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Presence of Human Friends and Pet Dogs as Moderators of Autonomic Responses to Stress in Women

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Autonomic responses were measured while 45 adult women performed a standard experimental stress task in the laboratory with only the experimenter present and 2 weeks later at home in the presence of a female friend, pet dog, or neither. Results demonstrated that autonomic reactivity was moderated by the presence of a companion, the nature of whom was critical to the size and direction of the effect. Ss in the friend condition exhibited higher physiological reactivity and poorer performance than subjects in the control and pet conditions. Ss in the pet condition showed less physiological reactivity during stressful tasks than Ss in the other conditions. The results are interpreted in terms of the degree to which friends and pets are perceived as evaluative during stressful task performance. Physiological reactivity was consistent across the laboratory and field settings.

Because individuals who experience pronounced, frequent, or enduring autonomically mediated cardiovascular responses to stress may be at risk for the development of cardiovascular disease (Clarkson, Manuck, & Kaplan, 1986; Manuck & Krantz, 1986), psychological variables that mediate or moderate autonomic reactivity to stress are important to consider. Nearly all research on psychological moderators of autonomic reactivity has focused on personality variables, such as coronary-prone behavior type, hostility, anger, aggression, anxiety, and denial (Houston, 1986). Relatively little attention has been paid to social psychological constructs such as attitudes and relationships. This study focused on the presence of others as a potential moderating variable in stressful situations. Specifically, we were interested in the degree to which potentially evaluative and nonevaluative others could act as buffers of autonomic reactivity during a stressful situation. In addition, we were interested in a comparison of laboratory and field sites.

Social facilitation theory (Zajonc, 1965, 1980) posits that the presence of others increases arousal, which in turn increases or decreases performance as a function of the degree to which task requirements are based on well-learned dominant responses. Zajonc's (1965) social facilitation formulation posited that the mere presence of others increases an individual's arousal and affects performance. Recently, Cacioppo, Rourke, Marshall-Goodell, Tassinary, and Baron (1990) clarified the impact of the presence of others on arousal by demonstrating that the presence of others does not increase basal levels of physiological arousal, but rather increases autonomic reactivity to specific stimuli.

In Zajonc's (1965) formulation, the notion of mere presence precludes consideration of the impact of the quality of the relationship between the performer and the other on the performer's level of arousal. Although some researchers have suggested that mere presence is sufficient to produce social facilitation (e.g., Markus, 1978; Schmitt, Gilovich, Goore, & Joseph, 1986), others have suggested that the mere presence of others is not sufficient (e.g., Carver & Scheier, 1981; Cottrell, 1968, 1972; Geen, 1981; Geen & Gange, 1977; Paulus & Murdoch, 1971). The latter group contend that the critical factor is essentially the cognitive anticipation of being evaluated by those others. However, a meta-analysis of the social facilitation literature conducted by Bond and Titus (1983) supported the mere presence rather than the evaluation apprehension view.

In a relevant study, Kamarck, Manuck, and Jennings (1990) investigated the presence of nonevaluative others on cardiovascular responses to stress. They found that cardiovascular reactivity for women performing a stressful mental arithmetic task was lower when performing in the presence of a nonevaluative female friend than when performing alone. Kamarck et al. ensured that friends were perceived as nonevaluative by instructing the friends to "silently cheer the subject on" while continuously touching the subject's wrist. The friends also wore headsets that the subject knew prevented them from hearing subject task responses, and the friends were engaged in a distracting task (i.e., completing questionnaires). Because the investigators prevented the perception of the friend as evaluative, the results of the Kamarck et al. study are consistent with the contention that the perceived evaluative nature of others is critical to the social facilitation of arousal. However, there was no condition allowing the perception of the friend as evaluative. That Kamarck et al. went to such great lengths to ensure that the friend was perceived as nonevaluative suggests that even close human friendship does not preclude the perception of others as evalua-

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tive during a stressful challenge. These findings indicate that further investigation focused on relationships could contribute to a more complete understanding of social support during acute stressful situations.

One way the buffering effect of social support is hypothesized to work is by actually reducing or eliminating physiological responses to stressful situations. House (1981) suggested that social support may reduce the perception that a situation is stressful, and may also, in some way, tranquilize the neuroendocrine system so that individuals are less reactive to perceived stress. Any model that attempts to predict a relationship between social support and stress reduction must consider individual differences in the need or desire for support and for types of support (Cohen & McKay, 1984; Cohen & Syme, 1985). Wills (1985) has proposed a typology of supportive functions and has suggested that the type of support may be important in understanding when social support actually acts to buffer pathogenic effects of stress. Cohen and Wills (1984) suggested that buffering effects depend on a relationship between the specific need evoked by a particular stressor and the functions provided by available supporters. The research of Kamarck et al. (1990) suggests that the presence of a nonevaluative other is necessary for social support to be functional in acutely stressful performance situations.

In recent years, several studies and reviews have suggested that pets may provide a supportive function that buffers people from stress and illness (Allen, 1985; Anderson, Hart, & Hart, 1984; Katcher & Beck, 1983). Gage and Anderson (1985) found that among pet owners experiencing high levels of stress, interaction with pets was identified as an important stress management practice. In a recent study, Siegel (1990) investigated physician use patterns among elderly individuals who owned pets and those who did not. Siegel found that pet owners reported fewer contacts with doctors than did non–pet owners and also reported that pets, especially dogs, helped their owners in times of stress. In perhaps the most widely cited study about pet ownership and human health (Friedmann, Katcher, Lynch, & Thomas, 1980), a significant relationship was reported between pet ownership and 1-year survival of patients after discharge from a coronary care unit. In this study, pet ownership was found to be more highly associated with survival than were marital status or family contacts.

These correlational data suggest that pets may function to reduce stress and its health effects by providing the kind of nonevaluative companionship that precludes the typically arousing effects of evaluative companions during stressful challenges. That the presence of domestic animals may serve to lower blood pressure and heart rate in humans has been explored in field studies as well. Most of these studies have linked human–pet interaction to reductions in cardiovascular activity. Lynch (1985), for example, found that whereas blood pressure rose significantly when pet owners talked to an experimenter, it either did not change or actually decreased when they talked to their pets. Friedmann, Katcher, Lynch, and Messent (1983) examined the effect of the presence of a friendly dog on children's blood pressure and heart rate while resting and while reading aloud, and found that the presence of the dog resulted in lower blood pressures both while the children were resting and while they were reading. Others have reported similar findings (Baun, Bergstrom, Langston, & Thoma, 1984; Grossberg & Alf, 1985; Grossberg, Alf, & Vormbrock, 1988; Vormbrock & Grossberg, 1988).

Because much of this research has been conducted in the field rather than in controlled laboratory settings, the degree of control over extraneous variables in these studies is not clear. For the same reason, the extent to which the field settings themselves serve to reduce autonomic reactivity apart from the influence of the presence of pets has not been determined. Furthermore, most of these studies did not involve subjects' own pets. Finally, in most of these studies the extent to which subjects were stressed is questionable because standard experimental stressors were not used.

The present study compared pet and human companions in terms of the influence of their presence on autonomic physiological responses to a standard experimental challenge. Mental arithmetic, a well-known laboratory stressor that produces reliable increases in autonomic reactivity, was used as the challenge. This investigation incorporated both a laboratory experiment and a field experiment using the same subjects to assess the comparability of the stress manipulation in both settings. The study was conducted exclusively with pet dog owners, who were accompanied in appropriate conditions by their own pet dog, a self-selected close human friend, or neither.

The rationale was based on the notion of pets as nonevaluative relative to human friends during performance of a stressful task. We hypothesized that subjects would respond with less autonomic physiological reactivity during stressful task performance in the presence of their dogs than in the presence of their human friends. Unlike previous investigations of human stress and "pets," in which the animals were typically unknown to the subjects, this study used pets with whom subjects had a self-reported close relationship.

Method

Overview

The study took place in two parts. First, subjects came alone to the psychophysiology laboratory at the State University of New York at Buffalo to participate in an initial experiment in which their autonomic responses were monitored during a standard psychological challenge (mental arithmetic). Two weeks after the laboratory segment, the experimenter visited subjects in their homes and repeated the experiment as it was performed in the laboratory but under one of three conditions to which subjects were randomly assigned: (a) presence of their pet dog, (b) presence of a close human friend, or (c) neither pet nor human friend present.

Subjects also completed questionnaires. These included the Pet Attitude Scale (Templer, Salter, Dickey, & Baldwin, 1981) and a questionnaire assessing data about pet ownership (e.g., number of pets and age of pet).

Subjects

Participants were 45 adult female dog owners in the community who responded to an advertisement to take part in a laboratory/home study about pet dogs. Each subject was paid $25 for her participation. The mean age of subjects was 38.95 years and ranged from 27 to 55 years. All subjects were White nonsmokers who were self-described "lovers of dogs." It should be noted that although the women in the study were very devoted to their pets, they were all accustomed to periods of separation each day. Because all subjects were employed outside their homes, both the laboratory and home sessions were run during evening hours and on weekends.

Settings

The initial experiment was conducted in a human psychophysiology laboratory. Subjects participated in an acoustically and environmentally controlled, electronically shielded recording room measuring approximately 2.5 × 3 × 2.5 m. The room contained audio speakers used for the presentation of instructions. Subjects were seated upright in a comfortable upholstered chair.

Subjects' homes were the sites for the second experiment. For each subject, the experimenter and subject selected a quiet room judged as appropriate for conducting the experiment. Invariably, these were living rooms, family rooms, or dens. Only individuals and pets (experimenter, subject, and friend or pet) appropriate to the condition to which subjects were assigned were allowed in the home.

Because it was necessary that the female experimenter be present in the same room as the subject in the home study, the same experimenter remained in the recording room during the laboratory experiment seated behind and to the right of the subject. As Cacioppo et al. (1990) have reported, it is not uncommon for experimenters to remain in the same room as subjects, or for subjects to know they are being observed, in studies involving psychophysiological recordings.

Apparatus

Because the second experiment was conducted in the field (i.e., subjects' homes), it was necessary to use portable physiological recording equipment. Physiological measures were recorded with the same portable equipment in both experiments. Skin conductance responses were measured and recorded using a portable, battery operated skin conductance system (Biomedical Instruments, Inc. Model T-68) and tape recorder. Systolic and diastolic blood pressure were measured with a portable monitor (Health Check CX-1) that provides relatively nonintrusive measurement by means of a small automatically inflating and deflating cuff attached to the finger. Pulse rate was measured with a Panasonic photoplethysmographic pulse meter (Model NKM 017).

Physiological Measures

Pulse rate was measured in beats per minute with the pulse rate photoplethysmograph attached to the subject's right ear. Pulse rate was recorded every 20 s throughout both experiments.

Skin conductance was recorded continuously with the system just described using two 12.55-mm MED Associates Ag-AgCl electrodes attached with adhesive collars (0.8 cm^2 recording surface area) to the thenar and hypothenar eminences of subjects' right hands.[1] Subjects washed their hands with soap and water and dried them with paper towels prior to attachment of the electrodes. A 0.05 molar NaCl electrolyte solution suspended in Parke-Davis Unibase cream was used for both skin conductance recordings. The number of fluctuations in skin conductance exceeding 0.05 micromhos during each 20-s period was later coded and tallied by experimenters blind to subject condition.

Blood pressure was measured from the proximal phallange of the index finger of the subject's left hand. Diastolic and systolic blood pressure were recorded once during the last minute of each rest period and once during the first minute of the performance of each task.

Procedure

Initial laboratory experiment. After subjects arrived at the laboratory, informed consent was obtained from them. Subjects also completed a health survey to ensure that they did not have known medical problems and that they were not taking medications that would affect physiological assessments or performance. All subjects qualified.

After subjects washed their hands, the various sensors and electrodes for recording physiological measures were affixed as described earlier. Subjects then were instructed to sit quietly and rest (approximately 10 min) while the physiological recording equipment was calibrated and adjusted. During a subsequent 5-min rest period, baseline physiological data were recorded. This was followed by an instruction period during which subjects listened to tape-recorded instructions about performing the upcoming arithmetic task. They were instructed to count backward rapidly out loud by 3s from a four-digit number upon a start signal. At the end of 2 min of counting, subjects were instructed to sit quietly and rest again. During this 5-min rest period, baseline physiological data were again recorded. Subsequently, subjects were instructed to perform a second rapid serial subtraction task, this time counting backward by 7s. As before, subjects performed the task for 2 min. Increasingly difficult values for subtraction were used within and between experiments to mitigate potential habituation effects. Physiological and performance data were recorded during both counting tasks. Following the second counting task, subjects were instructed to sit quietly for a final rest period (5 min), during which physiological responses were recorded. Finally, the sensors and electrodes were removed from subjects, and arrangements were made for the home phase of the study.

Home experiment. The stressors used in the laboratory were repeated in the home except that the two serial subtraction tasks used 13s and 17s, respectively, as the subtraction values for reasons discussed earlier. In addition, each subject was randomly assigned to one of three conditions: (a) with her dog and the experimenter present (pet present condition), (b) with her human friend and the experimenter present (friend present condition), and (c) with only the experimenter present (control condition). According to prearranged instructions, no other individuals were present in the home. In the friend present and control conditions, the animal was taken for a walk outside of the subject's home by a friend or relative. In all home conditions, as in the laboratory, the experimenter sat behind and to the right of the subject and tended to the equipment and experimental procedures.

In the pet present condition, no attempt was made to constrain the pet dog's movement or location within the room. Despite this lack of constraints, no dog sat extremely close to the subject (i.e., less than 3 ft [0.91 m] away), and no dog was touched or petted by a subject. All of the dogs initially walked quietly around the room and then sat during the experiment.

In the friend present condition, the friend sat on a sofa or chair located to the left of and at a 90° angle from the subject's chair with about 1 ft (0.30 m) separating the chairs such that their faces were

[1] In the laboratory, dual recordings were made for skin conductance using standard laboratory equipment (Grass Model 7D, eight-channel polygraph, lab computer, with appropriate amplifiers, etc.) as well as the portable equipment described above. A second set of skin conductance electrodes identical to those described for the portable equipment were affixed to the subjects' left hands for this purpose. This was done to gauge the reliability of the portable equipment for identifying skin conductance responses assuming that skin conductance response frequencies are the same during specified intervals in both hands. Correlations between the two assessments of skin conductance responses by minute were greater than .95 for all subjects.

approximately 4 ft (1.22 m) apart. Friends were told that the experiment was about "social support and reactions to stress." They were instructed to be supportive in any manner they chose. Despite being close enough either to touch or to speak to the subject, no friend did either.

The basic procedures, instructions, and recordings were the same as those used in the prior laboratory experiment.

Results

Self-Report Data

As expected, there were no mean differences in self-report data among subjects in the three conditions. One-way analyses of variance (ANOVAs) indicated that subjects did not differ across conditions in attitudes toward their pets. Group means on the Pet Attitude Scale (Templer et al., 1981) indicated that subjects in all conditions had extremely positive attitudes toward their pets (*M*s = 68.87, 68.87, and 68.6, respectively, for pet present, friend present, and neither present). Subjects also did not differ across conditions for number of pets at home, length of pet ownership, or age at which they first owned a pet.

Physiological Data

The major analysis for this study was a four-way multivariate analysis of variance (MANOVA) with one between- and three within-subjects variables. The four physiological measures were dependent variables. The between-subjects variable was home condition with three levels (pet present, friend present, or neither pet nor friend present). The first within-subjects variable was place (laboratory and home), the second was task (first and second mental arithmetic task), and the third was period (baseline and performance). The analysis was conducted using SPSS/PC+ software.

The dependent measures were skin conductance response frequency (SCR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate (PR). For this analysis, the dependent measures were computed for the last minute of each baseline rest period and the first minute of each task performance period. The dependent measures were entered into the analysis in the listed order, that is, as a function of the presumed level of sympathetic control underlying the physiological response (Blascovich & Kelsey, 1990). Although this ordering does not affect the multivariate tests, it does have implications for subsequent stepdown *F* tests and interpretations regarding the relative contributions of each variable to multivariate effects. Figure 1 depicts these data.

Tests of stress manipulations and setting. Data from the laboratory experiment indicated that the stress task manipulations were successful. The expected period effect (baseline < performance) was significant, Wilks's lambda = .003, $F(4, 39) = 3325.00$, $p < .00001$, indicating that the robust task effects were reliable. In addition, a task effect (first > second) was significant, Wilks's lambda = .721, $F(4, 39) = 3.78$, $p < .02$, indicating that the second task produced slightly but significantly less reactivity than the first. Subsequent stepdown *F* tests indicated that all physiological measures contributed significantly to the robust period effect in the laboratory setting, whereas only PR contributed significantly to the small task effect in the laboratory (see Figure 1 for depiction of mean dependent measures).

In order to compare autonomic responses in the laboratory and home settings, physiological data from subjects assigned to the control condition (neither pet nor friend present) were analyzed separately in a three-way within-subjects MANOVA. The variables for this analysis were place (laboratory and home), task (first and second), and period (baseline and performance). There were no significant effects for place. The expected effect for period was significant, Wilks's lambda = .002, $F(4, 11) = 1314.25$, $p < .0001$, indicating reliable differences between rest and performance. Subsequent stepdown *F* tests indicated that SCR, SBP, and PR contributed to the period effect. There were no significant main or interaction effects for task. The place by period interaction was significant, Wilks's lambda = .118, $F(4, 11) = 20.63$, $p < .0001$. As Figure 1 depicts, there was a greater range in SCR reactivity, primarily attributable to lower preperformance baseline levels in the home compared with the laboratory.

Stress buffering effects. In accordance with our major hypothesis, we predicted a three-way interaction (Condition × Place × Period), such that condition differences in reactivity would emerge only during the home experiment. Furthermore, we predicted that within the home setting subjects in the friend present condition would show greater autonomic reactivity than subjects in the pet present condition.

The results of the MANOVA confirmed these predictions. The Condition × Place × Period interaction was significant, Wilks's lambda = .012, $F(8, 78) = 78.01$, $p < .0001$. As expected, multivariate testing indicated that there were no main effects or interactions for condition in the laboratory (all relevant *F*s < 1.1 and *p*s > .36). There were, however, significant overall condition and period effects in the home setting, Wilks's lambda = .087, $F(8, 78) = 23.38$, $p < .0001$, and Wilks's lambda = .007, $F(4, 39) = 1314.78$, $p < .0001$, respectively. However, these effects were qualified by the predicted condition by period interaction in the home setting, Wilks's lambda = .008, $F(8, 78) = 102.59$, $p < .0001$, which is apparent in Figure 1. Subsequent stepdown *F* tests indicated that SCR, SBP, and PR contributed significantly to the Condition × Period interaction.

Planned contrasts revealed that in the home setting reactivity (difference from baseline) in the friend present condition was significantly greater than in the control (neither friend nor pet) condition, Wilks's lambda = .079, $F(4, 25) = 73.19$, $p < .0001$, which in turn was significantly greater than the pet present condition, Wilks's lambda = .029, $F(4, 25) = 207.96$, $p < .0001$. Subsequent stepdown *F* tests revealed that SCR and SBP contributed to these effects.

Performance Data

Performance on the mental arithmetic tasks was tracked for accuracy by the experimenter. Verbal responses were tracked according to whether subjects accurately subtracted the relevant value (3s, 7s, 13s, or 17s) from the start number for each task and, subsequently, from the result they verbalized for each prior subtraction. Thus, if subjects made an early error, they were penalized once but not subsequently. Subjects making no errors or

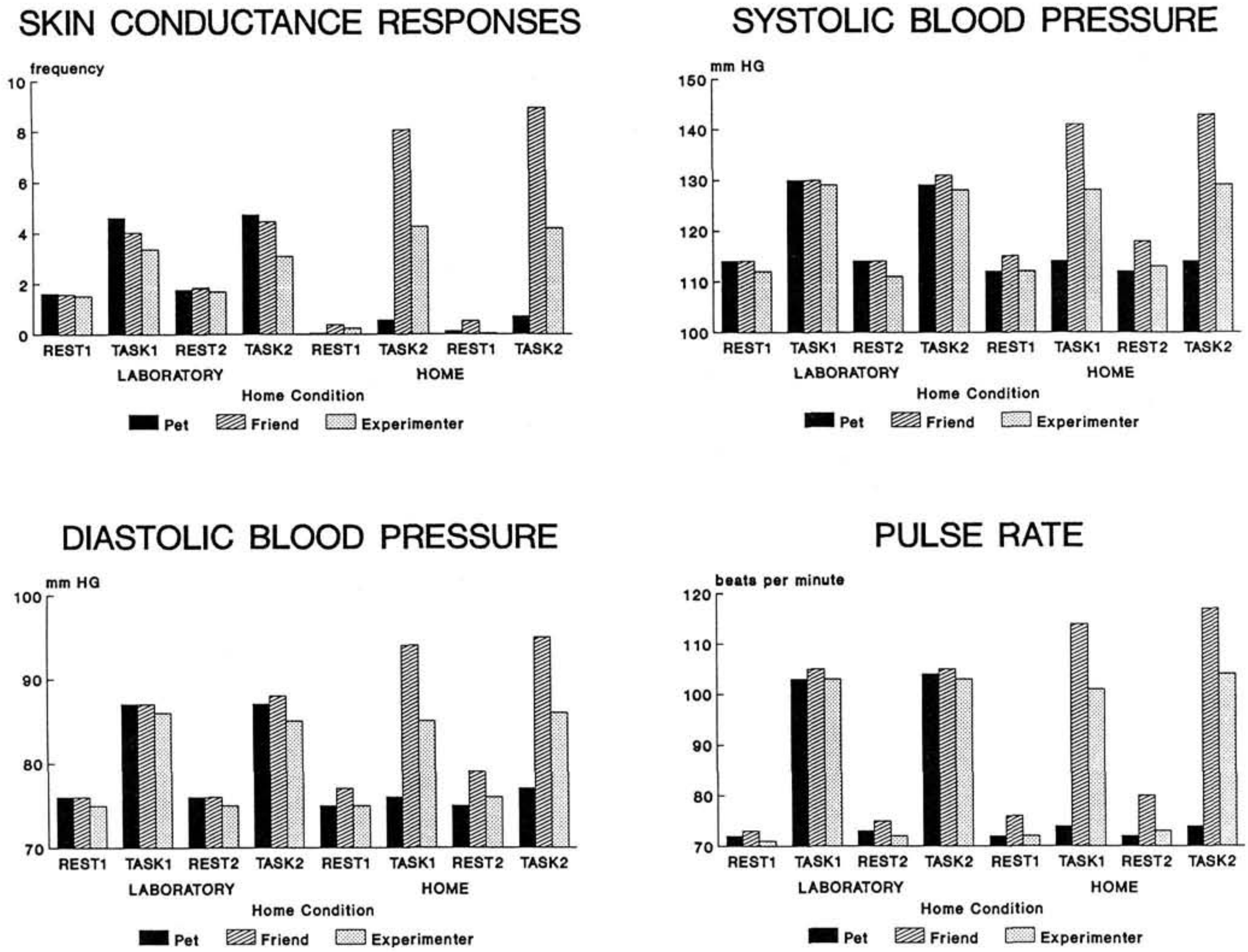

Figure 1. Mean autonomic measures by home condition, place, task, and period.

one error during each 2-min task were recorded as accurate for that task. Subjects making two or more errors were recorded as inaccurate for that task. Subjects recorded as inaccurate on either task within the laboratory or home experiment were regarded as inaccurate for that experiment.

Separate chi-square analyses comparing condition and accuracy were performed for the laboratory and home experiments. Summary frequency data for these analyses appear in Table 1. The first analysis revealed no significant effects during the laboratory experiment, $\chi^2(2, N = 45) = 3.46$, $p = .18$. The second analysis revealed a significant effect during the home experiment, $\chi^2(2, N = 45) = 37.62$, $p < .0001$, with all subjects in the friend present condition performing inaccurately and most subjects in the other two conditions performing accurately.

The experimenter also recorded whether subjects appeared to be exceptionally fast or slow in task performance. The results of chi-square analyses of these subjective judgments paralleled the patterns of the accuracy data. Subjects in the home experiment with a friend present were more likely to attempt to "race" through the task, which may have contributed to their inaccurate performance.[2]

Table 1
Frequency of Accurate and Inaccurate Performance by Place and Condition

Home condition	Laboratory		Home	
	Accurate	Inaccurate	Accurate	Inaccurate
Pet present	12	3	15	0
Friend present	15	0	0	15
Control	12	3	13	2

[2] It is possible that the faster task performance and, hence, faster speech rate of subjects in the friend present condition may have contributed to their relatively heightened blood pressure responses during task performance in the home session (cf. Lynch, 1985). However, several studies (e.g., Henderson, Bakal, & Dunn, 1990; Kelsey, 1991; Linden, 1987) have demonstrated that speech rate has minimal effects on measures of autonomic reactivity to stress, so it is unlikely that the increased speech rate can entirely explain the relative magnitude of the

Discussion

The results of this study demonstrated that autonomic reactivity to a challenging mental arithmetic task was moderated by the presence of a companion. Specifically, as compared with female subjects in a condition in which only the subject and a female experimenter were present, female subjects in a condition in which their pet dogs were also present showed little or no physiological reactivity during performance of the stressful task, whereas female subjects in a condition in which their closest female friends were present showed substantially greater physiological reactivity.

Our interpretation of these findings is that subjects with their pets present were apparently less psychologically threatened than were subjects with their friends present or subjects without a companion. That is, the presence of pet dogs during the performance of the stressful task provided the kind of nonevaluative social support that is critical to buffering physiological responses to acute stress. In contrast, subjects in the presence of their friends might have experienced heightened evaluation anxiety or embarrassment compared with those in the pet present and control conditions. Although our psychophysiological data point in this direction, the absence of self-report data regarding evaluation apprehension makes our interpretation somewhat speculative.

One might consider distraction as an alternative explanation for the decreased reactivity in the pet present condition. That is, subjects might have simply attended to their pets and not to the mental arithmetic tasks. However, in this study it is clear that the pet dog did not act merely as a pleasant and familiar distraction. Given that task performance quality did not differ between subjects in the pet present and control conditions in the home or among subjects in the laboratory setting, one can assume that subjects in the pet present condition were not particularly distracted by their pet dogs and remained engaged in the tasks.

Our data only allow us to speculate on why the presence of pet dogs reduces psychological threat during stressful challenge. Social support theorists (e.g., Cohen & Hoberman, 1983; Cohen & Syme, 1985) have suggested that positive feeling states may enhance an individual's capacity to adapt to stress. Certainly, pet dogs may evoke such feelings in their owners; for example, pets are often described as making people laugh and play and as always being happy to see their owners. Thus, the presence of pets such as dogs may induce positive feelings that are not evoked by one's human friends during performance of a stressful task, thereby reducing situational threat.

The physiological responses of subjects in the friend present condition are consistent with the notion that these subjects experienced greater evaluation apprehension during the stressful task even though their friends were clearly trying to be supportive.[3] Regarding performance, subjects in the friend present condition were less accurate than subjects in either of the other home conditions and less accurate than they had been in the laboratory session. Subjects in this condition tended to perform the serial subtractions much more rapidly than subjects in the other conditions and exhibited many more "restarts," which might have contributed to their lower performance. Unlike subjects in the pet present and control conditions, subjects in the friend present condition might well have been distracted by the presence of an evaluative friend. In general, the results in the friend present condition are consistent with social facilitation theory (Zajonc, 1965), particularly with the distraction/conflict reformulation of social facilitation theory by Baron, Sanders, and colleagues (Baron, 1986; Baron, Moore, & Sanders, 1978). This reformulation asserts that the presence of others increases drive and decreases performance on relatively novel or unlearned tasks.

The results of our friend present condition contrast sharply with those of Kamarck et al. (1990), who also used female subjects and female friends. We attribute these differences to the yeoman efforts that these investigators made to ensure that the friend was perceived as a nonevaluative other. Recall that friends in the Kamarck study touched subjects throughout the task, wore noise-blocking headsets to prevent them from hearing subject responses, and were engaged in their own task of filling out questionnaires. Therefore, as the researchers intended, it was extremely unlikely, if not impossible, for the friends to be perceived as evaluative.

It is not clear how important the element of touch was in the Kamarck et al. (1990) study. Although the literature suggests that touch between humans can engender positive feelings and reduce stress (e.g., Lynch, Flaherty, Emrich, Mills, & Katcher, 1974; Lynch, Thomas, Paskewitz, Katcher, & Weir, 1977) and that touching pets can reduce cardiovascular responses (Vormbrock & Grossberg, 1988), touch was not a factor in our study. Friends sat next to subjects on a sofa in a position that allowed them to see each other. Our only instructions to the friends were to be supportive in any way they preferred, but no one touched or spoke to subjects at any time during the home experiment. In our study, subjects were neither encouraged to touch their dogs nor discouraged from doing so, and dogs were neither leashed nor made to stay in one spot. Although subjects might have touched their dogs prior to the beginning of the experiment (e.g., when they brought them into the room), they did not pet or touch their dogs during the experiment itself. Thus, it appears that the "pet effect" in this study cannot be attributed to touch.

In this study, the presence of pet dogs provided the operationalization of a nonevaluative other, and humans provided the operationalization of an evaluative other. We are not suggesting that pet companions always fill the nonevaluative role[4] or that human companions always fill an evaluative role. Indeed, we suspect that pets would not necessarily be perceived as nonevaluative companions by individuals indifferent to or uncomfortable around them. Likewise, if human friends are perceived as

physiological responses across all the autonomic measures in this study.

[3] All friends were instructed to be supportive. Although none did so verbally, nearly all friends appeared to offer support nonverbally through eye contact and a forward leaning posture. Subjects in the friend present condition generally appeared to avoid their friends' attempts at eye contact.

[4] It is interesting to speculate that the stress buffering role of pets may, in part, explain their functional significance for humans and, hence, their historical presence in homes.

truly nonevaluative, they may act as buffers to stress, as Kamarck et al. (1990) have demonstrated. Furthermore, it is not clear that the presence of friends would produce increases in autonomic reactivity, as were found here, in stressful situations not involving task performance or "active" coping (Obrist, 1981), such as experiencing pain.

As our self-report data reveal, the women in this study were truly devoted to their pet dogs. Although many had spouses, friends, and children, they described the relationships they had with their dogs as special and different from all others. All of the women were lifelong animal enthusiasts and had experienced pets in their lives since early childhood. In open-ended postexperimental interviews, subjects described their dogs as members of their families and stated that major changes concerning career, location, and personal relationships, including marriage and divorce, were influenced by regard for how the dog would be affected. Several divorced women said that whereas husbands may come and go, and children may grow up and leave home, a "dog is forever." We were told that pets never withhold their love, they never get angry and leave, and they never go out looking for new owners.

It should also be noted that this study examined the moderating effects of pet and human companions on psychophysiological responses of individuals during acutely stressful experiences. Possible long-term effects of such companions were not examined. The nature of the relationship between the effects of acute experimentally induced stress and the cumulative effects of the stress of everyday life is not clear (Manuck & Krantz, 1986). However, to the extent that a positive relationship exists, our data are suggestive of health benefits of nonevaluative social support.

Finally, this study also demonstrated that a standard laboratory stressor such as mental arithmetic can be used to evoke levels of autonomic reactivity in home environments similar to those in the laboratory. This study provides a laboratory/field setting model for conducting psychophysiological reactivity experiments aimed at examining the impact of social psychological factors that are impossible, impractical, or inconvenient to implement in the laboratory. Its most immediate applicability is to studies examining the impact of the presence of others, including pets, friends, spouses,[5] children, caregivers, and so forth, on physiological concomitants of stress.

In our opinion, the results of this study are heuristic theoretically and empirically for work in the areas of human–pet interaction, social support and stress, and social facilitation. Across these areas, the pattern of our results suggests that the perceived nature of others present in stressful situations is critical in determining their effects on underlying physiological processes. In addition, the results here reveal that the nature of others present may interact with the situational context, suggesting complexities to which theoreticians and researchers have given little attention. In this study, even the presence of close friends did not preclude exacerbation of stress responses for subjects. Given that the mere presence of others is rarely "mere," increased effort should be made theoretically and empirically to identify important dimensions underlying relationships and to examine the interaction of these dimensions with various social contexts.

[5] An intriguing extension of this research into the area of close human relationships was suggested by the comments of a subject who called months after the experiment was over and asked if we could come back and repeat the study with a slight variation and compare the effect of her husband with that of her dog.

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