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A Bipolar Structure of Affective Experience: A Dichotic Listening Study

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Senior Honors Thesis
Abstract

A current debate ensues between the bivalent and the bipolar views of affect. This study has attempted to further support the side of bipolarity. The bipolar model of affective experience explains that affect is experienced along a single continuum and therefore a person processes only one feeling of affect at a time and cannot experience opposite states of affect simultaneously. I predicted that, in accordance with the bipolar model, participants would be unable to process semantic information from both positive and negative narratives at the same time in a dichotic listening. This inability would cause the participants to make shadowing errors when their attention shifted to the unattended channel as well as causing a vocal delay when the narratives switched auditory channels midway through the experiment. They would rate themselves in bipolar space throughout the experiment, but to then rate themselves in bivalent space when they made a summary judgment at the end of the experiment, since they are asked to combine their entire experience into a discreet rating. Twenty-one undergraduate students participated in a dichotic listening task while using the CTVG to continuously record their current state of affect in real time. The percent of errors made in shadowing, vocal delay, position on the grid for the summary judgments and the placement on the grid surrounding attention shifts were all measured. Results suggest that the structure of the affective experience follows the bipolar model. Implications of this research are discussed.
This paper focuses on the current debate about the structure of affect that poses the bivalent model of affective experience against the bipolar model. This is important because it gets at the heart of the scientific categorization of valence; whether it is one category, which would support the bipolar theory, or whether it is two categories, which would support the bivalent theory.

The study of affect is one that influences multiple areas of psychology. Affect steers human interaction and it is a factor in attitudes (Cacioppo & Berntson, 1994), stereotyping and prejudice (Cacioppo & Berntson, 2001), and personality (Watson, 2000), among others. There are various dimensions of affect that must be parceled apart. Valence and arousal are the two properties of affect. The structure of valence, defined here are pleasure-displeasure, is constantly being investigated. It is the most ubiquitous feature of affective experience, examined through various measures such as facial expressions (Kring, Smith, & Neale, 1994), psychophysiology (Cacioppo, J. T., Tassinary, L. G., Berntson, G. G., 2000), and self-reports (Watson, Wiese, Viadya, & Tellegen, 1999). Valence is the first and most important property of affect. It is seen as a crucial component in major theories of motivation and emotion. It has been documented that valence is consistently found to be the first factor in a factor analysis when examining self-reports of mood (Watson & Tellegen, 1985). Because valence is so crucial to the study of affect, Watson and his colleagues created the Positive Activation Negative Activation Scale to measure the two dimensions of affect (Watson, Wiese, Viadya, & Tellegen, 1999). The PANAS is now a frequently used scale for self-report measures.

One fundamental question that has troubled the conceptualization of affect is whether pleasure and displeasure are configured along one bipolar continuum, centered on a neutral point and extending in two directions, or two continuum, with neutral to pleasure as one, and neutral to displeasure as another, creating the bivalent theory. The bipolar and bivalent views are both used
in an attempt to explain the structure of affect. These two theories constitute the bipolarity debate.

The bipolarity debate and the study of affect have a long history. Wundt, for example, considered emotions to fall along a bipolar valence continuum (Reisenzien, 1992). Bipolarity is the original and long lasting idea that positive and negative states form one bipolar continuum centered on a neutral point. Bivalence is a newer theory that claims valence is composed of two independent states, demonstrated through two continuum, with neutral to pleasure as one, and neutral to displeasure as another (Cacioppo & Berntson, 1994). Some researchers claim this challenge to bipolarity is now the dominant model in the study of affect. Multiple areas within the realm of psychology have begun to expect a standard of bivalence, including the study of motivation (Carver & Scheier, 2002) and clinical psychology (Zautra, Johnson, & Davis, 2005).

**Bipolar Model**

The Circumplex model is a two-dimensional bipolar model used to measure core affect with arousal as the vertical axis and valence as the horizontal axis (Russell, 1980). Pairs of affect separated by several degrees are positively correlated; the pairs separated by 90 degrees are uncorrelated; the pairs separated by 180 degrees are negatively correlated. The Circumplex model has been shown to encompass a fuller measure of affect than simple structures (Russell & Barrett, 1999). The bipolar model suggests that a person cannot experience opposite states of affect at the exact same instant in time.

Russell (1980) demonstrated how affective states are best represented in a two-dimensional bipolar space with affective categories falling in a circular order. Participants were given stimulus words that described various states of affect and were instructed to place each word into one of eight categories (arousal, excitement, pleasure, contentment, sleepiness,
depression, misery and distress) and then to place the eight categories into a circular order with words opposite one another describing opposite feelings and words close to each other describing more similar feelings. A significant number of participants perfectly ordered the words as predicted. This suggests that any affect word could be defined as some combination of the pleasure and arousal components. This follows Schlosenberg’s (1952) idea of a circular order within a two-dimensional space. A circular ordering is further emphasized by the “fuzziness” of the boundaries of the affect words (Russell, 1980). Each word lacks specific definitional boundaries, so there is a gradual but distinct transition from one word to the next. Pleasure and excitement, for example, are close in the circular ordering because their boundaries overlap. A series of overlapping regions with fuzzy borders would result in the continuous placement of the affect terms around the perimeter of the affect space. More recently, Remington, Fabrigar, and Visser (2000) published studies where their data corresponded to the circumplex model using the Fourier series that Browne (1992) developed to specifically assess circumplex structure. Like Russell, Remington et al. found that the angle between positivity and negativity is estimated to be 180 degrees apart.

The circumplex model predicts that core affective experience is bipolar and one can only attended to positive or negative feelings at one time, but not both simultaneously. Core affect is defined as the ongoing, neurophysiological state that results from the evaluations of the internal and external environment (Russell, 2003; Russell & Barrett, 1999). It is how one is feeling at a particular moment though they may not be cognizant of it. People always have core affect, but are often unaware of their current state. It can be brought into consciousness when one experiences a change in core affect. This is analogous to Russell’s example of body temperature (Russell, 2003) He explains that we all have a body temperature at all times. One notices their body temperature when there is a drastic change, whether it be a drop or and increase in
temperature. When the temperature stabilizes or decreases in its low or high extremes, it once again fades into the unconscious. At any time, core affect can be mapped along a two-dimensional figure with pleasure-displeasure along one axis and activation-deactivation along the other axis. The consequence of psychometric studies suggest the positive and negative are 180 degrees away from each other so one does not have a core affect that encompasses both at the same time.

**Bivalent Models**

The Evaluative Space Model is a bivalent model of affect where biologically based positive and negative evaluative systems are assumed to be independent of one another so a person can process and feel positive and negative affect simultaneously. Originally created to compare sympathetic and parasympathetic nervous systems and their effect of the cardiovascular body system, the ESM was next applied to attitudes and evaluation and currently to affect (Bernston, Cacioppo, & Quigley, 1991; Cacioppo & Bernston, 1994; Cacioppo, Gardner, & Bernston, 1999). It outlines all possible affective outcomes, not just positivity and negativity. Affective processes are expressed as a summation of independent positive and negative evaluative channels. Reciprocal activation occurs when a given stimulus increases the activation of the positive system and decreases activation on the negative system, or vice versa; co-activation occurs when the positive and negative systems increase or decrease at the same rate; uncoupled activation occurs when increases or decreases of the positive and negative systems are unrelated to one another. They claim that the existence of separable mechanisms allows for the occasional, even if infrequent, co-occurrence of both positive and negative activation. Cacioppo and colleagues argue that co-activated positive and negative affect systems add together to produce ambivalent or mixed affect responses.
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The Dynamic Model of Affect (Reich, Zautra & Davis, 2003) presents another example of the bivalent structure of affect. It attempts to incorporate both bivalent and bipolar approaches to measuring affect. Reich and colleagues factor in the effect of stress on one’s experiential space and attention. They claim that stress negatively inhibits the system by overpowering it with multiple demands while low levels of stress allow complex processing of information. With this in mind, the researchers believe that when a person is under high levels of stress positive affect and negative affect become bipolar with “highly inversely coupled affect.” Reich, Zautra, and Potter (2001) claimed to find evidence for the DMA in two studies they conducted. The first study tested college undergraduates by administering the PANAS and by measuring cognitive simplicity with the PNS scale (Neuberg & Newsom, 1993). The second study assessed older adults and their response under the stress of chronic pain. The results of both studies suggest that the correlations between items were weaker under low-stress conditions. Reich et al. (2003) concluded that the two studies provided evidence that stress could inhibit one’s ability for complex processing, which therefore leads a person to shift from bivalence to bipolarity.

Evidence for bivalence

The psychometric dispute pertaining to bipolarity challenges the idea of what exact correlation defines bipolar opposites. This debate provided the foundation for what emerged as the bivalent view of affect. The most common way that researchers tested bipolarity was through the observed correlation between self-reported positive and negative feelings. If pleasant and unpleasant states are bipolar opposites, then the assumption is that their observed correlation should be \(-1.0\). The presence of one state (displeasure) should perfectly predict the absence of another (pleasure). Anything lower is considered evidence of bivalence (Reich, Zautra, & Davis, 2003). Studies have found correlations weaker than \(-1.0\) and have attributed it to bivalence (Schimmack, 2001).
Another vein of research designed to investigate bivalence has been to evaluate participants’ affective self-report measures. Larsen and colleagues have produced the most widely cited studies that show how people are able to report mixed feelings (Larsen, McGraw, & Cacioppo, 2001; Larsen, McGraw, Mellers & Cacioppo, 2004). In their 2001 series of studies, Larsen et al. tried to create situations that might induce affective co-activation. They recorded participants’ self-reported feelings both before and after exposure to positive and negative stimuli on unipolar Likert-type scales. The participants watched the movie *Life is Beautiful* as well as rated their affect on a typical day in college compared to moving out of a dorm at the end of one’s freshman year of college and graduating from college. They found that participants were more likely to report mixed affect after these events than before. The set of studies were criticized because the self-report measures were not taken in real time and follow-up studies were done to correct for this.

In an attempt to correct the confounds in the previous set of studies, Larsen, McGraw, Mellers, and Cacioppo (2004) conducted two studies looking at the effects of gambling on emotion. By creating outcomes that could have been better (disappointing wins) and outcomes that could have been worse (relieving losses), they sought to measure if the outcomes fostered neutral affect, sequentially mixed affect or simultaneous mixed affect. To obtain a continuous rating of affect in real time, participants were asked to press a button when they felt good and to release it when they no longer felt good. They were also told to press a different button if they felt bad and to release it if they no longer left bad. The participants were further instructed to press neither button if they felt neither good nor bad and to press both if they felt both good and bad at the same time. Larsen et al interpreted the results of the first study as evidence for mixed emotion of positive and negative affect. The results of the second study claim to demonstrate that mixed emotion is elicited simultaneously. This extension of Larsen, McGraw, and Cacioppo’s
(2001) work was viewed as further evidence for the bivariate model of emotion consistent with the ESM.

**Concerns with evidence for bivalence**

The assumption of a necessary perfect correlation is problematic. The observed correlation between alleged bipolar opposites varies with the time frame of assessment, the errors inherent in measurement, the response format used, and the specific items selected to assess each one (Feldman Barrett & Russell, 1998; Russell & Carroll, 1999). All could lower the observed magnitude of the correlation. Logistical problems with measurement techniques were demonstrated by Russell and Carroll (1999). In the discussion, they comment that a correlation of −1.0 can be achieved only when affect is measured with a bipolar format, but an empirical test of bipolarity requires a unipolar format. A bipolar format consists of a scale ranging from happy to sad while a unipolar format is two scales, one from neutral to happy, the other from neutral to sad. The predicted correlation between true bipolar opposites each measured on a unipolar format is −.467. The explanation is that many people respond to unipolar formats as if they were bipolar, treating the midpoint of the scale as neutral, rather than a moderate pleasure or displeasure. (Russell & Carroll, 1999). Russell and Carroll (1999) also refined the circumplex model of affect in their explanation of correlations. They suggested that instead of being perfectly negatively correlated, words at opposite ends of the bipolar continuum are mutually exclusive. A perfect negative correlation implies a linear relationship, but a mutually exclusive relationship yields a correlation weaker than −1. Response format must be taken very seriously and correlation coefficients cannot be expected to provide a definitive test of bipolarity in an attempt to resolve the bipolarity debate.

Because researchers have considered weaker correlations to support both bipolar and bivalent models, Larsen et al. have experimentally manipulated mixed emotions in their attempt...
to support a bivalent model of affect. These studies contain several shortcomings. The studies Larsen, McGraw and Cacioppo (2001) conducted found that although they strictly used a unipolar format and asked the participants to respond considering how they were feeling “right now, at this very moment”, the time period the participants evaluated may have been extended. Larsen et al. recognized the participants might have understood the task as reporting how they felt about the entire movie, which contained both happy and sad elements. Participants may also have been evaluating the entire day of graduation or moving out, which contained both happy and sad moments. Summation judgments may have been made instead of evaluating core affect. This becomes a point of concern because the utilization of summary judgments by participants does not accurately portray their change in affect in a given period of time. People may naturally summarize their affect into small increments of time that they see as small, but a minute is constructed of many smaller instants in the stream of consciousness. The longer the measurement moment, the greater the chances of shifting back and forth between pleasant and unpleasant affect and, therefore, the greater the chances of seeing bivalence in a summation judgment.

The follow-up studies conducted by Larsen, McGraw, Mellers, and Cacioppo (2004) avoided the problem of summary judgments by asking the participants to continuously record their changes in affect by pressing two buttons, but this methodology also contained several shortcomings. Pressing the buttons is a dual task, meaning a participant had to simultaneously track two motor movements rather than one movement to report changes in affect. It has been found that dual tasks are difficult for people to complete (Broadbent, 1982). This is demonstrated by the elapsed time (three to nine seconds) it took for the participants to record their responses of mixed affect. Some researchers believe that the dual task creates an attentional bottleneck (Pashler, 1998). When people perform two simultaneous tasks, processes involved for both tasks compete for access to the attentional bottleneck, resulting in delayed processing for one or both
tasks. So, regardless of whether transitory feelings are bipolar or bivalent, participants would have been under cognitive load while reporting their experiences, which would influence the participant’s reliability in using the buttons for positive and negative affect. Therefore, if the participant’s affect moves from positive to negative, the attentional bottleneck may cause a delay in the release of the button pressed for the positive response, creating a measurement of mixed affect.

**A new approach**

There are several ways in which these shortcomings may be repaired. We believe that a single task method for reporting continuous ratings must be used, thus overcoming the phenomenological issues of summary judgments and dual tasking. The Continuous Two-Dimensional Valence Grid is one such measure, as it allows participants to provide a continuous rating of their core affect in real time. The CTVG consists of pleasant and unpleasant along the axes. And individuals can use a stylus to continuously rate their affect by moving the stylus to the corresponding position on the grid. Moving along the axes indicates bipolarity and the utilization of the middle of the grid indicates bivalence. The grid is connected to a computer so the ratings are instantly recorded every 100 milliseconds. One hundred milliseconds is used because of Pashler’s (1994) finding that in making judgments, a person cannot experience two opposite affective states within a 100 ms period. Using the CTVG eliminates summary judgments since the participant is making a continuous rating in real time. It also eliminates the dual task paradigm seen in Larsen et al.’s button pressing because the continuous rating method using the stylus necessitates only one motor movement.

Dichotic listening is the second method designated to improve upon other studies of affect. Shadowing stimuli in one auditory channel by repeating out loud the words that are spoken as the narrative is heard while different stimuli plays in the unattended channel allows for
the possibility that the stimuli in the unattended channel may also influence the participant’s measurement of affect. Dichotic listening is a good method for testing bipolarity because it provides a tight control of attention, which is lacking in the Larsen et al. studies. In their series of research, it is not obvious what the participant is attending to when they are asked to rate their affect. When the participants come out from watching *Life is Beautiful* and are asked to document their affect, they could have been thinking about different elements of the movie or something completely separate for the experience of the movie, thus showing how by not controlling their attention, the material they are attending to is ambiguous and does not offer a strong argument for the bivalent model of affect. Dichotic listening, in contrast, allows us to control when the participant shifts from shadowing one set of affect inducing stimuli to a set of stimuli meant to induce the opposite affective state.

In a dichotic listening task, it has been shown that when shadowing, one may be able to pick up on the affective content of the unattended channel but not the semantic content (Bentin, Kutas, & Hillyard, 1995). The bivalent model predicts that since you can process positive and negative information simultaneously, one will feel both good and bad when something pleasant is playing in one ear and something unpleasant is playing in the other ear. If this is the case, there should be no cost when the stimuli switches. The bipolar model of affect, on the other hand, predicts that a person will process only positive or negative information. The affective experience will be congruent with the valence of the attended ear. The bipolar model would expect a cost, in the form of a delay, since positivity and negativity cannot be processed simultaneously. So when one’s attention shifts to a narrative of a different valence, the participant cannot continue to shadow the second narrative while processing the last information from the first narrative.
The feature-integration theory (Treisman & Gelade, 1980) gives further insight into the usefulness of a dichotic listening task to determine bipolarity or bivalence. The theory proposes that attention is directed at one object at a time, allowing those features which co-occur in the same field of attention to be combined into the correct, unitary whole. When task conditions, such as brief exposure, overloading, or the demands of a competing primary task preclude the consecutive focusing of attention on each of the items present, illusory conjunctions may be formed. This same combination of multiple parts parallels what I predict can be seen in a dichotic listening task when a participant switches their attention to the unattended channel. What the participants shadow then becomes muddled and erroneous, and can sometimes become a combination of words from the narratives being spoken in each auditory channel, demonstrating how narratives with opposite valence cannot be processed simultaneously. The bivalent model would predict that the influence would have no effect on the shadowing since both positive and negative information can be processed at the same time. The bipolar model of affective experience would demonstrate that the influence from the unattended channel will then cause interruptions in the shadowing since narratives of both positive and negative affect cannot be processed simultaneously. Interruptions in shadowing can be indexed by a number of things; these include misspoken and omitted words.

Measuring the vocal delay, or shadowing latency, was utilized by Treisman, Squire, and Green (1974) as a test on the effect of semantic processing and selective attention. Through the use of a dichotic listening task with word pairs, they found that semantic interference arose when participants switched their attention to the unattended channel the participant related the shadowed word and the word in the unattended ear and a vocal delay occurred. This delay would not be expected, particularly in the negative positive and positive negative conditions, if people
processed affect following the bivalent model since there would be no conflict in processing information with opposite affect.

I will use dichotic listening to test the bipolarity theory. Through the dichotic listening task I will attempt to support the proposition that pleasure and displeasure are configured along one bipolar continuum so positivity and negativity cannot be experienced simultaneously, as opposed to the bivalent theory that claims pleasure and displeasure are two distinct continuum that function separately allowing one to experience positivity and negativity simultaneously.

I predict that more shadowing errors will occur in the conditions of positive negative and negative positive that the conditions that use a neutral narrative. The conditions are named for the order in which the narratives used in the dichotic listening task will be presented (e.g. In the positive negative condition, the participant would first shadow the positive narrative while the negative narrative plays in the unattended channel and then the channels would switch so the participant was shadowing the negative script while the positive script played in the unattended channel). The inability to simultaneously process positive and negative information will make it difficult for the participant to switch from processing a positive script to a negative script or vice versa, thus causing the participant to incorrectly shadow or to omit a portion of the words altogether. I also predict that a vocal delay will occur when the participant makes the transition from shadowing one script to the second. A vocal delay is the pause in speech the participant makes when they process the change in narratives. The participants will rate their core affect on the grid as primarily bipolar during the experiment since the material in the unattended channel will not be in the instructed focus of attention and therefore not processed simultaneously.

Thirdly, I predict that participants will be primarily in bipolar space during the experiment, but will rate their experience as bivalent during the summary judgment. This will occur at a much stronger rate in the negative positive and positive negative conditions than in the neutral
conditions. Finally I tested a prediction on the bivalent model. It would estimate that after making an error a person would momentarily feel bivalent. I expect that this will not occur and the person will remain in bipolar space.

**Method**

**Participants/Subjects**

The participants were 21 undergraduate and graduate students, ranging between 18 and 26 years in age. They were given the choice of receiving payment or research credit and were recruited through fliers posted on campus. The condition to which a participant was assigned is representative of the order in which the narratives were to be presented. The participants were then randomly assigned to one of four conditions: positive negative, negative positive, neutral negative, or neutral positive. There were 6 participants in the positive negative condition, 7 participants in the negative positive condition, and 4 participants in each of the neutral conditions.

**Materials**

*CTVG*

The materials used in the study were the Continuous Two-Dimensional Valence Grid (CTVG) and spoken narratives. The CTVG is 6’x6’ and its axes are labeled with pleasant and unpleasant. Moving along the axes indicates bipolarity and the utilization of the middle of the grid indicates bivalence. The participant used a stylus to continuously record their affect in real time throughout the experiment. A computer recorded their coordinated on the grid every 100 ms.

*Narratives*

The narrative used to train the participant to shadow was information pertaining to King Penguins. The positive narrative is an excerpt taken from Jerry Seinfeld’s comedy sketch
Doctors. The negative narrative is an excerpt taken from Primo Levi’s *Survival in Auschwitz.* The neutral narrative is composed of various other information about King Penguins (see appendices A, B, and C). The narratives were all one minute in length. All stimuli were recorded using a male voice.

**Procedure**

The participants first completed the grid training stage. To train a participant to use the CTVG, the dimensions of the grid and how to use the stylus were explained. It was emphasized that there was no right or wrong way to use the grid as long as the participant was using it to document how they were feeling at that exact moment in time. They could move the stylus as quickly or slowly as they wanted and could utilize the axes or the middle of the grid as long as their movements correctly demonstrated their current state of affect. The researcher then read three different scenarios (see appendix D) to the participant so the participant could practice using the grid and become comfortable and familiar with the process of continuously rating their current state of affect.

Following the grid training, the participant was then trained to shadow. The process of shadowing was explained to the participant by the researcher. The participant then shadowed a practice narrative multiple times until comfortable with the process.

The participant then began the experimental stage. The researcher began recording the participant using a stationary microphone on the table in front of the participant. The narratives for the assigned condition were played through the headphones on the participant. The participant was directed to shadow only the narratives being played in the right ear. Different narratives were played simultaneously in the left and right auditory channels. Halfway through the experiment, the narratives switched auditory channels with no delay between the presentation of the two narratives. (e.g. a participant in the positive negative condition would have the
positive narrative playing in the right ear while the negative script was playing in the left ear. After thirty seconds the narratives would switch channels so the negative narrative would now be playing in the right ear and the positive narrative in the left ear.) The participant was told they would hear multiple narratives, but were not told the narratives would switch channels. Throughout the experimental phase, the participant used the CTVG to continuously record their affect while shadowing the two narratives.

**Results**

The mean percent of overall errors made was found to be $M = 19.5207$. The mean delay for overall errors was found to be $M = 1.8133$. The mean percent of time spent in bivalent space was found to be $M = .2710$.

To test predictions that switching from a narrative of one valence to a narrative of another would produce the greatest amount of errors, the data was analyzed using a univariate ANOVA. The percent of shadowing errors made by the participants in each of the four conditions (negative positive, positive negative, neutral negative, and neutral positive) was analyzed. $M = 26.9106$ for the positive negative condition, $M = 8.7618$ for the negative positive condition, and the mean for both the neutral conditions is approximately $M = 23$ (neutral negative $M = 23.2954$ and neutral positive $M = 23.4890$ (See table 1). The was not a significant difference between these means: $F(3, 20) = 1.902, p = .168$.

Looking more closely at the shadowing errors made by the participants, the data show that the participants did not move into bivalent space after making an error. The mean percent of time that the participants did switch from a bipolar rating to a bivalent rating is $M = 4.9738$. For the remainder of the errors made, the participants remained consistent in their rating.

It was found that the percent of errors corresponded to the vocal delay of the participants. First, the mean delay was calculated for the separate conditions. It was found that the positive
negative condition had the longest delay when the narrative switched with an $M = 3.0100$. The negative positive condition showed the shortest delay with an $M = .7071$. The mean delay for the neutral conditions fell in between with the neutral negative $M = 2.2000$ and the neutral positive $M = 1.5675$ (See Table 1). There was no significant difference between these means; $F(3, 20) = 1.833, p = .179$.

The findings for the summary judgment data support the hypothesis that when making the discrete judgment at the end of the experiment, the participants would rate themselves as feeling bivalent, especially those in the conditions of positive negative and negative positive. The grid was split into 25 squares to reflect 2 unipolar 5-point Likert scales as is found in PANAS (Watson & Tellegen, 1985). The 9 squares along the axes represent bipolar space and the 16 squares in the middle represent bivalent space. It was found that 42.9% of the time participants were making bivalent summary judgments. The other 57.1% of the time, participants were making a bipolar summary judgment. When those participants who reported a bivalent summary judgment were examined by condition, it was found that 77.8% were in the positive negative and negative positive conditions while only 22.2% were in the two neutral conditions.

The mean percent of total time spent in bivalent space as well as percent of time split between the narratives is shown in Table 3. The percent of time spent in each grid square is shown by condition in figures 1 through 4. Since there are nearly twice as many bivalent squares on the grid as bipolar squares, the probability of being in bivalent space instead of bipolar space is quite high even if one’s position on the grid is randomly chosen. This probability makes the results of this study conservative. The probability of being in bivalent space instead of bipolar space is high, making these results conservative. For the positive negative condition $M = .1364$, negative positive had $M = .3674$, neutral negative had $M = .2388$, and neutral positive had $M = .3363$. There was no significant difference between these means; $F(3, 20) = .732, p = .547$. For
the first narrative, the percent of time spent in bivalence for each condition was also examined. For the positive negative condition $M = .0150$, negative positive had $M = .2452$, neutral negative had $M = .2000$, and neutral positive had $M = .3983$. The percent of time spent in bivalent space during the second narrative was also examined. For the positive negative condition $M = .2578$, negative positive had $M = .4895$, neutral negative had $M = .2775$, and neutral positive had $M = .2742$.

**Discussion**

Several hypotheses important to continuing the bipolar versus bivalent model of affective experience discussion were tested in this study. I predicted that shadowing errors would occur and that a higher percentage of errors would occur in the conditions of positive negative and negative positive than the neutral conditions. Along with this prediction, I expected that the participants would not move into bivalent space after making an error as the bivalent mode predicts. I also predicted that a vocal delay would occur when participants switched from shadowing a narrative of one valence to a narrative of another valence and that this delay would be longer for the participants in the positive negative and negative positive conditions than the neutral conditions. I further predicted that the summary judgments for the participants in the positive negative and negative positive conditions would be recorded in bivalent space at a higher rate than those in the neutral conditions. I finally predicted that participants would not rate their affect in accordance to the bivalent model that claims people and process and feel both positivity and negativity simultaneously and so in this dichotic listening task their state of affect would be a combination of positivity and negativity. I believe the participants would rate their affect as being in bipolar space since they would not process both positivity and negativity at the same time.
The results provide some support for the main hypotheses of the study. A higher percent of errors was made by participants in the positive negative condition than the neutral conditions, but the lowest amount of errors was made in the negative positive condition. Participants rarely moved into bivalent space after making an error in shadowing. Participants in the positive negative condition experienced a longer vocal delay than the neutral conditions when their attention was shifted from a narrative of one valence to a narrative of another, but the negative positive condition has the shortest vocal delay. A majority of the participants in the positive negative and negative conditions rated themselves in bivalent space in their summary judgment; this was at a much higher rate than those in the neutral conditions.

The percent of errors made by the participants partially supports our second hypothesis that a larger number of errors would be made in the condition where a positive narrative was presented followed by a negative narrative in the attended channel and the condition where a negative narrative and then a positive narrative are presented in the attended channel than in the conditions where a neutral narrative was followed by either a positive or negative narrative. More errors were made in the positive negative condition than that neutral conditions, but the negative positive condition had the lowest percent of errors.

The bipolar theory of affective experience was further supported when participants failed to move into bivalent space after making an error is shadowing. The bivalent theory claims that since a person can process and experience positive and negative affect simultaneously, the attentional shift to the unattended channel and thus the errors in shadowing, would conclude with the person moving into bivalent space since they have processed the affective information from both narratives. I found that people remained consistent in their locations on the grid prior to and after the error was committed.
The data for the vocal delay partially support our hypothesis that participants would struggle to switch from processing one affect inducing narrative to a narrative that induced the opposite state of affect. This delay is shown most strongly in the condition of positive negative and supports the hypothesis. The negative positive condition has the shortest delay of the four conditions, which does not support my hypothesis. Both of the negative conditions also showed a vocal delay when the narratives switched auditory channels, which was unexpected. If the bivalent model of affect were correct, it could be assumed that the participants would have no trouble shifting from one narrative to the next and could easily process the quick change from one affective state to the opposite. The delay we predicted to see in the conditions of positive negative and negative positive would have demonstrated that the participants could not easily process opposite affect inducing narratives, thus two affective states were not acting independently. Since this was only seen in the positive negative condition, the results are ambiguous and further research is needed to reject or support the hypothesis.

These results for the vocal delay heavily demonstrate a positivity bias. The data for the positive negative condition follow the concept that it is difficult for a person to disengage from positive affect when there is a shift to negative affect (Mezulis, Abramson, Hyde, & Hankin, 2004). This lack of disengagement is visible in the long delay between when a participant was processing positive information and needed to quickly begin processing negative information. The tendency is then to make more errors because the participants could not disengage and begin processing the negative information as quickly as it was being received.

The results I found with the percent of errors mirrors what was found with the vocal delay. As the length of the delay increased, so did the percent of errors made. Words from the unattended channel may have been attended to at various times by the participant. As the
participant attempted to shift back to the material they were instructed to shadow, the difficulty in processing information of the opposite valence may have caused them to stumble and omit the correct words, thus making errors. This is consistent with Wood and Cowan’s (1995a, 1995b) replication of Moray (1959). They found that when shadowing, a third of participants were able to recall a switch from backward to forward speech and the participants who noticed this change in the unattended channel also displayed a drastic increase shadowing errors.

At first glance, the data from the summary judgments do not seem to support our hypothesis that participants will be more prone to rate their affect in bivalent space during the summary judgments. Further investigation revealed that these data, though seemingly unsupportive of our hypothesis, in truth do support our assertion. Although a greater percent of the participants rated themselves in bipolar space, there was a drastic division among the condition in regards to one’s judgment. Mixing 30 seconds of periods of positive and negative affect would logically lead to a participant rating their overall experience in bivalent space. There is less of a chance of this happening for the neutral conditions since both states of affect are not induced equally.

The percent of time the participants spent in bivalent space on the grid is unexpected. The means for the various conditions were much higher than anticipated, particularly in the negative positive condition and the neutral conditions. It may be the case that participants were combining their affective state during the first narrative with their changed affective state during the second narrative, causing the participants to evaluate themselves as being in a bivalent state. When split between the two narratives, the percent of time spent in bivalent space increases for all of the conditions with the exception of neutral positive. Though they spent more time than expected in
bivalent space, it was not found that participants were temporarily shifting into bivalent space after making an error in shadowing.

This study could be improved upon in several areas. The small sample size may have contributed to the ambiguity of the results. Addition participants are needed to better test these hypotheses. The positive narrative may have contributed to the positivity bias and so testing a different narrative may be beneficial. Also, it was found that non-native English speakers had a much higher rate of difficulty shadowing. In future research it may be necessary to recruit only native English speakers. Finally, it would be useful to get a baseline reading of the participants’ state of affect coming into the study to allow for further analyses if a bias were to occur again.

The implications of the bipolar and bivalent theories are far-reaching. Depending on whether there are two constructs or one measuring affect, the experience and expression of mixed emotion is a possibility or negated. Some researchers believe that the conscious experience is unified (Nagel, 1971; Searle, 2004). Different modalities come together to create a full conscious experience. Evidence for the bipolar theory would emphasize that positivity and negativity are one modality. Attention to a specific modality (visual, auditory, tactile) can push one to the forefront of the conscious experience, but these individual modalities are part of one experience and one cannot have two conscious experiences at the same time. The way in which affect is measured in psychological research would also need to be adjusted if the bipolar theory continues to show more evidence for its existence. Output systems and the manner in which knowledge is gathered and processed will be rethought.

This study illustrates the potential of dichotic listening tasks to continue the bipolar versus bivalent discussion. Further studies can be done that incorporate psychophysiological measures to allow the researcher to make a comparison between the responses of the physical
self against the self-report measures of the participant. Future research is needed to resolve the debate, but continued application of both subliminal and supraliminal tasks may help to resolve some of the persistent questions on the structure of affect.
References


Francis.


Schlosenberg, H. (1952). The description of facial expressions in terms of two dimensions.


Table 1

The means for vocal delay in seconds and the means for percent of errors made.

<table>
<thead>
<tr>
<th>Condition</th>
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<th>SD</th>
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Table 2

Total percent of shadowing errors made, percent of shadowing errors made during the first narrative, percent of shadowing errors made during the second narrative.

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Table 3

Total percent of time spent in bivalent space measured in seconds, percent bivalent for the first narrative, percent bivalent for the second narrative.

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<th>SD</th>
<th>tot2per</th>
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Figure 1. Percent of time spent in each grid square for the positive negative condition.

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Figure 2. Percent of time spent in each grid square for the negative positive condition.

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Positive
Figure 3. Percent of time spent in each grid square for the neutral positive condition.

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Figure 4. Percent of time spent in each grid square for the neutral negative condition.

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<tbody>
<tr>
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Appendix A

The doctor always wants you to take your pants off. “Take your pants off and get in there. I’ll speak to you with no pants. You take your pants off and then I’ll tell you what I think about everything. I speak to no one wearing pants.” A little psychological leverage for him. And any difference of opinion, pants always beats no pants. Just once I’d like to say to the doctor, “you know what, I’m not ready for you yet. Why don’t you go back to your little office and I’ll be with you in a minute. And get your pants off too.” What does he need that little office for? I guess he doesn’t want people to see him looking things up. What the hell was that? Jesus Christ that was kinda gross! I’m in big trouble here, that wasn’t the tube or the circle.

A friend of mine is going in for a nose job next week. A guy. Rhinoplasty, that’s what they call it. You’ve heard that term. Rhinoplasty. Rhino. Is that necessary? The person obviously is aware that there is a problem. They made the appointment.
Appendix B

On the morning of the 21st we learned that on the following day the Jews would be leaving. All the Jews, without exception. Even the children, even the old, even the ill. Our destination? Nobody knew. We should be prepared for a fortnight of travel. For every person missing on the roll-call, ten would be shot. [N]ight came, and it was such a night that one knew that human eyes would not witness it and survive. Everyone felt this: not one of the guards, neither Italian nor German, had the courage to come and see when men do when they know they have to die.

All took leave from life in the manner which most suited them. Some praying, some deliberately drunk, others lustfully intoxicated for the last time. But the mothers stayed up to prepare the food for the journey with tender care, and washed their children and packed the luggage; and at dawn the barbed wire was full of children’s washing hung out in the wind to dry. Nor did they forget the diapers.
Appendix C

Colonies of the so-called King Penguin are spread widely throughout the southern hemisphere. Their breeding areas stretch as far as the north of Antarctica to the islands southeast of Australia and southwest of New Zealand. The King is one of some 18 species of penguin, all of which live in the southern hemisphere.

The King penguin can reach a height of 90 centimeters and weigh between 11 and 15 kilograms, making it the second largest penguin species. King penguins have distinct patches of orange color on both sides of their head, which extend down and meet beneath the chin. They have yellow coloring just below the chin, and have slivery-grey chests. Part of their adaptation to the cold includes oily feathers, which cover the outer layers of the penguin. Underneath is a layer of soft down feathers and under that a thick layer of fat. This keeps the penguins so warm they will actually fluff their feather to released trapped heat in order to cool down.
Appendix D

Graduation Day – Scenario 1

Imagine that it is your graduation day. You have been waiting for this day for a long time. You think back to the anxiety of your first day of college. You were scared and became unsure of your decision to go to college at all. When your parents left, you felt alone and deserted. You just wanted to be back in the safety of your home. But now, four years later, you are a confident senior. You got invited to all the best parties and had many good times and you were able to take the best classes with the best professors. As you put on your cap and gown, you feel like a great success. Your roommates and your best friends are ready, and together you leave for the ceremony. You’ve been dreading the ceremony. And you concerns were not unfounded. The speaker is boring and the ceremony drags on. But now, as they are reading off the names the anticipation builds. Yours is next. As they read your name a rush comes over you. You turn back and see your parents proudly clapping. You’re happy to be a success in their eyes. As the dean firmly shakes your hand, you feel elated. Then as you retake your seat, a new rush comes over you. You are once again uncertain. You’ve come so far in college, but now you must start again in the real world. The economy is bad and you don’t yet have a job. You don’t want to live at home, but you can’t afford to live anywhere else. You are worried about your future. You break out of this horrible daydream as your friend’s name is read. You’re so happy that they made it, but at the same time you can’t shake your own apprehension. This is truly a bittersweet moment. You give one last thought to the difficult road you must now navigate, but then feel pure joy as the ceremony concludes and you throw your cap into the pure blue sky. You made it!

Move Out Day – Scenario 2

Picture that it is the last day of your junior year. As your phone rings, you hear your mom on the other line. She is downstairs. You can’t wait to see her. You have not seen your parents since Easter break. As you meet them at the door, you see their smiling faces and give your dad a hug. As you return to your room, you realize that you have a ton of stuff to move out. It’s not going to be fun making all those trips up and down the stairs in the sweltering heat. At least school is over though. Finals were long and difficult. You finished your last one this morning. You’re sure that you bombed it. You can’t believe how difficult it was. You’re not looking forward to seeing your final grade. But right now you’re relieved. The stress of school is over for a few months. Meanwhile, your roommate has finished packing and is walking out of the door. You say goodbye and know that you’ll miss them. You had a really fun year. You regret that you live across the country from them, and probably won’t see them all summer. After the packing is complete, you get into the car. That’s one more year that you’ve finished. When you come back to school, you will finally be a senior. In a way, you can’t wait for next year to begin. It should be a blast. First you have a tortuous 6 hour car trip ahead of you. You’re cramped in the back seat along with text books and clothes. Your parents turn on their favorite easy listening radio station. You can’t stand it. You think to yourself, “are we there yet?” You don’t know how you’ll survive the summer living with them. But then you think of all your friends at home. You can’t wait to see them. The summer should be a fun one. You turn around and take one last look
at your dorm. You know that once the car pulls away, all of your memories of junior year will be the past. They were both good and bad, but now you must move on.

**Breaking Up – Scenario 3**

It was a call that you knew was coming for months. Your boyfriend/girlfriend dumped you. You had considered making the call yourself numerous times. You also had wanted to break up with them. But what gets you is how they did it. What a jerk. You can’t believe they said all those nasty things about you. But you do like the result. You didn’t really want to be going out with them anymore. So you are relieved. But at the same time it still feels strange. You guys seemed like the perfect couple for over two years, until things recently took a turn for the worse. You like to remember the good times and all the fond memories you share. You guys had so much in common. You could always find a way to have fun together. Being single again is not how you felt it would be. Part of you wants to cry, but another part of you just wants to let loose and laugh. You wonder what will happen now. Will you ever find someone again, or will you be alone for the rest of your life? Maybe yes, maybe no. You can’t decide, you’re unsure. But at the same time a burden has been lifted from you. You knew this had to happen eventually, so it as good just to get it over with. Things had progressed to the point where they would never be the same again. As bad as that sounds you know it is true. The phone rings again. A rush comes over you. Is it them calling you back? Do they want to get back together? But it is only your friends. They’re inviting you to a party, you think you’ll go. Who knows, you may even meet someone there you like. You have a new freedom you haven’t known for a long time.