Fall 2013

Mood Effects on Memory

Wanyu Sun
University of Colorado Boulder, Wasu4532@Colorado.edu

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Investigator: Wanyu Sun

Dept. of Psychology

Wasu4532@Colorado.EDU

University of Colorado – Boulder

Thesis advisor: Alice F. Healy

Dept. of Psychology

Alice.Healy@Colorado.EDU

Defense November 1, 2013

Defense Committee:

Alice F. Healy, Dept. of Psychology and Neuroscience

Richard K. Olson, Dept. of Psychology and Neuroscience

Jennifer Lynn Bair, Dept. of Sociology

Abstract

Forty-eight subjects were given a questionnaire testing their memory for objects in a picture and a computerized navigation task testing their ability to remember and follow navigation instructions while they were in both a happy mood and a sad mood. Music and an object finding task were used to manipulate their mood. The Positive Affect and Negative Affect Schedule (PANAS) was used to verify their mood in each condition. The hypothesis was that subjects would do better and be more efficient on both tasks when they are in a good mood. The results did not yield significant main effects of mood on either task, but they did verify that the music and object finding task changed the subjects' mood as expected and they suggested more improvement on the navigation task in the sad than in the happy mood.

Keywords: questionnaire, computer program, mood, music, object, PANAS efficiency

Mood Effects on Memory

Many psychology experiments have been done to test the relationship between mood and efficiency. Different experiments have different conclusions, and there is not an agreed result about this topic. Some results show that a good mood might have a positive relationship with efficiency, but not all results agree with that conclusion.

One study conducted in 1985 by David Kavanagh, who was at the University of Sydney, and Gordon Bower, at Stanford University, was about mood and efficiency. They recruited 16 students from Stanford University with 9 males and 7 females. They wanted to find how mood could influence efficacy judgment concerning a variety of activities. There were three mood interventions: happy, neutral, and sad. Subjects were hypnotized under each mood intervention. For the happy mood, they were asked to imagine having a good time with an opposite sex friend; in order to elicit a bad mood, they asked subjects to imagine having a romantic failure with an opposite sex friend, for example, being rejected to set up a relation. They also asked subjects to imagine they were relaxed in a sofa and reading a book; in this way they hoped they could put subjects in a neutral mood. Given the mood scale from 1 (mild) to 10 (extreme), subjects were told to hold their mood around the intensity of 7. Each subject experienced all three moods, but with different orders to reduce confounding variables. When they were in each mood, investigator asked them 15 questions, and subjects were supposed to answer by what degree they thought they could successfully do a certain activity. One example of the questions was to ask subjects to decide by what degree they thought they could “attend a party where there will be no one you know”. The range of the ratings was from 0 (can’t do it) to 100 (certainly can do it). The experimental results indicated that when subjects were in a good mood, their performance on a

15-item questionnaire had an average score of 64.3. They had an average score of 46.3 in the sad condition and 57 in the neutral condition. They concluded, "emotional states have widespread impact on judgments by making mood-congruent thoughts more available" (Kavanagh & Bower, 1985, p. 507). One of the many implications of this study would be that happy mood would increase self-efficacy.

Cervone, Kopp, Schaumann, and Scott (1994) published their paper "Mood, self-efficacy, and performance standards: Lower moods induce higher standards for performance" in *Journal of Personality and Social Psychology*. In their study, they had a series of experiments. In one of their experiments, they had 90 undergraduates (45 men and 45 women) at the University of Illinois at Chicago who were taking introduction psychology. Equal number of female and male subjects were assigned randomly into three groups: positive, negative and neutral. Subjects' mood were measured by a questionnaire and then they were asked to imagine a scenario described on a tape, and they were also told to assess the duration. They had their mood tested twice after 10 minutes. In the negative condition, subjects heard a detailed narrative depicting that their best friend was dying from cancer. In the positive condition, subjects heard a narrative in which they won a free trip to Hawaii. In the neutral condition, subjects were asked to visualize their room at home. After the imagination, subjects had a mood self-report indicating how did they feel right now based on an 8-point scale. Then subjects had a questionnaire about their self-efficacy judgment and standards for performance. They were asked to rate their standard of performance and their level of self-efficacy in various domains. The level of self-efficacy was measured in four domains: social skills, general academic performance, academic grade attainment, and the completion of class assignments. For the first two: social skills and general academic performance, subjects were asked to judge their ability compared to others on a scale

ranging from 1 (“At least as well as some people”) to 10 (“Better than all other people”). For the last two “academic grade attainment” and “the completion of class assignments,” subjects were asked to indicate the absolute level of their performance and judged their capability. There were four items: “overall grade point average (GPA) this year” (5-point scale), “grade on a paper outside one’s major,” “grade on an unannounced quiz in one’s major,” “grade in introductory psychology.” They had two items assessing the percentage of class assignments subjects judged they could complete: “overall this academic quarter” and “reading assignments in introductory psychology.”

Analyses showed that the mood intervention was successful. They found “As predicted, negative mood induced a pattern of responses in which subjects’ standards substantially exceeded their efficacy expectations. This negative discrepancy largely reflected the effects of mood on standards. Subjects exposed to the negative mood induction held higher standards for evaluating their performance than subjects in the other condition. In contrast, mood had a lesser effect on perceived self-efficacy” (Cervone, Kopp, Schaumann, & Scott, 1994, p. 502).

Adrienne Elliott (2006) mentioned the relation between mood and self-efficacy in her article “Do coping responses and dietary restraint predict self-efficacy following depresses or elated mood induction in female smokers?” In her article, she tested 83 female smokers, and they were from a large private urban university and the local community. Mean age of them was 33, and 66% of them were white who reported smoking an average of 11 cigarettes every day. She said negative mood might have the influence to reduce self-efficacy and so smoking female who had negative mood would find it difficult to make goal directed efforts, meaning it was hard for them to quit smoking or lose weight. Among the 83 females she found both depressed mood and positive mood were significantly correlated to smoking refrain but not for eating refrain. Also,

positive mood and depressed mood had different effects on women who were high on dietary or who were low on dietary.

Many psychology experiments are interested in the relation between music and mood. Music has application in many fields, and the most popular application would be music therapy. Although music has been wildly used in practice, and the reason to apply music into life is that some people believe music can influence people's mood, but other people believe mood is not influenced by music.

Stratton Zalanowski (1991) from the Pennsylvania State University conducted an experiment "The Effects of Music and Cognition on Mood." In his study, he had 72 college students (28 male, 44 female) from introductory psychology or a music appreciation course, and none of them were music majors. They were signed into nine different groups randomly. They had two selections of music to represent positive mood and negative mood. For positive mood, they had as music Copland's Appalachian Spring theme; and they had Beethoven's Symphony No.3 in E flat. Op. 55. 2nd movement, 1st theme to elicit negative mood. During debriefing, subjects said they were not very familiar with these two songs, and one of the subjects said the music used to cause depression was his favorite song, so he was replaced. They also had a 63.5 cm by 106.5 cm poster reproduction of "Snap the Whip" by Winslow Homer, which was used as their second material. Based on the poster, subjects were asked to tell a happy, sad, or neutral story depending on which group they were in. In their study, they measured mood using a standard form of the Multiple Affect Adjective Check List (MAACL). Their subjects were also asked to answer a short questionnaire to report their subjective feelings about the music and picture on a Likert-type scale of 1-10. So they had two variables manipulated: music and story instructions. Three levels of story instructions were happy, sad, and neutral. Subjects were tested

in a small room with the poster put on the wall in front of them above the wall. Subjects were asked to make up a story based on that poster, what was going on and what would happen next. Subjects were given three minutes making up a story to a tape recorder with comfort volume level of pleasant or depressing background music or no music. Subjects filled out MAACL scale at the beginning and the end of the test session. After MAACL, they were asked to rate the picture and music. From data analysis, they found a significant main effect for story instructions but not for music. With neutral story instruction, if subjects had depressing music, they were more depressed with a significant value; if subjects had happy or no music, depression had a slight decrease. Furthermore story superseded the effect caused by music. No significant differences were found between the three happy story groups nor the three sad story groups. Sad story group subjects showed significant change to be more depressed, and happy story group had little change in depression. Looking at data analysis done to positive affect score, same thing happened as in negative affect score analysis. There was significant main effect for story instruction, but not for music. The rating for the picture also was only influenced by story instruction but not by music. People who made a happy story of it rated it most pleasant, and people who made a sad story of it rated it least pleasant regardless of music condition. For depressed music, they rated the music as depressed no matter what story they made; but for happy music, they rated it less happy when they were asked to make a sad story. The study indicated that cognitive instruction had more influence on mood than music. Music effect on mood was less than cognitive instruction, but it still had an effect on mood, as can be concluded from the condition when they made neutral story with different music conditions.

Van der Zwaag and colleagues (2012) conducted a study “The influence of music on mood and performance while driving.” Their purpose was to use driving, the most popular music

listening situational contexts, as an example to see how music can influence personal experiences and behavior. Nineteen subjects were in their study (13 men and 6 women), with age ranging from 22 to 44 years old ,and they had their driving license for 4 to 22 years. They reported they had mileage driven ranging from 6000 km to 700,000 km. There were three music condition: positive music, negative music, and no music. Before the experiment, subjects were asked to complete an introductory session in which they rated 60 songs on perceived valence and energy levels on 7-point Likert Scales. The 60 songs were from a database containing 1800 songs in total, and the reason they chose these 60 songs was that they have a large range of valence and energy values. After the rating, each subject selected 9 songs for both positive condition and negative condition. Of the 9 songs, 3 of them were used for music mood induction; 3 of them for the high demand drive, and the other 3 were for the low demand drive. The study used a ST Software driving simulator to mimic the situation of driving. Using UWIST Mood Adjective Checklist (UMACL), subjects' mood score of valence (ranging from unpleasant to pleasant); energy (ranging from tired/without energy to awake/full of energy) and calmness (ranging from tense to calm) were collected. The rating scale mental effort (RSME) was also used to assess mental effort. Subjects need to do the experiment in four parts in the driving simulator facility of the University of Groningen. The first one was an introductory session, and in the next three subsequent sessions they were measured by physiological sensors. At first they got a baseline for subjects' body conditions, during which they watched an 8 min Coral Sea diving movie. After this baseline assessment, subjects filled out the UMACL. After this task, they were asked to listen to a music for 8 min and were instructed to listen to music carefully because there would be questions about it. In the control group (no music), subjects were asked to sit and relax for 8 min. All subjects were not told the 8 min was used for mood induction. After 8 min, they filled

out the UMACL again. Next, subjects were instructed to drive as usual. After 8 min, they were instructed to park and the music was stopped. Then they were asked to complete the UMACL questionnaire and RSME scale. Compared to the first drive, the second drive was in a lane width and after that, subjects filled out UMACL and RSME again. There were significant main effects on valence and energy reaction scores during the mood induction. Positive music results in higher valence and energy reaction scores compared to both the negative music and the no music conditions.

In my experiment, all subjects were given a Positive and Negative Affect schedule (PANAS) to assess their mood before any manipulation to determine their mood baseline. Their mood was manipulated by both music and an object finding task. After the mood manipulation, they were given a questionnaire examining their memory for objects in a picture and a computerized navigation task to assess their ability to remember and follow navigation instructions both in a happy mood and in a sad mood. Their second and third PANAS scores were compared to their scores in the baseline condition, and in that way their mood changes could be observed. Finally their scores on the questionnaire and in the navigation task in the two condition were compared to determine whether their mood influenced their ability to perform these tasks.

Method

Subjects

There were 48 undergraduate students from introduction psychology classes in the University of Colorado at Boulder who served as participants. According to university policy, they earned 2 credits for participating in the study. Colorblind students were excluded due to the

presence of some questions about colors. Because there was no concern about gender difference, the 48 subjects tested were not gender restricted. As for gender, race was also not a restriction for participation. But in order to make sure subjects could totally understand what they were supposed to do and know each word on their questionnaires, PANAS scales, and instructions for the navigation task, non-native English speakers were excluded.

Design

This experiment used a within-subjects design. The independent variable was mood as elicited by happy music and finding an existing object or sad music and finding a non-existing object in a picture. The dependent variables were the scores on two questionnaires and on two navigation tasks.

Materials

PANAS is the mood scale test I used in my experiment. It contains 20 items with 10 positive items and 10 negative items. PANAS is the abbreviation of positive affect and negative affect schedule. Positive words are: interested, exited, strong, alert, enthusiastic, proud, active, inspired, determined and attentive. Negative words are: distressed, upset, guilty, scared, irritable, hostile, jittery, afraid, ashamed and nervous. Subjects were asked to rate their mood by giving scores for each word on the PANAS. Scores range from 1 to 5: 1 means very slightly or not at all; 2 means a little; 3 means moderately; 4 means quite a bit and 5 means very much. The sum of the scores for each of the 10 adjectives in each of the two categories (positive and negative) gives total positive and negative affect scores ranging from 10 to 50. A subject who has a high score on PA represents enthusiasm, energy, mental alertness and determination; a low score on PA represents lassitude and lethargy. A high score on NA represents anger, fear, guilt, tension,

sadness, scorn, and disgust; a low score on NA represents calmness and serenity. PA and NA are two independent scores. More information about PANAS can be found in method part and also in article "The effect of social interaction, exercise, and test stress on positive and negative affect" by Cutris W. Mclntyre and David Watson. How I use those scores is that I compared how the PA score changed before and after the intervention and how the NA score changed before and after the intervention. To be more specific, in my experiment, subjects filled out their first PANAS scales and those were used as baselines to measure how their mood changed during experiment. They filled out their second PANAS score after they listened to a song and finished an item-finding task. When a subjects is required to listen to happy music and finds an existing object in a picture, I expect a higher score on PA and a lower score on NA from the second PANAS score to indicate this subject's positive mood increased and negative mood decreased compared to the baseline condition because of the intervention. Otherwise after a subject listens to sad music and cannot find a non-existing object, I expect a lower score on PA and higher score on NA, indicating this subject became depressed due to our intervention.

I picked two pieces of music: Purple Passion and Pastorale. Purple Passion has a strong and fast-paced tempo and it gives people a feeling of happiness, whereas Pastorale is slow-paced and sounds sad. They have the length of 3 minutes and 49 seconds for Purple Passion and 3 minutes and 51 seconds for Pastorale. In order to prevent subjects being influenced by the music's name, I renamed the two songs as 1b and 2b.

I used a picture from the game "where is Waldo." I chose this picture because it has many items and many colors so looking for any particular object would be hard and would require effort on the part of the subject.

The questionnaire I used was a way to collect some data to be one of my dependent variables, which is based on this picture. For example, one question from the picture is “How many yellow toilets can you see in the picture?” I don’t want the questions on the questionnaire to be too obvious so that subjects with high self-efficacy and low self-efficacy would get same scores. There are two versions of the questionnaire, and each of them consists of 5 questions. The two versions of the questionnaire were originally from a 10-question questionnaire. The original questionnaire was designed to have a similar style for each pair of questions. Here is what I mean by similar style for each pair of questions: The third question was “What was the most frequently used picture pattern of the roof and fence” with 4 choices: A. Stars B. Stripe C. Solid Color D. Spots. The fourth question is “What was the big fuzzy animal in the middle of the picture?” with 4 choices: A. Lion B. Bear C. Tiger D. Monster. In Question 2 and Question 3, subjects are asked the question “what is in the picture,” which requires the subjects to retrieve information from memory. Question 5 asks subjects, “The background color was dark yellow” which is a true or false question. So does Question 6, “There are trees in the picture” and it is also a true or false question. For Question 5 and 6, both of them provide subjects with a statement and ask subjects to judge whether it is true or false. This question style doesn’t need subjects to come up with details by themselves but to see if they have memory for the picture, if they can give a correct judgment on the provided statement. Question 9 was “Did you see a carousel?” and Question 10 was “Did you see a small fishing pond?” Carousel and small fishing pond are not in the picture. Hence, if subjects answer “yes” on both of them, it is likely that they are answering these questions by guessing but not based on their memory. To split this 10-question questionnaire, even numbered questions went to the even version of the questionnaire, and odd numbered questions went to the odd version of the questionnaire. I call them

questionnaire O and questionnaire Ev. Questions in the two questionnaires have similar difficulty. Both of the two versions have two multiple-choice questions and one true or false question, which asked them if there was some object in the picture. The last two questions are yes or no questions asking them if they saw some object. Every subject got both of the two questionnaires in a counterbalanced order. Half of the subjects got questionnaire O after they heard the happy music and got questionnaire Ev after they heard the sad music; another half of the subjects got the questionnaires in the opposite order, they had questionnaire O after they heard the sad music and got questionnaire Ev after they heard the happy music. In case of ceiling effect or floor effect, I employed another dependent variable: what score subjects get from a computer program testing comprehension and memory for navigation instructions.

Here is a quotation from a power point (from Dr. Vivian Schneider) introducing what the computer program is: "Communication between air traffic controllers and flight crews primarily involves giving and receiving navigation instructions. Errors often occur under these circumstances. Although they are usually caught and corrected, they sometimes lead to incidents and accidents. We have been studying this communication situation with the eventual goal to determine ways to reduce such critical errors. In particular, we have been investigating factors influencing participants' ability to follow navigation instructions in a paradigm meant to mimic communication between air traffic controllers and flight crews." There was a piece of paper with instructions about what this computer program is and what the subjects would see in the experiment. After subjects read the instruction, I was with them and asked if they have any questions. I explained to them again what they were supposed to do and pointed out some frequently made mistakes. After that I asked them to show me how they would click on the instruction paper with grids on it. Then I gave them practice navigating on the computer to see if

they really understood what they were supposed to do and to help them if they had any further questions. In the main experiment, there were four 4x4 grids, which represented a 4-level matrix of 4x4 grids. A red star was shown in one of the small boxes. In my experiment, subjects heard navigation instructions through a headphone connected to a lab computer. Instructions in the headphones told them what direction they should move and how many steps or levels should they move. For example, if they heard “left two squares”, then subjects needed to click two boxes on the grid from starting point. There were 6 different levels of difficulties ranging from one command (e.g., “left 2 squares”) to six commands (e.g., “down 1 level, forward 1 step, right 1 square, back 1 step, left 2 squares, right 1 square”). There were 12 blocks of trials; each block had included every length (from 1 to 6) of instructions, but they were in random order. So there were 72 messages in total. I divided the trial sequences into two halve: two six-block navigation tasks, block A and block B, with 36 messages for each. They were used each time after mood intervention to test how people performed. The order of using block A and block B was counterbalanced; half of the subjects had block A first and then they had block B, and half of them have block B first and then block A. The messages were scored in an all-or-none manner; if subject got the message right, the subject got 1 point for that length; if the subject got it wrong, he or she got 0 points.

My hypothesis is that after an intervention that puts subjects in a good mood they can perform better than after an intervention that puts them into a bad mood. In previous versions of this task (e.g., Barshi & Healy, 2002) performance dropped off markedly as message length increased from one to six commands, with a large decline between Message Lengths 3 and 4. Also, subjects’ performance improved across blocks of trials, showing the benefits of practice. Some subjects might think that the navigation task is too difficult, especially given those long

length messages, so it was important for researchers to tell them at the beginning of the study that they would have a difficult task and they should not feel bad if they were not doing well because we are not expecting anyone to get all of the messages right, we just want to see what is their limit. Without this information, if subjects were not satisfied with their work, even though they were in a good mood condition, they could be easily frustrated.

Procedure

After they signed the consent form, they filled out their first PANAS scale. Their scores on NA and PA were recorded separately to be their baseline data. Then I gave them music of Purple Passion or Pastorale depending on which group they were in. Half of the subjects were aimed to be in the happy mood first and then in the sad mood. To manipulate their mood, subjects were asked to listen to the happy music and find an existing object and then to listen to the sad music find a non-existing object. In this condition, after their first baseline PANAS scale, they were given Purple Passion first and then they were asked to find an old man reading a newspaper. Music and object finding are the two independent variables and they always have the same direction to change subjects' mood: happy music always followed by looking for an old man reading a newspaper (existing object) and sad music always followed by looking for a skateboard (non-existing object). After the mood manipulation, they filled their second PANAS scale to record their mood after the first mood control. Then they answered either the even version or the odd version of the questionnaire and finished their first part of the navigation task. That was half of the experiment, the experiment was a within-subject design study and each of the subjects experienced both good and bad moods in a counterbalanced order. After the good mood condition, they were put into the bad mood condition. Subjects were asked to listen to the music Pastorale and find a non-existing object: a skateboard. When subjects were asked to find

an object, they were not told that there would be one object that existed in the picture and the other one that they were asked to find did not really exist in the picture. By doing so, when subject could not find the non-existing object, they would feel frustrated and thus the object-finding task could enhance their bad mood caused by the sad music. After the sad music and finding the non-existing object, they were asked to fill out their third PANAS scale following another questionnaire and the second half of computer program navigation task.

Subjects were signed into 4 groups randomly. In group A, subjects had happy music together with a task finding an existing object from a picture followed by the odd version of the questionnaire and the navigation task, and then they had the sad music and searched for a non-existing object followed by the even version of the questionnaire and the navigation task. In group B, subjects had sad music and searched for a non-existing object followed by the even version of the questionnaire and the navigation task, and then had happy music and found an existing object followed by the odd version of the questionnaire and the navigation task. In group C, similar to group A, subjects had happy music and found an existing object, and then had sad music and searched for a non-existing objects. What was different from group A is that subjects in group C had the even version of the questionnaire under the good mood and the odd version of the questionnaire under the bad mood. In group D, subjects had sad music and searched for a non-existing object first and then had happy music and found an existing object. The mood order is the same as group B but in group D, subjects had the even version of the questionnaire under their bad mood and had the odd version of questionnaire under their good mood. Happy music was always combined with finding an existing object and sad music was always combined with searching for a non-existing object because again, music and finding an object are two interventions that work together to intensify subjects' mood.

Results

In the analysis of the PANAS scores, there was a main effect of test type, $F(2, 94) = 3.688$, $MSE = 9.463$, $p = .0287$; subjects' PANAS scores were significantly different when they were at baseline, happy, or sad. Also subjects' affect type showed a significant main effect, $F(1, 47) = 339.663$, $MSE = 42.002$, $p < .0001$. Their positive PANAS scores were significantly higher than their negative PANAS scores overall. Of greatest interest is the interaction of test type and affect type, $F(2, 94) = 6.223$, $MSE = 11.236$, $p = .0029$. It showed a significant result, and it reflects the fact that positive affect was higher for the happy test than for the sad test, whereas negative affect was higher for the sad test than for the happy test. This interaction verifies that the music manipulation and the picture finding task had the desired effect on mood, with the happy music and successfully finding an object increasing positive mood and the sad music and failing to find an object increasing negative mood. We can see this pattern in Figure 1, with the positive bar higher in the happy condition than in the sad condition and the negative bar higher in the sad condition than in the happy condition.

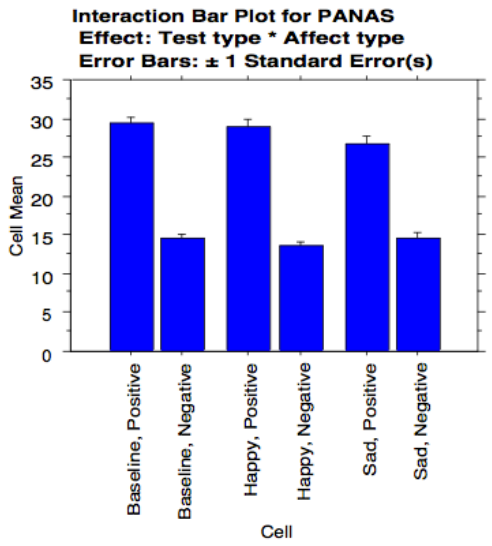

Figure 1. Mean PANAS score as a function of test type (baseline, happy, sad) and affect type (positive, negative).

When the analysis was restricted to the two affect types happy and sad, the results were also significant. The main effect of affect type is $F(1, 47) = 281.425$, $MSE = 32.051$, $p < .0001$. Subjects' positive PANAS score were significantly higher than their negative PANAS scores overall. The interaction of test type and affect type was also significant, $F(1, 47) = 9.300$, $MSE = 12.940$, $p = .0038$, which means listening to happy music and finding an existing object increased their positive PANAS scores and listening to sad music and finding a non-existing object increased their negative PANAS scores.

Originally the hypothesis was that subjects in a happy mood would do better on the questionnaire task than subjects in a sad mood, but the numerical difference was in the opposite direction. The difference was not significant, but on average, when people were in the sad condition, they got 3.250 questions right out of 5, and they got 2.896 questions right out of 5 when they were in happy condition, $F(1, 47) = 2.597$, $MSE = 1.159$, $p = .1138$.

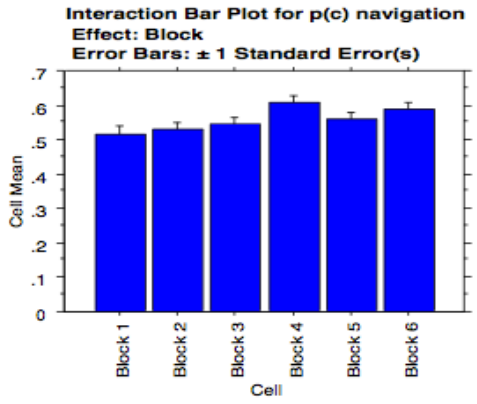

Figure 2. Proportion correct on the navigation task as a function of block.

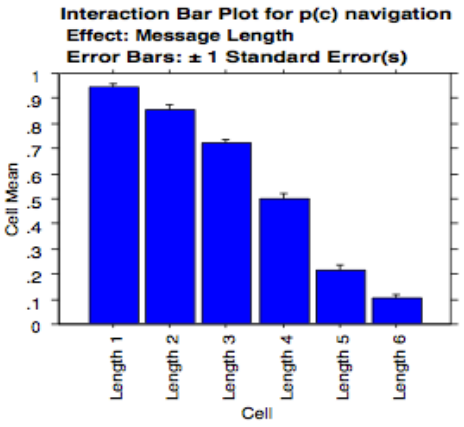

Figure 3. Proportion correct on the navigation task as a function of message length.

In the analysis of the navigation task, there was a significant main effect of block (see Figure 2), $F(5, 235) = 5.068$, $MSE = 0.140$, $p = .0002$; and significant main effect of message length (see Figure 3), $F(5, 235) = 345.178$, $MSE = 0.198$, $p < .0001$. Subjects' accuracy was significantly different when they had messages of different lengths and when they were in different trial blocks. Figure 2 shows that their performance generally improved with blocks due

to practice, and Figure 3 shows that their performance monotonically decreased across increasing message lengths.

There is no significant effect of mood, but the most interesting was the fact that the interaction of mood condition and block was marginally significant, $F(5, 235) = 2.025$, $MSE = .130$, $p = .0759$. In Figure 4, we can see that when people were in a happy mood, their performance on the navigation task did not vary much, but when they were in a sad mood, their performance on the navigation task was poor at first but then their performance improved when they did more blocks, presumably because they recovered from the sad mood.

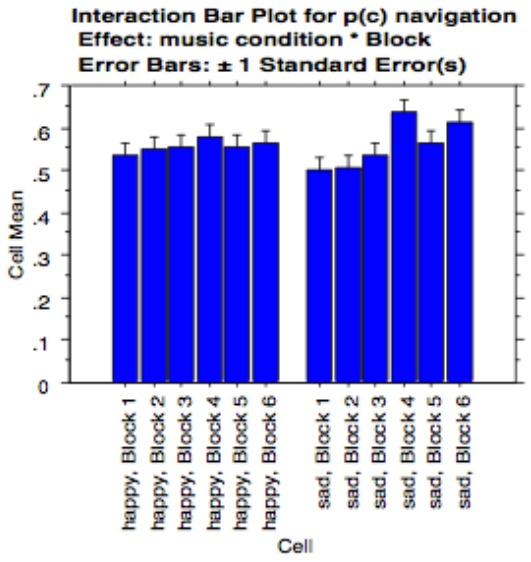

Figure 4. Proportion correct on the navigation task as a function of mood condition and block.

The interaction of block and message length was also significant, $F(25, 1175) = 2.356$, $MSE = .119$, $p = .0002$. In the first block, subjects could follow short message lengths, but they could not follow the commands accurately when the message lengths were greater than 2. With practice, they could manage longer commands. It is instructive to see how their performance improved if we compare Message Length 6 across blocks. Generally their performance on

Message Length 6 increased continuously across blocks (see Figure 5).

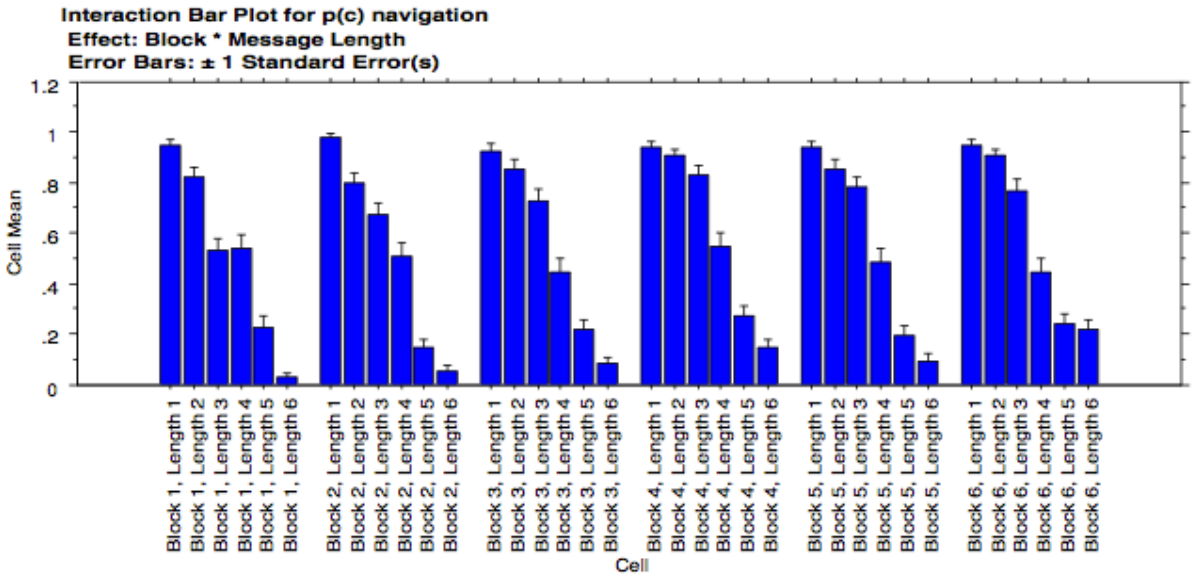

Figure 5. Proportion correct on the navigation task as a function of block and length.

Discussion

Music and the object finding task had influence on subjects' mood in my experiment. The two purposely confounded independent variables helped each other to influence subjects' mood, so at this point I cannot say it is the music or the object finding task that changed subjects' mood. It would be a good follow-up experiment to examine this issue, but in the present experiment, it is not important to know whether it is music alone or the object finding task alone that made subjects' mood change.

As in earlier experiments involving the navigation task (e.g., Barshi & Healy, 2002), subjects were more accurate with shorter message lengths than with longer message lengths, and generally they performed better and better over blocks. The improvement over blocks is due to

practice, and for this reason, half of subjects were put into the happy mood first and then the sad mood and the other half of subjects were put into sad mood first and then the happy mood. In this way, half of the subjects had their first navigation task when they were in a happy mood, and half of the subjects had their first navigation task when they were in a sad mood.

An interesting result showed up unexpectedly: When subjects were in a happy mood, they had a small improvement over blocks, but when they were in a sad mood, they had a larger and more consistent improvement over successive blocks. So subjects tended to do worse when they were in a sad mood at the beginning of practice, but they tended to do better when they were in a sad mood at the end of practice.

The data collected from questionnaire shows the opposite result as I hypothesized. In fact subjects got more answers correct in a sad mood than in a happy mood. The effect was not significant, and it is difficult to know whether the lack of significance is attributable to low statistical power, due either to the small number of subjects or the small number of questions. Besides exploring which independent variable influences mood more, music or the object finding task, figuring out whether there would be a significant difference for subjects in answering questions correctly given a large subject sample and a questionnaire with more questions could also be a interesting follow-up study. Because the purpose of the questionnaire was to measure subjects' efficiency to study a picture in a given amount of time, the more they answered correctly on the questionnaire means the more details they noticed and remembered and that should indicate whether they perceived the picture better.

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