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The Effect of Musical Valence on Pseudoneglect in a Likert-type Rating Task

Jane H. Barrow,[*1] Lindsay Wenger,[*] Janet E. Bourne,[#] Carryl L. Baldwin[*]

[*]*Department of Psychology, George Mason University, USA*
[#]*Bienen School of Music, Northwestern University, USA*
[1]jbarrow1@gmu.edu

ABSTRACT

Background

Music is widely listened to in everyday life, and has been shown to affect a wide range of behaviors from basic decision tasks to driving performance (North & Hargreaves, 1999). Music also has been shown to influence the emotional experience of its listeners, the valence of which can be predicted based on attributes such as tempo and key (Krumhansl, 1997). Another aspect of everyday life is the use of spatial attention, which is used in most tasks regardless of whether it is simple or complex. Could manipulating emotion through music affect spatial attention? Theories of emotion and spatial attention suggest that this may be the case (Arguin & Bub, 1993; Lee, Loring, Meader, & Brooks, 1990).

Pseudoneglect is a phenomenon where neurologically normal individuals demonstrate a reliable bias towards the left visual hemifield. Theories of spatial attention suggest that because the right hemisphere of the brain is more involved in visuo-spatial processing, it has greater activation which leads to the biasing of the left visual hemifield. This can be shown using a basic line-bisection task, where normal individuals reliably bisect the line to the left of true center. It is hypothesized that due to the greater activation in the right hemisphere from using spatial attention, there is a perceived elongation of the line that falls within the left visual hemifield, biasing the bisection toward the left (Arguin & Bub, 1993). Interestingly, this effect carries beyond simple line bisection: Nicholls and colleagues (2006) found that the effect carried into surveys that used a Likert scale to make judgments. Participants showed a reliable leftward bias in their ratings, regardless of the anchor, which was methodically flipped throughout the experiment.

One theory of emotion in the brain suggests that there are hemispheric asymmetries in the brain for different emotional valences. Studies using sodium amobarbital have shown that when the right hemisphere is temporarily deadened (and therefore the left hemisphere is more active), individuals experience feelings of elation and demonstrate laughter. When the left hemisphere is temporarily deadened (thereby allowing the right hemisphere to be more active), individuals react in the opposite manner, experiencing feelings of depression and often cry (Lee, Loring, Meader, & Brooks, 1990). Such evidence suggests that the left hemisphere is associated with positive emotions, while the right is associated with negative emotions. If this is the case, it might be possible to impact spatial attention, as measured by attentional biases in pseudoneglect, by manipulating emotions, and therefore hemispheric activation.

Aims

The current study sought to determine if manipulating emotional valence through music would increase, reverse, or ameliorate pseudoneglect in neurologically normal individuals. It was hypothesized that negative emotions, which were predicted to activate the right hemisphere of the brain, would increase pseudoneglect, whereas positive emotions, which were predicted to activate the left hemisphere of the brain, would reverse pseudoneglect.

Method

One hundred fourteen participants performed a rating task using a visual analog scale on works of art in silence or while listening to music with a sad or happy valence. The musical stimuli were combined into two medleys. The happy medley consisted of selections from Mendelssohn's Violin Concerto in E Minor, Op. 64, 3rd movement, Haydn's Piano Concerto in D Major, Hob. XVIII:11, 1st movement, and Prokofiev's Romeo and Juliet, Op. 64, "Gavotte," while the sad medley consisted of selections from Faure's Elegie, Op. 24, Bruch's Kol Nidrei, Op. 47, and Albinoni's Adagio in G Minor. The valence of the medleys was confirmed using independent raters. Each medley was approximately 15 minutes in length, and was set on continuous repeat during the experiment so that there was no gap in musical presentation. The music was presented at 45 dB amid a quiet background.

Participants rated both portrait art that contained a human face and abstract/scene art that did not contain a human subject. Each image was rated for valence by a pilot group of participants, such that there were equal numbers of positive, negative, and neutrally valenced images. Positive portrait stimuli contained happy faces generally combined with bright hues and positive scene stimuli contained bright colors and energetic lines. Negative portrait stimuli contained unhappy faces generally combined with dampened color and negative scene stimuli contained washed out hues with flatter lines and disturbing imagery. Neutral portraits featured a face that had an enigmatic expression and neutral scenes featured an unexciting subject.

The rating took place on a visual analog scale which allowed the participants to drag a marker along a line marked only by two anchors – there were no numbers for use during rating as one would find on a traditional Likert scale. When rating portraits, the participants were asked to rate how happy or sad the person in the picture appeared to be. When rating scenes, participants were asked to rate how cheerful or upsetting they found the image to be. Half-way through the experiment, the anchors were switched so that positive anchors were on the right side of the screen for half of the experiment, and on the left side for the other half. Half of the participants started with the positive anchor on the right and half started with it on the left. Although there were no numbers visible to the participants, the scale went from +100 to -100. For the

purposes of this paper, only the portrait results will be discussed.

Results

The results of the trials where the positive anchor was on the left, and therefore returned a negative value, were reverse coded so as to be comparable to the ratings where the positive anchor was on the right. A 2 (anchor direction) x 3 (image valence) x 3 (music type) mixed ANOVA revealed a main effect of image valence, $F(2, 222) = 3.56$, $p = .03$, partial $\eta^2 = .03$, such that regardless of anchor direction, the stimuli were ranked differently based on their valence. This resulted in a neutral value of 0 with negative scores indicating sad valance and positive scores indicated happy valance. Planned comparisons revealed unexpectedly that neutral stimuli were rated as significantly sadder ($M = -4.36$, $SE = 1.31$) than happy stimuli ($M = -1.44$, $SE = 1.41$; $p = .14$) or sad stimuli ($M = 1.01$, $SE = 1.46$; $p = .01$). There was also a main effect for music condition, $F(2, 111) = 3.28$, $p = .04$, partial $\eta^2 = .06$, indicating that regardless of the stimulus, those in the happy music condition rated stimuli as happier ($M = 1.28$, $SE = 1.45$) than those in the silent condition ($M = -2.71$, $SE = 1.28$), who rated stimuli as happier than those in the sad condition ($M = -3.37$, $SE = 1.24$). Finally there was an interaction between anchor direction and music condition, $F(2, 111) = 3.26$, $p = .04$, partial $\eta^2 = .06$, which is shown in Figure 1. The result demonstrates that in the silent condition, stimuli were rated as happier when the positive anchor was on the left, indicating pseudoneglect. This effect was reversed in the presence of happy music, however, and when sad music was present, the pseudoneglect effect was ameliorated.

Conclusions

The results from the neutral (silence) music condition, replicate earlier findings of pseudoneglect, showing that individuals rated stimuli as happier when the positive anchor was on the left as compared to the right. If there was no spatial bias, the rating should have been the same regardless of which side the positive anchor was on. Additionally, the effect was actually reversed when happy music was playing. This suggests that activation of the left hemisphere due to the evocation of positive emotions may have overridden the activation in the left hemisphere due to the use of visuospatial attention, shifting the bias to the right.

The finding that the sad music condition resulted in a shift in the bias toward the right runs opposite to the hypothesis, since the prediction was that additional activation in the right hemisphere due to negative emotion would actually increase pseudoneglect and the bias toward the left. It is possible that the results are due more to arousal than valence, which was not measured during this experiment. If this was the case, the valence theory of emotion in the brain would not make the correct predictions regarding biases in spatial attention.

Additionally, there is the issue of strange ratings of the stimuli – neutral images were rated as sadder than either happy or sad images. Since this was not the result of the pilot testing of the images, it is unclear as to why participants ranked the stimuli in this way. The strangeness of the valence rankings, however, does not affect the pseudoneglect findings, since those are comparisons between the same ranking on two differently anchored scales. It is also possible that a few of the stimuli were not particularly good examples of each valence, thereby affecting the results for each condition.

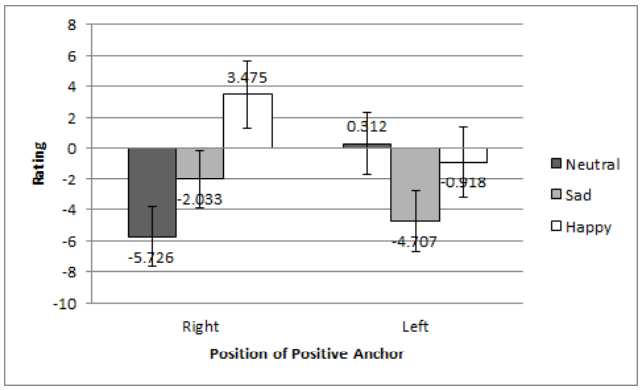

Figure 1. Mean rating as a function of anchor position and music condition. Error bars indicate standard error.

The results of this study indicate that pseudoneglect is something that can be modulated through changes in the emotional state of the perceiver, which can be influenced by music. Although the results were not conclusive in terms of the hypothesis, it is clear that the bias in spatial attention was affected by music and the emotions evoked by it.

Keywords

Pseudoneglect, musical valence, spatial attention, hemispheric specialization, emotion.

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