THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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ENTITLED...The Effects of Arousal on Emotion

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF...Bachelor of Science in Liberal Arts and Sciences...

Instructor in Charge

HEAD OF DEPARTMENT OF Psychology
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The goals of the present study were to answer the following questions: (1) Is emotional experience affected by arousal? (2) Does the effect of arousal on emotional experience depend upon personality? (3) Is emotional experience related to hemispheric arousal bias? Fifty-five college students were randomly assigned to one of two groups: (1) Caffeine group, which received a caffeinated lemonade-flavored beverage, or (2) Placebo group, which received a lemonade-flavored beverage. Subjects completed the Fysenck Personality Inventory (FPI). Subjects were grouped as extraverts or introverts based on a median split of their score on the FPI. Thirty minutes after consuming the beverage, subjects completed the Chimeric Face task, a measure of hemispheric arousal bias. Subjects were then shown four film clips intended to elicit affect. After each clip, subjects completed a self-report measure of emotional experience. Results show that arousal interacted with personality in influencing emotions. Extraverts tended to report more emotion when they received caffeine, while introverts tended to report less emotion when they received caffeine. Hemispheric arousal bias was related to emotion in response to one of the positive affect-eliciting film clips. It appears that the more aroused the right hemisphere was, the more subjects tended to reported happiness.
There are a number of ways in which individuals differ in their experience and expression of emotions. For example, individuals differ not only in the number of positive and negative emotions they experience, but also in the intensity with which they experience these emotions, and in the way these emotions are expressed. Numerous hypotheses have been proposed to explain these individual differences. Several of these emphasize the role of arousal in emotion. Research suggests that different levels of arousal may mediate the types of experiences an individual seeks from the environment and influence how an individual reacts emotionally to the experiences (Zuckerman, 1979). Recent studies also suggest that the right hemisphere is superior for processing the emotional aspects of information (Silberman & Weingartner, 1986). Arousal could influence the intensity of an emotion (Leventhal & Tomarken, 1986), or it might provide the cognitive information about stimuli that gives an individual the emotional experience (Valins, 1966). Emotional states may also be influenced by particular patterns of autonomic arousal (Ekman, Levenson, & Friesen, 1983).

Arousal is also a central feature in Eysenck's theory of personality (1947). He proposed that extraverts seek higher levels of arousal, while introverts seek lower levels of arousal. In a test of the relation between extraversion and arousal, Mathew, Weinman, and Barr (1984) found significant negative correlations between extraversion and cortical blood flow in all brain regions. If extraverts and introverts differ in their preferred level of arousal, the effect of arousal on emotion may differ in the two groups.

The present study examines three variables which we believe may be related to emotional experience and expressiveness: autonomic arousal, hemispheric activation, and extraversion. We will examine each variable separately focusing on how the variable is related to emotion and arousal. Before we describe these variables, we will present a general introduction to the topic of emotions and their expression.
Emotion

For many years, four types of theories have dominated research on emotion (Beckthal & Tomarken, 1986). Each theory offers its own clear, concise definition of emotion, suggests the mechanisms underlying it, and identifies the questions that should be addressed. The Darwinian-Evolutionary Theory assumes the existence of multiple emotions and focuses on their form (expressive response patterns), functions, and evolutionary history. Darwin postulates that emotions are innate or instinctive, but questions whether or not humans have any instinctive power of recognizing them (Darwin, 1872/1965). The body reaction theory assumes different emotions are a product of different patterns of autonomic response. The actual perception of physiological changes is necessary for the production of subjective feelings of emotion (James, 1890). The central neural theories seek to identify the neural structures involved in emotional expression, feeling, and behavior. For example, in Cannon's model, an external situation stimulates receptors which excite the cortex. In the cortex, conditioned processes determine the direction of the response, e.g., to whom or what the response should be directed (Cannon, 1927). The cognition-arousal theory attempts to define emotion as the integration of thought and/or perceptions with arousal. Both physiological arousal and an attribution of the arousal are necessary to experience an emotion (Schachter, 1964).

Emotional Expression

Darwin (1872/1965) was one of the first to study expressive response patterns of emotion. He stated that facial expressions and affect vocalizations are innate, evolved behaviors which offer social, communicative, and survival value for the organism. Evidence for this innate perspective comes from Ekman's (1982) two studies conducted in New Guinea with people who had little, if any, contact with outsiders. It was found that, for each emotion, their facial expressions involved using the same facial
muscles used by people from literate cultures. Ekman (1984) therefore concluded from this and other studies that there are six distinct "primary emotions" which are recognized across cultures: anger, disgust, surprise, fear, sadness, and happiness. Contempt was later added as a seventh primary emotion (Ekman & Friesen, 1986).

Although the innate component of emotional expressions seems firmly established, some researchers contend that facial expressions are socially learned and controlled by the culture (e.g., LaBarre, 1947; Leach, 1972; Mead, 1975). Ekman and Friesen (1969) investigated this hypothesis in a cross-cultural study examining the social regulation of emotions. They found that there were cultural differences in facial expressions in the presence of another person, but not when the person was alone. The findings led to the notion of "display rules" which are socially learned rules that govern the expression of emotion.

Somewhat similar to the cognition-arousal theory, Royce's (1984) theory views the expression of emotion as a product of the interaction between cognition and affect, where cognition interprets inputs and affect controls arousal level. The factor-gene model (Royce, 1984) states that emotionality, referring to individual differences in the expression of emotion, is a multidimensional construct.

Although emotional expression is primarily due to variations in affect, it is also dependent upon cognitive and affective systems. The core assumption of the factor-gene model is that there are multiple factors at both the behavioral and genetic levels, and that they are linked by a variety of unspecified, intervening mechanisms.

Next we will look at the relationship between emotional expression and neurological and psychiatric disturbances, which may provide information about the many factors involved in the expression of emotion.
Deficits in Expressing Emotion

Disturbances of emotion expressivity are sometimes seen in patients with various neurological and psychiatric disorders. Neurological evidence indicates that facial expressions of emotion can sometimes be independent of the individual's subjective emotional experience. Ross and Meridam (1979) studied two patients who, after lesions in their right hemispheres, lost the ability to express their emotions facially and vocally (referred to as prosody). However, the patients stated that their ability to experience emotion was not impaired, only its outward expression. According to Rinn (1984), many patients with pseudobulbar palsy, a condition which results from lesions in the corticobulbar pathways, exhibit involuntary laughing and or weeping despite feeling no emotion. Some patients also experience an emotion that is incompatible with their expression, such as feeling angry while laughing.

Other neurological evidence shows that patients with Parkinson's disease exhibit flattened affect. Alpert and Rush (1983) compared the affective expressions of 16 patients with severe Parkinson's disease, 11 schizophrenics, and 16 normal controls. They found significant differences between all three groups. Subjects' facial expressions, expressive gestures, vocal emphasis, and eye contact were all rated. The patients with severe Parkinson's disease scored lower than the normal controls, and the schizophrenics scored lower than both the patients with Parkinson's disease and the controls. These findings may have implications for the understanding of deficit symptoms found in patients with these disorders.

Emotional Expressiveness and Psychopathology

Numerous studies have examined the emotional expressions of schizophrenics and normals. An international study found that 66 percent of the schizophrenic patients studied exhibited flat affect (World Health Organization, 1973). A study conducted by Andreasen (1979) compared 30
schizophrenics with 19 manics and 20 depressives, all of whom were hospitalized at the time of the study. Andreasen found that 53 percent of the schizophrenics and 40 percent of the depressives were rated as having unchanging facial expressions. Pogue-Geile and Harrow (1984) rated the presence and severity of several symptoms in a sample of 30 schizophrenics and 33 unipolar depressives approximately one and one half years after hospital discharge. The schizophrenics were rated as having significantly greater flat affect than the depressives. In a study examining facial expression in both schizophrenia and depression, Brown, Sweeney, and Schwartz (1979) rated the facial expressions of schizophrenic and depressed patients during their ward activities. They found that schizophrenics display significantly higher degrees of positive affective expressions than depressives. Herenbaum (1987) examined the facial response to affect-evoking stimuli among four groups, blunted schizophrenics, nonblunted schizophrenics, depressives, and normal controls. He found that blunted schizophrenics were less expressive than the other groups regardless of the valence of the stimuli. Herenbaum also found that depressives were less expressive in response to positive stimuli when compared to normals, yet more expressive than blunted schizophrenics. Similar to Herenbaum's findings, Oltmanns, Strauss, Heinrichs, and Driesen (1988) found that when exposed to affect-eliciting film clips, schizophrenics exhibited significantly fewer facial expressions of emotion than normals. Overall, these studies found that depressives and schizophrenics tend to be less expressive than normals.

**Autonomic Arousal**

One factor believed to be related to emotion and its expression is autonomic arousal. For the past 20 years, Schachter and Singer's cognition-arousal theory has dominated social-psychological research (Leventhal & Tomarken, 1986). Their theory states that an emotional state is the product of an interaction between two components, physiological arousal (characterized as heightened sympathetic activation) and a cognition about the cause of that arousal. Since arousal is perceived as emotionally non-specific, it determines only the intensity of emotional states, while cognitions determine their
The emotion is that both arousal and cognitions are necessary components for an emotional experience. However, they are not jointly sufficient since the perception or attribution of a causal connection between the two is additionally necessary for emotional experience to arise (Leventhal & Emery, 1985).

In an experiment conducted by Schachter and Singer (1962), subjects were given either epinephrine or a placebo, and were told that they were receiving vitamins. Subjects given the arousal-inducing drug were either informed of the side effects or not informed. As predicted, subjects given epinephrine and informed of the side effects, and those given the placebo scored lower on both the self-report and observation scales of emotionality than the uninformed group. The proposed explanation was that the placebo group lacked the arousal component and the informed group knew that their arousal state was artificially induced.

Valin’s (1966) theory goes one step further than Schachter and Singer’s. In his view, the role of arousal in emotion is to provide cognitive information that tells the individual that some potentially emotional stimulus has had internal effects. “Emotion” thus becomes an entirely cognitive phenomenon because both the quality and the quantity of the experience are provided by informational inputs, from the environment and the body, respectively (Parkinson, 1985).

Although Schachter and Singer argue that emotion is a cognitive phenomenon, there exists a different and conflicting model. A potentially important dimension of affective states is the autonomic arousal associated with a particular emotional state. Research supports the idea that emotional states vary in terms of the level and also the pattern of associated arousal. Schwartz, Weinberger, and Singer (1981) had subjects imagine themselves experiencing happiness, sadness, anger, and fear, and then measured diastolic and systolic blood pressure as well as heart rate. They found that imagining certain emotions (e.g., anger) was associated with higher overall increases on these cardiovascular measures than was imagining other emotions (e.g., sadness). Ekman, Levenson, and Friesen (1983) found autonomic pattern differences among the six universal emotions. A state of anger was associated with high skin temperature and high heart rate, while states of fear and sadness were associated with low
heart rate. These authors propose that it was contracting the facial muscles into the emotion signals which elicited the emotion-specific autonomic activity. These studies raise the question of how such complex patterns of autonomic activity relate to changes in the nervous system, cognitive processes, and the subjective experience of emotion.

The previous studies go beyond Schachter and Singer's work to suggest that a person's level of autonomic arousal may influence the cognitive label applied to stimuli in the environment, in addition to stimuli in the environment influencing what cognitive label is applied to one's state of arousal.

Hemispheric Lateralization

A second component believed to influence emotion is hemispheric lateralization. It is well known that the two cerebral hemispheres are not identical in functioning (Silberman & Weingartner, 1986). There are indications that the hemispheres differ in their involvement with emotion and related behavior. The significance of brain lateralization has been emphasized by indications that emotional processes are asymmetrically represented in the brain (Tucker & Williamson, 1984). Evidence shows that the right hemisphere is essential for normal emotional communication. Right hemisphere lesions disrupt the patient's ability to understand emotion conveyed by facial expression or tone of voice (Heilman, Scholes, & Watson, 1975). Indications of the right hemisphere's role in normal communication include a left ear advantage for interpreting emotion in tone of voice (Safer & Leventhal, 1977) and a greater intensity of emotional expression on the left side of the face (Sackheim, Gur, & Saucy, 1978).

The details of emotional lateralization are not well understood and rather broad. According to Silberman and Weingartner (1986), three general hypotheses of emotional lateralization exist in the literature. The first hypothesis states that the right hemisphere is superior for processing the emotional aspects of information. The second is that the right hemisphere shows overall dominance in the regulation of states of subjective emotional feeling (mood and affect). The third is that the right
hemisphere is involved in processing negative emotions, while the left hemisphere is more closely associated with the processing of positive emotions.

An example of one of the hypotheses is a model of hemispheric emotional regulation proposed by Levy, Meller, Banich, and Burton (1984). They hypothesized that when activation of the right hemisphere is high, negative affect prevails, and when it is low, positive affect predominates. While this view is consistent with the literature, it neglects to mention the effects on mood of alterations of left hemisphere function (Silberman & Weingartner, 1986).

Hemispheric lateralization has also been linked to psychopathology. Asymmetric patterns of hemispheric activation are found in emotionally disordered persons and in strong emotional states in normal persons (Tucker & Williamson, 1984). Poor right hemisphere performance has been observed during depression in psychiatric patients and during a depressed mood in normal students (Tucker, Stensie, Roth, & Shearer, 1981). The level of activation of the left hemisphere may also be influenced by emotional variables. Many schizophrenics evidence both an overactivation and a dysfunction of the left hemisphere (Flor, Henry, 1976; Gur, 1978).

A great deal has yet to be learned about the relation between hemispheric lateralization and emotional expressivity. The brain is the center of both emotion and arousal regulation. Right hemispheric activation may be the cause of variable emotional expressiveness. There is a need to investigate the possibility of pathways which link emotion, emotional expressiveness, and arousal.

Extraversion-Introversion

Eysenck proposed a two dimensional (extraversion-introversion and neuroticism-stability) theory of personality (Eysenck, 1947). He developed the Eysenck Personality Inventory (EPI) (Eysenck & Eysenck, 1968) for the measurement of these two dimensions. Individuals scoring high on the extraversion scale tend to be outgoing, impulsive, and uninhibited, having many social contacts. An introvert is a quiet, introspective person who is reserved and distant except to friends. High scores on
Arousal and Emotion

the neuroticism scale are indicative of emotional lability and over-reactivity. These individuals are emotionally over-responsive and tend to have difficulties in returning to a normal state after emotional experiences (Mathew, Weinman, & Bawn, 1984).

The extraversion-introversion dimension is believed to have an inverse relationship with cortical arousal. In an experiment conducted by Mathew et al. (1984), regional cerebral blood flow was measured in 51 right-handed females whose personality was examined with the EPI. Significant inverse correlations were found between the brain blood flow and the extraversion-introversion score of EPI. Neuroticism does not seem to be related to cortical arousal.

Eysenck's formulation of the extraversion-introversion dimension has some conceptual links with the strength-of-the-nervous-system theory. According to Pavlov (1927), introverts are conceived of as having higher levels of excitability and lower levels of inhibition than extraverts. It follows that introverts are more sensitive to stimulation. Gray (1967) has offered a reformulation of the theory which identifies the arousal component with sensitivity to stimulation. Being more aroused, the introvert amplifies incoming stimulation and is particularly sensitive to aversive stimulation.

One approach to arousal manipulation is through the use of caffeine to induce differential arousal increments. Studies of phasic skin conductance responses by Smith (1983) have shown group reversal effects, with introverts exhibiting larger responses under placebo and low stimulant doses and extraverts showing greater responsivity under high doses. The overall pattern of results suggests that, under lower levels of stimulation, introverts are relatively more aroused and responsive than extraverts, and relatively less aroused under high levels of stimulation.

Goals

The goal of the present study was to explore the relationship between arousal and emotion. We attempted to answer the following questions: (1) Is emotional experience affected by arousal? (2) Does the effect of arousal on emotional experience depend on subjects' hypothesized arousal preference, as
indicated by extraversion scores on the Eysenck Personality Inventory (EPI)? (3) Is emotional experience related to hemispheric arousal bias?

Method

Subjects

Sixty right-handed subjects were recruited for the experiment from the undergraduate population at a large midwestern university. They were informed of the possible side effects of caffeine, and were screened for medical contraindications. Five subjects with medical contraindications were excluded from the study, yielding a final subject sample of 33 males and 22 females (age range: 17 to 27, M = 19.24, SD = 1.67).

Procedure

Subjects were called by the experimenter prior to the experiment in order to inquire about their weight and any prior bad experiences with caffeine. Subjects were asked to refrain from consuming caffeine for 6 hours prior to the experiment. Experiments were run either at 9:00 A.M. or 5:00 P.M. to control for time-of-day effects of differing levels of arousal between extraverts and introverts (Revelle, Humphreys, Simon, & Gilliland, 1980). Before the experiment, subjects were randomly assigned by the experimenter's assistant to one of two groups: (a) Caffeine group, which received a sugar-free lemonade-flavored beverage to which caffeine (approximately 4 mg/kg of body weight) was added, or (b) Placebo group, which received a sugar-free lemonade-flavored beverage to which quinine (to approximate for the bitterness of caffeine) was added. The drinks were made by the experimenter's assistant before the experiment. The experiment was run double blind, with neither the subject nor the
Atnusal and I motion

experimenter knowing whether or not the drink contained caffeine. After finishing the drink, subjects completed a handedness questionnaire, and the Eysenck Personality Inventory, Form A (EPI). The EPI is a self-rated 57-item questionnaire designed to measure the orthogonal dimensions of extraversion and neuroticism.

Subjects were divided into introverts and extraverts based on a median split of their scores on the EPI. Subjects who scored below an 18.0 were grouped together as introverts, and subjects who scored 18.0 and above were grouped together as extraverts.

Thirty minutes after consuming the beverage, subjects completed the Chimeric Face task, a measure of hemispheric arousal bias. In this task, subjects choose which of two faces looks happier (Levy et al., 1983b).

Upon completion of the Chimeric Face task, subjects were shown four filmclips from commercially available films intended to elicit emotional responses. Bugs Bunny and Bill Cosby: Himself were chosen to elicit a positive response, happiness. Raiders of the Lost Ark and Alien were chosen to elicit a negative response, disgust. The filmclips lasted between 3 and 3.2 minutes, and differed in intensity. Bugs Bunny and Raiders of the Lost Ark were less intense, while Bill Cosby: Himself and Alien were more intense. Subjects were videotaped while watching the filmclips. After each clip, subjects completed an emotional experience questionnaire asking them how disgusted and happy the filmclip made them feel. Ratings were made on a 7-point Likert scale anchored as follows: 1 - not at all; 3 - slightly; 5 - moderately; 7 - extremely. Happiness ratings in response to Bugs Bunny and Bill Cosby, and disgust ratings in response to Alien and Raiders of the Lost Ark were selected for data analysis.

Results

First we performed a manipulation check to see if caffeine had the intended effect. At the end of the experiment, we asked subjects whether or not they thought they had received caffeine. Results are
presented in Table 1. We found a significant association between group membership (caffeine vs placebo group) and the prediction of their condition, $X = 10.48, p = .001$. Subjects who received caffeine were more likely to think they had received caffeine than were the subjects who received placebo.

In order to examine the influence of arousal and extraversion on emotion, we performed a personality (extraversion vs introversion) X arousal (caffeine vs placebo) multivariate analysis of variance (MANOVA) with the following dependent variables: reported happiness in response to Bugs Bunny and Bill Cosby, and reported disgust in response to Alien and Raiders of the Lost Ark. The MANOVA revealed a significant interaction between caffeine and personality, Wilks lambda $= .96, p < .002$. We then conducted separate analyses of variance (ANOVA) on each of the four dependent variables. We found a significant interaction between caffeine and personality for reported disgust in response to Alien, $F(1,49) = 12.63, p = .001$ and reported happiness in response to Bugs, $F(1,49) = 12.92, p = .001$ (see Table 2, and Figure 1 (a-d)). There was a trend for an interaction between reported disgust in response to Raiders, $F(1,49) = 2.67, p = .109$. There was a significant omnibus main effect for caffeine on the four emotion variables, Wilks lambda $= .58, p = .050$. Individual ANOVA revealed a significant main effect of caffeine for Bugs, $F(1,49) = 5.04, p = .050$, with the effects for Alien and Raiders approaching significance, $F(1,49) = 3.61, p = .063$, and $F(1,49) = 1.21, p = .079$ respectively. Main effects for extraversion were not found.

It appears that the reason for the significant interaction in the MANOVA and ANOVA is that extraverts tended to report more emotion when they received caffeine than when they did not. Introverts, on the other hand, reported less happiness in response to Bugs when they received caffeine than when they received the placebo.

To assess whether or not hemispheric arousal bias was related to emotional experience, we examined the correlations between the Chimeric Face task, a test of right versus left hemispheric activation, and the four emotion variables. As can be seen in Table 3, there was a significant correlation between the Chimeric Face task and reported happiness in response to Cosby, $r = .26, p = .05$. It
appears that the more activated the right hemisphere was, the more subjects reported happiness (lower scores on the Chimeric Face task indicate higher right hemispheric activation).

Discussion

The results of the present study indicate that arousal does influence emotional experience. However, the effect of arousal on emotional experience depends on subjects' hypothesized arousal preference. Introverts reported more emotion in the placebo condition than when they received caffeine. On the other hand, extraverts reported more emotion when they were given caffeine than when they were in the placebo condition. We hypothesize that the introverts who received caffeine may have "shut down" due to excessive arousal, and therefore reported less emotion. The extraverts, on the other hand, were brought to an optimum level of arousal which may have increased their reported emotional experience. While this account is plausible, there are many other possible explanations for the relationship between reported emotion and arousal that need to be examined.

It is interesting to note that the interaction between arousal and personality varied with the valence of the stimuli. The arousal manipulation affected extraverts' response of negative emotion more strongly than it affected their reported positive emotion. In contrast, arousal affected introverts' response of positive emotion more strongly than it affected their reported negative emotion. It is not clear why this effect occurred. It is possible that this effect was mediated by mood. Future studies should take this possibility into account.

The relationship observed in this study between hemispheric arousal bias and emotional responses is inconsistent with that reported in the literature. We found that higher right hemispheric activation was significantly correlated with happiness in response to Cosby. Previous research has found higher right hemispheric activation to be related to negative affect. It is not clear why we observed this inconsistency. It could be that the Chimeric Face task is not necessarily a test of right versus left hemispheric activation, but rather it could be measuring right versus left anterior or right versus left.
posterior activation. In order to clarify the relationship between hemispheric activation and emotion, future studies should use a test of hemispheric activation which is clearly associated with a particular brain region. At present, it is unclear which aspects of neural activation the Chimeric Face task is measuring.

It is interesting to note that the only film not related to personality or caffeine was the one most related to hemispheric arousal bias. This relationship is puzzling, and is something for future research to address.

In future analyses, we will examine the relationship between arousal and emotional expressiveness (subjects were videotaped while viewing the filmclips). We hypothesize that subjects who received caffeine will be more emotionally expressive than those who didn't, but we also feel that this effect will interact with personality. We will also examine the effect of arousal on mood, and whether mood may have mediated the effect of arousal on responses to the affect-eliciting filmclips. Analyses performed on the two groups who correctly predicted their caffeine condition may provide information about subjective arousal level and emotional experience.

Our results cannot explain exactly how arousal affects emotion. Emotion could be influenced by either hemispheric arousal or by autonomic arousal which interacted with personality. It is not clear which arousal system we manipulated via the caffeine. It is also unclear what type of arousal we were measuring.

In future research, a within-subjects design would be helpful to look at the effects of different levels of caffeine given to a subject. It would also be advantageous to perform a validity check on the effect of caffeine on the individual. Many factors can influence the way one will respond when given caffeine. Individuals differ in their tolerance to caffeine, and two hundred milligrams of caffeine may affect different individuals in different ways. Future research looking at increases and decreases in heart rate and/or skin conductance as tests sensitive to changes in the autonomic nervous system would be extremely fruitful. An ideal study would be to give an individual varying amounts of caffeine over a period of weeks, and monitor their autonomic changes over a period of three hours following each
administration of caffeine. It would be interesting to examine the effects of depressants on extraverts and introverts. If introverts received depressants, would this make them more emotional? Future research is necessary to clarify the relationship between arousal and emotion. The present study has shown that arousal is related to emotion, but future research must keep in mind the role of an individual's preferred level of arousal in emotional experience.
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Author Notes

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Table 1. Subjects' predictions of their caffeine condition and actual experimental condition.

<table>
<thead>
<tr>
<th>Condition</th>
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<th>NO</th>
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</thead>
<tbody>
<tr>
<td>CAFFEINE</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>PLACEBO</td>
<td>5</td>
<td>22</td>
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</table>
Table 2. Means and standard deviations of reported emotional responses* to filmclips

<table>
<thead>
<tr>
<th></th>
<th>INTROVERTS</th>
<th></th>
<th>EXTRAVERTS</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Caffeine</td>
<td>Placebo</td>
<td>Caffeine</td>
<td>Placebo</td>
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<tr>
<td>Bugs</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
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<td>5.93</td>
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<td>SD</td>
<td>1.12</td>
<td>0.92</td>
<td>0.84</td>
<td>0.95</td>
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<td>Cosby</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
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<td>5.29</td>
<td>5.21</td>
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<td>1.33</td>
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<td>M</td>
<td>4.61</td>
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<td>SD</td>
<td>2.36</td>
<td>1.64</td>
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<td>Raiders</td>
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</tr>
<tr>
<td>M</td>
<td>3.23</td>
<td>3.14</td>
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<td>2.25</td>
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*Reported happy in response to Bugs Bunny and Bill Cosby, and disgust in response to Alien and Raiders of the Lost Ark.
Table 3. Correlations between right hemispheric arousal bias (as reported by scores on the Chimeric Face task) and emotional responses.

<table>
<thead>
<tr>
<th>Film Title</th>
<th>Correlation</th>
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<tbody>
<tr>
<td>Bugs</td>
<td>.085</td>
</tr>
<tr>
<td>Cosby</td>
<td>-.261*</td>
</tr>
<tr>
<td>Alien</td>
<td>.074</td>
</tr>
<tr>
<td>Raiders</td>
<td>-.080</td>
</tr>
</tbody>
</table>

*p < .05
Figure 1(a-d). Emotional responses of introverts and extraverts to the film clips.
DISGUST

caffeine
placebo

ALIEN

*** p < .001

introverts
extraverts
b) HAPPY

![Graph showing the comparison between caffeine and placebo for introverts and extraverts.](image)

**BILL COSBY**
c) HAPPY

Placebo

p < .01

p < .001

Introverts

Extroverts

BUGS BUNNY
RAIDERS OF THE LOST ARK

DISGUST

caffeine placebo

* p < .05
** p < .01

introverts extraverts