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Interaction of Hemispheric Brain Dominance and Treatment Type on Lowering the Frontalis Muscle Tension in College Students

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Interaction of Hemispheric Brain Dominance and Treatment Type
on Lowering of Frontalis Muscle Tension in College Students

A THESIS
The Honors Program
College of St. Benedict/St. John's University


In Partial Fulfillment
of the Requirements for the Distinction "All College Honors"
and the Degree Bachelor of Arts
In the Department of Psychology

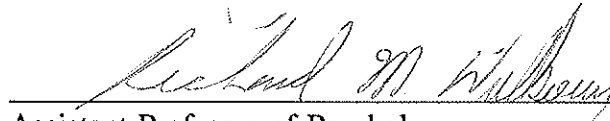
by
Lynda S. Haag
April, 1991

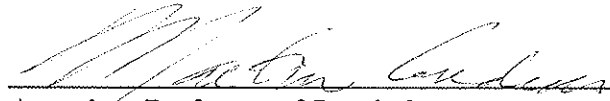
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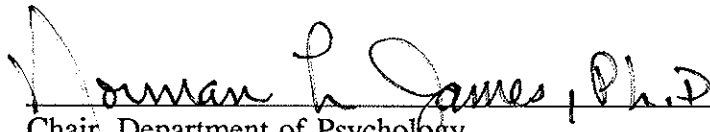
PROJECT TITLE: Interaction of Hemispheric Brain Dominance and Treatment Type
on Lowering of Frontalis Muscle Tension in College Students

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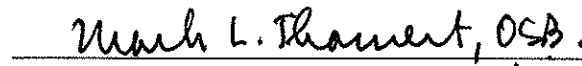

Director, Honors Program

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Abstract

It was hypothesized that a combination of imagery and biofeedback would be more effective in reducing frontalis muscle tension than either imagery or biofeedback alone. Also, because spatial and artistic abilities are often attributed to right-brain strategies, it was hypothesized that subjects who use a "right-brained" cognitive style would be more successful using guided imagery than subjects who use a "left-brained" cognitive style. Subjects were 12 college students, six "right-brained" and six "left-brained" as determined by a hemispheric strategy questionnaire. Each subject received imagery, biofeedback or both for 6 nonconsecutive days. Collapsing across days, 3 X 2 analyses of variance (ANOVAs) yielded nonsignificant results for both variables as well as for the hypothesized interaction. Success of muscle tension reduction depended only on initial tension levels. A floor effect was suspected and was attributed to subject selection. Trends suggest that both imagery and biofeedback are equally effective as relaxation techniques for college students who are not clinical patients. Also, subjects who improved the most with treatment did so only because they were initially more tense than other subjects.

Interaction of Hemispheric Cognitive Styles and Treatment Type on Lowering Frontalis Muscle Tension in College Students

The American Medical Association has estimated that 80% of medical disorders are stress-related or psychosomatic (Inner Tell EMG Training Manual, 1979). This statement implies that effectively handling stress would decrease the number of doctor visits that Americans are currently making. One way to help patients handle stress is by teaching them relaxation techniques. This study investigates two relaxation techniques, biofeedback and guided imagery.

Biofeedback is a technique which gives a patient direct, accurate information about internal physiological states. Biofeedback has been used in a number of ways. For years clinicians have been trying to help people learn how to control blood pressure, skin temperature and muscle tension with biofeedback (Blanchard & Epstein, 1978). The most common use of biofeedback is electromyographic-mediated biofeedback which measures muscle tension. An electromyograph (EMG) can be set up to measure tension in almost any external muscle of the body, however, the frontalis muscle of the forehead is the most common site for EMG biofeedback (Blanchard & Epstein, 1978). One reason for this is that the frontalis is a voluntary and naturally controllable muscle, and therefore an exemplary site for patients to learn biofeedback. Another reason for using this site is because frontalis muscle tension is reportedly a good indicator of overall muscle tension throughout the body (Blanchard & Epstein, 1978; Inner Tell EMG Training Manual, 1979). Research by Haynes, Griffin, Mooney & Parise (1975) also supports EMG biofeedback as an effective treatment for patients with muscle contraction headaches. A great deal of research has been done on EMG and frontalis muscle tension. These studies

show that EMG biofeedback is indeed effective in reducing frontalis muscle tension (e.g., Coursey, 1975; Haynes, Moseley & McGowan, 1975).

The question which logically follows these studies is: Is EMG biofeedback a more effective means of relaxation treatment than other types of relaxation treatments? Research shows that this is not the case. Rather, relaxation training (Silver & Blanchard, 1978) and progressive muscle relaxation (Sime and DeGood, 1977) seem to have the same rate of success as biofeedback. EMG biofeedback, relaxation training and progressive muscle relaxation induce muscle tension reductions that are not significantly different. Qualls and Sheehan (1981) suggest that biofeedback used in conjunction with imagery relaxation techniques could be more effective than biofeedback alone.

The clinical use of imagery techniques is another recent addition to the world of medicine. Previously, athletes have used mental imagery (psychocybernetics) extensively to improve their athletic skills by practicing a movement or technique over and over again with their imagination (Yandell, 1990). It has been suggested that imaging can help people overcome a variety of ailments from broken bones to infertility (Epstein, 1989). Some cancer treatment programs include imagining the patient's white blood cells attacking cancer cells like soldiers on a battle field (Epstein, 1989; Achterberg, 1978). Imagery has also been used in relaxation programs to help patients reduce physiological tension (Sheikh & Pachuta, 1986).

It has been suggested that certain cognitive characteristics give patients a predisposition for using imagery effectively (Epstein, 1989). One of these characteristics is the type of hemispheric brain dominance or cognitive style (Korn & Johnson, 1983).

The right cortex is considered the origin of creative and visuo-spatial skills, while the left cortex controls language and logical skills (Springer & Deutsch, 1981). Epstein (1989) and Korn and Johnson (1983) suggest that people should tap into their right cortex to be successful using imagery.

Following up on these suggestions, two hypotheses are set forth in this study: 1) A combination of imagery and biofeedback will be more successful in reducing frontalis muscle tension than either imagery or biofeedback alone; and 2) subjects classified as using mainly right cognitive styles will be more successful using imagery to reduce frontalis muscle tension than those subjects who were classified as using left cognitive styles.

Methods

Subjects

Subjects were 12 students who attend the College of St. Benedict and St. John's University, two small, private, Benedictine-affiliated liberal arts colleges in central Minnesota. The students were studying majors in physics (1), psychology and art (1), computer science (1), natural science (1), accounting (6), liberal studies (1) and chemistry (1). They were selected from 92 students who completed the first two sections of a hemispheric brain dominance questionnaire written by Ivan Muse (Brigham Young University) which was included in a popular article by McKean (1985; see Appendix). This questionnaire assessed subjects' use of cognitive styles commonly associated with right-brain strategies and left-brain strategies. 6 right cognitive style (RCS) subjects and 6 left cognitive style (LCS) subjects agreed to take part in an experiment involving

relaxation techniques; 7 subjects were men, and 5 were women. Of the males, 4 used RCSs and 3 used LCSs; 2 of the females were classified as using RCSs, and 3 were classified as using LCSs.

College students were not the preferred population to be studied; chronic stress patients or tension headache patients would have been preferred due to the facts that a) their elevated tension levels would make them more representative of the target population of this study, and b) progress would have been recognized more readily with these types of subjects. However, because of limited accessibility of this group, college students were used as subjects.

Apparatus/Instruments

Muse's questionnaire (see Appendix) which was used to classify subjects by cognitive style consists of three sections. Section 1 includes items on how people using different cognitive styles perceive their environment and on how they approach problems. Subjects using a right cognitive style perceive more from their right visual field and tend to be creative, spontaneous, and holistic thinkers. Subjects using a left cognitive style perceive more from their left visual field and tend to be logical, analytical and organized (Springer & Deutsch, 1981). Section 2 asks what types of problems subjects prefer to solve. Two of the problems were "left-brain" problems involving math and logic, and two of the problems were "right-brain" problems dealing with visualization and imagination.

92 subjects completed sections 1 and 2 and were assigned point values for answers according to the interpretation section included in McKean's article. Results for these sections were calculated. 18 subjects had high scores (above 82), possibly indicating left

cognitive style. 30 subjects had low scores (below 68), possibly indicating right cognitive style. 41 subjects scored in the range between 68 and 82. These scores were possible indicators of nondominant cognitive styles. 3 subjects filled out the questionnaire incorrectly. These 3 subjects and the 41 subjects who scored in the middle range were not contacted again.

The 48 subjects who scored very high or very low were asked to complete Section 3 which involved a 5-minute face-to-face session with the experimenter. 23 subjects agreed to complete Section 3. For this section the experimenter sat in front of the subject and asked 10 questions which the subject answered verbally. Correct answers were of no consequence. Rather, lateral eye movements were recorded while subjects were thinking of the answers. On the premise that lateral eye movements are controlled by areas of the frontal lobe located in the contralateral hemisphere, Bakin (1969) suggested that a person glances in the opposite direction of the hemisphere which is currently more active (Springer & Deutsch, 1981). This implies that if a person glances in the left direction while thinking, that person is using RCSs, and the person who glances right when thinking uses LCSs.

Scores from Section 3 were added to scores from Sections 1 and 2. The total points possible was 170. Subjects were categorized as having right cognitive styles, with total scores of 84 or below, left cognitive styles, with total scores of 120 or above, or nondominant cognitive styles, with total scores falling between 84 and 120. Of the 23 subjects who completed all three sections of the questionnaire, 10 subjects were classified as using RCSs, 7 were classified as using LCSs, and 6 were classified as using

nondominant cognitive styles. 6 subjects who used RCSs and 6 who used LCSs were selected to participate in the experiment.

A single-subject pilot study was performed to compare the two different types of audio feedback available. One type was narrow-band white noise, and the other was a single tone. In this study the subject recommended that the white noise be used because it was less irritating to the listener, enabling the subject to concentrate better.

Frontalis muscle tension was measured using a Lafayette electromyogram (Model #78055) with a standard 3-electrode assembly of 18mm electrodes. The electrodes were filled with electrode gel and adhered to the subject's forehead using double-faced adhesive collars and an elastic adjustable headband which held the collars in place with Velcro. The Lafayette electromyogram continuously monitored frontalis muscle tension while the experimenter recorded the measurements on a chart every 15 seconds.

For subjects receiving audio biofeedback, headphones were hooked up to the main component of the EMG so that direct feedback from the EMG could be transmitted to the subject. For subjects receiving guided imagery, a tape player was used to play an 11.5 minute recorded guided image assembled by the experimenter from guided images printed in Guided Imagery: Workshop Training Manual by Sheikh and Pachuta (1986).

Another single-subject pilot study was conducted to determine if the subjects assigned to the imagery with biofeedback group would be able to hear both the recorded tape and the audio biofeedback clearly. In this study the subject could hear both clearly when allowed to make minor adjustments in the volumes of the tape player and the EMG. In the present study subjects were told that it was important that they be able to hear both

the tape and the biofeedback clearly. At the beginning of each session, due to individual hearing differences, the EMG volume was adjusted slightly under the direction of the subject.

After the study was completed, a survey was distributed to the subjects to be completed and sent back to the experimenter. This survey included questions about the subject's perception of the treatment. 9 out of 12 surveys were completed and returned.

Procedure

The 12 subjects were asked to participate in 20-minute sessions twice a week for three weeks. Except for one instance with one subject, all sessions were scheduled at least 2 days apart. Subjects were pseudorandomly assigned to three treatment groups such that 2 subjects who used RCSs and 2 subjects who used LCSs were included in each group. Each group was then assigned to one of three different treatments: imagery, biofeedback, or imagery with biofeedback.

All sessions took place in the same room. The subjects were told how the EMG worked and asked if they had any questions regarding the apparatus or the experiment. Subjects were told that the treatment they were receiving is being used in a clinical setting for relaxation therapy. The subjects were not informed about other experimental groups being tested. Only one subject received treatment at a time. Before the initial treatment, all subjects read and signed a consent form.

Treatment

An EMG was used with all subjects so that the experimenter could record muscle tension throughout the sessions. Surface electrodes were placed on the frontalis muscle

3.7 cm away from the midline and 2.5 cm above the eyebrows. The ground electrode was placed above the nose between the other two electrodes. Subjects were not permitted to view the EMG readings.

In addition, subjects who were assigned biofeedback (biofeedback and imagery with biofeedback groups) used headphones which were plugged into the EMG console. Through these headphones subjects received direct audio biofeedback from the EMG. The biofeedback was narrow-band white noise. The pitch of this noise varied directly with frontalis muscle tension as measured by the EMG. Subjects who used imagery only did not use the headphones. Rather, they listened to a recorded guided relaxation image played on a tape player placed about 45 cm in front of them.

The imagery with biofeedback group was treated with both the imagery and the biofeedback simultaneously. Treatment time for all subjects was 11.5 minutes per session, and EMG readings were recorded every 15 seconds.

Results

The hypothesis that imagery with biofeedback would be more effective than either imagery or biofeedback alone was not supported. Also, the hypothesis that subjects who used RCSs would be more successful than subjects who used LCSs for reducing frontalis muscle tension with guided imagery was also not supported. Means and standard deviations were calculated on initial muscle tension for each session, lowest muscle tension attained during each session, and the greatest reduction in muscle tension attained during each session. Table 1 displays these means and standard deviations for each session for all twelve subjects.

Table 1
Means and Standard Deviations on Initial, Lowest and Reduced
Muscle Tension for all Subjects During Each Experimental Session, n=12
(measured in microvolts)

Session	Initial	S.D.	Low	S.D.	Drop	S.D.
1	3.38	1.82	1.7	.59	1.68	1.39
2	3.18	.87	1.63	.60	1.56	.64
3	3.86	1.46	1.77	.75	2.1	1.34
4	3.48	1.76	1.83	.78	1.66	1.24
5	3.43	1.59	1.68	.65	1.75	1.16
6	2.93	1.07	1.77	.91	1.17	.49

Table 2
Means and Standard Deviations on Initial, Lowest and Reduced Muscle Tension for
Subjects During Each Experimental Session, Grouped by Cognitive Style
(measured in microvolts)

Subjects with Right Cognitive Styles, n=6

Session	Initial	S.D.	Low	S.D.	Drop	S.D.
1	3.03	.89	1.50	.35	1.53	.76
2	3.37	.66	1.65	.69	1.72	.60
3	3.27	.64	1.52	.53	1.75	.73
4	2.87	.55	1.57	.61	1.30	.65
5	3.48	2.24	1.78	.85	1.70	1.57
6	2.63	.59	1.48	.41	1.15	.50

Subjects with Left Cognitive Styles, n=6

Session	Initial	S.D.	Low	S.D.	Drop	S.D.
1	3.73	2.48	1.90	.74	1.83	1.91
2	3.00	1.07	1.62	.55	1.38	.68
3	4.47	1.85	2.02	.90	2.45	1.77
4	4.10	2.37	2.08	.90	2.02	1.63
5	3.37	.71	1.57	.43	1.80	.70
6	3.23	1.41	2.05	1.21	1.18	.44

Means and standard deviations for initial, lowest and reduced muscle tension during each session were also calculated for subjects grouped according to cognitive style, n=6. These data are included in Table 2.

Table 3
Means and Standard Deviations on Initial, Lowest and Reduced Muscle Tension for Subjects During Each Experimental Session, Grouped by Treatment Type (measured in microvolts)

Subjects Using Imagery Only, n=4						
Session	Initial	S.D.	Low	S.D.	Drop	S.D.
1	3.30	1.45	1.73	.77	1.58	.82
2	3.90	1.07	2.00	.85	1.90	.53
3	4.53	1.75	1.65	.71	2.88	1.90
4	3.48	1.07	1.80	.75	1.68	.51
5	4.70	2.36	1.80	1.18	2.90	1.25
6	2.45	.53	1.38	.48	1.08	.30
Subjects Using Biofeedback Only, n=4						
Session	Initial	S.D.	Low	S.D.	Drop	S.D.
1	4.00	2.84	1.85	.69	2.15	2.23
2	3.10	.35	1.43	.26	1.68	.57
3	3.56	1.68	1.85	.89	1.70	1.11
4	4.38	2.78	2.08	1.11	2.30	1.84
5	2.90	.50	1.70	.38	1.20	.69
6	3.45	1.79	2.15	1.51	1.17	.45
Subjects Using Imagery with Biofeedback, n=4						
Session	Initial	S.D.	Low	S.D.	Drop	S.D.
1	2.85	1.1	1.53	.39	1.33	1.01
2	2.55	.53	1.48	.50	1.08	.62
3	3.53	1.04	1.80	.88	1.73	.77
4	2.60	.63	1.60	.54	1.00	.94
5	2.68	.41	1.53	.34	1.15	.50
6	2.90	.26	1.78	.39	1.13	.62

In addition, Table 3 shows the means and standard deviations for initial, lowest and reduced muscle tension during each session for subjects grouped according to treatment type: imagery only, biofeedback only, or imagery with biofeedback, $n=4$.

A repeated measures analysis of variance showed no significant changes in muscle tension levels across sessions. For initial muscle tension, $F(5,55)=.8413$, $p>.1$. For lowest muscle tension, $F(5,55)=.2721$, $p>.1$, and for reduced muscle tension $F(5,55)=1.1898$, $p>.1$. Due to this nonsignificance, data were collapsed across sessions.

Means of muscle tension for each 15-second trial (collapsed across sessions) were calculated for all subjects ($n=12$), subjects with RCSs ($n=6$), subjects with LCSs ($n=6$), subjects treated with imagery only ($n=4$), subjects treated with biofeedback only ($n=4$), and subjects treated with a combination of imagery and biofeedback ($n=4$). These means can be seen on Figure 1.

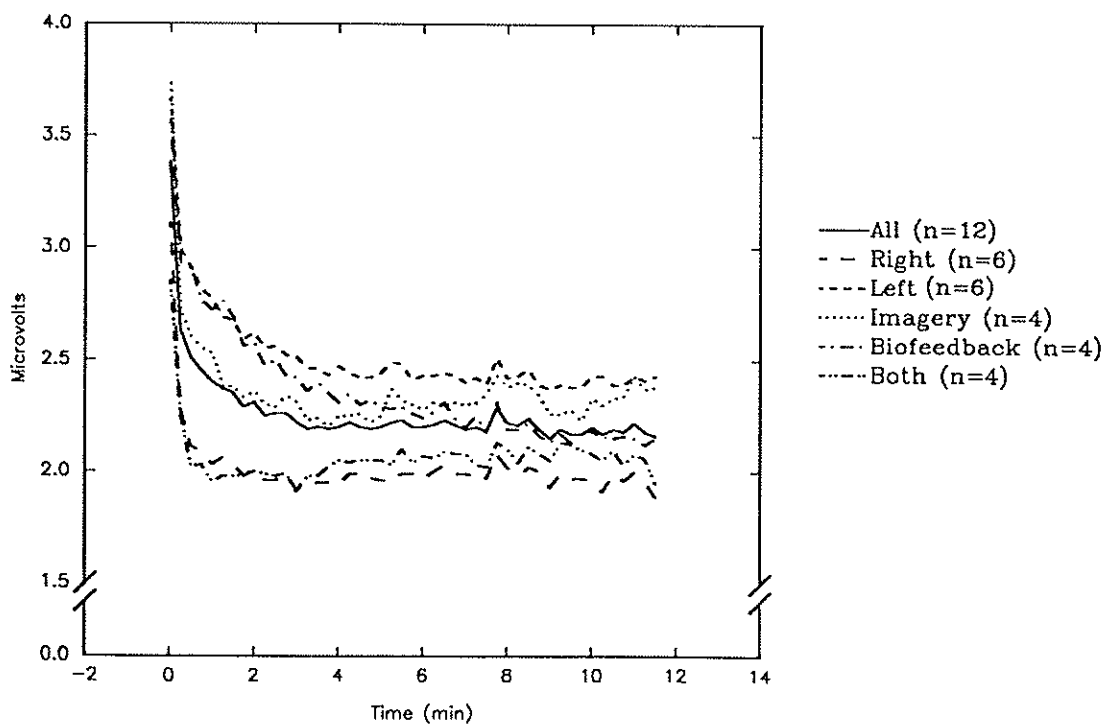


Figure 1 Mean tension across days for each 15 second measurement.

Collapsed across sessions, means of muscle tension were also calculated for each 15-second trial for RCS subjects treated with imagery (n=2), RCS subjects treated with biofeedback (n=2), RCS subjects treated with imagery and biofeedback (n=2), LCS subjects treated with imagery (n=2), LCS subjects treated with biofeedback (n=2), and LCS subjects treated with imagery and biofeedback (n=2). The means are displayed on Figure 2.

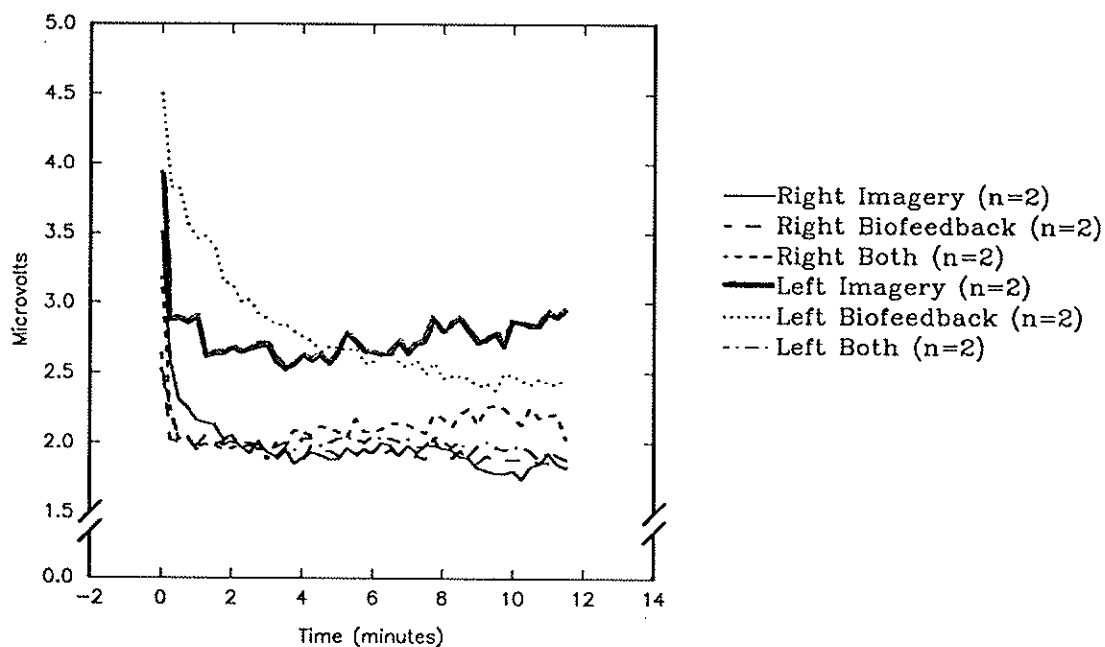


Figure 2 Mean tension across days for each 15 second interval.

Collapsed across sessions, 3 X 2 ANOVAs were conducted to determine differences in tension levels by treatment type and cognitive style. The three dependent variables were initial tension, lowest tension and reduced tension, all measured in microvolts.

There were nonsignificant differences among initial levels of tension for the three treatment groups: $F(2,9)=.8409$, $p>.1$. There were also nonsignificant differences among

the lowest muscle tension attained by subjects in the three treatment groups: $F(2,9)=.1253$, $p>.1$. Additionally, differences in reduced tension during sessions were nonsignificant: $F(2,9)=1.4977$, $p>.1$.

Figure 3 shows mean initial and mean lowest tension levels for the three different treatment groups for each session. For each of the treatment groups, $n=4$.

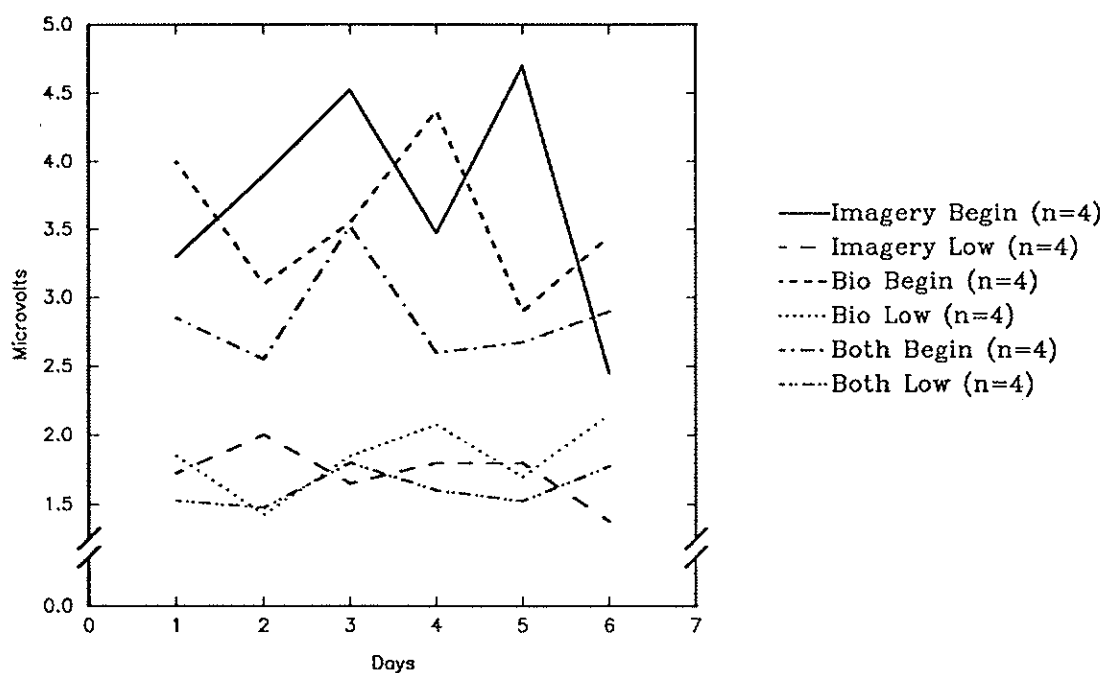


Figure 3 Mean initial and lowest tension by day and treatment.

Figure 4 depicts mean beginning and mean reduced tension levels for the three treatment groups for each session. For each of the treatment groups, $n=4$.

An ANOVA was conducted on the frontalis muscle tension measurements of the subjects as grouped according to cognitive style. The differences in initial tension levels were nonsignificant: $F(1,10)=.8693$, $p>.1$. Differences in lowest attained levels of tension were also nonsignificant: $F(1,10)=.7175$, $p>.1$. The ANOVA showed nonsignificant

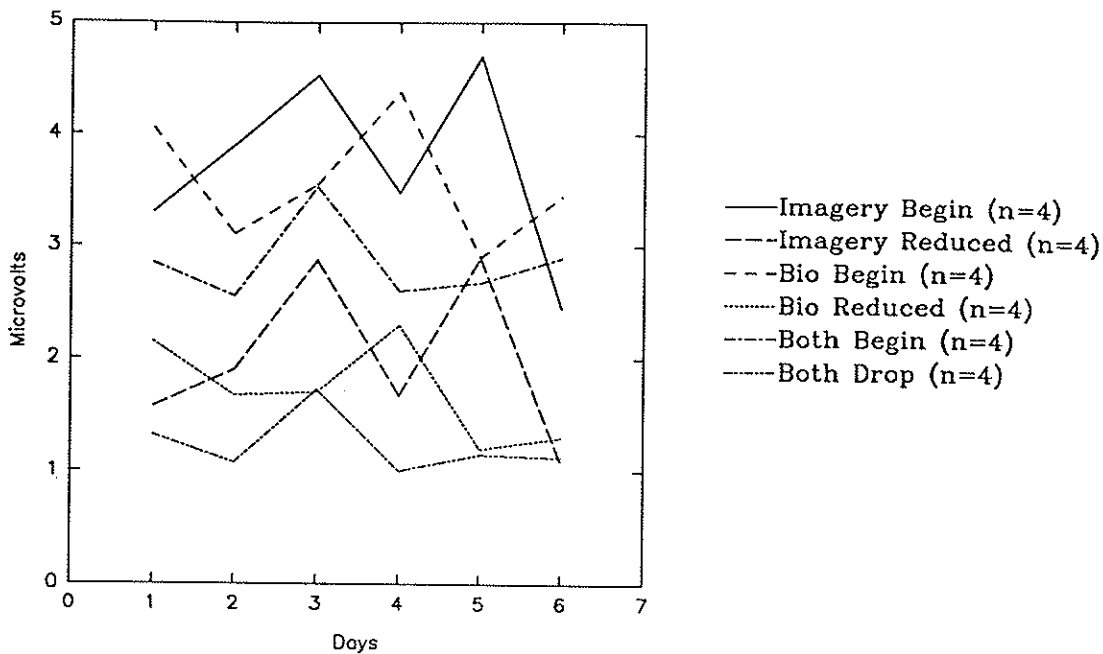


Figure 4 Mean initial and reduced tension by day and treatment.

differences in reduced tension among the two groups as well: $F(1,10)=.4138$, $p>.1$.

Figure 5 displays mean beginning and mean lowest tension levels for the two subject groups who used either RCSs or LCSs ($n=6$) for each session.

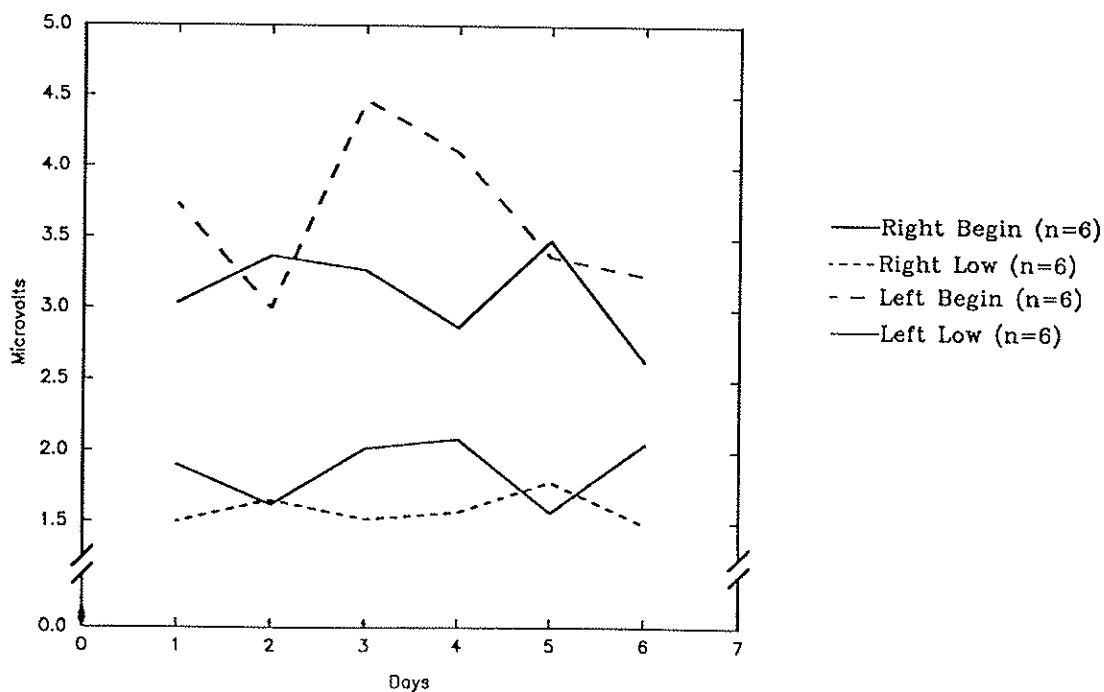


Figure 5 Mean initial and lowest tension by day and cognitive style.

Figure 6 illustrates mean beginning and mean reduced tension levels for the two subject groups for each session. For both subject groups, $n=6$.

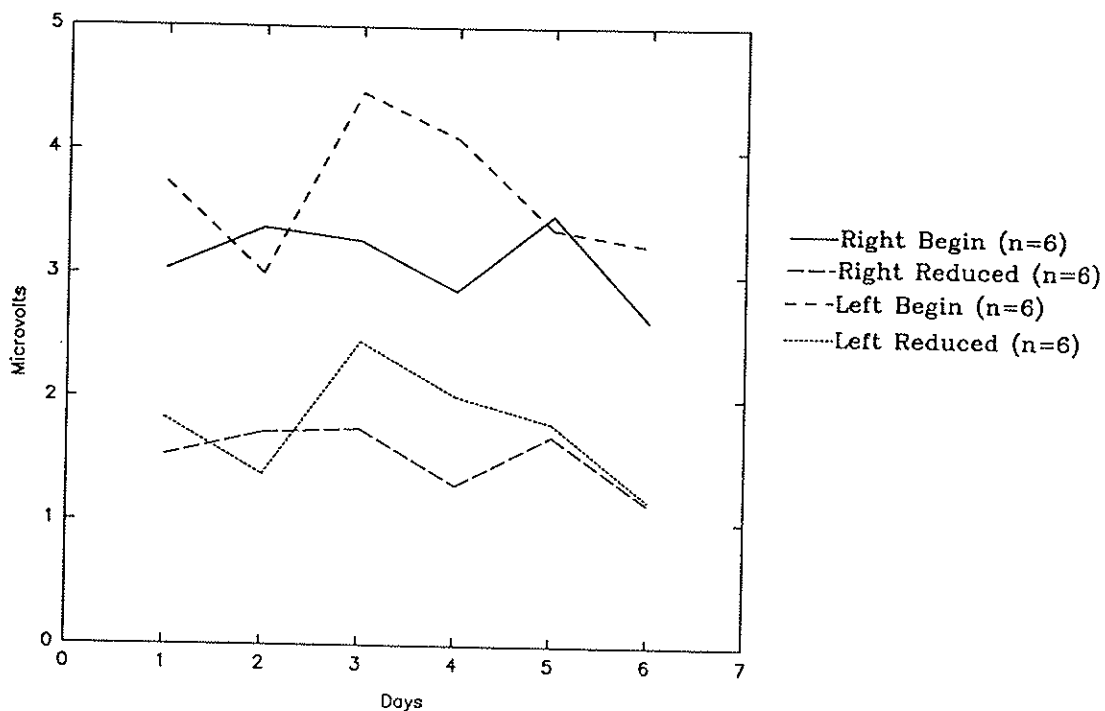


Figure 6 Mean initial and reduced tension by day and cognitive style.

Because of the small number of subjects treated with imagery only, data analysis could not be conducted on the differences in muscle tension for subjects who were treated with imagery and who used either RCSs or LCSs. Figure 7 shows mean initial muscle tension and mean low muscle tension during each session for subjects who used imagery only and who were classified as using RCSs or LCSs.

For this same set of subjects who were grouped according to cognitive style and were assigned to the imagery only treatment group, Figure 8 illustrates the mean initial muscle tension and the mean reduced muscle tension during each of the 6 sessions.

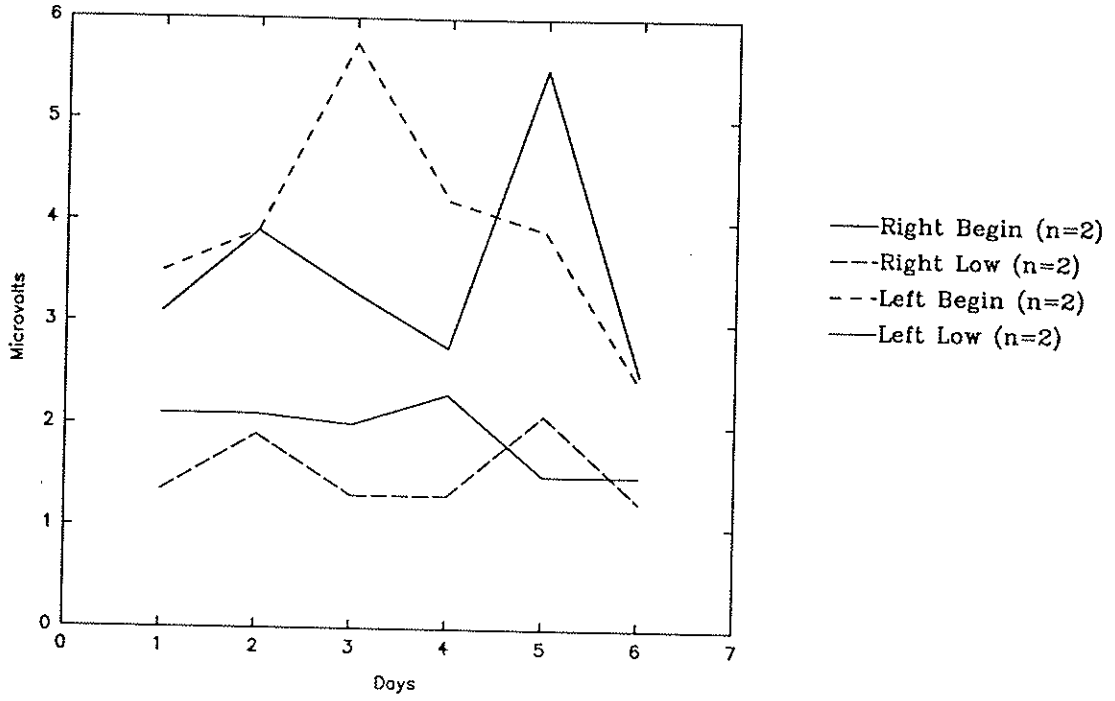


Figure 7 For subjects using imagery, mean initial and lowest tension by day and cognitive style.

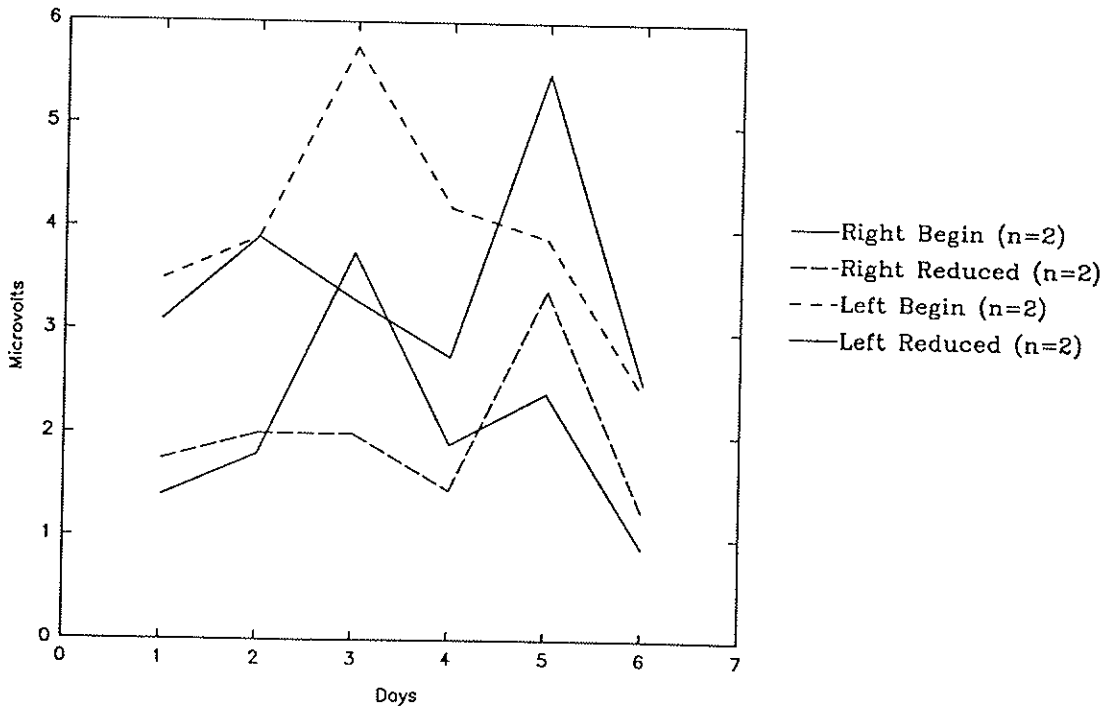


Figure 8 For subjects using imagery, mean initial and reduced tension by day and cognitive style.

Discussion

The results of the experiment did not support the hypothesis that imagery with biofeedback is more effective than either imagery or biofeedback alone. Nonsignificant differences were found for reduction of frontalis muscle tension among the three treatment groups. The experiment also did not support the hypothesis that subjects who use a right cognitive style are more successful than subjects who use a left cognitive style in reducing frontalis muscle tension with a guided imagery relaxation technique. A nonsignificant difference in reduction was apparent between the two groups using imagery.

These findings support research which has suggested that there is no significant difference in success rates between biofeedback and other relaxation techniques (Haynes et al., 1975; Silver & Blanchard, 1978). These findings are inconsistent with another study which indicates that imagery added to biofeedback can be a superior relaxation technique (Qualls & Sheehan, 1981).

An interesting finding of this study was a floor effect. The fact that a person's muscle tension has a lower limit of about 1 microvolt and the fact that the subjects studied were college students and not clinical stress patients suggest that the success or failure of muscle tension reduction while using a clinical technique could have been due to initial tension level. This hypothesis was also suggested in a previous study in which success of EMG biofeedback for college students was examined and no significant differences among treatments were found (Drennen, Rutledge & Wattles, 1985).

Perhaps using a clinical, or more tense, group of subjects would provide

differential results among treatments. According to Dr. Jim Tuorila, a clinical psychologist at the Veteran's Administration Hospital in St. Cloud, MN, initial tension levels for clinical patients are typically 16 to 18 microvolts (personal communication). These tension levels are substantially higher than any of the levels exhibited by the subjects in the present study.

For college students the present study found that success of tension reduction was not due to the type of treatment or to the cognitive style of the S; instead, success depended on the state of tension at which the subjects began. Those subjects who were the most successful started out with the highest EMG ratings; those subjects who were the least successful had the lowest initial EMG ratings. This suggests that the success of the relaxation treatments could be dependent only on how much tension the subject had to lose!

This study suggests that in college students there is little difference in the effectiveness of different relaxation techniques. This may not be generalizable to clinical patients because, in a more variable population with higher tension, different treatments may, in fact, have significantly different success rates. Therefore, to investigate the success of relaxation treatments for clinical patients, research using clinical patients as subjects should be conducted.

Results of this experiment imply that both imagery and biofeedback are equally effective as relaxation techniques for normal college students. This has some interesting implications for college students because those who are seeking relaxation techniques may benefit from whichever technique they personally prefer based on cost, convenience and

perceived effectiveness.

The concept of perceived effectiveness brings up an important point that was noted in the post-experimental survey distributed to subjects in this study. Though their EMG readings showed them to be relaxed, subjects who used biofeedback reported that they did not feel relaxed; rather they felt drained after concentrating on the tone. When asked if they felt relaxed during biofeedback, some of them responded, "Not exactly...I was very tense. Trying to lower the tone took concentration...", "No, just hearing the tone after a while got to be annoying. At times I almost felt frustrated because I felt I couldn't relax..." This suggests that more research should be done on the relationship between physiological relaxation and perceived relaxation. It was also speculated that those subjects assigned to imagery may not have altered their state of tension due to visualization of the image. Rather, the effect could be due to the comforting tone of the voice on the tape. One subject likened listening to the voice to listening to soft music to relax.

Another important variable which should be considered is the fact that a national crisis occurred in the middle of this study, the beginning of the Persian Gulf War. Most of the subjects alluded to the fact they had difficulty relaxing when the nation had just gone to war.

In this study frontalis muscle tension was used as an indicator of overall muscle tension. Although the validity of this indicator is not currently being contested, this premise may fall into question if it is found that people can train specific muscle groups to relax without affecting other areas of the body. Research indicates that it is possible for rats to constrict blood vessels in one ear and simultaneously dilate vessels in the other ear (Dicara & Miller, 1968). If humans, like rats, can learn to selectively control

physiological processes, one might be generally relaxed while the frontalis muscle remains tense or vis versa. Therefore, a relaxed frontalis muscle may not necessarily indicate that the individual's overall level of tension has been reduced.

Due to the low number of subjects in this study the statistical power was low. The nonsignificance may have been due to the fact that no real differences in muscle tension were present among the subject groups; however, closer inspection of Figure 1 and Figure 2 would lead one to believe that there are, in fact, differences in tension levels between groups. This conclusion would seem particularly to stem from observing the large differences between ending tension levels of subjects using right cognitive styles and subjects using left cognitive styles. These nonsignificant but visible differences in ending tension levels also reflect nonsignificant but visible differences in initial tension levels. For both initial and ending tension levels, subjects who use RCSs were lower than subjects who use LCSs.

This observation may suggest that people who are creative, artistic and spatially oriented experience less stress than people who are logical and analytical. One reason for this is that jobs or areas of study that are tailored for the RCS person may, in fact, involve less pressure than fields which emphasize LCSs. This prompts one to question whether cognitive styles influence a person's academic and career choices or whether a person's academic and career choices cause a person to use a particular cognitive style.

Another reason for differences in overall tension levels between the two groups may be that people who use LCSs perceive more constraints and limitations than do people who use RCSs. It is sensible to assume that a direct relationship exists between the limitations a person perceives and the stress he or she may experience. The additional limitations perceived by a LCS person may be a result of using logical, structured

paradigms to understand and solve problems.

If there is a difference in stress levels between people who use right versus left cognitive styles, it may be related to how a person perceives the world in general. Analytical people may struggle to rationalize every aspect of life. In many instances, like natural disasters, this seems impossible. For the person who thinks in logical terms, the inability to explain events rationally may induce stress. The RCS person, on the other hand, may not seek to systematize the world as the logician does. The logician might deconstruct the world into categories that have been clearly defined while the creative, artistic person may more readily speculate on new, unexplored explanations for events. People who use RCSs may be exempt from some logical constraints and therefore exhibit lower tension levels than people who use LCSs.

This study presents an interesting notion that cognitive style could be related to a person's ability to relax and to handle stress. Further research using more subjects should be conducted to investigate this relationship. Also, other research could be done correlating cognitive styles with factors that have already been associated with stress such as locus of control and personality type.

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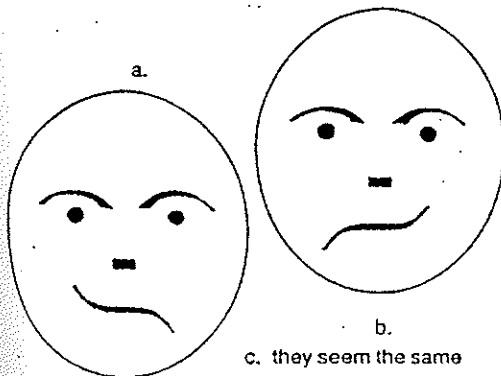
SECTION ONE

Muse's Cerebral Dominance Questionnaire

1. When you go to a movie, do you prefer to sit
 - a. on the left side of the theater
 - b. on the right side of the theater
 - c. in the center, or no preference
2. Do you like to work
 - a. on a team
 - b. by yourself
3. When someone gives you an assignment, do you prefer
 - a. highly specific instructions
 - b. rather flexible instructions
4. Do you tend to make decisions
 - a. on a gut feeling or hunch
 - b. after careful analysis and thought
5. In general, do you feel that laws
 - a. should be strictly enforced for everyone
 - b. should be enforced only after considering individual circumstances
6. To motivate yourself, do you prefer
 - a. competing with yourself
 - b. competing with others
7. Which drawing is closest to the way you hold a pen?



8. Which face seems happier to you?



9. Would you prefer to be married to someone who
 - a. has unusual ideas and daring concepts
 - b. is a thorough planner and organizer

10. When you shop, do you tend to buy
 - a. after reading labels and comparing costs
 - b. on impulse
11. Does daydreaming help you make decisions
 - a. frequently
 - b. sometimes
 - c. rarely
12. Which makes you happiest:
 - a. doing a crossword puzzle
 - b. sketching or drawing
 - c. finishing a work assignment
 - d. singing in the shower
13. When you meet someone, is it easier to
 - a. remember the name
 - b. remember the face
 - c. both are equally easy or difficult
14. Pick the two adjectives that best describe how you work.
 - a. organized (efficient, orderly)
 - b. imaginative (good at thinking up new ideas)
 - c. outgoing (work well with others)
 - d. result-oriented (complete everything you start)
 - e. intellectual (use reasoning powers to solve tasks)
 - f. intuitive (reach conclusions by a "sixth sense")

15. At a meeting, do you prefer
 - a. a graphic slide presentation
 - b. a dynamic speaker
16. When driving in a city that you know slightly, do you
 - a. get a map and ask for explicit directions
 - b. navigate by your own sense of direction
17. In a discussion, do you usually feel that
 - a. there are clear right and wrong positions
 - b. both sides have merit

18. After attending a play or movie, do you prefer
 - a. to talk to others about it
 - b. to think it over privately
19. When do you do your best work?
 - a. early in the morning
 - b. late in the afternoon or evening
 - c. at no particular time of day
20. If chosen to be a leader, would you rather be known as
 - a. humane, understanding, empathetic
 - b. logical, organized, fair

SECTION TWO

Here are four problems. Rank them in order of preference, with number one being the type of problem you most like to solve, and number four being your least favorite. (You needn't answer the questions, although the answers will be given for those who want them.)

Problem A

A grain company mixes seed costing 20 cents a pound with seed costing 25 cents a pound to produce a blend of seed costing 22 cents a pound. How many pounds of the more expensive seed are in a 50-pound sack of this mixture?

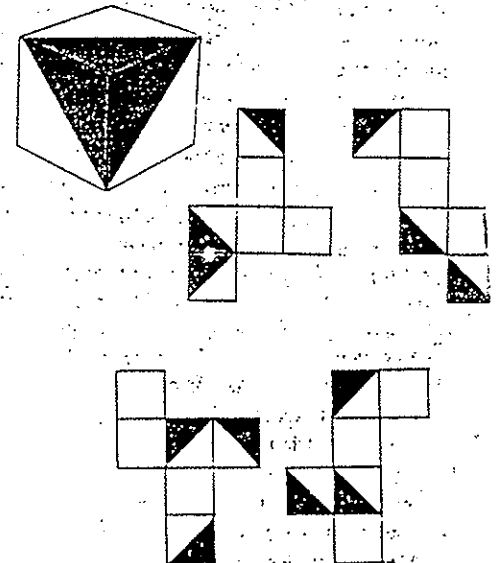
- a. 20
- b. 25
- c. 30
- d. 40
- e. none of these

Problem B

You're confined to a prison cell that has two doors. One leads to freedom, the opposite one to instant death. You don't know which door is which. With you are two jailers. One of them always tells the truth; the other always lies. Again, you don't know who is who. You may ask either of the jailers—but not both—one question. What question should you ask to learn which door leads to freedom?

Problem C

Which of the following four cutouts could be folded in such a way that it produces the cube in the drawing?



INTERPRETING THE LEFT-BRAIN, RIGHT-BRAIN QUESTIONNAIRE (pages 40 and 41)

Problem D

The words *house*, *village*, and *thumb* are all related to the word *green* in that they combine with *green* in a common word or phrase: *greenhouse*, *village green*, *green thumb*. In each example below, find the word that relates to all three:

- a. blue, cake, cottage
- b. water, pen, soda
- c. up, book, charge
- d. man, screen, sure

SECTION THREE

For this section, you need a partner. Give the magazine to your partner now, and don't read the rest of these instructions.

Instructions for partner: Sit in front of the person being examined and ask the ten questions below. Pay no attention to the answers, but watch the person's eyes to see in which direction he first glances when mulling over the problem. Put a check in the appropriate box below. (He need not glance exactly to the side; if he glances up and to his left, that's considered a leftward glance.) If he doesn't look to either side, don't check either box.

1. How many letters are there in the word *California*?

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

2. A cube has how many points (i.e., pointed corners)?

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

3. What was the name of your favorite grade school teacher?

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

4. Multiply seven times fourteen in your head.

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

5. Name the letters of the alphabet that have curves in their capital-letter forms.

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

6. Give three meanings for the word *pound*.

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

7. What color shirt (blouse) did you wear yesterday?

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

8. How many doorways do you pass through going from the street to your bedroom?

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

9. Name the letters of the alphabet that contain the sound *ee*.

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

10. Which way does the profile of *George Washington* face on a quarter?

<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------

SECTION ONE

Answers that tend to indicate a left-brain preference get five points each. Right-brain answers get one point. Answers that indicate no preference get three points each.

1. a=5 b=1 c=3

The theory here is that left-brain people may tend to sit on the left side of theaters so the screen will fall more into their right visual field, which sends information direct to the left hemisphere of the brain. For right-brainers, the situation is reversed.

2. a=1 b=5
3. a=5 b=1
4. a=1 b=5

The answer to question number 4 depends on the fact that right-brain people may be more likely to jump to emotional or intuitive conclusions, while left-brain people are usually more analytical.

5. a=5 b=1
5. a=1 b=5
7. a=1 b=5 c=5 d=1
8. a=5 b=1 c=3

Since the right hemisphere of the brain is usually more emotionally sensitive, most people see figure A as happier. Presumably this is because the smiling side of its mouth falls in the left visual field, which goes direct to the right hemisphere.

9. a=1 b=5
10. a=5 b=1
11. a=1 b=3 c=5
12. a=5 b=1 c=5 d=1
13. a=5 b=1 c=3

Left-brain people tend to be better at remembering names than faces. For right-brainers, the reverse is true.

14. a=5 b=1 c=1 d=5 e=5 f=1
15. a=1 b=5
16. a=5 b=1

Left-brainers usually want explicit directions, while right-brainers regard asking for directions as an admission of failure.

17. a=5 b=1
18. a=5 b=1
19. a=5 b=1 c=3

Left-brainers tend to be morning people, right-brainers evening people.

20. a=1 b=5

SECTION TWO

Problems A and B are left-brain problems, because they involve mathematics and logic, respectively. The other two are right-brain,

because they depend on visualizing a folded figure (problem C) or thinking of imaginative connections between words (problem D). Score this section according to which two problems you preferred to do. Find your score in the table below:

Problem ranked number two

	A	B	C	D
A	-	15	11	11
B	15	-	11	11
C	7	7	-	3
D	7	7	3	-

Problem ranked number one

ANSWERS TO SECTION TWO



Problem A: a. 20 pounds.

Problem B: Ask either jailer, "If I asked the other jailer to point to the door to freedom, which door would he point to?" Then go through the door opposite the one the jailer indicates. If you put the question to the truthful jailer, he'll honestly tell you what the other jailer would've said—that is, a lie. If you ask the lying jailer, he'll lie and tell you the opposite of what the truthful jailer would've said.

Problem C: b.

Problem D: a. cheese; b. fountain; c. cover; d. fire

SECTION THREE

Some studies have suggested that people glance in the direction opposite to the hemisphere that is most active at the time. That is, a person who looks to his left may be using his right hemisphere, and vice versa. So give yourself five points for every  glance, one point for every  glance, and three points for each pair of boxes that your tester left unchecked.

Add your scores for sections one, two, and three together. If the total is between 34 and 85 points, you've shown a preference for right-brain thinking. You may have creative, musical, or artistic talents. You often rely on feelings and intuition in making decisions. You're good at spotting overall patterns based on limited evidence, and excel at solving complex problems that demand a creative and insightful approach. You detest dealing with messy details.

If you scored between 119 and 170 points, you've demonstrated a preference for left-brain thinking. You're likely to be a verbal, logical, analytical person, perhaps with mathematical skills. You're meticulous and well organized, and excel at activities that require careful planning, cost projections, and attention to detail. You'd rather see one project earned through to completion than six half finished.

If you scored between 86 and 118 points, you've indicated that you use both right-brain and left-brain thinking equally.