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Anger and Stress

The Role of Landscape Posters in an Office Setting

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Anger and stress management have become important issues in the modern workplace. One out of four American workers report themselves to be chronically angry, which has been linked to negative outcomes such as retaliatory behavior, revenge, interpersonal aggression, poor work performance, absenteeism, and increased turnover. We hypothesized that people who work in office environments decorated with aesthetically engaging art posters would experience less stress and anger in response to task-related frustration. Two hundred and ten college students were randomly assigned to different office conditions where abstract and nature paintings were hung on the walls. Participants performed four mild anger-provoking computer tasks and then reported their levels of state anger and stress. Results indicate that different office conditions had a significant influence on state anger and stress for males but not for females. Males experienced less state anger and stress when art posters were present. Through mediation analysis, we found that increased proportions of nature paintings decreased state anger because of decreased levels of stress.

Keywords: *state anger; stress; landscape; office environments; art posters*

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Introduction

Anger in the Workplace

Anger has become increasingly recognized in recent decades as a major problem in the American workplace. It is common to see in the daily newspaper or on the nightly news broadcast a story about an overstressed, disgruntled employee attacking or even killing coworkers. Indeed, recent studies show that one of four American workers is chronically angry at work (Gibson & Barsade, 1999), contributing to more than 16,000 threats and 700 attacks in offices across the United States each work day (Kaufer & Mattman, 2004). Anger has also been linked to other, more insidious outcomes, such as decreased productivity, increased absenteeism, ineffective work relationships, and a variety of health complaints, including anxiety, stress, depression, high blood pressure, and heart disease (Begley, 1994; Diamond, 1982; Friedman & Roseman, 1974; Gibson & Barsade, 1999; Neuman & Baron, 1997).

These adverse outcomes are estimated to cost American businesses billions of dollars each year (Hughes, 2001). As a result, many organizations have begun to implement programs to address workplace anger. These programs typically include conflict-resolution training, counseling services, and anger management workshops (Rai, 2002). Often overlooked in these efforts, however, is the physical work environment and its impact on anger in the workplace. Because the physical setting forms the framework in which work activities occur, it is quite possible that particular features are related to feelings of anger. Understanding these relationships, then, could go a long way toward ameliorating the problem of workplace anger and violence.

But what is anger, and what are the eliciting factors? Spielberger (1996) describes two types of anger: state and trait. In general, the former is a temporary emotional state that consists of feelings of annoyance, rage, or both, with concomitant activation of the autonomic nervous system (Spielberger, 1996). The primary external causes of state anger are obstructions to goal-directed behavior and acts perceived to be unjust. People also experience anger when they are harassed, assaulted, or attacked (Spielberger & Sydeman, 1994; Törestad, 1990). Trait anger, on the other hand, refers to a disposition over time that influences whether situations are perceived as anger provoking, as well as how often state anger is experienced. Individuals high in trait anger "are likely to perceive a wide range of situations as anger-provoking, and to respond to such situations with elevations in state anger" (Spielberger, 1996, p. 7).

In general, younger individuals such as adolescents and college students have higher state and trait anger levels than older persons (Spielberger,

1996). Gender plays a distinctive role as well. Men and women experience state anger differently, with men typically experiencing higher levels of state anger in the same situations (Forgays, Forgays, & Spielberger, 1997; van der Ploeg, 1988).

Environments and Anger

Research on environments and anger has focused primarily on ambient characteristics of public spaces; very little is known about the impact of the physical work environment on anger. Ozone levels and higher daily temperature have been found to be positively associated with family disturbances, as well as assaults against persons (Rotton & Frey, 1985). There is also evidence that persons living in noisy neighborhoods tend to be more annoyed than persons living in quiet neighborhoods (Evans, Hygge, & Bullinger, 1995). Other research has related crowding to hostility, increased defensive postures, and negative remarks (Evans, 1979). One study with a closer link to office environments found that high room temperature and air pollution were linearly linked to anger (Baron & Bell, 1975; Rotton, Frey, Barry, Milligan, & Fitzpatrick, 1979).

A growing number of studies suggest that exposure to natural elements like water and trees—whether it is simulated or actual—tends to mitigate anger. Residents of buildings surrounded by vegetation, for example, reported less aggression against their partners than residents of buildings surrounded by built elements (Kuo & Sullivan, 2001). Similarly, people who viewed videotapes of natural settings reported lower scores for the Anger and Aggression factor of the Zuckerman Inventory of Personal Reactions than persons viewing urban environments (Ulrich et al., 1991). Feelings of anger also decreased among people who had walked through a nature reserve but increased among people who had walked in urban settings without vegetation (Hartig, Evans, Jamner, Davis, & Gärling, 2003). Finally, nature scenes, with and without coordinated nature sounds, have been found to reduce agitated and aggressive behaviors (Ulrich, 1979; Whall et al., 1997).

Stress in the Workplace

Aside from anger, stress is another well-documented workplace problem. Stress is widely defined as the process by which an individual responds to a situation that is challenging, demanding, or threatening to his or her well-being (Baum, Fleming, & Singer, 1985). Recent surveys indicate that 40% of U.S. workers experience stress in their workplace, and 75% of workers believe that today's workers have more on-the-job stress than workers of a generation

ago (National Institute for Occupational Safety and Health [NIOSH], n.d.). Workers who are more stressed feel less competent, when compared with workers who experience less stress (Bhagat & Allie, 1989), make fewer rational decisions (Keinan, 1987), and want to quit their jobs (Chen & Spector, 1992). Stress is also related to absenteeism, lack of productivity, and increased turnover (Jackson, 1983), and can lead to sabotage, interpersonal aggression, hostility, poor health, and even injury (Chen & Spector, 1992; NIOSH, n.d.). Thus, stress in the workplace poses a threat not only to the well-being of workers but also to the health of organizations.

Environments and Stress

Several investigations have found that exposure to nature such as trees, grass, and flowers can effectively reduce stress (Ulrich, 1979, 1981; Ulrich et al., 1991). A prospective controlled experiment showed that stressed blood donors had lower pulse rates and blood pressure on days when a television in a waiting room displayed a nature videotape compared with days when an urban videotape or daytime television was played (Ulrich, Simons, & Miles, 2003). Individuals sitting in a room with views of trees experienced more rapid declines in diastolic blood pressure, indicating greater stress reduction than persons sitting in a viewless room (Hartig et al., 2003). Individuals exposed to nature-dominated roadside environments, compared with those exposed to built-dominated roadsides, subsequently evidenced less physiological (sympathetic) reactivity when they worked on challenging tasks (Parsons, Tassinary, Ulrich, Hebl, & Grossman-Alexander, 1998).

By contrast, ambiguous and abstract environmental features have been shown to increase negative emotions such as aggression and anxiety and to adversely impact health. For example, heart surgery patients exposed to pictures of water and trees had lower anxiety and required fewer doses of strong painkillers than those who were exposed to abstract pictures (Ulrich, Lundén, & Eltinge, 1993). In another study, patients were observed to vandalize abstract pictures on walls of a mental health unit (Ulrich, 1986). Although certain abstract pictures were torn down, thrown on the floor, and smashed, there were no observed instances where nature pictures were the targets of aggressive acts.

Surprisingly, little research has been devoted specifically to studying the benefits of nature in an office setting. One study found that people with views of nature from their office desks had lower levels of job stress, fewer health problems, and higher levels of life satisfaction than people with views of built environment views or with no outdoor views (Kaplan, Talbot, & Kaplan, 1988). A European study of employees in different workplaces found that window views of nature buffered job stress and increased

reported health-related well-being (Leather, Cox, & Farnsworth, 1990). Similarly, another study suggested that office workers with nature views have fewer ailments, are less frustrated, and are more satisfied with and enthusiastic about their jobs (Kaplan, 1995).

Individual Differences

Gender and individual differences have been found to moderate many of the relationships described above. Taylor, Kuo, and Sullivan (2002) found that green space outside the home helped girls lead a self-disciplined lifestyle but did not help boys. In certain contexts, men have been found to prefer complex and high-tension paintings, whereas women prefer quiet, romantic nature scenes (Zuckerman, Ulrich, & McLaughlin, 1993). These researchers also found that high-sensation seekers liked tension-evoking nature paintings, whereas low-sensation seekers liked realistic portrayals of nature. Finally, Hartig and his colleagues (2003) recently observed that males and females experienced sad emotions differently in response to natural and urban environments.

Anger and Stress Links

Previous research indicated that state anger is correlated with state anxiety and state curiosity (Spielberger, 1996), but the relationship between anger and stress is not clear. Some research findings indicate that stress might be a precedent of anger. For example, stressful working positions increase both blood pressure and frustration (Bongard & al' Absi, 2003). Others indicate that anger might be a precedent of stress. Expressing anger is highly stress-inducing (Tavris, 1989). Previous research has shown that depressed people can have strong feelings of anger (fight) and desires to run away (flight), but these fight/flight defenses can become blocked, inhibited, and arrested, increasing stress (Gibert & Gilbert, 2003). The direction of the relationship between anger and stress has not been determined and merits further investigation.

Theoretical Frameworks

There are two primary alternative explanations of how visual environments affect anger and stress. Evolutionary and distraction theories can suggest how the specific content of visual surroundings can lead to positive benefits.

Evolutionary theory has been used routinely to understand the positive outcomes of natural surroundings. For example, it has been claimed that positive responses to nature have a partly genetic basis (Appleton, 1996; Kaplan & Kaplan, 1995; Ulrich et al., 1991). The general argument is that the

human species has evolved within natural environments over a long period of time and has relied on nature for such things as gaining shelter, food, as well as aesthetic pleasure (Appleton, 1996). Consistent with this reasoning, settings that contain nature are consistently preferred to settings that do not contain nature (Browne, 1992; Getz, Karow, & Kielbaso, 1982; Herzog, Kaplan, & Kaplan, 1976; Sullivan, 1994). Previous research also found that unthreatening forms of nature help to reduce stress more than built environments (Ulrich et al., 1991, 2003). These findings indicate that exposure to natural elements plays an important role in reducing stress and anger. Nature also has been shown to contribute to recovery from mental fatigue resulting from sustained directed attention. Mentally fatigued individuals suffer from (a) a lowered ability to concentrate, think clearly, and solve problems; (b) heightened irritability and a disinclination to be helpful or even civil; (c) an inability to get along in the world; and (d) a tendency to be accident-prone (Herzog, 1997). Lowering levels of mental fatigue by exposing oneself to nature would thus be expected to reduce levels of frustration and anger.

Distraction theories provide an alternative perspective that relies on the presumed innate tendency of all positive events, natural or otherwise, to both spontaneously attract attention and concurrently decrease the potency of negative events. For example, directing attention to a more pleasant and positive experience “sidetracks” attention from an unpleasant experience such as concurrent pain (Fernandez, 1986). Kaplan and Kaplan (1995) explain that “the nervous system seems to be structured in such a way that pleasure and pain tend to inhibit each other; thus the experience of pleasure tends to reduce or eliminate pain” (p. 189). Coss (1973) also indicates in his cutoff hypothesis that people distract themselves by switching attention between modalities to avoid uncomfortable situations. Consistent with this line of reasoning, distraction techniques have been used effectively to divert patients’ pain during invasive medical procedures (Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003).

Hypotheses

Distraction research implies that visual displays such as art posters would redirect people’s attention away from negative emotions. People in an office setting with art posters are likely to experience less state anger and stress than those without any art posters. Also, based on evolutionary theory, nature is expected to influence various states of well-being in individuals. However, we know very little about how nature affects people’s anger and stress in everyday situations—and virtually nothing is known

about its effects in stressful, angering work situations. The evolutionary theoretical perspective strongly suggests the possibility, however, that scenes of nature could play a role in reducing peoples' state anger and stress in an office setting. People in an office setting with nature posters may experience less state anger and stress than those with no art or abstract posters.

The purpose of our research is to investigate the possible effects of nature and/or abstract posters in an office setting on state anger and stress for both males and females. Another purpose is to explore the interrelationships among environmental settings, stress, and state anger. Our specific hypotheses are as follows:

1. Participants experience less state anger as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters.
2. Participants experience less stress as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters.
3. Participants with higher trait anger experience higher state anger and stress than those with lower trait anger.

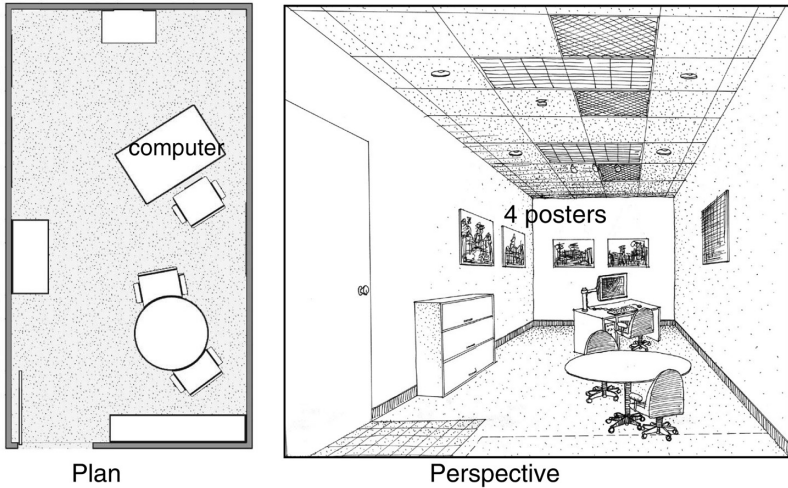
The direction of our first three hypotheses is clear, based on the literature review; however, neither the extant literature nor any theories provide a strong basis for making predictions as to the direction of the relationship between stress and state anger. Consequently, our last hypothesis embraces two possible directions:

4. (a) Participants experience lower levels of state anger mediated through reduced stress as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters. (b) Participants experience lower levels of stress mediated through reduced state anger as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters.

Methods

An experiment was conducted to investigate the effects of art posters on participants' levels of state anger and stress in a laboratory room similar to many office workplaces. We created four office conditions: an office with abstract posters on the wall, an office with nature posters on the wall, an office with both nature and abstract posters, and finally an office with no posters on the wall. We changed the office conditions randomly prior to each run of the experiment.

Figure 1
The Office Arranged With a Computer Desk and Chair Oriented
Toward Four Posters Hanging on Two Adjacent Walls



Setting

The office setting was created in the Environmental Psychophysiology Laboratory at Texas A&M University. The windowless space had an area of approximately 167 square feet (9'-6" × 17'-6"). Four posters were hung on two office walls—two posters on each wall (see Figure 1). A small blackboard was mounted on a third wall. A computer desk and chair were oriented toward the poster walls, equipped with an 18-in. color monitor, keyboard, mouse pad, and mouse. The room also had other generic office furniture such as bookshelves and file cabinets.

Participants

A total of 210 psychology students participated for partial course credit. Participants were randomly assigned to each office condition: 36 participants in an office with no art posters, 36 participants in an office with abstract posters, 105 participants in an office with both abstract and nature posters, and 33 participants in an office with nature posters. In the condition with both abstract and nature posters (105 participants), there were 35 participants with

one abstract and three nature posters, 34 participants with two abstract and two nature posters, and 36 with three abstract and one nature posters. Among the 210 participants, 100 were female and 110 were male. Participants ranged from 17 to 25 years in age, with an average age of 19.3.

Variables

Independent variables. The independent variables consisted of four different office conditions. We created three different office conditions using a total of 12 art posters: 6 nature posters and 6 abstract posters (see Appendix A). The posters were randomly selected to create (a) an office with abstract posters, (b) an office with nature posters, and (c) an office with both abstract and nature posters. The total number of posters used in each condition was four. The fourth office condition did not have any posters at all. The following posters were chosen by the authors after viewing thousands of posters based on the following matching criteria: complexity, color, size, composition, and amount of water and vegetation.

Nature Posters

“Ile St. Martin,” by Claude Monet
 “After the Rains,” by
 Allan Stephenson
 “Reflections of Spring,” by
 Joseph Fontaine
 “A River Through the Woods,”
 by Christian Zacho
 “Vetheuil in Summer,” by
 Claude Monet
 “Autumn Tapestry,” by
 Norma Forsberg

Abstract Posters

“Blue II,” by Joan Miro
 “Phenomena: Continental Shelf,” by
 Paul Jenkins
 “Composizione,” by Joan Miro
 “Improvisation 31,” by
 Wassily Kandinsky
 “Signal Field,” by Gregg Robinson
 “Composition Lyrique,” by
 Wassily Kandinsky

Dependent variables. The dependent variables were self-reported state anger and stress. State anger was measured by Spielberg’s (1996) 10-item State-Anger Scale. Examples of state-anger items include “I am furious,” “I feel like hitting someone,” and “I am burned up.” The participants were asked to report the intensity of their feelings “right now, that is, at this moment” by rating themselves on the following 4-point Likert scale: *not at all*, *somewhat so*, *moderately so*, and *very much so*. Unrotated

factor analysis of the 10-item scale generated a single factor. The reliability coefficient (alpha) of the anger factor is .88, and the proportion of variance accounted for in the factor is 51%.

Stress was measured by a 10-item Stress Adjective Checklist (King, Burrows, & Stanley, 1983). The reliability coefficient (alpha) of the stress scale was .86. Examples of stress adjectives include *calm*, *tense*, and *distressed*. Four categories of response scale were provided for each adjective: *definitely do not feel*, *do not feel*, *slightly feel*, and *definitely feel*.

We also videotaped participants' behaviors regarding how they responded to art posters such as looking at the posters, touching the posters, approaching the posters, and glancing at the posters. Their behaviors were coded into each category and their frequencies were counted.

Other variable. Trait anger was included in this study to assess the true effects of office conditions on state anger after controlling the effects of trait anger on state anger. It was measured by Spielberger's (1996) 10-item Trait-Anger Scale. The range of reliability coefficients (alpha) of the Trait-Anger Scale was .70-.89. Examples of trait-anger items include "I have a fiery temper," "I am a hot-headed person," and "I get angry when I'm slowed down by others' mistakes." The participants were asked to describe themselves "in general" for each trait-anger statement on the following 4-point scale: *almost never*, *sometimes*, *often*, and *almost always*.

Procedures

An experimenter welcomed each participant, explained to him or her the experimental procedure, and obtained from each a signed consent form. The experimenter told the participants that we were conducting research on performance of a variety of computer tasks. Participants were then seated at the computer station in the experimental room and asked to respond to a series of questions (appearing on the computer screen) about their general health and personal background. Afterward, each participant completed two experimental sessions. Each session consisted of two anger- and stress-provoking computer tasks, 5 (of 10) state anger questions, and 5 (of 10) stress questions. There were two 2-min breaks: one at the end of each experimental session. After the second break, each participant answered questions on their trait anger.

Participants were never asked to look at the posters. The posters were in the participants' peripheral view while they focused on the computer tasks. The posters were simply placed on the wall as background decorations.

Two female university students ran the experiment. Neither was informed of the experimental hypotheses. The students were trained to follow the same experimental protocol, to increase experimenter interreliability and to mitigate potential experimenter effects. They also ran approximately 20 practice sessions monitored by the authors before collecting the actual data. Participants entered responses directly into the computer, where they were stored in data files. This was done to eliminate the possibility of errors because of data entry.

Computer Tasks

Four computer tasks were designed and used as stressors to provoke stress and anger. These tasks, which are described in Appendix B, were adapted from pencil-and-paper anger-provoking tests used in previous studies to cause anger through blocked goal attainment, insult, injustice, personal threat, and loud noise: the Automated Teller Machine task (Muter, Furedy, Vincent, & Pelcowitz, 1993), Angle-Matching task (Brissett & Nowicki, 1973), Letter Detection test (Hodapp, Heiligtag, & Stoermer, 1990), and Etch-A-Sketch task (Zurawski & Houston, 1983). All these high attention absorbing computer tasks were very difficult to accomplish. They also provided various negative feedbacks and were often accompanied by loud beeps.

Results

The results section consists of five parts. First, we compare our sample means and standard deviations to a normative sample. Second, we report descriptive statistics for the different office conditions and the correlations among state anger, trait anger, and stress. Third, we report preliminary analysis that examines the interactions between gender and office conditions on state anger and stress. Fourth, we carry out an analysis of variance to test the effects of office environments and trait anger on state anger and stress for both male and female participants separately. Finally, we report the result of a multistep mediation test among office conditions, stress, and state anger.

Normative Sample Comparison

Means, standard deviations, 95% lower- and upper-confidence intervals, minimums, and maximums for state anger and stress are reported in Table 1. The mean for our study sample for state anger ($M = 14.68$) is higher than for other college students ($M = 14.10$). However, the normative value mean is

Table 1
Descriptive Statistics for Major Dependent Variables

	Normative Value	Study Sample					
	Mean	Mean	<i>SD</i>	95% CI Lower	95% CI Upper	Min	Max
State anger	14.10 ^a	14.68	5.20	13.97	15.39	10	39
Trait anger	20.22 ^a	18.29	5.33	17.56	19.01	10	34
Stress	2.38 ^b	3.26	2.77	2.88	3.63	0	9

a. College students (Spielberger, 1996).

b. Diverse groups of civilians, army personnel, and patients (King, Burrows, & Stanley, 1983).

Table 2
Means and Standard Deviations (*SD*) for State Anger and Stress for Different Office Conditions

Office Conditions	State Anger			Stress		
	Male Mean (<i>SD</i>)	Female Mean (<i>SD</i>)	Total Mean (<i>SD</i>)	Male Mean (<i>SD</i>)	Female Mean (<i>SD</i>)	Total Mean (<i>SD</i>)
No poster	18.45 (7.41)	13.00 (2.78)	16.03 (6.38)	4.50 (2.44)	3.06 (2.77)	4.02 (2.66)
Abstract posters	14.61 (4.69)	15.33 (6.04)	14.97 (5.34)	3.44 (2.96)	4.17 (3.85)	3.79 (3.42)
Mixed	14.51 (4.60)	14.19 (5.47)	14.35 (5.03)	2.30 (2.15)	3.67 (2.78)	2.92 (2.50)
Nature poster	14.63 (4.40)	13.00 (3.06)	13.94 (3.92)	2.74 (2.38)	3.07 (3.15)	3.03 (2.75)

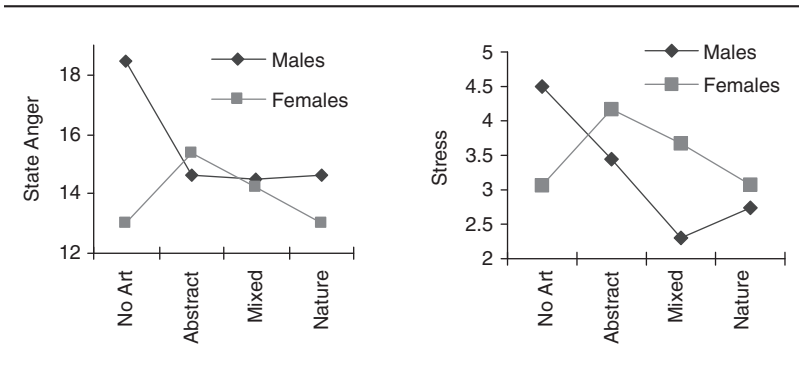
Table 3
Intercorrelations Among Major Variables

	1	2
State anger	1.00	
Trait anger	.38****	1.00
Stress	.63****	.25****

*** $p < .001$. **** $p < .0001$.

within the 95% confidence interval of our study sample. The mean for trait anger ($M = 18.29$) is significantly lower than the normative sample ($M = 20.22$). In addition, the mean for stress ($M = 3.26$) is significantly higher than the normative value ($M = 2.38$). Our sample is roughly comparable to previous samples of state anger and stress. The mean differences

Figure 2
The Graphs of State Anger and Stress by Office Condition Show Significant Gender Effects, as Well as Interaction Effects Between Office Conditions and Gender



for state anger and stress may have been caused by the four computer tasks that were used in this study as stressors. The normative tests for state and trait anger did not have any stressor, whereas the normative tests for stress had a nondemanding visual search detection task before completing the Stress-Arousal Checklist (King et al., 1983; Spielberger, 1996).

Descriptive and Correlational Statistics

The means and standard deviations for both state anger and stress are presented in Table 2. The descriptive statistics indicated that male and female participants have somewhat different responses to the various office conditions. Male participants experience the highest levels of state anger and stress in an office setting with no art posters at all, whereas female participants experience the highest levels of state anger and stress in an office setting with all abstract posters. Also, male participants experience the lowest levels of state anger and stress in an office setting with mixed art posters, whereas female participants experience the lowest levels of state anger and stress in an office setting with all nature posters.

Correlations among the three dependent variables are reported in Table 3. State anger is positively correlated with trait anger ($r = .38, p < .0001$) and stress ($r = .63, p < .0001$). Stress is also positively correlated with trait anger ($r = .25, p < .001$).

Preliminary Analysis

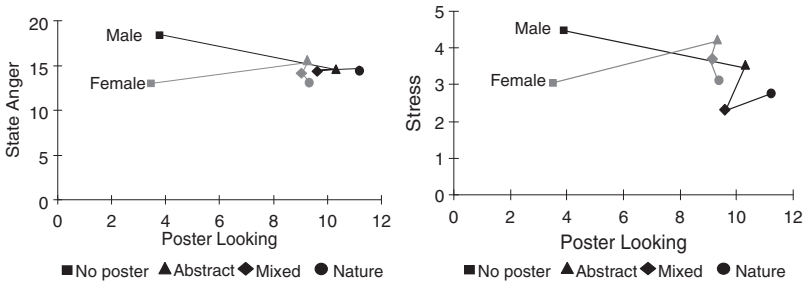
The effects of office conditions on state anger and stress should be analyzed separately for males and females. This determination comes from the following preliminary data analysis. Significant main gender effects were found, as well as interaction effects between office conditions and gender (see Figure 2). It seems that male participants experience the highest state anger and stress in no art office conditions, whereas female participants experience the lowest state anger and stress in the same office condition. Our decision to separate the data by gender is also supported by the findings of previous research (Forgays et al., 1997; Taylor et al., 2002; van der Ploeg, 1988; Zuckerman et al., 1993).

To investigate whether males and females responded differently to the posters in the office, we ran a t test. The mean frequency of looking for males is 8.90 ($SD = 5.15$), and the mean for females is 8.06 ($SD = 5.33$). This revealed no gender differences in how much attention is paid to the posters or wall (in the no poster condition) in terms of looking, touching, approaching, and glancing at the posters or walls, $t(196) = -1.13$, $p = ns$ (two tailed). We also investigated how frequency of looking influences both genders' state anger and stress for different office conditions (see Figure 3). Both males and females were engaged in more frequent looking behaviors in office conditions with posters than office conditions with no posters at all. For females, there is a suggestion that looking behaviors are positively related to state anger and stress, but the relationships are not significant. For males, it appears that looking behaviors are negatively related to state anger and stress, but only the relationship between state anger and looking behaviors is significant ($\beta = -.21$, $p = .04$).

The Effects of Office Conditions and Trait Anger on State Anger and Stress for Males and Females

We investigated the possible effects of different office settings, and trait anger on state anger and stress. To better understand the interaction effects between office conditions and gender on state anger and stress, we ran a two-way analysis of variance for both male and female separately. Our first hypothesis is that participants experience less state anger and stress as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters. Our second hypothesis states that participants with higher trait anger experience higher state anger and stress than those with lower trait anger.

Figure 3
The Influence of Looking Behaviors on State Anger and Stress for Different Office Conditions



As seen in Table 4, we found that different office conditions do not influence female participants' state anger and stress. Only trait anger significantly influenced participants' levels of state anger. For example, female participants with high trait anger experience significantly higher levels of state anger than those with low trait anger.

For male participants, office conditions have a significant influence on state anger, $F(3, 102) = 3.09, p = .03$, and a significant influence on stress, $F(3, 102) = 4.84, p = .004$ (see Table 5). The LSD post hoc comparisons reveal that male participants in an office with no art posters experience significantly higher levels of state anger than those in an office with abstract art ($\Delta = -3.84, p = .02$), mixed art ($\Delta = -3.94, p = .003$), and nature art posters ($\Delta = -3.82, p = .02$). In other words, male participants experience less anger when there are art posters (any type) in the office setting than when there are no art posters at all. Also, results show that male participants in an office with no art posters experience significantly higher levels of stress than those in an office with mixed art ($\Delta = -2.20, p = .001$) and all nature art posters ($\Delta = -1.76, p = .02$). It seems that as long as there are some nature posters in an office, male participants experience less stress.

Trait anger also significantly affected male participants' levels of state anger $F(1, 102) = 9.26, p = .003$ and stress $F(1, 102) = 7.29, p = .008$. In other words, male participants with high trait anger experienced significantly higher levels of state anger and stress than those with low trait anger.

Mediation Models Testing Office Conditions, Stress, and State Anger for Male Participants

Because the existing literature does not specify the clear direction of the relationship between state anger and stress, we ran two mediational analyses. The first analysis designates stress as a mediator between office condition and state anger. The second analysis indicates that state anger precedes stress. In other words, art posters in an office setting help to decrease participants' levels of state anger, which in turn affect stress.

Does stress precede state anger? For the first mediational analysis, we hypothesize that male participants experience lower levels of state anger through reduced stress as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters. In other words, art posters in an office setting help to decrease people's levels of anger because of decreased levels of stress. Baron and Kenny (1986) indicate that a successful mediation requires the following three conditions: (a) the independent variable must significantly affect the mediator in the first regression analysis, (b) the independent variable must significantly affect the dependent variable in the second regression analysis, and (c) the mediator must significantly affect the dependent variable while the effects of the independent variable on the dependent variable must be zero to be a perfect mediator in the third multiple regression analysis. For a partial mediator, the independent variable must be significantly less in the third analysis than in the second. These mediation effects are tested using ordinary least square regression analyses in the method prescribed by Baron and Kenny (1986) and Evans and Lepore (1997). To show mediation effects, the independent variable (office conditions) must be a significant predictor of possible mediators (stress) and the dependent variable (state anger), respectively. As we see in the first and second columns of Table 6, these two steps have been satisfied; office conditions are significantly related to stress ($\beta = -.31, p < .001$), as well as state anger ($\beta = -.20, p < .05$) independently.

The next step in the mediation test is to conduct a multiple regression using the independent variable and the potential mediating variables to predict the dependent variable. In this particular case, the potential mediator (stress) must significantly predict the dependent variable (state anger) while the effects of office conditions are reduced to an insignificant level. Accordingly, we ran a multiple regression, using office conditions and stress to predict state anger. As can be seen in the third column of Table 6, the possible mediator (stress) significantly predicts state anger ($\beta = .73$,

Table 4
Analysis of Variance of State Anger and Stress As a Function of Office Conditions and Trait Anger for Female Participants

Source	df	State Anger			Stress		
		F	η	Power	F	η	Power
1. Office conditions	3	1.78	.22	.44	.65	.14	.18
2. Trait anger	1	5.10*	.22	.60	.96	.09	.15
1 \times 2	3	2.01	.24	.49	.65	.14	.18
Residual	92						

* $p < .05$.

Table 5
Analysis of Variance of State Anger and Stress As a Function of Office Conditions and Trait Anger for Male Participants

Source	df	State Anger			Stress		
		F	η	Power	F	η	Power
1. Office conditions	3	3.09*	.27	.71	4.84**	.34	.91
2. Trait anger	1	9.26**	.28	.87	7.29**	.24	.77
1 \times 2	3	.32	.09	.11	.21	.07	.09
Residual	102						

* $p < .05$. ** $p < .01$.

$p < .0001$), whereas the effects of office conditions reduced to almost zero ($\beta = .03$, $p = ns$). Thus, stress mediates the relationship between office conditions and state anger. These results indicate that office conditions affect participants' levels of stress, which in turn affects state anger. In other words, art poster changes from no art posters to all abstract posters, mixed poster types, and all nature posters in office settings help to decrease people's levels of anger because of decreased levels of stress.

Does state anger precede stress? For the second mediational analysis, we hypothesized that male participants experience lower levels of stress through reduced state anger as the office condition changes from no art posters to all abstract posters, mixed poster types, and all nature posters. The mediation effects of state anger on the relationship between office conditions and stress can only be sustained if the following three relationships are satisfied: (a) office conditions must significantly affect state anger, (b) office conditions must significantly affect stress, (c) state anger must

Table 6
Stress Mediates the Relationship Between Office Conditions and State Anger for Male Participants

Variables	Regression 1 Stress			Regression 2 State Anger			Regression 3 State Anger		
	B	SE B	β	B	SE B	β	B	SE B	β
Office conditions	-.78	.23	-.31***	-1.01	.48	-.20*	.16	.36	.03
Stress							1.50	.14	.73****
R^2	.10			.04			.52		

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

Table 7
State Anger Fails to Mediate the Relationship Between Office Conditions and Stress for Male Participants

Variables	Regression 1 State Anger			Regression 2 Stress			Regression 3 Stress		
	B	SE B	β	B	SE B	β	B	SE B	β
Office conditions	-1.01	.48	-.20*	-.78	.23	-.31***	-.44	.17	-.18**
State anger							.34	.03	.69****
R^2	0.04			.10			.55		

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

significantly affect stress while the office conditions regression coefficient must be zero to be a perfect mediator (or significantly less than the coefficient in second regression to be a partial mediator).

As can be seen in Table 7, office conditions are significantly related to state anger ($\beta = -.20, p < .05$). Second, office conditions are significantly related to stress ($\beta = -.31, p = .0009$). Finally, as can be seen in the third column of Table 7, state anger is significantly related to stress ($\beta = -.69, p < .001$); however, the effects of office conditions are not reduced to 0 or an insignificant level ($\beta = -.18, p < .01$). Consequently, state anger fails to mediate the relationship between office conditions and stress.

In summary, we empirically assessed the direction of the relationship among office conditions, state anger, and stress and concluded that the most conservative explanation for our results is that stress mediates the relationship between office conditions and state anger. Conversely, state anger does not mediate the relationship between office conditions and stress.

Discussion

This study investigated the possible effects of art posters in an office setting on state anger and stress. More specifically, we examined differences in state anger and stress when office settings included posters with abstract art, nature art, mixed abstract and nature art, and no posters at all. Results clearly indicated that trait anger, gender, the existence or absence of art posters, and the content of art posters all play important roles in affecting state anger and stress in an office setting.

Different office conditions had a significant influence on state anger and stress for male participants but not for female participants. One possible explanation for the lack of a relationship between different office conditions and female participants' state anger and stress is that females experience their state anger and stress differently from males. Forgas et al. (1997) found that expressing anger is a more distinctive and significant decision for females than for males. In other words, females are likely to express anger less readily than males. Moreover, the gender differences within normative college student samples were substantial. Female college students have a much lower state anger score ($M = 12.30$) than their male counterparts ($M = 15.89$) (Spielberger, 1996). Another explanation may be that our anger-provoking tasks were more effective for males than for females. However, we have no data to support this explanation. Future research should examine how females' state anger and stress are influenced by different office conditions with different anger-provoking procedures and different environmental stimuli.

For males, we found that participants in an office with no art posters experienced significantly higher levels of state anger than those in an office with abstract art, mixed art, and nature art posters. In other words, male participants experienced less state anger when there were art posters (of any type) in the office setting than when there were no art posters at all. In this finding, both abstract and nature posters were positive distractions and could have sidetracked participants' attention away from their concurrent state anger. This finding is somewhat conflicting with previous research findings. Abstract paintings and sculpture were found to have a negative influence on people's behaviors and emotions (McLaughlin, Beebe, Hirshfield, Lindia, & Gubbanc, 1996; Ulrich, 1986; Ulrich et al., 1993). One possible explanation for the abstract posters being positive distractions is that many of our abstract posters were playful, curvilinear, inspired by nature, and more organic than geometric formations.

Also, results show that male participants in an office with no art posters experience significantly higher levels of stress than those in an office with mixed art and all nature art posters. It seems that as long as there are at least some nature posters in an office, male participants experience less stress. This finding is consistent with many research findings that test evolutionary theory. Exposure to nature slides, views, pictures, parks, or wilderness has been found to reduce stress (Kaplan, 1995; Kaplan et al., 1988; Ulrich, 1979, 1981; Ulrich et al., 1991).

We found that stress mediated the relationship between office conditions and state anger. In other words, office conditions affect levels of stress, which in turn affects state anger. Stress has been an important final outcome variable in scientific environment and behavior research. By extending the path to anger, this research makes an important contribution to the environment and behavior research community. By documenting this systematic link in an office setting, these findings may help to create a less stressful and more peaceful workplace setting.

Conclusion

Stress and anger in the workplace have been a threat to employees and employers, as well as to society. This study investigated how different office conditions influence state anger and stress. We found that nature and abstract art posters have a significant influence on state anger and stress for male participants but not for female participants. Male participants experienced less state anger when there are art posters on the wall of the office setting than when no art posters are present. They also experienced less stress when there were mixed abstract and nature art posters or all nature art posters. We also found a systematic link between office conditions, stress, and state anger. Stress mediated the relationship between office conditions and state anger. In other words, people tend to be less stressed in offices with art posters and, as a result, experience decreased levels of anger (i.e., are less likely to become angry). This (stress- and anger-reducing) effect of posters tends to be greatest when nature content is present in the posters. A large percentage of Americans experience stress in their workplace. One simple way to reduce their state anger and stress may be to hang some nature art posters on the wall.

Appendix A

Nature and Abstract Art Posters

Nature Posters



Ile St, Martin - Monet



After the Rains -Stephenson



Reflections of Spring - Fontaine



A River through the Woods - Zacho



Vetheuil in Summer - Monet

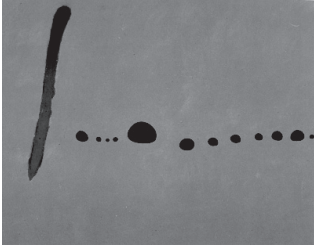


Autumn Tapestry - Forsberg

(continued)

Appendix A (continued)

Abstract Posters



Blue II - Miro



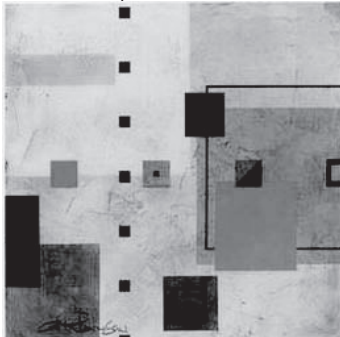
Phenomena: Continental Shelf - Jenkins



Composizione - Miro



Improvisation 31 - Kandinsky



Signal Field - Robinson



Composition Lyrique - Kandinsky

Appendix B

Computer Task Descriptions

Automated Teller Machine Task

This task was based on automated teller machines that can be found at most banks. Participants in this research conducted some transactions such as deposit, withdrawal, and transfer. The system was user-hostile, and it involved negative feedback such as “You are TOO SLOW” with a loud beep when participants had not completed their transactions within a short time limit. It also provided vague instructions such as “UNPACK BYTES” to confuse participants.

Angle-Matching Task

The task consists of 28, 1×1 square inch example cards with different angles (5-degree intervals) on the bottom of the computer screen, and a 2×2 square inch instruction card with a target angle on the top of the computer screen. The angles were rotated in different directions, and the sides had unequal lengths. Participants were required to choose angles from the example cards that matched the target angle on the instruction card. However, none of the angles on the example cards matched the target angle on the instruction card exactly. Participants received screen messages during the task informing them that their answers were wrong and at the end of the task informing them that their performance was under average.

Letter Detection Test

The task consisted of a moving train of letters B–F, proceeding from right to left or left to right on a computer screen. For each trial, a target letter was defined. At the occurrence of a target letter, participants needed to place the cursor on the target letter. This task was difficult because of the quick movement of the letters. In addition, participants received a mild sound stimulus. Participants were told that this noise would go away if their task performance was superior to that of a comparable student sample. However, the noise was not removed.

Object Tracing Task

The task was to ultimately trace an eight-pointed star using the mouse on a computer screen within a short period of time. It is based on the Etch-A-Sketch task (Zurawski & Houston, 1983). The mouse was programmed to move the cursor in random directions other than the standard mouse direction and to occasionally freeze. Also, screen messages were programmed to provide negative feedback such as “You are 35% accurate, whereas other participants typically were 75% accurate.”

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