

## Personal Space Invasions in the Lavatory: Suggestive Evidence for Arousal

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The hypothesis that personal space invasions produce arousal was investigated in a field experiment. A men's lavatory provided a setting where norms for privacy were salient, where personal space invasions could occur in the case of men urinating, where the opportunity for compensatory responses to invasion were minimal, and where proximity-induced arousal could be measured. Research on micturation indicates that social stressors inhibit relaxation of the external urethral sphincter, which would delay the onset of micturation, and that they increase intravesical pressure, which would shorten the duration of micturation once begun. Sixty lavatory users were randomly assigned to one of three levels of interpersonal distance and their micturation times were recorded. In a three-urinal lavatory, a confederate stood immediately adjacent to a subject, one urinal removed, or was absent. Paralleling the results of a correlational pilot study, close interpersonal distances increased the delay of onset and decreased the persistence of micturation. These findings provide objective evidence that personal space invasions produce physiological changes associated with arousal.

In the study of person-environment relations, the concept of personal space has been postulated as a variable that, in part, determines how people respond to their social and physical environments. Sommer (1969) defined personal space as the "area with invisible boundaries surrounding a person's body into which intruders may not come" (p. 26). Investigations of personal space phenomena suggest that individuals seek to maintain psychologically comfortable interpersonal distances. If an invasion of personal space takes place, individuals will move away from others and reestablish the personal space boundaries (Felipe & Sommer, 1966; Sommer, 1969) or engage in compensatory behaviors that minimize the closeness (Patterson,

Mullens, & Romano, 1971; Cowan, Note 1). Other findings suggest that individuals will avoid invading the personal space of others (Barefoot, Hoople, & McClay, 1972; Sommer & Becker, 1969) or will engage in submissive gestures or verbalized apologies to minimize the impact of invasion (Efran & Cheyne, 1974; Felipe & Sommer, 1966; Knowles, 1973).

Although these behavioral responses related to personal space invasions have been documented and described, there has been little systematic investigation of the reasons why these responses occur. In a recent review, Evans and Howard (1973) concluded that "we do not as yet thoroughly understand all the variables which are relevant to [personal space] behavior, and we are even further away from being able to explain why and how personal space operates for human beings" (p. 341). The most common explanatory position is that emotional arousal is an important variable intervening between personal space and the behavioral responses to personal space invasion. Evans and Howard (1973) and Sommer (1969) are among those who have suggested that invasions of personal

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space are interpersonally stressful, increasing arousal and discomfort, and that it is this arousal that produces the behavioral responses. These behavioral responses occur because they reduce the arousal caused by the personal space invasion.

Although there is a clear relationship between personal space invasions and the behavioral responses to invasions, there is little unambiguous evidence that arousal plays any role, much less a mediating role, in this relationship. Findings from animal species other than man that chronic crowding is related to adrenal hypertrophy (Christian & Davis, 1966; Deevey, 1966) suggest prolonged arousal, but do not imply that similar processes operate in humans. Various self-report data suggest that human subjects report discomfort and negative feelings as a result of personal space invasions (Efran & Cheyne, 1974; Porter, Argyle, & Salter, 1970) or crowded conditions (Dabbs, 1971), but these reports may have been produced by factors other than arousal.

Several authors have attempted to obtain more direct indications of arousal. Efran and Cheyne (1974) attempted to measure changes in cardiovascular activity as a result of invasions, and Dabbs (1971) attempted to obtain measures of palmar sweating under conditions of crowding. In both cases the results were inconclusive. McBride, King, and James (1965) measured subjects' galvanic skin responses when they were approached at various distances from various angles by male and female experimenters. They found greater decreases in skin resistance with closer approaches, with frontal rather than side approaches, and with opposite-sex experimenters. Although this study is often cited as providing the most direct indication that personal space invasions produce arousal, it also is not conclusive, at least by itself. The subjects were instrumented, participating in an experiment, and aware of the dimension being manipulated, all of which may have made their behavior and responses different from disguised or naturally occurring invasions (Knowles & Johnsen, 1974).

As an alternative to the laboratory, a men's lavatory provides a setting where personal space violations can occur in a natural yet

sufficiently standardized way. Although Kira (1970) has pointed out that use of the bathroom evokes concerns for privacy among members of the middle class, public facilities do not allow complete privacy, particularly in the case of men urinating. Urinals are open and placed side by side so that, under crowded conditions, men stand shoulder to shoulder, coactively engaging in private elimination. Unlike other settings, including the laboratory, these personal space intrusions in the lavatory are minimally confounded by compensatory responses—moving away, changing body orientation, using hands and arms as an interpersonal buffer, reducing eye contact—that a subject makes to an invasion. If compensatory behaviors occur to reduce the arousal caused by invasions, then it would be impossible to measure the degree of arousal accurately if subjects were free to engage in these compensatory behaviors.

In addition, research on micturation suggests that it is a process sensitive to arousal (Scott, Quesada, & Cardus, 1964; Straub, Ripley, & Wolf, 1950; Tanaeho, 1971). At the onset of micturation, the detrusor muscles of the bladder contract, increasing intravesical pressure and forcing urine out of the bladder. At the same time, the two sphincters of the urethra relax, particularly the external sphincter, allowing urine to flow. Social stressors appear to affect both these mechanisms of micturation. Straub et al. (1950) showed that a stressful interview produced a marked and sustained increase in intravesical pressure. Scott et al. (1964) reported that fright and embarrassment inhibited relaxation of the external sphincter of the urethra.

The relationships between social arousal and micturation suggest that, if an individual intent on micturating were subjected to a stressor, the onset of micturation would be delayed because of a reduction in the degree of relaxation of the external sphincter, while the duration of urine flow, once begun, would be foreshortened because of increased intravesicle pressure. If personal space invasions produce arousal, then subjects standing closest to others at lavatory urinals would show increases in the delay of onset of micturation and decreases in the persistence of mictura-

tion. Because of the novelty of these hypotheses, a pilot study was first undertaken to investigate whether any relationship between interpersonal distance and micturation times could be observed.

### *Pilot Study*

A field observation conducted at a men's lavatory at a western U.S. university provided evidence for a correlation between interpersonal distance and micturation times. Men entering a restroom to urinate were allowed to choose a urinal under prevailing ecological conditions. Data were recorded for 48 subjects, users of the men's lavatory. A user was included as a subject if the degree of interpersonal distance between him and the next nearest user remained constant throughout the duration of his urination. The restroom contained two banks of five urinals, which were bowl-type receptacles jutting out of the wall and containing about 3 inches (8 cm) of standing water, which the user flushed.

An observer was stationed at the sink facilities and appeared to be grooming himself. When a potential subject entered the room and walked to a urinal, the observer recorded the selected urinal and the placement of the next nearest user. He also noted (with a chronographic wristwatch) and recorded the micturation delay (the time between when a subject unzipped his fly and when urination began) and the micturation persistence (the time between the onset and completion of urination). The onset and cessation of micturation were signaled by the sound of the stream of urine striking the water in the urinal.

Of the 48 subjects recorded, none selected a urinal immediately adjacent to another user, 23 were separated by one urinal from the next nearest user, 16 were separated by two urinals, and 9 were separated by three or more urinals. The fact that no subjects were observed choosing an adjacent urinal may reflect active avoidance of the most proximate interpersonal distance. Even with this restricted range of interpersonal distance, significant correlations were found for both measures. Micturation delay showed a negative

correlation with the three levels of interpersonal distance,  $r(46) = -.315, p < .05$ .<sup>1</sup> Subjects standing one urinal away had a mean delay of 7.9 seconds, subjects two spaces away had a delay of 5.9 seconds, and subjects three or more spaces away had a delay of 5.7 seconds. Micturation persistence showed a positive relationship with the three levels of interpersonal distance,  $r(46) = +.562, p < .001$ . The mean persistence was 19.0 seconds with one space, 24.4 seconds with two spaces, and 32.0 seconds with three or more spaces.

This pilot study, while lacking controls on subject self-selection and open to various interpretations, did suggest that the hypotheses warranted more controlled investigation. The correlations found were in the direction predicted by the hypotheses. Moreover, the pilot study suggested that the micturation measures could be used as the dependent variables in an experimental study. Thus, the following experiment was conducted to test the hypothesis that decreases in interpersonal distance lead to arousal as evidenced by increases in micturation delay and decreases in micturation persistence.

## METHOD

### *Overview*

In a field experiment conducted in a men's lavatory at a midwestern U.S. university, subjects were randomly assigned to one of three levels of interpersonal distance. Men who entered a three-urinal lavatory to urinate were forced to use the leftmost urinal. A confederate was placed immediately adjacent to the subject, one urinal removed, or was absent from the lavatory. An observer stationed in a toilet stall timed the delay and persistence of micturation.

### *Subjects*

Data were gathered on 60 users of the men's lavatory. A user was included as a subject if no other user (besides the confederate) was present during his urination. If someone else was present or entered during urination, the user was not counted. Conditions were randomly assigned and prepared before the subject entered the lavatory. Subjects were not informed that they had participated in an experiment.

<sup>1</sup> Two-tailed probabilities are used throughout.

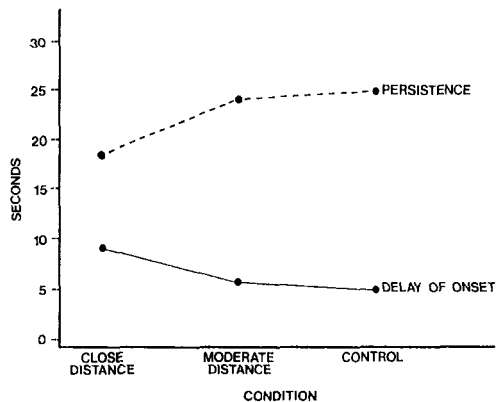


FIGURE 1. Micturation times.

### Procedure

The observed lavatory was just off a main hallway, adjacent to a large classroom. The observed use rate averaged about one person every 6 minutes. The restroom contained two toilet stalls and three urinals. The urinals were 18 inches (46 cm) wide with 18 inches of tile between adjacent urinals and extended up from the floor about 4 feet (1.2 m). The urinals were automatically flushed at 10-minute intervals.

The subjects were forced to use the leftmost urinal under one of three levels of interpersonal distance. In the close distance condition, a confederate appearing to urinate was stationed at the middle urinal, and a "Don't use, washing urinal" sign accompanied by a bucket of water and a sponge was placed on the rightmost urinal. This arrangement left a distance of approximately 16 to 18 inches (40 to 46 cm) between the shoulders of the subject and confederate. In the moderate distance condition, the confederate stood at the rightmost urinal and the bucket and sign were placed in the middle urinal. This arrangement left a distance of 52 to 54 inches (132 to 137 cm) between the subject and the confederate. In a control condition, the confederate was not present in the lavatory and both the middle and right urinals had signs on them with the water bucket in between.

An observer was stationed in the toilet stall immediately adjacent to the subjects' urinal. During pilot tests of these procedures it became clear that auditory cues could not be used to signal the initiation and cessation of micturation. The urinals were so silent that even the confederate standing adjacent to the subject could not hear the urine striking the urinal.<sup>2</sup> Instead, visual cues were used. The observer used a periscopic prism imbedded in a stack of books lying on the floor of the toilet stall. An 11-inch (28-cm) space between the floor and the wall of the toilet stall provided a view, through the periscope, of the user's lower torso and made possible direct visual sightings of the stream of urine. The observer, however, was unable to see a

subject's face. The observer started two stop watches when a subject stepped up to the urinal, stopped one when urination began, and stopped the other when urination was terminated. These times allowed calculation of the two dependent variables: delay of onset and persistence of micturation.

### RESULTS

The hypotheses that decreases in interpersonal distance would lead to increases in the delay of micturation and decreases in the persistence of micturation were tested in a multivariate analysis of variance of the effects of conditions on the two micturation measures. Each measure was heteroscedastic, but square root transformations of the data made the cell variances comparable, and the analysis was performed on these transformed scores. The multivariate analysis indicated a significant difference among distance conditions,  $F(4, 112) = 10.38$ ,  $p < .001$ . A priori multivariate comparisons among conditions showed that the close distance produced responses significantly different from the moderate distance,  $F(2, 56) = 10.04$ ,  $p < .001$ , and that the confederate-present conditions produced responses significantly different from the confederate-absent condition,  $F(2, 56) = 14.53$ ,  $p < .001$ . Figure 1, which presents the mean seconds for micturation delay and persistence in each condition, shows that the effects were in the predicted direction.

A test of the univariate effects of distance on micturation delay revealed significant differences among conditions,  $F(2, 57) = 12.44$ ,  $p < .001$ . Micturation delay increased from a mean of 4.9 seconds in the control condition to 6.2 seconds in the moderate distance condition to 8.4 seconds in the close distance condition. The a priori tests indicated that the close condition led to significantly longer delays than the moderate condition,  $F(1, 57) = 9.01$ ,  $p < .004$ , and that the confederate-present conditions led to significantly longer delays than the confederate-absent condition,  $F(1, 57) = 15.86$ ,  $p < .001$ .

<sup>2</sup> Although the silence of the urinals necessitated a change from the pilot study in the mode of observation, it had the advantage of making the confederate credible. During tests of the experimental procedures, none of the test subjects had any suspicions about the confederate's activity.

Micturation persistence also showed significant differences among conditions,  $F(2, 57) = 4.41, p < .017$ . The pattern of means, from 24.8 seconds in the control condition to 23.4 seconds in the moderate distance to 17.4 seconds in the close distance condition, shows the predicted decrease in the persistence of micturation. The close distance produced shorter persistence times than the moderate distance,  $F(1, 57) = 4.49, p < .038$ , and the confederate-present conditions produced shorter persistence times than the confederate-absent condition,  $F(1, 57) = 4.33, p < .042$ .

The analysis of the effects of interpersonal distance on micturation times supported both hypotheses. Closer distances led to increases in micturation delay and decrease in micturation persistence. Both of these effects, which across conditions produced a negative correlation between cell means, appeared in spite of the fact that the two measures tended to be positively correlated. The within-cell correlation between micturation delay and persistence was  $+.349$ , which reflected comparable correlations within each condition ( $r_s = +.308, +.304, \text{ and } +.542$  for the control, moderate, and close distance conditions).

#### DISCUSSION

Variations in interpersonal distance in a lavatory appear to be related in systematic ways to variations in micturation times. The pattern of results supports the hypothesis that arousal increases with decreases in interpersonal distance. The arousal model of personal space invasions proposes that close interpersonal distances are interpersonally stressful, increasing arousal and discomfort, and that it is this arousal that produces behavioral responses to invasions. The purpose of this field study was to investigate the first half of the model, that arousal results from interpersonal closeness, and the findings support this part of the arousal model. What has not been shown by this study or earlier studies is whether the arousal leads to or causes the behavioral responses to personal space violations, as hypothesized in the second half of the model. The arousal indicated in this study may be a concomitant of invasion that has no effect on immediacy behav-

iors. Subsequent research is needed to investigate the second half of the arousal model.

The results of this experiment reproduced and complemented the results of the pilot study. Both micturation delay and persistence were shown to be related to interpersonal distance, and similar patterns of means were observed. Although neither set of data is precise enough to allow assessment of the form of the relationship between distance and micturation times, it appears that the closest distance had much more of an effect than the next closest distance. This pattern is reminiscent of the nonlinear, exponential relationships observed for much greater distances (Bratfisch, 1969; Ekman & Bratfisch, 1965; Lundberg, Bratfisch, & Ekman, 1972). The present data are not incompatible with Ekman's suggestion that emotional involvement decreases as an inverse power function of distance.

Finally, the present study suggests that the dependent measures may have some utility as unobtrusive measures of social arousal in laboratory as well as field settings. In a laboratory, the effects of intravesical pressure could be more sensitively estimated by using the volume of urine expelled as a covariate to the persistence measure. Presumably, differences in the amount of urine expelled contributed a great deal of variance to the persistence measures in the present study. Yet, both micturation delay and persistence were sensitive to situational differences. Although the parameters of these measures have not been extensively studied, the present study implies that they have some construct validity as indicators of arousal.

#### REFERENCE NOTE

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