensity (measured peak current) required substantial repetition in order to elicit any sensation. The train of repetitive 0.5-ms pulses of liminal intensity had to persist for on average 500 ms in order to elicit any sensation. This minimum ‘‘utilization train duration’’ (UTD) was independent of the pulse repetition
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<td>200</td>
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*Abbreviations: HOQ = scores based on 25 items; W = ratio of whole responses to part and whole responses (repressive:low); M = percentage of human movement responses (repressive:low); C = percentage of response using color (repressive:high); CH = percentage of responses using shading (repressive:high); Fab = percentage of responses elaborated associatively (repressive:low).

**Weighted for age.

***Subject rankings on repressiveness scale (1 = most repressive).
frequency (although 30 to 60 pulses/s were usually employed) and of electrode area, polarity of pulses, as well as other factors. Trains shorter than the UTD produced no conscious sensation unless the intensity was raised. For pulse trains longer than the UTD, conscious sensation simply persisted at the same near-threshold level of intensity. The curve relating current intensity to train duration (to elicit a sensation) was therefore flat at all train durations greater than the average of 500 ms, but began to rise sharply at train durations below about 500 msec. (Libet, Alberts, Wright et al., 1964; Libet, 1966). Comparable cortical delays also appear to operate for the development of awareness of a peripheral skin stimulus, even when the latter is a single brief pulse. Evidence for this has been presented elsewhere for late evoked potentials (Libet, 1978, 1981; Libet, Wright, & Gleason, 1982; Libet, Wright, Feinstein, & Pearl, 1992).

THE STUDY

Discovery of the UTD indicated that a surprisingly long time requirement for neural activations was needed to give rise to a threshold conscious sensory experience, a finding that has a number of implications for conscious processes (Libet, 1973, 1978, 1966). For present purposes it is of special interest that UTD values determined at different times in the same subject exhibited relatively little variation, but UTDs could vary among different individuals from as little as 200 ms to more than 800 ms. In the present study we hypothesized that those individuals having a longer UTD would also exhibit a greater tendency to repression.

The psychological tests administered included the Rorschach; the Early Memories Test; the Information, Comprehension, Similarities, and Vocabulary Subtests of the WAIS; and the Hysteroid-Obsessoid Questionnaire (HOQ). The Rorschach test has been used in previous studies to assess personality style characteristics associated with repression (Gardner, Holzman, Klein et al., 1959; Schafer, 1954; Luborsky, Binder, & Schimek, 1965). The Early Memories Test is a clinical tool useful in determining the range of memories available to a person and their particular style and content (Mayman, 1968). The four WAIS Subtests were selected to give a sample of the subject’s cognitive functioning: The Vocabulary Subtest in particular provides an estimate of the subject’s intelligence and is known to be quite stable over time. The Rorschach, Early Memories, and WAIS subtests were submitted to three clinical judges for a global rating of repressiveness on a 5-point scale (Smokler & Shevrin, 1979).

The HOQ is a standardized paper-and-pencil test designed to assess characteristic patterns of hysterical and obsessional personality styles (Caine & Hawkins, 1963). For reasons of time, of the 48 true–false statements making up the questionnaire only the first 25 were administered to all subjects. These 24 items were evenly distributed across the 11 subscales of the test so that scores based on these items were likely a reliable estimate of the total score As a standardized personality test the HOQ does not depend on clinical judgment as does the Rorschach and thus offers a more objective assessment of repressive personality style.

RESULTS

In order to estimate the relationships between the judges’ ratings of repressiveness and the UTD, a trend test for Kendall’s tau was applied (Elving & Whittock, 1950).
Kendall’s tau is a nonparametric correlational measure that is especially suitable for small samples. Its main advantage is that its exact probability distribution is known. When each of the three judges’ repressiveness rankings were compared with the UTD ranking, the trend among the judges was statistically significant (normal deviate = 1.84, \( p = .033 \), one-tailed test) (see Table 2). When the individual determinants on the Rorschach considered to be related to repressiveness were compared with the UTD on the basis of the same trend analysis a statistically significant relationship in the expected direction was found (normal deviate = 2.60, \( p < .005 \), one-tailed test) (see Tables 1 and 2). These two findings cannot be considered entirely independent of each other because the judges based their repressiveness ratings in part on their assessment of these determinants, although several other tests entered into the judges ratings of repressiveness as well. However, the HOQ scores were not known by the judges. When these scores were compared to the UTD, the finding was statistically significant in the expected direction (normal deviate = 1.88, \( p < .03 \), one-tailed test; see Table 2).

As evidence for convergent validity we found that the HOQ correlated highly with Rorschach determinants (critical ratio = 3.75, \( p < .002 \)), as well as with the judges ratings of repressiveness (normal deviate = 2.93, \( p < .02 \)), suggesting that the HOQ was measuring the same thing as the Rorschach and the judges’ ratings, albeit with greater objectivity.

Neither age nor intelligence as estimated by the Vocabulary Subtest correlated significantly with the UTD (see Table 2).

Note should be taken of the fact that one subject (J) did not fit as well with the repressiveness hypothesis as did the other subjects. In particular, the judges rated this subject less repressive than her large UTD would predict. With this small a subject group it is hard to account for this discrepancy. This subject is the only female in the group and it is possible that women may not have on average a higher UTD level than men so that a high UTD score may not be associated with as high a repressiveness score. Nevertheless, her presence in the sample did not vitiate the positive results obtained for the group.

**DISCUSSION**

To our knowledge we are reporting for the first time indications that neural parameters of conscious experience are correlated with measures of repressiveness. This finding suggests that it may indeed be possible to explore the neurophysiological processes involved in repression itself. Thus far, this study suggests that a certain personality constellation associated with repression is also associated with a longer
time period for consciousness to develop for a sensory stimulus. This in itself is still some distance away from demonstrating that a particular unacceptable desire or wish is kept from consciousness by an act of repression. The causal relationship that may be involved in a correlation between repressiveness and longer UTDs is not known. It is also important to note that the simple conscious sensation elicited and the experimental conditions during the UTD determination were emotionally neutral, thus making it unlikely that repression itself was involved in the longer UTDs. Rather, it is attractive to hypothesize that people who might need a longer time for activation of consciousness may be those who have a head start in the direction of developing repression as a defense against unacceptable unconscious wishes, much as people with high intelligence might be more disposed to developing intellectualization as a defense. The UTD may provide a necessary but not sufficient condition for repression. The third author has pointed out elsewhere that a substantial neuronal delay in achieving awareness of a sensory stimulus might provide the physiological opportunity for repression or other modifiers of the final content of awareness to become effective (Libet, 1966). Interestingly, this time interval before consciousness is achieved would accord well with the psychoanalytic concept of the preconscious during which potential interactions with more dynamic unconscious processes can take place (Shevrin, in press).

In view of the small numbers of subjects, this study needs to be repeated with a larger group and with subjects for whom there is a much shorter time interval between the estimation of the UTD and the personality assessment, although there is no reason to believe that either the UTD or personality change radically over time. Another limitation of the research is inherent in the procedure for determining the UTD. It can only be administered to patients suffering from some disorder, in this instance dyskinesias linked to parkinsonism. To what extent findings based on such patients can be generalized to a larger population remains unknown. The within-subject design, however, supports the inference that the relationship between the UTD and repressiveness exists for these subjects. Moreover, it is unlikely that in view of the good life adaptation of these patients and their high average intelligence that they were suffering from dementia of any severity. There is no reason to believe that the movement disorder from which they were suffering adversely affected their consciousness or their personality.

REFERENCES


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