

The effect of Arousal on Emotional recall
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Introduction

Many basic elements encountered during a lifetime can act as stimulants. Stimulants in any form arouse the sympathetic nervous system; they boost energy, heighten alertness, increase activity, and generally produce a pleasant feeling. When people experience emotion, they are moved in some way, with feelings similar to the effect produced by a stimulant. Willaim James (1884), proposed that the autonomic nervous system is more than just an indication of emotion. According to James, it was the emotion. He took the position of thinking that we cry because we are sad, we tremble because we are afraid, and we attack because we are angry, and said instead that the stimulus evokes autonomic changes. As a result of this order of stimulus and responses, we decide we are sad because we cry, we are afraid because we tremble, and we are angry because we attack. According to James, an emotion is the perception of what is happening within the nervous system as a result of a specific stimulus, and not the cause of that change.

Schachter and Singer (1962), wanted to test the relationship of emotion and physiological changes. They used a stimulating drug to induce nearly the same physiological state in two groups of people to see

whether both groups reported the same emotion. They then put their subjects in different situations to see if the subjects would report the same emotion regardless of the situation. They concluded from their experiment that the physiological state is not the same thing as an emotion, but it may be perceived as one of several emotions. Despite the fact that two different studies, by Marshall and Zimbardo in 1979 and Maslach in 1979 (Kalat, 1990), failed to replicate Schachter and Singer's results, they were right in calling attention to cognition in relation to the labelling of emotion. The important factor, relevant to this research is that, not only is cognition of the physiological arousal an important element in the labelling of an emotion, but so too is physiological arousal a determining factor in the perception of the intensity of the emotion on recall.

Defining emotion

However it is labelled or described, emotion still requires defining. Many researchers have taken on this responsibility and the suggestion of Mandler (1975), as reported by Whissell (1991), is to ignore it. They

recommend that a unitary definition not be forced, but that data continue to be gathered until the question answers itself, or until enough data exists to warrant a serious effort at unification. So, with this thought in mind and the vast extent of emotional representation (e.g.,: fear, anger, love, etc.), the best we can do is to suggest that emotion is a feeling marked by impulse to outward expression and often accompanied by complex bodily reactions (Whissell, 1984); therefore, the operational definition of emotion, for the purpose of this research, will be the arousal perceived by the subjects to be his/her emotion.

The connection between emotion and memory

The connection between emotion and memory is made at the time of recall, and the timing of arousal enhances memory by focusing attention to the event that produces the emotion. This all relates to Easterbrook's Cue Utilization Theory (Jubis, 1990, & Burke, Heuer & Reisberg, 1992), which stated, in part, that high arousal is associated with increased selectivity of attention to that which is causing the

arousal¹. In addition to this increased selectivity, we have the information from the research connecting arousal and recall by McLean (1969) and Scott (1990), showing that arousal induction can improve the accessibility of delayed memory by increasing the strength of the consolidation process that accounts for the retaining of memory. Recall of events that occurred during high arousal was superior to that which occurred during low arousal.

Emotion is defined both in labelling and strength by the degree of arousal at the time of the emotion arousing event. The question still remains however, as to whether the inducement of the physiological responses by artificial means at the time of recall, would also intensify the perception of that emotion on recall even more. Would the effect of a stimulant at the time of recall cause an individual to perceive the recall of that emotion more intensely?

¹Easterbrook's Cue Utilization Theory is that high arousal is associated with increased attentional selectivity which, in extreme cases, may entail neglect of environmental cues. Under low arousal, selectivity is low and cues irrelevant to the situation and may be indiscriminantly attended to (Jubis, 1990). The only aspect of this theory relevant to this research is the idea that high arousal is associated with increased attention.

Anxiety at the time of recall (test anxiety)

The only research found, relating arousal to the time of recall, was that of test anxiety. Test anxiety is not the recall of an emotional event, but it is related to recall while emotionally aroused. It was first thought that arousal in the form of anxiety interfered with performance during tests. In the instance of test anxiety, one would, on first impression, think that this would demonstrate the effect of emotion on recall. It does not. First of all, test anxiety, in most cases, is not the recall of an emotional event, and, the emotions, or more precisely the arousal, felt at the time of the exam or test, is a result of anxiety caused by the inability to recall information. The test anxious response emerges from cognitive interference and feelings of helplessness from lack of effort, distress, anger, disgust and/or shame. This response arises as the result of difficult tasks, feelings of failure, or a combination of the two, and is identified with a decrease in performance on cognitive tasks (Arkin, Detchon & Maruyama, 1982). Test anxiety can be separated into two components, worry and emotionality,

and worry is strongly related to impairment of performance (Klinger, 1984). Klinger went even further by saying that test anxiety is the effect of, rather than the cause of, poor performance, and that test preparation correlates with test performance.

The inducement of physiological responses

When emotions, and the recall of emotions, are studied in experimentation, one of the aspects to be considered is the induction of emotional mood states in the subjects to suit the experiment. The experimental induction of emotional mood states and their physiological responses during an event, or in a specified task, is now known to produce a variety of effects on memory and cognitive processes, (Ellis, Thomas, McFarland and Lane, 1983). Results of the effect of induced mood on the retrieval of memories of actual life experiences has been rather consistent (Teasdale and Russell, 1983).

In a search of the literature associating emotion and recall, it was found that researchers studying the effect of arousal on memory, as a result of arousal induced at the time of the event to be remembered, used

many different stimulants to induce arousal during the event to be recalled. These included; alcohol and white noise (Jubis, 1990), white noise (McLean, 1969), loud or soft tone bursts (Hans Phaf & Wolters, 1986), the recall of jokes told to students during exams [high arousal] and the recall of jokes told to students during lectures [low arousal] (Maher & Van Giffen, 1988), and sexual excitation (Scott, 1990), all of which show that arousal at the time of an event not only influences but also enhances the recall of that event.

For the purpose of this research, the arousal of emotion will be initiated by an actual life experience and then a physiological state will be induced at the time of recall by the use of a stimulant. The medium selected for the purpose of stimulant for this research is caffeine.

Caffeine as a stimulant

Caffeine, a common ingredient in many popular foods and drinks, is ingested daily in large amounts by most people. Although there are numerous studies on the effect of caffeine, these have reported many

differing results, and, there was not one entry found, in a search of the literature, on the effect of caffeine in relation to its effect of emotional arousal at the time of recall.

Earlier investigations had failed to find behavioral effects from caffeine at doses below 200-300 mg., or amounts equal to 1.5 to 2.5 cups of average strength coffee, yet Silverman and Griffiths, (1992), have shown that doses as low as 32 m. of caffeine improved auditory vigilance and reaction time without affecting self-reports of mood; and, that individuals could learn to discriminate up to as little as 10mg of caffeine from a placebo. The drug discrimination procedures used by Silverman and Griffiths (1992), in order to determine the limits of human sensitivity to caffeine, revealed effects of dietary doses of caffeine previously thought to be behaviorally and physiologically inactive, thereby extending the known limits of human sensitivity to caffeine.

Most findings on the effect of caffeine on the autonomic and central nervous systems were described as and included enhanced auditory vigilance and reaction time (Silverman and Griffiths, 1992); nervousness,

irritability, agitation, headache, tachypnea, tremulousness, reflex, hyperexcitability and occasional muscle twitching (Velever and Templer, 1982); sustained attention and motor activity (Baer, 1987); profound effects on recognition performance of high impulsives after conceptual and acoustic acquisitions (Gupta, 1993); improved performance on a sustained attention task, the logical reasoning task and semantic memory tasks (Smith, Kendricks & Maben, 1992); and as a treatment for apnea in premature infants, because it increases the central nervous system's response to carbon dioxide, (Eisenberg and Kang, 1984). Despite all of these symptomatic aspects of caffeine, Smith, Kendricks and Maben (1992) reported that caffeine had no effect on free recall when administered at the time of the event to be recalled, and both Smith et al. (1992) and Silverman and Griffiths (1992) showed a distinct consistency across gender in their responses under the influence to caffeine.

Hypotheses

Emotion has the possibility of affecting memory at two different stages, first during the storage of

material, a phenomenon, according to the amount of research available, that is much studied; and during recall, a phenomenon, according to the research available, that has not been studied at all. During counselling sessions, either group or individual, self-help group meetings, or even the relating of an event for any other purpose, such as, as a witness, the recall of an emotional event could possibly be coloured by the current physiological state of the person recalling the event. Research has clearly demonstrated that the physiological state could be induced and/or aroused by something as simple and everyday as drinking coffee or cola. If the physiological state of an individual is aroused during the recall of the emotion, is there an effect on the perception and reaction to that memory?

The proposed hypothesis would be as follows: Could arousal, induced using caffeine as a stimulant, cause an individual to perceive the experience of an emotion on recall more intensely than how the emotion was originally experienced? I would like to suggest that yes, the perception of an emotion on recall is not always the same as the original experience, the recall

would be affected by the present physiological state of the subject, and the ingestion of stimulants could be the probable cause.

Bibliography

Arkin, R., Detchon, C., & Maryuana, P. (1982). Roles of Attribution, Affect, and Cognitive Interference in Test Anxiety. Journal of Personality and Social Psychology, vol. 43, no. 5, p. 1111-1124.

Annotation: This research shows that the test anxious response appears to consist of cognitive interference, feelings of helplessness, distress, anger, disgust and shame. This response appears to be elicited by difficult tasks, feelings of failure or a combination of these events, and it is closely associated with decrements in performance on cognitive intellectual tasks.

Baer, Ruth A., (1987). Effects of caffeine on classroom behaviour, sustained attention, and a memory task in preschool children. Journal of Applied Behaviour analysis, 20, 225-234.

Annotation: This research listed some of the methodological problems that one must take into consideration when doing research with caffeine. One of the problems she cited is that caffeine is sometimes administered in doses of caffeine that, although

consistent with reported daily caffeine consumption, are much larger than the average person could consume in a single serving of any real-life, caffeine-containing food. This study represented the first attempt in the literature to detect a clinically significant affect of real-life amounts of caffeine on the behaviour of individual children under natural circumstances.

Burke, A., Heuer, F., & Reisberg, D., (1992).

Remembering Emotional Events. Memory and Cognition, vol. 20, (3), p. 277-290.

Annotation: These researchers report that retention-intervals' effects serve to retard the processes of forgetting. A number of mechanisms might product this slowed forgetting, including stronger encoding of emotional events at the time they occur.or perhaps a retrieval advantage for emotional events as other retrieval paths decay. The data from this research corresponds with other findings that there is a narrowing or redirection of attention during emotional events.

Eisenberg, Marion & Kang, Nancy, (1984). Stability of Citrated Caffeine Solutions for Injectable and enteral Use. The American Journal of Hospital Pharmacy, vol 41, p.2405.

This method of formulation for caffeine use in infants is effective in demonstrating that caffeine is used as a stimulant of arousal in cases of apnea, even for premature infants.

Ellis, C. H., Thomas, R. L., McFarland, A. D., & Lane, J. W. (1985). Emotional mood states and retrieval in episodic memory. Journal of Experimental Psychology, 11(2), 363-370.

Annotation: This research was to determine if an induced mood (depressed mood in the case of this study) does affect retrieval of information from memory. This study is an attempt to determine whether a negative or disruptive mood state interferes with the encoding of information by prompting some capacity that would normally be allocated to the process of encoding the criterion task. These researchers suggest that it is possible that the cognitive activities associated with retrieval interfere in a more direct sense, in that the

depressed cognitions of the subject compete directly with the activities necessary for successful retrieval of information.

Facts and comparisons, Loose-leaf drug information service, (January, 1993). p. 230- 230b. Facts and Comparisons, Inc., St. Louis, Mo.

Annotation: This is a monthly update that contains information on all drugs, their uses and effects, meant for use by individuals in the health care services. There are three pages in this update pertaining to caffeine.

Gupta, Uma, (1993). Effects of Caffeine on Recognition. Pharmacology Biochemistry and Behaviour, vol. 44, p. 393-396.

Annotation: This research studied the effects of caffeine on human performance that is not only task specific but is also performed under the influence of caffeine. The results demonstrate profound effects on recognition performance of high impulsives after conceptual and acoustic acquisitions. The arousal level of high impulsives is considerably enhance by

caffeine and consequently their memory improved after acoustic acquisition, but is hindered after conceptual acquisition.

Hans Phaf, R. & Wolters, Gezinus, (1986). Induced Arousal and Incidental Learning During Rehearsal. American Journal of Psychology, vol. 99, p. 341-354.

Annotation: In this research, where tone bursts act as a stimulant, it was shown that high arousal level strengthens the association between items in the serial recall of events. Increased arousal is shown to affect the intensity of information processing, resulting in better storage of the selected stimulus cues.

James, W. (1884). What is an emotion. Mind, 9, 188-205.

Annotation: This is the original of work of William James and he took the position that we cry because we are sad and we tremble because we are afraid and said that the stimulus evokes the autonomic changes.

Jubis, Rebecca, (1990). Effects of Alcohol and White

Noise on Recall of Relevant and Irrelevant Task
Components. Perceptual and Motor Skills, vol.
71, p. 691-702.

Annotation: Jubis gives us Easterbrook's Cue Utilization Theory (1959) in which he proposes that high arousal is associated with increased attentional selectivity which, in extreme cases, may entail neglect of environmental cues. Under low arousal, selectivity is low and cues irrelevant to the situation may be indiscriminantly attended to. As arousal increases, selectivity is enhanced and attention is biased toward the more relevant task components at the expense of the irrelevant ones.

Kalat, James, W., (1990). Introduction to Psychology,
(2cnd. ed.). Wadsworth Publishing Company,
Belmont, California, 94002.

Annotation: This book provided information on the James-Lange Theory of Emotions, which is important when we consider that first an emotion is a physiological response evoked by a situation. The emotion then, according to James and Lange, is our perception of those changes. is given a label dependent on the

situation or event causing the physiological response.

This book has also provide information in regards to the Schachter and Singer Theory of Emotions. The determining factor with this theory is that the physiological state is not the same thing as the emotions. This physiological state could be perceived as any of several emotions and the naming of the emotion is dependent on the cognitive appraisal.

Kebeck, Gunther & Lohaus, Arnold, (1986). Effect of Emotional Arousal on Free Recall of Complex Material. Perceptual and Motor Skills, vol. 63, p. 461-462.

Annotation: Contrary to the Easterbrook hypothesis, the results of this research confirm the hypothesis that peripheral elements of a material are remembered less well when emotional arousal is high during acquisition. There seems to be a focusing effect on central elements of a plot, but this focusing does not lead to better recall.

Klinger, Eric, (1984). A Consciousness-Sampling Analysis of Test Anxiety and Performance.

Journal of Personality and Social Psychology,
vol. 47, no1 6, p. 1376-1390.

Annotation: This research wanted a clear view of how anxiety affects performance during test anxiety. It was first thought that arousal, in the form of anxiety, interfered with performance. Klinger shows that because anxiety can be separated into the two components of worry and emotionality, and worry is strongly related to impaired performance, that anxiety is the effect rather than the cause of poor performance, and that test preparation correlates with test performance.

Maher, Kathleen & Van Giffen, Katherine, (1988).

Memory for Wording and Meaning of Content-
Relevant Jokes Presented in Differing Arousal
Conditions. Psychological Reports, vol 63, p.
899-905.

Annotation: This research used student's examinations as a high arousal agent. The experimental subjects were told jokes during an examination, while the control group of subjects were told jokes during a lecture, low arousal. More jokes presented during high

arousal were remembered than those that were presented during low arousal.

McLean, P.D., (1969). Induced Arousal and Time of Recall as Determinants of Paired-Associate Recall. British Journal of Psychology, vol. 60, p. 57-62.

Annotation: The theory behind this research proposes that the occurrence of any psychological event will result in a process that establishes permanent memory, and that the increased arousal during the event will produce a more intense trace activity and render the association less available for immediate memory, while consolidating it for greater permanent memory. The results show that support for the concept of preservative consolidation and demonstrates that noise (used to induce arousal) presented at the time of presentation affects recall performance.

Schachter, S. (1962). Cognitive, social, and physiological determinants of emotional state. The psychological Review, 69, 379-399.

Annotation: This study tested the relationship of

emotion and physiological changes. As a result, Schachter concluded that the emotional state is not the same thing as the emotion, but maybe perceived as one of several emotions.

Scott, Randall, (1990). Effect of Sex on Excitation Transfer and Recall of Television News. Psychological Reports, vol. 66, p. 435-441.

Annotation: This study used sexual arousal as the stimulant to measure how many events were remembered from a news broadcast. It has shown that, yes, more news stories were remembered by subjects who viewed the high arousal scenes prior to the news broadcast, than by those who viewed the low arousal scenes prior to the news broadcast. This research demonstrates that arousal, at the time of or shortly prior to an event, can affect recall of that event.

Silverman, Kenneth and Griffiths, Roband R., (January, 1992). Low-dose caffeine discrimination and self-reported mood effects in normal volunteers. Journal of the Experimental Analysis of Behaviour, 57, 91-107.

Annotation: A caffeine versus placebo discrimination procedure was used in this research to determine the lowest caffeine dose that could be discriminated or detected in normal volunteers. In order to determine whether the variable and subtle effects of dietary caffeine doses reflect variation in human biological sensitivity, these researchers taught 7 caffeine abstinent subjects to discriminate caffeine from a placebo at doses as low as 10 mgs. This drug discrimination procedure revealed behavioral effects of dietary doses of caffeine previously thought to be behaviourally and physiologically inactive, thereby extending the known limits of human sensitivity to the arousal factors of caffeine.

Smith, A.P., Kendrick, A.M., & Maben, A.L., (1992).

Effects of breakfast and caffeine on performance and mood in the late morning and after lunch.

Biological Psychology/Pharmacopsychology, 26, 198-204.

Annotation: This research shows that caffeine produced a consistent pattern of improved performance on a sustained attention task. Subjects given caffeine

reported greater alertness and feelings of well being demonstrating that caffeine does indeed affect the arousal of mood. It also shows that there was no effect on free recall, nor was there any inconsistency across the sexes, male vs. female.

Teasdale, John D. & Fogarty, Sarah, J., (1979).

Differential effects of induced mood on retrieval of pleasant and unpleasant events from episodic memory. Journal of abnormal psychology, 88 (3), 248-257.

Annotation: This research used induced mood states to study the effect of depressed mood on the accessibility of memories of past real-life experiences of a pleasant or unpleasant nature. These studies represent an effect of mood at the stage of memory retrieval; as memories were already in long-term memory, the effects of induced mood could not have been on memory formation or retention. The effects of mood induction on retrieval of different types of memory observed in the present experiment have been interpreted as effects of mood on the accessibility of memories. It is also possible that they represent direct effects to the

procedures used to induce mood, rather than the mood induced.

Teasdale, John D. & Russell, Louise M., (1983).

Differential effects of induced mood on the recall of positive, negative and neutral words. British Journal of Clinical Psychology, 22, 163-171.

Annotation: This study examined the effect of induced mood on the recall of previously learned personality trait words. An experimentally induced mood state has been shown to affect the accessibility of positive and negative information differently. Similarly, narrative accounts of the experience of others, when presented in neutral mood, may remain relatively isolated in memory from the concepts and experiences associated with distinct mood states in subjects previous experience.

Veleber, David M. & Templer, Donald I., (1984).

Effects of caffeine on anxiety and depression. Journal of Abnormal Psychology, 93(1), 120-122.

Annotation: This research related caffeine consumption to mood and found a positive correlation in its

relationship to anxiety. Symptoms referable to arousal by caffeine included nervousness, irritability, agitation, headache, tachypnea, tremulousness, reflex hyperexcitability and occasional muscle twitching. This positive relationship between postanxiety scores and caffeine dosage was expected because of caffeine's known pharmacological actions.

Whissell, Cynthia, (1984). Emotion: A Classification of Current Literature. Perceptual and Motor Skills, vol. 59, p. 599-609.

Annotation: This report gives advice on how to study emotion by ignoring it. Whissell reports on how Mandler (1975) counsels researchers not to force a unitary definition on a concept which is presently characterized by such a variety of theoretical expressions, but rather to continue gathering data until the question answers itself, or until enough data exists to warrant a serious effort at unification.

Whissell, Cynthia (1991). An Heuristic for the study of the effects of emotion on memory. Perceptual and Motor Skills, 72, 3-10.

Annotation: An heuristic (a set of questions) for emotion-laden research is outlined and will be helpful in organizing information from research studies. The heuristic is set out in a convenient table with questions pertaining to subjects, encoding and the procedures used for encoding, the interphase interval, the procedures used for recall, and the mechanism used. As an investigative technique, it encourages the researcher to ask questions such as: Why? How? What happened? and, What did it mean?

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Running Head: Arousal & Emotional Recall

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Abstract

It is habitual, when relating traumatic events during counselling sessions, self-help meetings, or as witnesses, to accompany this communication with cups of coffee. This research investigated whether caffeine-induced arousal during recall causes perception of emotions differently from when originally experienced. Twenty Algoma University students watched an emotionally charged movie and immediately answered a questionnaire on how intensely they perceived their emotions during the movie. Two days later, the subjects' physiological state (arousal or non-arousal) was manipulated by either 200 mgs of caffeine (stimulant) or a placebo (non-stimulant). They then answered the questionnaire again. When arousal is not present at recall, the perceived intensity of emotion diminishes. When arousal is present at recall, the perceived emotion is reestablished close to the intensity experienced during the event being recalled. What we consume does affect how we remember.

The effect of Arousal on Emotional Recall

In Western society, when people relate traumatic or emotionally-laden events in either group or individual counselling sessions, self-help group meetings, or even the relating of the event for any other purpose such as being a witness, the social custom is to accompany this type of communication with cups of coffee. Caffeine, a drug found in coffee as well as in other dietary sources such as chocolate and soft drinks, is a common stimulant (Facts and Comparisons, 1993) causing physiological arousal. Physiological arousal manifests itself in such ways as increased heart rate, blood pressure, sweaty palms and fidgetiness, all of which are, according to William James (1884), present during an emotive state.

Emotional arousal can affect memory at two different stages, first, during the storage of material, and second, during recall (Whissell, 1985). The effect of emotional arousal during storage of memory has been studied at great length, while the effect of emotional arousal during recall has not been studied. Research on emotion and recall shows that

emotional arousal at the time of an event to be recalled not only influences but also enhances the recall of that event (Burke, Heuer, & Reisberg, 1982; Ellis, Thomas, McFarland & Lane, 1985; Gupta, 1993; Jubis, 1990; Kebek & Lohaus, 1986; Maher & Van Giffen, 1988; McLean, 1969; Phaf & Wolters, 1986; Scott, 1990; Smith, Kendriks & Maben, 1992; Teasdale & Fogarty, 1979; & Teasdale & Russell, 1983). If high arousal is responsible for increased attention during an event, thus causing it to be more easily recalled, would not the presence of high emotional arousal at the time of recall as well, also intensify or enhance that memory, causing the emotion to be perceived as having been more intense?

The purpose of this research was to determine if the ingestion of caffeine, immediately prior to the recall of an emotional event, and the physiological arousal resulting from this caffeine, affected that recall, causing it to be perceived as more intense. The hypothesis was that, under these conditions, subjects would perceive their emotions as being equal to or more intense than those experienced during the

emotional event being recalled. Those subjects not receiving caffeine at time of recall would have a diminished perception of the intensity of the emotions being recalled.

In order to test this hypothesis, subjects watched an emotionally charged movie and two days later conditions of arousal and non-arousal of subjects were manipulated by the administration of either caffeine tablets or a placebo. It was expected that those subjects receiving the caffeine would recall the perception of the emotions experienced during the movie as being stronger or equal to those emotions perceived at the time of the event.

Method

Subjects

The S's were 20 Algoma University students, 12 females and 8 males. An additional 2 females had agreed to participate but were excused because they were on medication. Six of the subjects were from the a first year psychology class and they received some course credit for each phase of the study in which they

took part. The other 14, recruited from two marketing classes, were volunteers and received no credit for taking part.

The s's were told that the experiment concerned the effects of caffeine on memory. They were kept blind to the aspect of perceived intensity of emotion on recall. All subjects signed a consent form confirming they were in good physical health, were not on any form of medication or drugs, had prior to taking part in this research project ingested both caffeine and Vitamin C (the placebo) with no adverse or allergic reaction and were aware that they would be required to take 200 mgs of caffeine or 500 mgs of Vitamin C orally during part of the experiment.

In consideration of a potential ethical requirement, Dr. E. Bedhun, a family practitioner in Sault Ste. Marie, acted as advisor in regards to the drug administration aspect of this research.

The emotional event

The emotion invoking event was in the form of the movie "Shattered Dreams", This 27 minute production of

the National Film Board of Canada, portrays the pain experienced by a family when their youngest son commits suicide as a result of schizophrenia, and they also learn that another son is suffering from the disease. This movie was selected because of its high emotional content. None of the S's taking part in the study had previously seen the movie.

Measuring instrument

A questionnaire was made up of several questions pertaining to actual events that occurred in the movie watched by the S's. Buried within these questions were questions about the strength of emotions encountered during the movie. The relevant questions actually used for measure were: Q8, "When Ben's mother spoke about his illness, how sad did you feel?", Q12, "When Clem spoke about Ben buying the gun, how sad did you feel?", Q19, "When the two brothers were sitting by the campfire discussing how the second brother had beat the disease, how happy did you feel?". In each of the listed questions, the scenario was stated first in an attempt to invoke the emotion felt during the movie.

while reading the remainder of the question. The word "you" was underlined to point out that the question was in regards to the subject's own feelings.

The emotional words "happy" and "sad", determined by Whissell (1981), to contain dimensions of high arousal, were used in the relevant questions.

The S's were required to fill out the same questionnaire during both Phase 1 and Phase 2. The reply to these questions was marked on a likert type scale, with only "very strongly" or "not at all" at either end. The numbers 1 through 7 were on a corresponding scale to the one used and was applied when reading the data. Also included among the questions were other 'not of interest' questions using the same Likert type scale so that this was not a distinguishing feature to the relevant questions.

Caffeine and placebo

Neither the caffeine tablets nor the placebo require a prescription. The caffeine tablet used is sold under the name "Stay awake", and its only active ingredient is caffeine. Each tablet contains 100 mgs.

of caffeine which is comparable to one cup of brewed coffee. The subjects in the experimental group each received 200 mgs of caffeine (two tablets). The reasons for selecting the tablets over an actual cups of coffee were: control of caffeine content and amount was ensured, the addition of milk and sugar to coffee did not become confounding variables, and potential subjects might not agree to drink black coffee.

All S's abstained from alcohol, coffee, tea, colas, chocolate, or any other known product containing a stimulant of any kind, for four hours prior to both Phase 1 and Phase 2. Caffeine is metabolized in the liver and excreted unchanged in the urine, and in the adult, plasma half-life, on average is 3.5 hours (Facts and Comparisons, 1993; Julien, 1992). For this reason, the time of abstinence ensured that arousal, during Phase 1, was a result of watching the movie, and during Phase 2, the result of the caffeine tablets. This was verified by a compliance check at the end of the questionnaire.

The placebo used was simple Vitamin C. Vitamin C is 'essentially nontoxic'.....with respect to safety,

ascorbic acid (vitamin C) is ideal (Pauling, 1976, p. 139). The Wampole brand selected is non-chewable and similar in appearance to the caffeine tablets. Each contains 250 mg. of Vitamin C and has no stimulating effect. Each subject in the control group received 500 mgs (two tablets).

Procedure

During Phase 1, all S's viewed the movie and answered the questionnaire immediately afterwards. The score attained here set a baseline for comparison to the score attained in Phase 2.

Two days later, the S's returned for Phase 2. When all were seated, each was handed an envelope. The envelopes had been sealed and then, with the envelope right side-up with the flap facing the experimenter, were neatly sliced open, either up the left side or the right side. The right opening envelopes contained two caffeine tablets while the left opening envelopes contained two placebo tablets. The envelopes were piled alternately and handed out randomly to S's so that the experimenter was blind to who was assigned to

the experimental (caffeine) group or the control (placebo) group. The S's were provided with water and all took their tablets at the same time.

Since the peak level of caffeine in the plasma is achieved 15 to 45 minutes after consumption (Facts and Comparisons, 1993), S's waited twenty minutes after taking the tablets. The S's had been informed in advance to bring any reading or homework for this period. After the wait, they answered the same questionnaire they had answered immediately after watching the movie. They were told to put their answered questionnaire into the envelope that had contained their pills. After all questionnaires were handed in, the S's were debriefed and given a full explanation of the experiment. They were encouraged to ask any questions they had in relation to the study.

The scores from the caffeine group were compared to the placebo group, and then both of these groups were compared to their base-line score. This resulted in a two-by-two within group repeated measures design.

Results

In the questionnaire, question 19, asked how happy the subject felt, while the other relevant questions, 8 and 12, asked how sad the subject felt. The scores for question 19 were inverted so the scores for all questions moved in a continuous direction, from very sad to very happy.

The data were treated using ANCOVA because the scores at baseline (the emotional event) were different for the two groups. The tests indicated that the main effect, decrease of arousal from baseline to recall, was significantly larger in the placebo group than in the caffeine group, $F(1,17) = 6.26$ $p < .023$, for all relevant questions, as demonstrated in figure 1. Question 1 was the only one to show a decrease of perceived intensity of emotion for the caffeine group with an even greater decrease for the placebo group on the same question. The remaining two questions showed an increase in perceived intensity of emotion for the caffeine group while the placebo group showed a decrease.

Insert fig. 1

As presented in figure 2, the mean scores for the caffeine group at the time of the event ($\bar{M} = 4.3167$) showed very little change at the time of recall ($\bar{M} = 4.2833$); while the mean scores for the placebo group at the time of the event ($\bar{M} = 4.125$) showed a significant decrease at the time of recall ($\bar{M} = 3.7750$).

insert fig. 2

Discussion

The results of this study clearly indicate that when arousal is not present, the perceived intensity of emotions on recall diminishes from the time of the event to the time of recall. As expected, caffeine produces profound effects on reestablishing the level of perceived intensity of emotion at the time of recall. It is notable that on questions 12 and 19, the level of perceived intensity of emotion for the

caffeine group increased rather than decreased.

It would be interesting to investigate the level to which the perceived intensity of emotion increased with more than the 200 mgs of caffeine, and also to determine whether this increase is reestablished after longer periods of time.

In summary, the present results indicate that people who indulge in many cups of coffee while relating pertinent, emotional events, should be made aware that what they are ingesting could affect what they are remembering.

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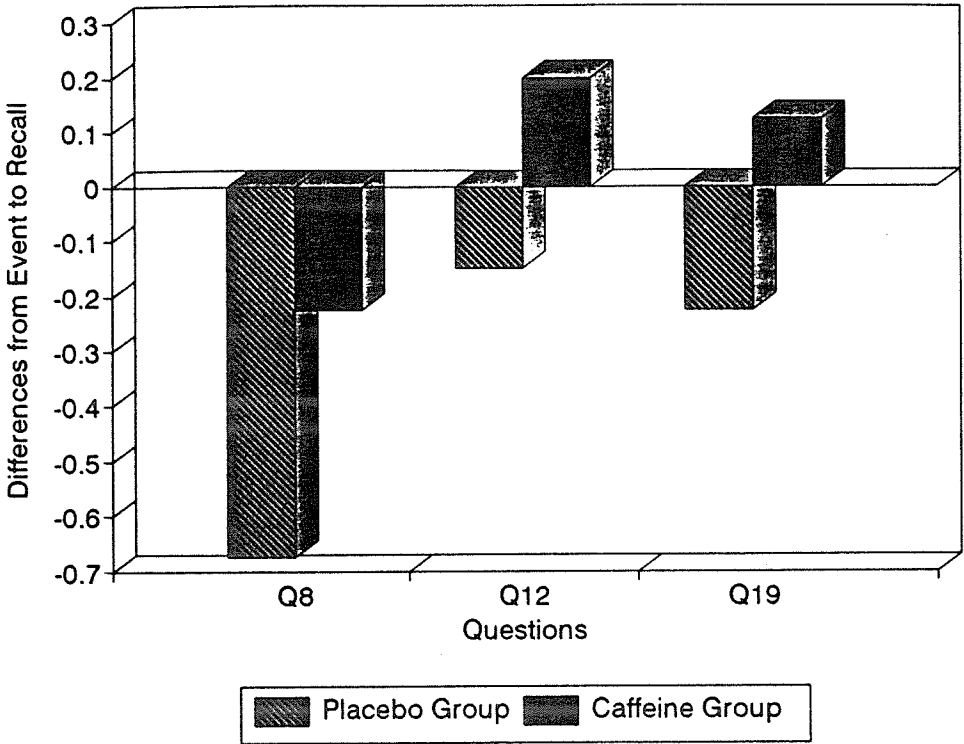
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Figure Captions

Figure 1. Differences in scores from baseline (event) to recall between the placebo group and the caffeine group for the three relevant questions.

Figure 2. Decrease in mean scores of perceived intensity of emotion for the placebo group and the caffeine group from the time of the event to the time of recall.



Arousal & Emotional Recall

