

OBSERVATIONS ON THE EFFECTS OF
SUBLIMINAL STIMULATION

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by
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In the study of human emotional response, much research has been concerned with the expressions of emotions through facial activity, postures, and gestures. Recently, it has become possible to give an indication of what is occurring physiologically when a particular emotion is being expressed through the use of electromyographic (EMG) measurement. What the EMG primarily does is to measure contractions of the voluntary facial muscles that are relative to the expression of different emotions.

Through the use of the EMG, it is possible to determine the emotional responses of a subject even when there is no overt physical indication of feeling. This ability to measure covert response is of particular importance in this study, which involves stimuli presented in such a manner that the subject is unaware of the stimulation. These stimuli were designed to produce a mild emotional reaction, thus providing data for the EMG measurements.

The relationship of emotion to physical response is not a new discovery. A study by Ax (1953) proved the existence of a correlation between emotional stimuli and physiological reactions. Ax posed the question concerning the difference between physiological responses in a "fight or flight" situation, with "fight" regarded as anger and "flight" as fear. He measured reactions such as blood pressure, skin

temperature, heart rate, and perspiration, since these variables had the advantages of being constant in nature and not consciously controlled by the subject, and they could be recorded by skin measurements, which had the advantage of not being invasive or disturbing to the subject. His conclusion was that differences did exist (Ax, 1953). This study was the first to indicate a quantitative relationship between emotion and bodily expression.

The existence of this relationship has been hypothesized since the mid-nineteenth century. Duchenne (1867/1959) was the first to relate muscular reactions to emotional states. His method was to electrically stimulate particular muscles in order to simulate expressions, which he then assessed in terms of specific muscle groups. At about the same time, Charles Darwin (1872/1965) began to recognize the social implications of expressions. He noted that certain postures and expressions had a common cross-cultural occurrence. Also, particular emotions (e.g., rage) evoke similar facial reactions (such as teeth-baring) across species. Later research supports this view with regard to "basic" human emotions such as fear, happiness, and anger (Fridlund and Izard, 1983).

The combination of EMG techniques with subliminal emotional stimulation provides an interesting field of study. The subject is stimulated in a way which cannot be directly

affected by conscious attitudes toward experimentation, and the EMG yields an instantaneous measure of a stimulus' emotional impact. The EMG data are graphed on a computer monitor and recorded on magnetic media.

Subliminal stimulation, defined as having a duration too brief to be consciously interpreted by a subject, was the subject of some fifty studies by Lloyd Silverman over a period of twenty years. The purpose of these studies was to activate the unconscious and then study the resulting effects on overt behavior (Adams, 1982). These studies have since become the subject of much controversy, especially regarding the supposed use of subliminal stimulation in commercial advertising and popular music. While there is no evidence to support the existence of subliminal stimuli in these contexts--if anything, these messages are an "eye of the beholder" phenomenon (Vokey & Read, 1985)--there may be a potential for abuse since the unconscious is involved. However, it should be pointed out that the brief, non-repeated, and relatively mild stimuli used in the present study will not have any permanent effect whatsoever on the subjects involved, being not much different from exposure to those mentioned above and quite similar in effect to brief glances at billboards or television commercials. In this context, the abuse potential does not exist.

While there have been many criticisms of Silverman's research, it has been proven that subliminal messages do have

an effect on feelings and behaviors. One experiment conducted on autonomy in depressed college-age females used his method of subliminal psychodynamic activation, which involved a four millisecond (msec) tachistoscopic exposure to both psychodynamic (producing attitudinal effects) and neutral (control) stimuli in a double-blind situation. The subjects, who were eighteen depressed female college students, were assessed before and after both exposures. The hypotheses were that 1) the statement "Leaving Mom is wrong" would induce guilt and increase depression, and 2), the message "Mommy and I are one" would provide symbiotic gratification (in part due to the choice of the word "Mommy") and thus reduce depression. The first hypothesis was supported by the research (Dauber, 1984).

Another experiment conducted on a broader group of students also bore out the conclusion that subliminal messages have an effect on behavior. In this study, thirty-six counseling students were randomly assigned to groups which received the following treatments: 1) subliminal presentation of unpleasant emotional concepts; 2) similar presentation of pleasant concepts; 3) presentation of pleasant emotional concepts on a supraliminal level; and 4) similar presentation of unpleasant emotional concepts. After stimulation, the subjects were required to evaluate a simulated client. (Goncalves and Ivey, 1987)

One major development used in this study was a "mask"

stimulus that closely followed the subliminal message and effectively blocked it from the subject's conscious attention. This caused the subjects to lose the ability to detect the stimuli. The subjects were shown to be capable of semantic interpretation of an unconscious stimulus. The mask stimulus consisted of a straight row of twelve capital "X"s on a white card in the following arrangement:

XXXXXXXXXXXX

This masking of the primary stimulus was first suggested by Marcel (1983) and has been shown to be effective. The results of this experiment showed that the pleasant subliminal stimuli did produce a significant effect on the subjects and how they evaluated their clients, thus supporting the idea that "evaluations and responses are influenced by information presented outside of conscious awareness" (Goncalves & Ivey, p.238).

A program has been developed for the investigation of subliminal stimulation on a subject's reactions and behaviors. The messages are of approximately four msec duration, somewhat above the level defined as subliminal, which is one msec. This program, called "Flash" and developed by Dr. Michael Stratil, is capable of running on an IBM-PC microcomputer, eliminating the problems previously

caused by the computer's minimum display time of approximately 17 msec (Mefford, 1986).

The problem with presenting stimuli subliminally is not the only one encountered in this particular study. The use of EMG equipment also presents some practical problems. One of these is "arousal confound," which results from extraneous factors interfering with responses or invalidating them. There are also problems with measuring techniques, since the electrodes could come away from the skin without the subject or the experimenter noticing. Another problem is the physical intrusion of the electrodes, which could inhibit or exaggerate responses. Possibly the most serious problem, though, is the "experimental demand characteristic." This is interference caused by the subject's awareness that an experiment is being conducted which obviously has some relationship to facial expression. The subject may make faces in order to "help" the experimenter, or may decide to prevent any expressions at all from occurring in an attempt to destroy the experiment (Fridlund & Izard, 1983). This tendency to try to please the experimenter in this study would be a particularly disturbing problem since responses to subliminal stimuli are typically covert and the subject is consciously unaware of the usual (or "right") response. This is one reason why the stimuli are presented subliminally.

The purpose of this experiment was to determine the immediate effects of slightly suprathreshold stimuli on a group

INFORMED CONSENT FORM
EMG Research Study
Spring, 1988

of subjects. For all intents and purposes of this research, the stimuli are to be regarded as subliminal, for the effects tend to be very similar. The specific emotions which are elicited by the stimuli are not of any particular interest at this point, since the primary purpose of this study is to provide a basis for further research on subliminal stimulation and the reactions it causes.

METHOD

In this project, 103 students were randomly assigned to one of three groups to receive the following treatments: 1) pleasant stimuli, 2) unpleasant stimuli, and 3) neutral stimuli. Each group consisted of forty-eight statements, or in the case of the neutral condition, forty-eight spaces in which no stimuli appeared. In the pleasant and unpleasant conditions, after every six statements a blank space appeared, so that there were a total of forty-two statements. This was done in order to establish a control situation for each subject to establish the intensity of the responses to the conditional stimuli.

Each subject was asked to read and then sign a statement of informed consent (Figure 1). The attitude survey "Research Questionnaire 13" (fig. 2 & 3) was then administered. The reason for this questionnaire was to

I understand that the purpose of this research is to investigate various forms of attitude stimulation and various behavioral manifestations of attitude. I understand that subliminal stimulation may be used in some conditions and that the purpose of such stimulation is to measure my momentary reactions to it, not to change my attitudes in any permanent way. I understand the procedures to consist of the following: (a) completion of a questionnaire and (b) completion of a computerized task while attached to five electrodes. The entire session will be completed within a period of two hours. Based on existing published research, the investigator firmly believes that the study will provide sufficient scientific benefit to justify the time and resources being spent on it by myself and others.

I understand that Dr. Michael Stratil is the principal investigator responsible for the overall design and execution of this study. He agrees to be available to discuss my experience in completing the above procedures. In order to insure that every subject has a similar experience, however, he will not be able to explain all aspects of the study. Similarly, because of the complexity of the data, he will not be able to explain the results until some appreciable time after the data collection phase of the study has been completed.

I understand that I may expect no pain and only minor physical discomfort from the procedures employed in this study, that the physical discomfort will come simply from having the electrodes attached to my body, that I will not be exposed to electrical shock, and that the procedures have no known harmful effects.

I understand that the information obtained from or about me will be kept confidential and that only group data will be used and reported.

I understand that I am free to refuse to participate in any procedure and to answer any question at any time without prejudice to me. I understand that I am free to withdraw my consent and to withdraw from the research at any time without prejudice to me.

I understand that, by completing the research session described above, I will receive two hours of credit toward fulfilling the research requirement in a psychology course offered by the Department of Psychology at Pembroke State University. I understand that other opportunities for fulfilling this requirement are available, including experiences that do not require me to serve as a subject.

I understand that my consent to participate in this research does not waive any of my legal rights.

Having read and comprehended the above statement, I hereby agree to participate as a volunteer in the scientific investigation described in that statement.

Subject's name (print) _____

Subject's signature _____

Date _____

FIG. 1: Statement of informed consent.

RESEARCH QUESTIONNAIRE 13

Michael L. Stratil, Ph.D.

P.T.C. 2:

INSTRUCTIONS

- Please fill in the information required at the top of the answer sheet. First write in each letter or number, and then fill in the appropriate bubbles below that space. Be sure to make a very dark, round, and full mark in each bubble. For "Group 1," put 5999.
- This questionnaire is a measure of your attitudes and opinions on a variety of different topics. There are no "correct" or "incorrect" answers. Please try to express your opinions as openly and honestly as you can.

Answer each item by selecting a number from the following scale:

1	2	3	4	5	6	7
NOT AT ALL TRUE					COMPLETELY TRUE	

Thus, you can use any number between 1 and 7. The more you feel an item to be true, the larger should be the number you choose.

As you begin you will notice that a substantial number of the questions are fairly similar to one another in content and wording. The purpose of this similarity is to allow me to select the very best items from a wide range of alternatives. Please approach each item with a fresh attitude.

Enter your answers by filling in the corresponding bubble on the answer sheet. Be sure to make a very dark, round, and full mark.

- I have had a lot of experience making my own decisions.
- It is likely that even our most hostile enemies have some good ideas.
- My family and I communicate very well, and we understand each others' points of view.
- My teachers tend to be very sloppy in grading my work.
- Other people are often annoyed by the things I say or do.
- I feel that I'm an exceptionally capable and resourceful person.
- I tend to agree with any idea that my friends like.
- I am capable of writing a very clear and well-organized paper.
- There have been at least a few times when I have acted unreasonably.
- My parents have a strange way of looking at things, and I've had to unlearn many of their ideas.
- Most people have a lot of trust in my judgment and respect for my opinions.
- My emotions often prevent me from giving my best answer to a teacher's question in class.
- Most of my teachers have been very caring and dedicated.
- I have very little faith in myself.
- It is wise to avoid people with strange and unusual ideas.
- While I was growing up, I felt that the rest of my family was firmly behind me.
- Our true feelings are often hidden, and it's healthy to explore them to gain a greater understanding of ourselves.
- Other people don't think of me as a leader.
- My mind is able to grasp complicated ideas.

- I don't express unpopular opinions, even when something important is at stake.
- I feel very good about the way my self-worth has grown over the years.
- I resent the large amount of power that teachers have had over me throughout my days in school.
- I have never at any time felt fed up with a difficult situation.
- I have really problems that interfere with my studies.
- There are many sensitive subjects that people should never talk about.
- Over the years, I have frequently been selected as a spokesperson or group leader.
- Often I get so uptight about an exam that I don't concentrate on studying.
- I often rely on my own ideas when making a decision, and I'm prepared to make an unpopular decision if necessary.
- I am very good at figuring out what material is most important for an exam and what is secondary.
- Most teachers do a very good job of explaining their objectives.
- I often feel unsure of my opinion on important matters.
- There have been some occasions in my life when an emotional impulse has caused me to do something foolish.
- I have a bad attitude toward myself most of the time.
- When faced with a tough decision, I like to open my imagination to many possible solutions.
- My parents have been very helpful in teaching me how to get along with people.
- I often have a hard time trying to imagine the people and actions described in a novel.
- I feel very good about my accomplishments.

- On those occasions when I've tried to lead other people, things have turned out badly.
- People with extreme political views should not be allowed to speak in public, as they tend to upset the community.
- I like to make my own decisions, and I have a lot of trust in my judgment.
- I have never once felt wronged or disliked for another person.
- My parents have paid little attention to my schooling, and they haven't done much to help me.
- Listening to a frank discussion on some emotional issue can be very interesting.
- I feel very dissatisfied with my personality.
- I wish that my teachers had been more patient in explaining difficult subjects.
- Many people seem to appreciate my good qualities and to like my way of doing things.
- When I need to, I can work quickly on an exam without getting uptight.
- I often get confused when trying to reach major decisions, and I seek a lot of help with them.
- On at least one occasion in my life, I've taken offense at something that wasn't meant to be insulting.
- I have no respect for people who openly reject the group and do things differently from everyone else.
- My teachers were very interesting and lively, and they made the learning process quite enjoyable.
- My parents' attitude toward my education has been very constructive and helpful.
- When I try to influence other people's thinking, they usually resent my behavior and see it as interference.
- I get so nervous during an exam that I tend to lose track of what I'm doing.
- I have a lot of faith in my own reasoning, and I'm not discouraged when someone else disagrees with my conclusions.
- Our ideas about life are far from perfect, and we can greatly benefit from studying the beliefs and values of other societies.
- I have a basic feeling of confidence and self-respect that helps me a lot in dealing with people.
- My family has a one-sided way of looking at me, and they don't understand my feelings.
- When the odds are stacked against you, it's best to throw in the towel early and avoid a painful failure.
- Teachers often get carried away with their picky rules.
- When a group is divided over some issue, I can usually find a solution that satisfies most of the members.
- I have a good memory for the information that teachers present in class.

- On controversial issues, my opinions are often strongly influenced by what other people think.
- Our enemies have nothing valuable to say, and we should ignore them.
- I have a deeply rooted feeling of inadequacy that I can't ever overcome.
- I have never been so worried about anything that my ability to concentrate was weakened.
- When I was a child, my parents usually understood me, respected my judgment, and treated me in ways that helped me grow.
- In my experience, most teachers are fair and reasonable when they assign final grades.
- Most people either avoid me or talk me for granted.
- My vocabulary is fairly limited, and I have a hard time understanding textbooks.
- I feel confident of my own opinions, and I'm willing to act on them.
- There is too much tension and emotional turmoil in my family.
- In striving for an important goal, it is sometimes sensible to take a few calculated risks.
- I've learned to expect good things from myself.
- Many people consider me an effective leader, and they look to me for direction.
- During an exam, I'm able to concentrate and keep my thoughts well organized.
- I let my friends have too much influence on my life.
- While school administrators may pretend to have students' interests at heart, they really don't.
- I've known some occasions when a minor fellow has gotten me upset.
- I feel comfortable discussing important issues with my parents.
- Some national problems are so hopeless that we should stop worrying about them.
- People show little regard for my views, and they hardly ever seek my advice.
- While taking notes in class, I often get confused and can't keep up.
- I often take the initiative in solving my own problems.
- I like to explore new ways of doing things--despite the frustrations and disappointments that sometimes result.
- I often feel that I lack substance and inner strength.
- I don't agree with many of the lessons that my parents tried to teach me.
- I have had a very good relationship with my teachers in school.
- There has never been a moment when I felt regret or self-pity.
- When I'm doing something with a group of people, they often turn to me as the group's natural leader.

establish the subject's basic attitudes prior to stimulation. This portion of the experiment took approximately thirty minutes, and was conducted in a quiet room with a desk, chair, and writing materials provided, but no other distractions or interruptions.

For the next stage of the experiment, the subject was moved to another room where an IBM-PC microcomputer was set up with the program "FLASH" to provide the task and stimulation. Each subject was seated as comfortably as possible within easy reach of the computer keyboard. A headband was then fitted which held a set of five electrodes. After cleansing the skin and applying electrode paste to aid in the conduction of impulses, one electrode was attached with sterile adhesive tape to the inside of the right forearm. The other electrodes were attached as follows: two were placed closely side by side to the skin of the left cheek overlying the zygomatic major (cheek) muscle, and two more were applied to the brow over the corrugator (brow) muscle. (fig. 4) Most subjects reported that they did not find the electrode placement disturbing or uncomfortable.

The computer was connected via a series of cables to an EME apparatus in an adjacent room which was in turned hooked to another computer which provided a graphic display of the data as they were collected. The electrodes attached to the brow provided one set of information, and the electrodes attached to the cheek another. The single

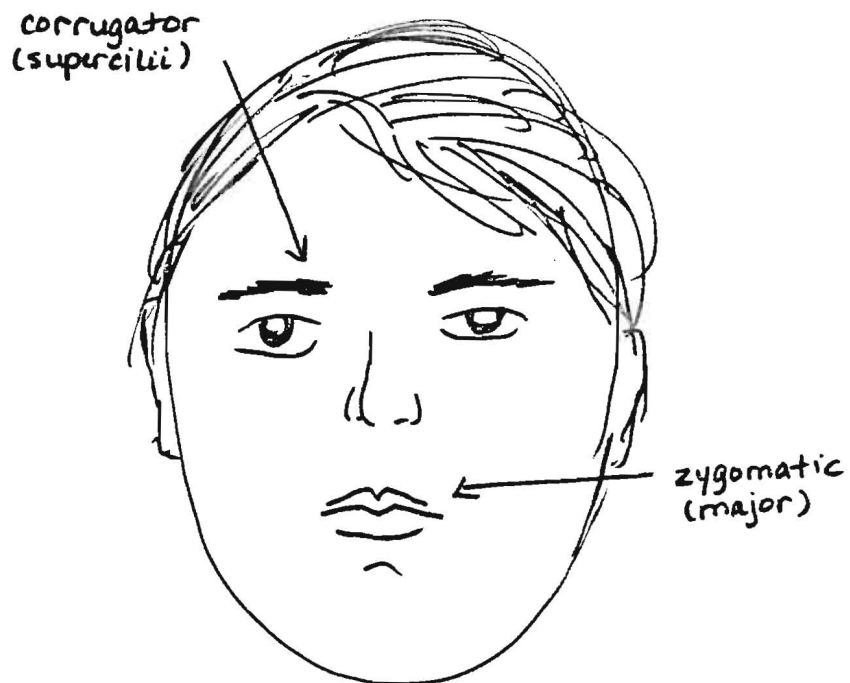


FIG. 4: Facial muscles monitored in EMG study.

electrode attached to the forearm provided a control by being attached to the surface over a muscle which remained inactive throughout the task. The information was displayed by a computer program called CODAS, with 500k of memory allotted per subject throughout the duration of the research.

Once the subjects reported feeling relaxed, the computer was turned on to begin the second portion of the experiment. The subject was given a set of instructions, followed by a task of forty-eight trials. Depending upon which group to which the subject had been assigned, the stimuli were as follows:

Pleasant condition: 1) "I am a good student" 2) "Life is wonderful" 3) "Reading is fun" 4) "I will go to heaven" 5) "I am a great person" 6) "Mommy is happy" 8) "I will find true love" 9) "My teacher is smiling at me" 10) "God is alive" 11) "Mommy and I are one" 12) "I am strong" 13) "Dad is happy" 15) "I have many friends" 16) "I am very healthy" 17) "My grades are excellent" 18) "I am very intelligent" 19) "Dad is very loving" 20) "I make my own decisions" 22) "I will succeed in life" 23) "Everyone loves me" 24) "I have a good memory" 25) "My teacher likes me" 26) "Mom respects me" 27) "Being different is good" 29) "Mommy is very loving" 30) "America is great" 31) "I am very decisive" 32) "My family is very close" 33) "Daddy and I are one" 34) "I am very smart"

36) "I am attractive" 37) "My teacher is praising me" 38) "I am very independent" 39) "God loves me" 40) "I am a wonderful person" 41) "The world is full of love" 43) "The woman is kissing her child" 44) "I can fly through the air" 45) "He broke free from his chains" 46) "The doctor said there is hope" 47) "The man and woman hugged each other" 48) "Everything was a success" Items numbered 7, 14, 21, 28, 35, and 42 were neutral (blank) statements which appeared as " ".

Unpleasant: 1) "I am a poor student" 2) "Life is hard" 3) "Books are frustrating" 4) "I may go to hell" 5) "Most people ignore me" 6) "Mommy is unhappy" 8) "Some people dislike me" 9) "My teacher is glaring at me" 10) "God is dead" 11) "Mommy and I are strangers" 12) "I am weak" 13) "Dad is angry" 15) "My friends have all gone away" 16) "I am sick" 17) "My grades are too low" 18) "I am foolish" 19) "Dad is selfish" 20) "Other people dominate me" 22) "I may fail in life" 23) "Someone hates me" 24) "I have a bad memory" 25) "My teacher dislikes me" 26) "Mother thinks I'm childish" 27) "Being different is bad" 29) "Mommy is hard on me" 30) "America has been beaten" 31) "I am very wishy-washy" 32) "My family is divided" 33) "Daddy and I are separated" 34) "I am dense" 36) "I am unattractive" 37) "My teacher is criticizing me" 38) "I am very dependent" 39) "I have annoyed God" 40) "I am a dull person" 41) "The world is full of sorrow" 43) "The woman is hitting her child" 44) "I am a prisoner" 45) "He was held by

his chains" 46) "The doctor said it is hopeless" 47) "The man and woman fought with each other" 48) "Everything was a failure" At the end of the task using the unpleasant statements, six more statements of a more pleasant nature were added to counteract any mild agitation or depression which may have resulted from the unpleasant stimuli. These statements were identical to statements 12, 16, 18, 23, 36, and 41 from the set of pleasant statements.

These statements were presented to the subjects in the form of a task consisting of estimating the number of capital "X"s which were flashed momentarily on the blank screen. The subjects were shown a string of "X"s in the upper left of the screen and instructed to guess how many appeared. The display was deliberately too brief to permit counting, with the number of "X"s ranging from 0 to 80. Each trial was marked by a tone which sounded to indicate to the experimenter that a stimulus was being presented. Once the subject had entered a response, the correct answer was provided. The subject was then instructed to indicate mood by answering the question, "How do you feel at this moment?" by choosing a number on a scale of 1 to 7, with the lower numbers indicating a bad mood and the higher numbers indicating a more positive one. After this part of the task had been completed, a rest period of approximately 20,000 msec ensued. This resting period was necessary in order to allow the subject to overcome the effects, if any, of

stimulation and return to a relaxed state.

As the subject completed each task, responses were constantly displayed and recorded on the EMG apparatus, which was located in a separate room. Tones were used to indicate the beginning of the task, each stimulus, and the completion of the task. The subjects were permitted to view their data if they wished to do so, but for purposes of structure, it was not possible to fully explain the meaning of the data, which could have confounded the results if the subjects informed those who had not yet participated in the research of precisely what the experiment concerned. Each subject was informed of the correspondence of electrodes to graphic display of responses, and told that the tones, which appeared as large dots on the display, were indications of "certain stimuli."

RESULTS

The data from all 103 subjects were pooled together across all three conditions (pleasant, unpleasant, and neutral) after preliminary results showed similarities in responses. These results were determined by using statistical tests to determine the mean (average) of all responses for each of the three conditions, and then analyzed by use of a one-way analysis of variance (ANOVA) test. The

CORRELATION OF DIFFB AND DIFFC (FIG. 5)
 N=103
 GROUP 1

	TEMPORAL COMBINATION						MEAN
	12	13	14	23	24	34	
1	-.053	-.107	-.213	-.154	-.069	-.182	-.130
2	-.135	-.173	-.145	-.124	-.252	-.144	-.162
3	-.334	-.231	-.440	-.254	-.440	-.190	-.315
4	-.045	-.267	-.283	-.302	-.290	-.353	-.257
5	-.481	-.398	-.470	-.242	-.258	-.033	-.314
6	-.314	-.375	-.351	-.292	-.328	-.266	-.321
7	-.234	-.307	-.258	-.231	-.370	-.341	-.290
8	-.253	-.247	-.179	-.428	-.319	-.261	-.281
9	-.359	-.277	-.431	-.305	-.343	-.410	-.354
10	-.181	-.509	-.382	-.478	-.348	-.429	-.388
11	-.467	-.357	-.278	-.313	-.280	-.440	-.356
12	-.259	-.300	-.301	-.101	-.423	-.392	-.296
MEAN	-.260	-.296	-.311	-.269	-.310	-.287	

ANOVA was based on the difference between brow and cheek scores. These tests were conducted by use of a computer program for statistics, and proved that the results of this study had a small probability (.042 per cent) of having occurred by chance. The data for these statistics were obtained from the CODAS program which was used in conjunction with the EMB apparatus. Due to the limitations of this computer program, it was only possible to analyze the data from the first 46 trials. Trials 47 and 48 were not included in the final analysis. However, these items were among the mildest in nature, so the effects of their omission are most likely to be relatively insignificant.

The delay which occurred after each stimulus was the period of time which was analyzed for emotional response. This 20-second (20,000 msec) period was divided into five periods of four seconds each. The first four periods were the most statistically reliable, so the last period was deleted. This last period showed no important changes, merely the expected decline in response which occurs in the delay after any stimulus has been presented.

Each subject's responses were separately averaged for each segment of the response period of each item. In one of the analyses, the mean brow score was correlated with the mean cheek score for all the items. Each item was analyzed by brow response and cheek response throughout each of the four periods. The score was determined by the difference

CORRELATION OF DIFFB AND DIFFC (FIG.6)
 N=103
 GROUP 2

	TEMPORAL COMBINATION						MEAN
	12	13	14	23	24	34	
13	-.347	-.343	-.286	-.297	-.211	-.229	-.286
14	-.318	-.506	-.361	-.226	-.186	-.370	-.328
15	-.248	-.228	-.149	-.269	-.331	-.246	-.245
16	-.251	-.375	-.385	-.283	-.111	-.257	-.277
17	-.386	-.235	-.285	-.270	-.286	-.175	-.273
18	-.101	-.332	-.435	-.200	-.287	-.326	-.280
19	-.435	-.470	-.374	-.159	-.161	-.263	-.310
20	-.054	-.292	-.276	-.354	-.206	-.027	-.201
21	-.257	-.265	-.278	-.345	-.410	-.390	-.324
22	-.122	-.135	-.331	-.152	-.430	-.224	-.232
23	-.415	-.353	-.168	-.394	-.310	-.472	-.352
24	-.463	-.359	-.301	-.422	-.491	-.020	-.343
MEAN	-.363	-.324	-.302	-.281	-.275	-.250	

CORRELATION OF DIFFB AND DIFFC (FIG. 7)
 N=103
 GROUP 3

	TEMPORAL COMBINATION						MEAN
	12	13	14	23	24	34	
25	-.320	-.556	-.458	-.330	-.297	-.373	-.389
26	-.391	-.248	-.222	-.344	-.300	-.301	-.301
27	-.463	-.396	-.336	-.425	-.400	-.269	-.382
28	-.350	-.321	-.210	-.439	-.311	-.373	-.331
29	-.381	-.385	-.388	-.280	-.392	-.299	-.354
30	-.227	-.352	-.328	-.277	-.355	-.104	-.274
31	-.255	-.357	-.475	-.332	-.446	-.378	-.374
32	-.282	-.499	-.348	-.313	-.392	-.376	-.368
33	-.283	-.404	-.376	-.294	-.392	-.419	-.361
34	-.326	-.360	-.419	-.264	-.370	-.320	-.343
35	-.354	-.548	-.533	-.329	-.346	-.329	-.406
36	-.318	-.322	-.468	-.425	-.515	-.114	-.360
MEAN	-.328	-.396	-.380	-.338	-.376	-.305	

CORRELATION OF DIFFB AND DIFFC (FIG. 8)
 N=103
 GROUP 4

	12	13	TEMPORAL COMBINATION				MEAN
			14	23	24	34	
37	-.318	-.449	-.495	-.359	-.489	-.466	-.429
38	-.383	-.455	-.456	-.208	-.434	-.469	-.397
39	-.438	-.460	-.374	-.324	-.333	-.142	-.348
40	-.419	-.287	-.255	-.222	-.375	-.474	-.329
41	-.467	-.279	-.360	-.329	-.311	-.316	-.344
42	-.475	-.256	-.203	-.143	-.345	-.333	-.293
43	-.409	-.373	-.351	-.244	-.383	-.468	-.373
44	-.387	-.539	-.577	-.501	-.545	-.509	-.506
45	-.383	-.200	-.343	-.137	-.374	-.375	-.307
46	-.489	-.121	-.127	-.253	-.221	-.237	-.243
MEAN	-.406	-.336	-.356	-.282	-.382	-.379	
TOTAL MEANS	-.319	-.373	-.337	-.292	-.370	-.300	

between brow and cheek response for each item, and all significant scores were negative, indicating an inverse relationship. The scores were correlated by comparing them between periods, resulting in the following temporal combinations: periods one and two, one and three, one and four, two and four, and three and four. This resulted in six temporal combination scores for each item. The correlation obtained for each combination fell within the range -1.00 to 1.00. A score equal to or greater than .246 was considered to be significant in this study. The scores read as negative numbers due to the inverse relationship between the brow and cheek scores, indicating strong responses to the stimuli.

After all temporal combination scores had been determined, they were compiled in chart form (figs. 5-8) to determine the mean score for each item across all combinations and the mean score for each combination with the items divided into four groups, three of twelve items each and the last consisting of ten items. These mean scores revealed significant responses to 40 of the 46 items tested, and significant responses in each group to all of the temporal combinations. All mean scores were determined by using the Introductory Statistics microcomputer program by Freeman F. Elzey (Elzey, 1987). This was done in order to avoid clerical errors and insure accuracy.

Of the 46 items tested, all but six had significant response scores. Of the 40 which were significant, sixteen

had relatively high scores of more than .350. The ten highest were items numbered, in descending order, 44, 37, 35, 38, 25, 10, 27, 31, 43, and 32. All analyses are speculative in nature.

Item 44, across all three conditions, had the highest score of .506. This was the only item to score above .5 level of significance. The statements in the pleasant and unpleasant conditions were respectively "I can fly through the air" and "I am a prisoner." The concept of freedom seemed to provoke a strong emotional response, as shown by the content of these two statements. It is possible that there was an unusually strong response to the unpleasant condition, which is among the most threatening of the items. None of the items related to religion, intelligence, or parent/child relationships evoked a response as strong as that which could be viewed as a reassurance of or a threat to personal freedom. There were several other items related to freedom of decision-making, dependence on others, and the freedom of another individual, but this was the only one which presented a direct assurance or a direct threat to the subject's own sense of control.

The second-highest-scoring item was number 37, which in the two conditions read "My teacher is praising me" and "My teacher is criticizing me." The score for this item was .429, .077 lower than that for item 44. The high level of response to this statement could have been related to the task and the

subject's performance. A strong performance on the task would have resulted in increased confidence, which could in a positive response to the stimulus. On the other hand, a poor performance could result in a heightened response to the statement in the unpleasant condition. This response would have been strengthened either way by the realization that each subject was participating in the study in order to receive a grade in a psychology class. This could have resulted in a pressure to perform, which could produce a strong response related to both performance and the desire to avoid an unpleasant result (having to write a research paper) by failing the task.

A blank item, number 35, resulted in the third-highest score, which was .406. There could be several reasons for this, as no other blank item scored at this level, although all scored at the level of significance or above. This could have been an exceptionally delayed response to item 34, which read "I am smart"/"I am dense." It is possible that the unconscious, either pleased or made anxious by the statement about intelligence, was in essence "shocked" by the following blank item, which had no effect in confirming the subject's intelligence or lack thereof. Whatever the cause, this was the only blank item which evoked any kind of strong response.

Item 38 scored .397, with the statements "I am very independent"/"I am very dependent." Like item 44, this is related to freedom, but in a different manner. The

unpleasant statement is surely unsettling to the ego, but there is no threat involved. The pleasant statement contains some assurance, but is not as extravagantly worded as item 44. However, the basic concept is the same and resulted in a similar, albeit weaker, response.

"My teacher likes me"/"My teacher dislikes me" were the statements presented in item 25, which scored a level of .389. These statements were quite similar in nature to those in item 37, regarding the approval of an authority figure. In this case, the wording was again more generalized and less threatening, as in the differences between items 44 and 38. While most students seek the approval of their professors, such a broad term as "like" or "dislike" does not seem to have the same effect when used as an item implying action on the part of a professor ("praising" or "criticizing").

Religious beliefs were a factor in the score for item 10, which stated "God is alive"/"God is dead." This score, .388, indicated either a confirmation of belief or a direct assault of belief. In a person of Judeo-Christian heritage, the statement "God is dead" would have an upsetting effect or cause a negative feeling of defiance and preparation to defend one's beliefs. However, in an atheist, the opposite would be true. In either case, a belief would be either questioned or supported, which would result in a relatively strong response.

The statements "Being different is good"/"Being different is bad" would depend on the subject's self-concept to a great degree to provoke a strong response. The score for this item was .382. This statement could be considered as peripherally related to the concept of freedom, which has thus far been shown to be the most powerful in eliciting responses. Also related is the subject's idea of what it is to be "different," and whether this difference is the result of physical or social factors, and whether or not it is voluntary in nature. The freedom to be different within one's own social boundaries could affect response, whether in the absolute conformist, to whom being different is unquestionably bad; or an individual of rebellious nature, to whom being different in appearance, ideas, or capabilities, would be considered good. This subject would have a strong positive response to the condition designated as unpleasant, and a strong negative response to the positive condition. In the conformist, the responses would be opposite. It is interesting to note that none of the subjects were reported as having any obvious physical handicaps, so the connotations of the word "different" were probably based for the most part on social roles. Items 10 and 32 were possibly the only ones evoking highly significant responses in which the assignment of conditions as pleasant and unpleasant was left up to the individual.

Item 31. "I am very decisive"/"I am wishy-washy" is

another which supports the hypothesis that freedom-related statements result in the most powerful responses. It has a relationship to direct control over one's life, more so than the other items, which tend to each deal with a different aspect of personal freedom. These items seem to be independent of any political connotations, especially since the one government-related item, "America is great"/"America is weak" (item 30) reached the barely-significant score of .274. (.028 above the level of significance.)

A score of .373 was obtained by item 43, "The woman is kissing her child"/"The woman is hitting her child." This is one of only two items which scored in the uppermost ten which was related to family relationships. This item apparently has some emotional value, which would vary from one subject to the next depending on, among other things, how the subject feels toward children. However, the reason that this item did not score higher may be due to the fact that it obviously relates to someone other than the subject. It is, however, the only very high-scoring item from which the subject can easily remain detached, since it does not use the highly personal terms "I," "me," or any others which imply a direct relationship to the subject. Apparently, the concept of the mother-child relationship is sufficient to elicit a strong response. In fact, this item scored higher than the item "Mommy and I are one"/"Mommy and I are strangers" used so frequently in previous studies.

The final item of the ten highest scorers was number 32, "My family is very close"/"My family is divided," the only one of the ten which concerned the relationship to the subject's own family. It scored at a level of .368. The closeness of the family is unquestionably a very personal concern, and the only significant stimulus which cannot be interpreted in any ambiguous way.

Of the 46 items, there were only six which did not score at or above the level of significance. These were items 1, 2, 20, 22, 46, and 15. None of these items were blank.

"I am a good student"/"I am a bad student," item 1, scored at a level of .130, well below the level of significance. This is somewhat unexpected, due to the high scores on the items related to student-professor relationships. However, it could be due to the subject's concept of his or her standing as a student based solely on grades and study habits, and have little or nothing to do with the self-concept with regard to intelligence. Another reason for this low score could be that it was the first stimulus presented. The unconscious mind at this point had not had time to expect or react to a message. This seems to be supported by the fact that the response level increased over the delay period, rather than decreasing as in the later items.

Item 2, "Life is wonderful"/"Life is hard" received a

score of .162. It is possible that this statement is too general in nature to cause much of a response. Also, it is only the second stimulus, and the enormous increase from item 2 to item 3 shows that it is possible that the subliminal stimuli took two trials to begin being noticed and cause reactions.

A "freedom" item, number 20, had the low score of .201. The statements presented were "I make my own decisions"/"Other people dominate me." The reason for this discrepancy is uncertain. It seems to be very similar to some of the high-scoring statements, in particular number 31. However, some slight difference must make a difference in the way messages are interpreted by the unconscious. Perhaps the difference lies in the introduction of "other people" into the statement, as opposed to the very definite "I am wishy-washy" in item 31.

A score of .232 was obtained by item 22. "I will succeed in life"/"I may fail in life." This is another item in which a subtle change in wording may have made a significant difference. If the unpleasant stimulus were to read instead "I will fail in life," the change might have resulted in a stronger response.

The final item in the analysis, number 46, scored at a level of .243. This item, "The doctor said there was hope"/"The doctor said it is hopeless," has no bearing on the subject's life unless he or she is seriously ill. For this

item, the low score is quite understandable.

The last item to score below the level of significance nearly reached it at a score of .245. This item was number 15, which consisted of the statements "I have many friends"/"My friends have all gone away." This is one of the mildest stimuli, with a small potential to be upsetting. To say that one's friends have "all gone away" does not necessarily imply a permanent separation or not having ever had any friends at all, and would therefore fail to be upsetting. The statement in the positive condition is an assumption that many people tend to make in their lives and as such would be reassuring, but not enough to cause any major reaction.

The scores for each temporal combination proved that there was a tendency for the responses to fall off from periods 1/2 to 3/4. This was true in three of the four groups. In group one (items 1-12), the strongest response occurred in temporal combination 1/4. The response in period 1/4 was .260, and by period 3/4 had increased slightly to .287. This could have occurred as a result of the possible delay before the subjects began to respond in a measureable way, as referred to in the discussions of stimuli for items 1 and 2. In all other groups, responses started off strongly in periods 1/2 and decreased markedly by periods 3/4. The purpose of measuring these temporal combinations and comparing periods was to determine approximately how long it

took the subjects to begin responding and the duration of the responses. This information would be useful in future research when determining the optimum delay period after the presentation of each stimulus.

DISCUSSION

This study was intended to prove that subliminal stimuli do have an effect on the expression of emotion in normal subjects. While this experiment has supported this hypothesis, it is not in itself a definitive study. Rather, it serves as an exploratory analysis which is intended as a basis for further research.

One area which could prove to be an important ground for future study involves separate analysis of responses in the pleasant, unpleasant, and neutral conditions. Strong overall responses such as those which occurred in this study could be the result of more than one factor, and possibly result from an unusually strong response in the pleasant condition combined with an average response in the unpleasant condition to simulate a moderately significant response or vice versa. Research involving separate analysis would solve this problem, while providing a more detailed picture of exactly what types of stimuli provoke certain responses.

Another improvement which could be made in the future would entail the use of more sensitive measuring devices. Electrodes could be placed on the other facial muscles which affect expression and make it clearer whether a strong response is positive or negative. These electrodes, in the future, may be able to be made smaller and more sensitive, which would increase their effectiveness tremendously.

A thorough study of the levels of response during the delay period is yet another area which could be a base for future research. It would be interesting to determine whether a definite pattern exists for the reaction time, intensity of response, and decay of response.

Past studies have shown that the use of subliminal stimuli have been demonstrated to be effective in an unpleasant condition, yet this effect does not seem to be reversible. Pleasant conditions do not seem to have nearly as much effect. Furthermore, all subliminal stimulation seems to have a very temporary effect. Further research could show why this is so and how it could be possible to stimulate subjects effectively in a positive manner. If an effective way of doing this and producing lasting effects was found and applied prudently in therapy, the benefits to depressed patients could be enormous.

One final area which could provide a very interesting dimension of research would relate to a correlation of the personality scales obtained in the attitude survey with the

EMG scores. This could demonstrate what types of personalities responded most strongly to the stimulation, and what types of items caused the strongest responses.

Subliminal stimulation remains a somewhat obscure, misunderstood, and controversial field of research. Continued studies in this area could yield useful information and insights in the ongoing search for a more thorough understanding of emotion and its expression.

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