Heart Rate Response to Touch[1]

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The effect of tactile stimulation on heart rate (HR) in humans was investigated under three conditions: 1) Experimenter outside of room in which subject is sitting; 2) experimenter in the room with the subject; 3) experimenter in the room while touching the subject's right wrist. Nonsignificant increases in HR were observed when the experimenter entered the room (X = 0.64 beats per minute (bpm)). Conversely, large decreases occurred when the experimenter placed his hand on the subject's wrist (X = 9.16 bpm, $p < 0.05$). To determine if tactile stimulation alone accounts for these differences three comparisons were made in a second experiment: 1) Experimenter out of test room, subject touches own wrist; 2) experimenter in room standing near subject; 3) experimenter touching subject's wrist. Subjects showed slightly elevated HR during the self-touch condition (X = 1.26 bpm, not significant). Although no change was noted with the experimenter standing beside the subject, there were decreases, as in Experiment I, when the experimenter touched the subject's wrist (X = 1.75 bpm, $p < 0.05$). These results suggest that the observed decreases in HR were contingent upon another person's touch. While self-tactile stimulation produced a slight increase in HR, tactile stimulation by another caused bradycardia.

Dramatic physiological and behavioral changes have been attributed to tactile stimulation within a social context. These effects include developmental arrest and depression in infants who are deprived of tactile stimulation (5, 11), accelerated growth and intellectual development in infants (2) and retarded children (12) who are given extra tactile stimulation, reductions in ruminative vomiting (3, 10), and reductions in the physiological response to noxious stimuli in animals (1, 7). Usually discussed in the context of the psychoanalytic theory of oral dependency, these effects have generated few attempts to study systematically the characteristics of the stimuli or settings that produce them.

Experiments by Gantt et al. (4) suggest that tactile-social stimulation produces a reliable cardiac deceleration in several animal species. Lynch et al. (8) and Mills et al. (9), however, observed cardiac accelerations in response to touch with the human patients they studied in a coronary care unit.

The two experiments reported here were designed to determine whether cardiac deceleration occurs in response to touch in normal humans; whether the presence of another person without tactile stimulation, or tactile stimulation in the absence of another person are sufficient to produce the response; whether male and female subjects respond differently to touch by a male experimenter; and whether the cardiac response to tactile-social stimulation habituates over trials.

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EXPERIMENT I

Method

Subjects Four men and four women (average age 26.4 years), nurses, medical students, and research technicians, volunteered in response to advertisements and were paid for their participation. Blood pressures taken before the session were below 150 mm Hg systolic and 90 mm Hg diastolic in all participants.

Procedures All testing was conducted in a sound attenuation room with the subjects seated in front of a console. A closed-circuit television camera was used to monitor movement and compliance with instructions. A Grass model 78D polygraph recorded heart rate.

Prior to the actual session it was explained to each subject that we were interested in the effects of tactile stimulation on cardiovascular functioning. Electrodes were placed on the shin of the left leg and on the right ear lobe. Subjects then sat in the sound attenuation room in front of the console. The experimenter explained that he would close the door and that they should remain quiet.

It was further explained that after one minute the door would be opened and the experimenter would stand next to the subject, that the subject need not look at the experimenter, but had only to relax and to sit quietly. After 30 seconds the experimenter placed his hand on the subject's wrist and kept it there for 30 seconds. The experimenter then removed his hand, stood an additional 30 seconds next to the subject, and then left and closed the door. This procedure was repeated 5 times during a single session, with one minute between repetitions. These experimental procedures required approximately 40 minutes.

At the end of the session, each subject was asked what he thought had happened to his heart rate when the experimenter's hand was placed on his wrist.

Heart rate was computed for each of the five 30-second experimental periods (experimenter absent before touching, experimenter present before touching, touching, experimenter present after touching, experimenter absent after touching). These values, averaged for the five trials of a subject to obtain one value for each experimental period for each subject, were then entered into a two-factor analysis of variance with one within-subjects factor (experimental periods) and one between-subjects factor (sex). Paired comparisons between experimental periods were then made by t tests for related measures.

RESULTS

Figure 1 shows heart rates in each experimental period. Males and females are combined because the analysis of variance indicated that there was no significant sex difference ($F(1,6) = 2.53$, $p > 0.05$), and no significant interaction between sex and experimental periods ($F\ (4,24) = 2.28$, $p > 0.05$). Touching was associated with an average reduction in heart rate of 5.0 beats per minute (bpm) relative to the door-closed condition. The mere presence of the experimenter had an opposite effect; heart rate was increased by 1.3 bpm. These inferences were supported by statistical analyses. In the analysis of variance the main effect for experimental periods was significant ($F\ (4,24) = 10.70$, $p < 0.001$). Paired comparisons showed that heart rate during touching was significantly lower than during every other interval ($p < 0.01$ in each comparison). The experimenter entering the room before touching caused a significant increase in heart rate ($t\ (7) = 2.68$, $p < 0.05$) as compared to the experimenter absent condition.

EXPERIMENT II

Experiment I established that heart rate deceleration occurs in response to tactile-social stimulation in humans and that touching is a necessary component of the effective stimulus. Experiment II was designed to determine whether tactile stimulation without the presence of

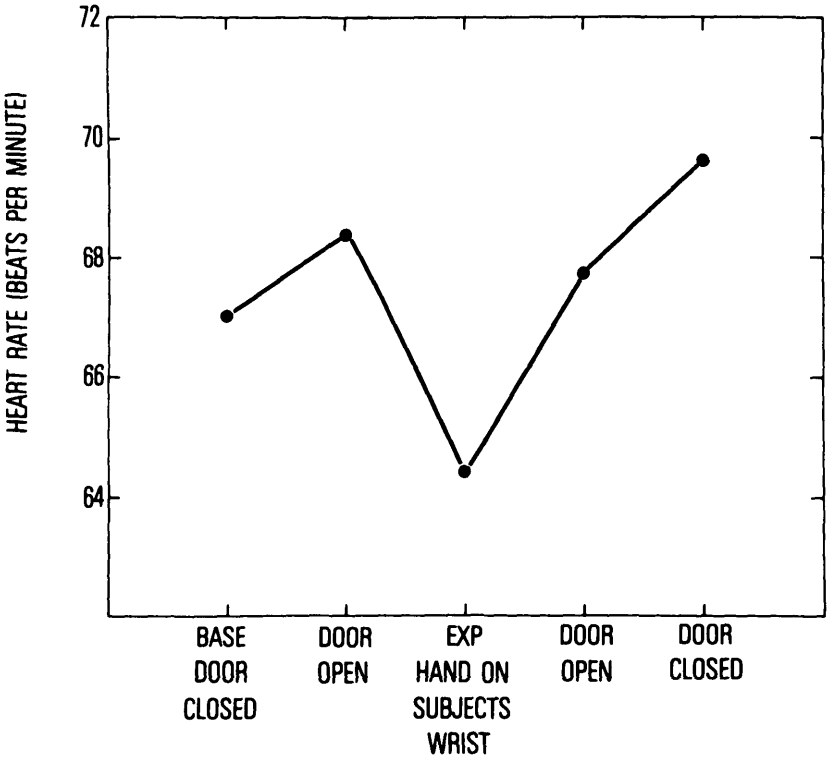

Fig. 1. Heart rate changes to experimenter present not touching, experimenter present and touching, experimenter not present, Experiment I.

another person is sufficient to produce cardiac deceleration. This was done by comparing the effect of having the subject touch his own wrist while isolated in the acoustical chamber to the effect of having the experimenter touch the subject's wrist.

METHOD

Subjects

Subjects were 5 women and 3 men (average age 25.8 years) recruited in the same manner as in Experiment I. Apparatus was the same.

As in Experiment I, subjects were told that we were interested in the effects of tactile stimulation on cardiovascular functioning. After electrode placement, subjects were seated in front of the console and instructed as follows:

> Please sit quietly and try as much as possible to relax. I will close the door. During this time, remain seated and do not move around. In about 30 seconds a green light will come on and remain on for 30 seconds. During this time I want you to place your left hand on your right wrist. Please leave it there until the light goes off. As soon as it is turned off, return your hand to the arm of your chair. Thirty seconds later, I will open the door and stand next to you for 30 seconds. Then I will place my hand on your wrist for 30 seconds. During this time, just try to relax, and it is not necessary to look at me. After 30 seconds I will remove my hand but will continue to stand next to you for 30 seconds more. Then I will close the door. We will be repeating this procedure five times. Any questions?"

Subjects were asked at the end of the session what they thought had happened to their heart rate while the experimenter's hand was on their wrist.

Data were averaged across trials for each subject as in Experiment I, and the same type of analysis of variance was used.

RESULTS

The data for males and females are combined because, as in Experiment I, sex was not a significant main effect (F (1,6) = 0.65) or interaction term ($F(5,30) = 0.16$).

Figure 2 shows that having the subject touch himself while alone in the chamber produced no change or a slight increase in heart rate; having the experimenter touch the subject produced a cardiac deceleration. The statistical analyses support these impressions. The analysis of variance yielded a significant main effect for type of trial ($F(5,30) = 3.39$, $p < 0.025$). The t test for paired comparisons showed that heart rate was significantly lower during the experimenter-touch condition as compared to self-touch ($t(7) = 3.67$, $p < 0.01$), as compared to door closed and no one touching the subject's wrist (t (7) = 3.46, $p < 0.05$) and as compared to experimenter present but not touching the subject (t (7) = 2.53, $p < 0.05$).

Because subjects in both experiments had been presented with five repetitions of two 30-second period of experimenter-present-but-not-touching followed by a 30-second period of ex-

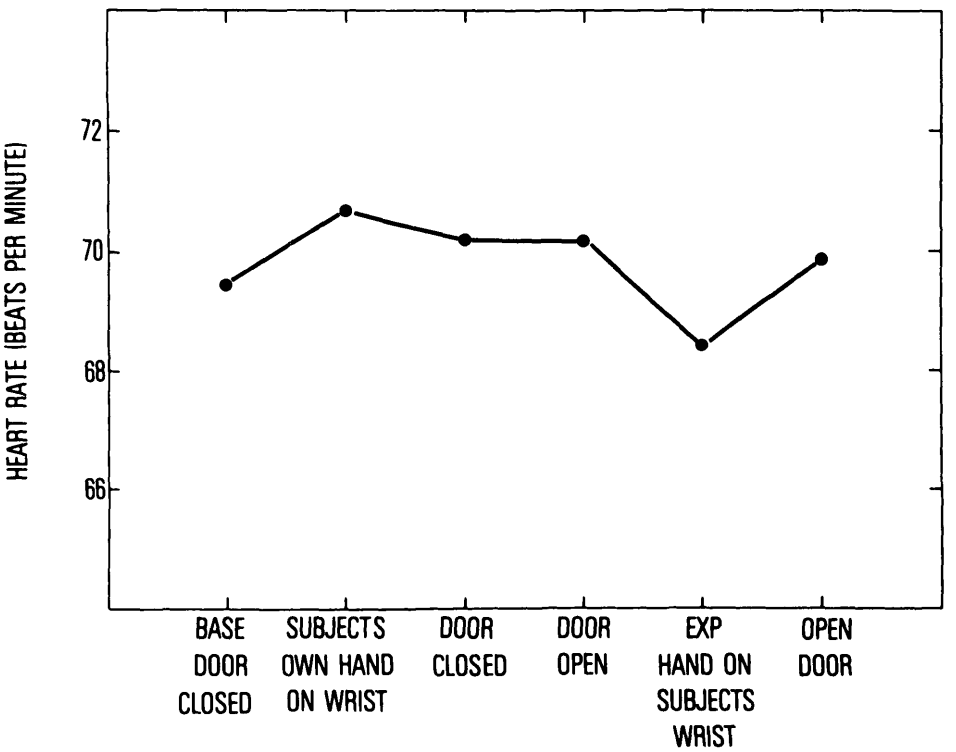

Fig. 2. Heart rate changes to experimenter and self-touch conditions, Experiment II.

perimenter-touching-subject's wrist, the following analysis combined the results of Experiments I and II. To test whether the magnitude of heart rate deceleration produced by touching was related to the baseline heart rate, we compared baseline heart rate (experimenter-present-but-not-touching) to a heart-rate change score. This change score was computed by taking the difference between baseline and the experimenter-touch condition. Figure 3 shows this relationship, with an obtained correlation of r 0.57 ($p < 0.02$).

To determine whether the cardiac response to touching habituates or extinguishes across trials, we computed heart rate during baseline and during the experimenter-touch condition for each trial separately. Figure 4 shows that the response did not habituate over five trials.

In order to examine the effects of expectancy on the heart rate response to touching, subjects were asked immediately following the experimental session what they felt happened to their heart rate when the experimenter touched their wrist. All responded that they believed their heart rate went up.

DISCUSSION

Experiments I and II showed that healthy human subjects respond to being touched by another person with heart rate deceleration. This is similar to the response of several infrahuman species to human touch (3, 6), but differs from the cardiac acceleration shown by coronary care patients when they are touched by nursing staff (8, 9). These differences in

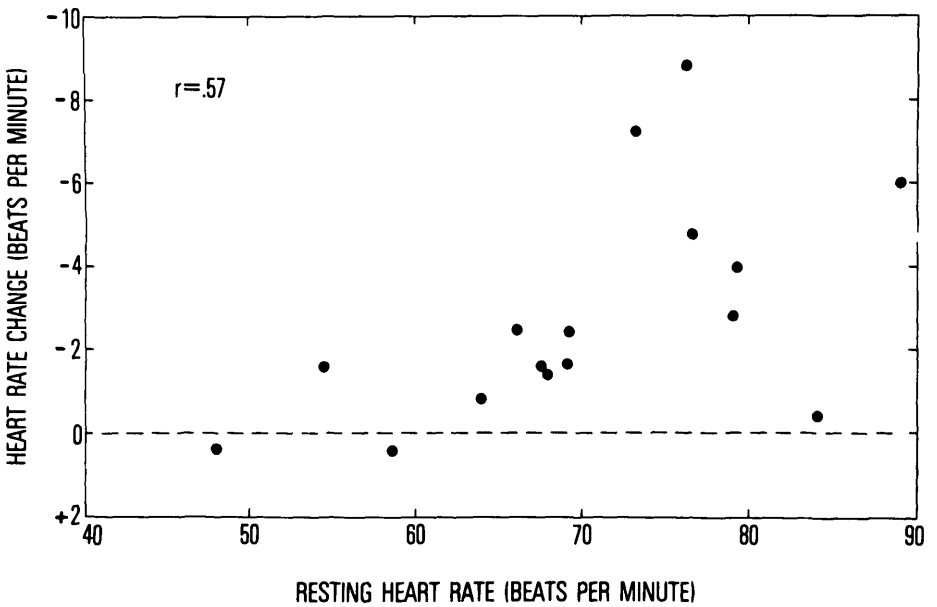

Fig. 3. Correlation between baseline HR and experimenter touch conditions. The higher the baseline HR the larger the decrease produced by touching.

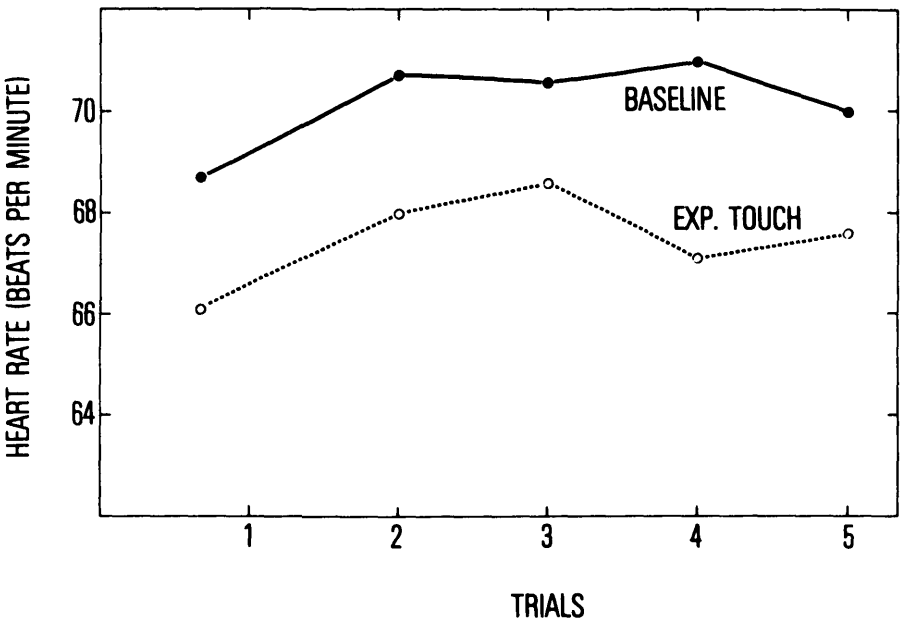

Fig. 4. Heart rate for baseline and experimenter touch conditions over 5 trials in Experiment II.

outcome between the two populations of human subjects may be due to differences in drugs and/or states of consciousness, or they may be related to the psychological significance of having one's pulse taken by a nurse in a coronary care unit.

Although the cardiac response of the healthy human subjects we studied was qualitatively similar to that of other species, it appeared to be much smaller. The magnitude of the response was however, a function of the starting heart rate; subjects with low resting heart rates showed smaller decelerations when touched than did subjects with higher resting heart rates. Thus, larger and more clinically meaningful changes in heart rate might occur in response to touch if subjects were aroused beforehand by exercise or emotion.

The studies reported here have further defined the necessary characteristics of the stimulus that produces cardiac deceleration. Neither the presence of another person who does not touch the subject nor tactile stimulation by the subject himself while alone are sufficient to evoke cardiac deceleration. Both tactile stimulation and the presence of another person who does the touching are required. Also a difference between the sex of the person doing the touching and the person touched does not significantly affect the response.

Is the cardiac response to tactile-social stimulation an orienting response, a classically conditioned response, or an unconditioned reflex? Failure of the response to habituate or extinguish over a series of five trials suggests that it is a reflex. Also, since all subjects believed that touch had increased their heart rate even though 14 of 16 showed cardiac decelerations, and because the response was not influenced by the sex of the experimenter, the occurrence of the re-

sponse seemed unrelated to the subjects' expectations. The hypothesis that this cardiac response to touching is a reflex is consistent with the observation that this is a potent response in infants (11, 12). Definitive tests of the reflex hypothesis await studies of animals raised without human or conspecific touching.

REFERENCES

1. Anderson SL, Gantt WH: The effect of person on cardiac and motor responsivity to shock in dogs. Cond Reflex 1:181–189, 1966
2. Casler L: The effects of extra tactile stimulation on a group of institutionalized infants. Genet Psychol Monogr 71:137–175, 1965
3. Gaddini R, Gaddini E: Rumination in infancy, in Dynamic Psychopathology in Childhood. Edited by C Jessner, E. Pavenshidt. New York, Grune & Stratton, 1959, pp. 166–185
4. Gantt WH, Newton JEO, Royer FL, Stephens JH: Effect of person. Cond Reflex 1:18–35, 1966
5. Harlow HF: The nature of love. Am Psychol 13:673–685, 1958
6. Lynch JJ, Fregin GF, Mackie JB, Monroe RR: Heart rate changes in the horse to human contact. Psychophysiology, 11:472–478, 1974
7. Lynch JJ, McCarthy JF: Social responding in dogs: heart rate changes to a person. Psychophysiology, 5:389–393, 1969
8. Lynch JJ, Thomas SA, Mills MS, Mainow K, Katcher AH: The effects of human contact on cardiac arrhythmia in coronary care patients. J Nerv Ment Dis 158:88–99, 1974
9. Mills ME, Thomas SA, Lynch JJ, Katcher AH: Effects of pulse palpation on cardiac arrhythmia in coronary care patients. Nur Res 25:378–382, 1976
10. Richmond JB, Eddy E, Green M: Rumination: a psychosomatic syndrome of infancy. Pediatrics, 22:49–55, 1958
11. Spitz RA, Wolf KM: Anaclitic depression: an inquiry into the genesis of psychiatric conditions in early childhood. Psychoal Stud Child 2:313–342, 1946.
12. Temerlin MK, Trousdale WW, La Crone HH, Harrison CH, Rundell OM: Effects of increased mothering and skin contact on retarded boys. Am J Men Defic 71:890–893, 1967