relationship between QEEG relative power and hypnotic susceptibility

Doil D. Montgomery
Kimberly V. Dwyer
Shannon M. Kelly
Nova Southeastern University

The purpose of this study was to investigate the relationship between quantitative electroencephalograph relative amplitude, relative power and hypnotic susceptibility. Hypnotic susceptibility, measured by the Wickramasekera Experience Inventory, was found to be positively correlated with QEEG theta relative amplitude ($r = 0.260$, $p < .10$). In addition, hypnotic susceptibility was found to be negatively correlated with QEEG alpha relative amplitude ($r = -.323$, $p < .05$) and alpha relative power ($r = -.322$, $p < .05$). These findings suggest that QEEG relative amplitude and QEEG relative power, as correlates of hypnotic susceptibility, may be a promising avenue for future research.

Hypnotic susceptibility is traditionally defined as the degree of responsiveness to a standard series of suggestions following a hypnotic procedure (Hilgard, 1965). Many studies have examined physiological correlates of hypnotic susceptibility using EEG measures. One example is the recent findings by Barabasz, A., Barabasz, M., Jensen, Calvin, Trevisan, & Warner (1999) who found robust markers of hypnotizability with ERP’s at P300 when responses were time locked to events. Previous research has found the spontaneous EEG to be associated with hypnotic susceptibility in several regions of the cortex when measuring theta (Crawford, 1994). Ulett, Akpinar, and Itil (1972) found EEG differences between high and low susceptible people, with high susceptible people exhibiting decreased theta and increased alpha and beta activity during hypnotic induction and low susceptible people showing the opposite. In their review of the literature, Graffin, Ray, and Lundy (1995) concluded that high susceptible people produce more EEG theta and alpha in resting conditions than low susceptible people.

The present study was designed to address the ongoing debate concerning the correlation between EEG and hypnotic susceptibility. From our review of the literature, investigators have found the relationship between alpha power and hypnotizability to be inconsistent. However, previous research has not extensively examined EEG relative amplitude or relative power as correlates of hypnotic susceptibility. Due to the inconsistent findings of the
amplitude and power of various bandwidths, relative amplitude and relative power were also chosen as the variables of interest in this investigation.

Method

Participants

Forty-one volunteer adults, ranging in age from 22 to 40 years ($m = 26.39$, $SD = 4.27$), served as subjects for this study. Participants were 9 males and 32 females enrolled in a graduate level psychology course at a private university in the Southeastern United States.

Instrumentation

The QEEG was assessed using the Autogenics A620 EEG Feedback System Assessment Software, Version 2.2. The specifications of the A620 are available in Linden (1996) and Monastra et al. (1999). The system uses a fast Fourier transformation algorithm of 2 second epochs of the EEG which are then reviewed for artifacts and combined with other epochs to determine power and amplitude for selectable bandwidths of the spontaneous EEG. A monopolar technique was utilized with both earlobes serving as reference. Cz was used as the active site based upon the International 10-20 system. This site is often used by clinicians to change EEG patterns associated with attentional problems and as reported in Monastra et al. (1999) appears the most promising site for assessment procedures on the basis of spectral analysis for measuring attentional components of arousal. Both earlobes and the Cz area were cleansed with rubbing alcohol followed by Omni-prep. Grass gold plated cup electrodes were attached with Ten20 conductive electrode paste. Electrode impedance was kept below 10 K ohms.

Measures

The Wickramasekera Experience Inventory (WEI), a 24 item true-false, self-report questionnaire, developed by Wickramasekera, (1988) was used as the measure of hypnotic susceptibility. The WEI was construct validated by Wickramasekera by correlating it with the Tellegen Absorption Scale (TAS, Tellegen & Atkinson, 1974) and the Harvard Group Scale of Hypnotic Susceptibility (Shor & Orne, 1962) which were found to have correlations of .82 and .55, respectively (I. E. Wickramasekera, personal communication, July 17, 1977 and November 18, 1997). The WEI contains one item, which applies only to female respondents. That item was excluded from the data.

<table>
<thead>
<tr>
<th>Table 1:</th>
<th>Means and standard deviations of QEEG bandwidths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amplitude</td>
</tr>
<tr>
<td>Theta</td>
<td>M = 12.11</td>
</tr>
<tr>
<td></td>
<td>SD = 5.11</td>
</tr>
<tr>
<td>Alpha</td>
<td>M = 18.33</td>
</tr>
<tr>
<td></td>
<td>SD = 8.60</td>
</tr>
<tr>
<td>Beta</td>
<td>M = 8.91</td>
</tr>
<tr>
<td></td>
<td>SD = 2.42</td>
</tr>
</tbody>
</table>

Amplitude = microvolts, Power = picawatts
Procedure

Subjects completed the experimental procedure individually. After completing consent forms, subjects’ heads were measured for electrode placement and the sites were cleansed as described. Subjects were asked to sit comfortably still with the eyes closed and to try to refrain from moving or rolling the eyes. All subjects had a 90-second QEEG assessment. Each 90-second QEEG recording was divided into 45 two-second epochs. At least twenty, 2-second, minimal artifact epochs were selected for quantification from each assessment. The WEI was administered to subjects in two group formats between two and six weeks following the QEEG assessment.

Results

Psychometric Results of the WEI

In this study, the coefficient alpha reliability estimate was .70 and the mean WEI score for the group was 8.34 with a standard deviation of 0.60. In a previous study by Wickramasekera, the mean WEI score for a sample of 183 National Aeronautics and Space Administration (NASA) employees was 9.4 with a standard deviation of 5.4 (I. E. Wickramasekera, personal communication, July 17, 1997).

QEEG Data

The means and standard deviations of the QEEG data are presented in Table 1. As expected the amplitude and power of alpha bandwidth was the largest, with theta being greater than beta. This same order was present in the relative analysis. From the QEEG data amplitude, relative amplitude, power, and relative power of the bandwidths of theta, alpha, and beta were selected for correlation with the WEI. Relative amplitude and relative power were calculated by dividing theta (4-8 Hz), alpha (8-12 Hz), and beta (13-21 Hz) bandpasses individually by the total for theta, alpha, and beta (see Table 2). Pearson product-moment correlations between theta, alpha, and beta amplitude and WEI scores were .216, -.118, and .108 respectively, none of which reached significance at the .05 level. However, the correlations between WEI scores and relative amplitude for theta, alpha, and beta were .260, -.323, and .167 respectively. Relative amplitude of theta was positively correlated with WEI while alpha relative amplitude was negatively correlated with WEI. The WEI was not correlated with any bandwidth based upon absolute power. However, the WEI was positively correlated with relative power for beta and was negatively correlated with relative power for alpha. The correlation between amplitude and power for all the bandwidths was .561, p < .01.

<table>
<thead>
<tr>
<th>Table 2: Correlations between bandwidths and WEI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Theta</td>
</tr>
<tr>
<td>Alpha</td>
</tr>
<tr>
<td>Beta</td>
</tr>
</tbody>
</table>

* p < .10  
**p < .05
Discussion

The results of this study support a significant relationship between relative theta amplitude and hypnotic susceptibility, such that increased relative theta amplitude was associated with increased hypnotic susceptibility. Our finding regarding theta’s direct relationship with hypnotic susceptibility replicates the findings of Graffin et al. (1995). Our study found relative amplitude and relative power of alpha to be negatively correlated with hypnotic susceptibility. Examining the literature, the relationship between alpha and hypnotizability has been found to be unsupported by Dumas (1977). However, Barabasz (1983) in a response to Dumas (1977) reported findings indicating a mixture of significant and non-significant correlations between alpha and hypnotizability. The Barabasz (1980, 1983) perspective was supported by Perlini and Spanos (1991). Graffin et al. (1995) found a significant direct relationship between absolute alpha power and hypnotic susceptibility as measured by the Stanford Hypnotic Susceptibility Scale, Form C (SHSS, Weitzenhoffer & Hilgard, 1962). Differences between the current results and previous findings may be due to the use of a different measure of hypnotic susceptibility; the small deviations of scores of our sample on the WEI; the site of EEG recording, which is over the sensory motor area of the cortex versus the frontal temporal lobes; and/or a characteristically different sample, as the sample in the current study consisted of volunteer adults from a graduate level psychology course with a mean age of 26. In the Graffin et al. (1995) study the sample consisted of recruits and volunteers from an undergraduate level introductory psychology course which would have an estimated mean age of 18. The approximate 8 year difference in age between the current study and the Graffin et al. (1995) study may have impacted the current findings due to changes in the EEG associated with aging (Surwillo, 1990, p. 17-21). Another major difference between our study and the Graffin et al. (1995) study is that they used a method of sequential screening to select subjects from the upper and lower scores on two measures of hypnotic susceptibility. This technique provided either high-susceptible or low-susceptible subjects. Therefore, subjects with extreme levels of susceptibility may have unique levels of EEGs when compared to subjects not selected for this characteristic.

Additionally, the choice of relative amplitude and relative power as the QEEG variable of interest may also have impacted the findings. The technique of using relative amplitude and relative power rather than absolute amplitude or absolute power may be an important technique to highlight QEEG characteristics as they relate to individual differences, such as hypnotic susceptibility, even though relative amplitude and relative power may have some limitations due to the computational technique. The results of this study provide evidence that a quick and simple method of assessment of hypnotizability may be provided through the use of the WEI. It also demonstrates the findings of EEG’s relationship to hypnotic susceptibility to a different region of the cortex (Cz).

References


