The Effects of Deep Pressure Touch on Anxiety

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Occupational therapists who work with hyperactive children and adults who are in an aroused state sometimes employ deep pressure touch (DPT) as a therapeutic method to achieve calmer behavior. This pilot study attempts to measure effects of DPT on objective and subjective anxiety. Twenty-three healthy college students, serving as their own controls, self-administered DPT via a specially designed apparatus. Heart rate and self-reported anxiety were compared under conditions of DPT (experimental) and confinement without DPT (control). Data on subjects' trait anxiety also were analyzed. Although the group as a whole did not relax significantly more under experimental conditions than under control conditions, the degree of subjective relaxation was greater in the experimental group. These results, coupled with a significant intragroup difference in the response of subjects with high trait anxiety, were encouraging. This study provides direction and focus to investigators interested in further research on the validation of an empirically useful treatment technique.

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Touch, in general, can range from a light, barely perceptible sensation to one that is heavy, deep, and painful. The sensation of deep pressure touch (DPT) exists between these two extremes. One definition of DPT is mechanical deformation of the skin, coupled with stimulation of the underlying fascia and periosteum (Mountcastle & Darian-Smith, 1968). In less technical language, an occupational therapist might define DPT as one of several somatosensory sensations arising from hugging, cuddling, squeezing, stroking, or holding.

In clinical treatment programs for hyperactive, learning-disabled, aroused autistic, and schizophrenic persons, many occupational therapists have employed DPT and observed its calming effect. Methods of providing DPT have included rolling up a patient in a snug blanket or playing body contact games or games such as the "mat sandwich" described by Wilbarger and Kuizanga (1975). Ayres (1964) and Knickerbocker (1980, p. 115) advocated the use of DPT with children demonstrating hyperactivity, distractability, and tactile defensiveness. Ayres (1979) reported that this technique promotes calmer, more organized interaction with the environment in such children. In addition to the effects reported by therapists, several physicians have explored a "holding technique" with hyperactive children and proposed its use as an alternative to medication for some persons (Henderson, Dahlin, Partridge, & Engelsing, 1973; Arnold & Sheridan, 1980).

DPT is considered a valuable technique because it is noninvasive, is easily applied, and has no known adverse side effects. It also is generally pleasurable and therefore self-motivating. Because the technique does not require conscious effort as do some other forms of relaxation training, it can be useful with persons with limited concentration and attention spans. Furthermore, the technique does not require special or expensive equipment, as does, for example, biofeedback training.

Current evidence substantiating the effectiveness of DPT as a calming, relaxation technique is derived mainly from observations by therapists. However, most therapists probably would agree that DPT is not an effective calming technique with all patients. This leaves in question whether effective treatment stems from the treatment technique itself, the patient (who for some reason does or does not respond), some confounding interpersonal variable between the therapist and patient, or the manner in which the technique is administered. This paper represents an initial effort to measure and describe the effects of this therapeutic technique. The variables of confinement, self-control, personality, effect of temperature, and interpersonal effect are discussed and considered for their possible influence on a person's response to

DPT and their relevancy for the design of a DPT apparatus.

Literature Review

The application of DPT as a calming technique dates back to the Middle Ages. Mechanical restraint with shackles and chains was used to manage agitated and violent patients in insane asylums (Hunter & Macalpine, 1963, p. 606). By the late 1600s, straitjackets and body jackets replaced the use of chains and also produced a noticeable beneficial effect: Patients no longer howled, screamed, and thrashed about all night as they had done when chained. Body jackets and straitjackets, unintentionally achieving the status of a treatment technique, quickly earned a reputation for suppressing physical excitement and restoring mental tranquility and reason in the patient. The straitjacket was dismissed eventually as an unethical form of treatment and replaced by the use of sedative drugs and solitary confinement (Hunter & Macalpine, 1963).

In psychiatric facilities today, therapists and staff report that maximum restraint commonly involves placing the patient in the supine position, strapping the wrists and ankles to the bed, placing a double sheet over the patient's trunk and extremities, and tightly tucking the sheet under the mattress. Although the primary intent is maximum restraint, it is readily apparent that the patient also receives DPT from the shoulders down through the thighs in this immobilized, confined position.

The body jacket, laced from shoulders to ankles, and the sheet wrap appear to apply DPT in a manner similar to the mat sandwich technique employed in occupational therapy clinics today. Although DPT is inherent in confinement or physical restraint, it is unclear whether DPT or confinement itself produces a calming effect. Moreover, the effects of confinement could be physical (e.g., reduced proprioceptive flow to the central nervous system) (Gellhorn, 1958) or psychological (e.g., forced submission to authority or intimidated, cowering surrender to an overpowering force), in the latter instance, the results may be deceiving. As Kelly (1980) explains, a central state of excitation, fear, or terror can paradoxically accompany a physically calm outward appearance.

This raises questions about control under confining conditions. Knickerbocker (1980, p. 115) and Grandin and Scariano (1986) stressed the importance of self-control in the application of DPT to reduce hyperexcitability; but hyperexcitability also has been reduced in the absence of self-control (Arnold & Sheridan, 1980; Hunter & Macalpine, 1963; Kumazawa, 1963). Rotter (1966) suggested that the issue of control, in general, may be a personality characteristic. He explained that individuals with an internal locus of control (LC) are likely to attempt to actively master their environment, whereas those characterized by an external LC generally demonstrate more passivity relative to their environment. When control is exercised over individuals, those with an internal perspective are more resistive whereas those with an external perspective expect external control and are less resistive. Thus, motivation, effort, and performance in activities or situations could be influenced by one's active or passive participation as well as one's perceived internal or external LC.

Montagu (1971, p. 127) suggested that a "snugly, comforting environment," in which a person is tucked in and enveloped by sheets which do not allow air to circulate against the skin, provides reassurance and security. Peiper (1966, p. 606) stated that "there is no better sedative" than to be cradled in a mother's arms. This raises questions of the possible role of temperature (i.e., warmth) and interpersonal/social influences in one's response to DPT.

Animal studies suggest that something more fundamental than temperature regulation may be involved in responses to DPT. Hartsock (1979) provides evidence that nestling behavior in pigs may be motivated by the need for contact comfort rather than warmth. He reported that piglets (who can easily die of hypothermia if not placed under a heat lamp) preferred to lie against a wall or the side of a sow instead of the middle open area of the pen where the heat lamp is located. Similarly, Harlow (1958, 1959) found that baby monkeys, deprived of their birth mother, preferred to cling to an unheated cloth surrogate mother rather than sit on a warm heating pad.

The extent to which the interpersonal variable influences one's response to DPT is difficult to evaluate. Although studies which eliminate the interpersonal variable do not completely resolve this issue, they do seem to suggest that the DPT stimulus, by itself, has a profound influence on one's state of arousal.

Kumazawa (1963) found that heavy clips placed on the ears and skin of the neck and back of 43 normal rabbits in an aroused state produced "deactivated" electroencephalograms (EEGs) consisting of spindle bursts and high-amplitude slow waves in the anterior cortex and irregular waves in the hippocampus. These EEG patterns were accompanied by drowsy behavior (relaxed muscle tone, pupillary constriction, and narrowing of the lid aperture). As the amount of skin pressure increased, the effects were greater, appeared earlier, and lasted longer. Similar effects were observed when the rabbits' limbs and heads were mechanically restrained in a stereotaxic apparatus.

Other studies reinforce Kumazawa's findings. Teitelbaum (1982) reported that pressure on the torso or head and neck (using a bandage or cinch) deactivates the postural support system in normal adult animals. Several other studies (Takagi, 1956) demonstrated that a pressure stimulus (bilateral pinching) decreased tone in limb muscles of rabbits, particularly in young, slightly anesthetized or decorticated animals. As the intensity of the pressure stimulus grew, movement was more inhibited, and in lower order animals a motionless, hypnotic state was produced. Takagi and Kobayasi (1950) reported the results of a study which indicated that skin pressure produces reflexive and functional influences on the bronchi and pulmonary vessels, a decrease in metabolic rate (decreased oxygen consumption), and a decrease in pulse rate, with wide variation between subjects. Their results, gleaned from experiments with animals and humans, led them to conclude that pressure is inhibitory not only to the motor system, but to the whole autonomic system.

The foregoing analysis of some of the components of DPT suggests complex and intertwining variables. That DPT apparently has a calming effect suggests that the extensive literature on anxiety and relaxation techniques may provide guidance in selecting appropriate measurement parameters and tools for DPT study.

In the literature, anxiety is often chosen as a dependent variable. It appeared to be a reasonable choice for this study as well. Anxiety is defined by Kelly (1980) as the "subjective experience of apprehension or tension, imposed by the expectation of danger or distress or the need for a special effort" (p. 13). Although emotional tension is implied, physical tension in skeletal muscles is considered to be concomitant. Relaxation is generally defined as the absence of tension. The relationships between anxiety, mental and physical tension, and relaxation are complex. Contradictory results and conclusions are not uncommon, and most researchers admit that measurement tools, methodology, methods of data quantification and data treatment, and the subject's mental state (attention, motivation, personality, etc.) exert their influence.

In anxiety/relaxation studies, it is common to employ a variety of measurements, including objective psychophysiological tools (e.g., electromyography, heart rate, skin conductance), subjective tools (e.g., standardized self-reports and rating scales), and personality tests. The State-Trait Anxiety Inventory (STAI), developed by Spielberger, Gorsuch, and Lushene (1970), is one such subjective tool frequently used to assess both situational (state) anxiety and anxiety that is a relatively stable characteristic or trait of the individual. Test-retest reliability and correlational validity have been established for the STAI. The STAI is reviewed in detail by Greenstein (1983).

Some convincing studies have found that heart rate, electromyography, and subjective anxiety are significant indices of change in tension (Alexander, White, & Wallace, 1977) and that muscle tension correlates with trait anxiety (Smith, 1973) and state anxiety (Alexander et al., 1977). Despite conflicting results, the STAI is still regarded as an effective tool for measuring responses to relaxation procedures.

Confinement, self-control, personality factors (such as trait anxiety and LC) and interpersonal factors may influence a person's response to DPT. However, an apparatus created to apply DPT could eliminate the interpersonal variable, thus allowing the researcher to focus on the effects of DPT itself on the subject. Ideally, such an apparatus would allow the subject at least some degree of control over its use. Confinement was chosen as a control procedure, given the difficulty of eliminating it entirely as an element of the apparatus. Although confinement may exert its own influence, its effects would likely be subordinate to DPT's.

Because the optimal amount and duration of pressure for therapeutic purposes have not been established, and because the roles of confinement, self-control, and personality remain unclear, a pilot study might reasonably set out to assess how a normal population, under stress, would respond to DPT. The hypotheses of this study, therefore, were as follows:

1. DPT will reduce objective and subjective anxiety
2. High trait anxiety subjects will respond to DPT differently than low trait anxiety subjects.

Method

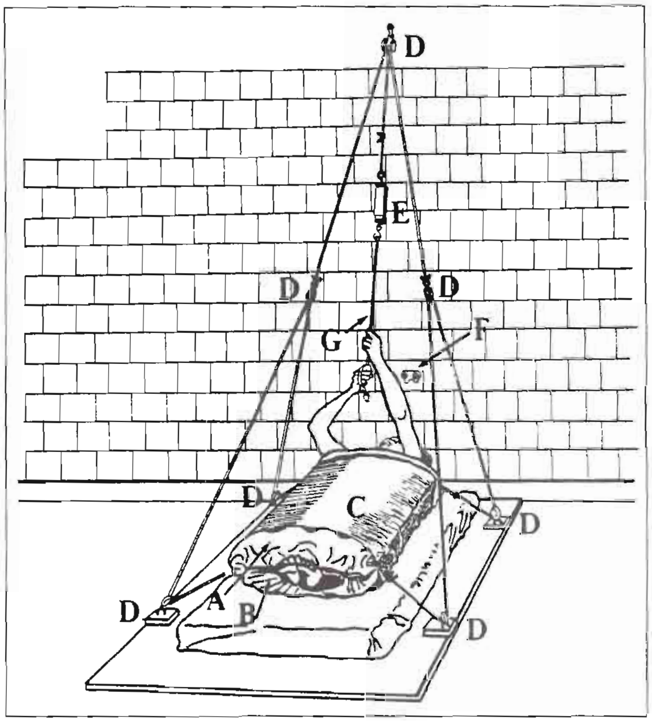
DPT Apparatus

A special apparatus (see Figure 1) termed a *hug machine* (Hug'm) was designed to administer DPT to the body surface between the midchest and calves. It consisted of two stacked air mattresses, which were resting on a stationary mattress, and a rope and pulley system. A nylon tarp encircled the air mattresses and was connected to the rope and pulley system, which was then secured to the wall above the subject's head. A rope with a 50-lb spring scale was suspended from the wall pulley. A cam cleat was attached to the wall above the subject's head.

Measurement Tools

Heart rate, measured by 60-second wrist pulse, was used as a measure of objective state anxiety. Subjective anxiety was measured by a STAI Form X-1 (A-State) questionnaire (Spielberger et al., 1970), and anxiety as a personality trait was measured by STAI Form X-2 (A-Trait) questionnaire. The STAI A-State questionnaire asks a subject to respond to 20 ques-

Figure 1
Top View of Subject in Hug'm Apparatus



Note. A, top air mattress; B, bottom air mattress; C, tarp; D, pulleys; E, spring scale; F, cam cleat; G, Rope (transfers pull from the wall pulley to the floor pulleys to the tarp, thereby providing squeeze).

tions designed to measure how he or she feels "right now"; the A-Trait Form asks subjects to respond to similar questions based on how they "generally feel" (Spielberger et al., 1970, pp. 20–21) Raw scores range from 20 (low state and trait anxiety) to 80 (high state and trait anxiety).

Subjects

Seventy-eight normal, healthy students, 18 to 35 years of age, from the University of Alabama in Birmingham (UAB) volunteered to participate. After screening, 12 subjects were chosen randomly from a high trait anxiety group, and 14 subjects were chosen randomly from a low trait anxiety group. High trait anxiety was defined as a raw score of 40 or higher on the STAI (A-Trait) questionnaire (i.e., at or above the 61st percentile for college undergraduates), and low trait anxiety was defined as a raw score of 30 or lower (i.e., at or below the 24th percentile) Three subjects withdrew from the study for personal reasons. The mean age of the 3 men and 20 women remaining in the study was 21.9 years, with a range of 19 to 32 years. The population consisted of 5 black students and 18 white students. All subjects were free of physical injury, pain, and medication, and had been instructed not to participate in any vigorous activity prior to their test sessions.

Procedures

To satisfy the study requirement of testing an anxious population, data were collected during the stressful weeks of midterm exams, a time of high anxiety, as documented by Francis (1979). In addition, the novel and vague nature of the Hug'm was expected to precipitate some stress and apprehension. Sessions took place in a semilit room with a temperature between 23.5 and 26 °C.

Each subject was involved in one experimental session and one control session, each lasting 45 minutes and scheduled within 1 to 3 days of each other. To counterbalance the ordering effect of these two sessions, a mix of high trait anxiety and low trait anxiety subjects participated in the control session first and the experimental session second; the other subjects, also mixed, took the sessions in reverse order.

Procedures during the first 15 to 20 minutes of both sessions included tape-recorded instructions and a pretest (the STAI A-State questionnaire). Then subjects positioned themselves supine on the bottom air mattress. Following a 3-minute rest period, the investigator obtained a wrist pulse. Next, the experimental or control procedures were introduced.

Experimental Session

The subject was sandwiched between the partially inflated air mattresses and was instructed to pull on the suspended rope (see Figure 1) Acting via the rope and pulley system, the nylon tarp provided a force in opposite directions, and in effect produced a squeeze or circumferential DPT on the subject's body. Each subject was instructed to select the most comfortable amount of pressure and then to secure the rope in the cam cleat on the wall. The subject received pressure for 15 minutes, a time determined by a preliminary study The subject was permitted to keep his or her eyes opened, closed, or to alternate between open and closed. The subject's arms and feet remained unrestrained throughout the procedure. When the pressure and top air mattress were removed by the investigator, wrist pulse was taken again and recorded while the subject remained supine. Finally, the subject completed a posttest STAI A-State questionnaire.

Control Session

Confinement without DPT was provided by placing the top air mattress approximately 10 cm to 15 cm above the subject on a 30-cm-high scaffold. The nylon tarp was wrapped around the sides of the scaffold so that the subject was enclosed in a "tunnel" from midchest to calves, allowing air to circulate between the body and the top air mattress. Each subject assumed the same position as during the experimental procedures, pulled on a suspended rope not connected to the pulley system, and then secured it in the cam cleat. The resistance during the pull on the rope was set at 35 lb on the spring scale, a value also determined from the preliminary study. The remaining procedures were identical to those used during the experimental session except that, after the 15-minute period, the top air mattress and scaffold were removed.

Results

For all data, a *p* value of ≤0.05 was established as the level of significance and paired *t* tests were used to analyze the data.

Changes in Objective and Subjective State Anxiety

The first hypothesis predicted that DPT would reduce objective and subjective anxiety. However, there were no significant differences in objective state anxiety as measured by heart rate within either the experimental or the control groups, or between the groups ($t = .36$; $p = .72$; see Table 1). Also, a comparison of the two STAI state anxiety baseline means revealed no significant differences between groups ($t = .41$; $p = .68$). Although both control and experimental groups showed a significant decrease in mean STAI state anxiety from the baseline (see Table 1), a comparison of the mean drop in state anxiety between the experimental and control groups was only 1.9, which was not significant ($t = 1.13$; $p = .27$).

Since no statistical or clinically significant differences in objective and subjective state anxiety were found between experimental and control groups, it must be concluded that DPT (as administered by the Hug'm) did not reduce objective or subjective anxiety in the sample population studied.

Trait Anxiety

The second hypothesis was that high trait anxiety subjects would respond differently than low trait anxiety subjects. Yet no significant differences in the mean heart rate were found between these two groups. Similarly, no significant differences in pretest STAI scores were found for either the high trait anxiety or low trait anxiety group (see Table 2).

A 2 × 2 ANOVA was used to clarify the STAI State Anxiety scores (see Table 3) by assessing the effect of the two variables, treatment and level of trait anxiety, and the interaction between those variables.

The results of the ANOVA (see Table 3) show no significant difference between experimental and control conditions regardless of the level of trait anxiety ($F = 1.36$); no significant difference in state anxiety between high and low trait anxiety regardless of the treatment (experimental vs. control) ($F = 0.00590$); and no significant interaction effects between the level of trait anxiety and the treatment conditions ($F = 0.654$). Because the high trait anxiety group did register a significant decrease in *subjective* anxiety during the experimental procedures and not during the control procedures (although a comparison of the mean decrease in the two procedures showed no difference), a multiple comparison procedure, the HSD (Honestly Significant Difference, Tukey's *W*) test, was employed (Steel & Torrie, 1980). No significant difference was found at the $\alpha = 0.05$ level ($W = 4.933$), confirming the *t* test results and indicating that the control had some positive effect on the subjects.

From the above results, it must be concluded that in the sample population studied, the response to DPT by high trait anxiety subjects is not different from the response of low trait anxiety subjects.

Room temperature may have interfered with some subjects' relaxation response since it was not possible to hold this variable absolutely constant. No significant correlations were found between the amount of pressure in the experimental procedure and personality variables or between amount of pressure and changes in anxiety. The location and amount of pressure on a particular body area, however, could have influenced an individual's response to DPT since patters of respiration can be altered by pressure on the chest and diaphragm (Takai & Kobayasi, 1950; Gesell & Moyer, 1941; von Euler 1968). For instance, in the self-clasping behavior of monkeys in Harlow's studies (1958, 1959), and the employment of the straitjacket (Hunter & Macalpine, 1963), DPT appeared to be most concentrated on the ventral thoracic region. In the Hug'm study, some individuals stated that they felt most of the pressure on their

Table 1
Mean Pre- and Posttest Heart Rate and STAI State Anxiety Scores for Control and Experimental Sessions

	Pretest			Posttest			Differences				
	N	x̄	*SD*	*N*	x̄	*SD*	*N*	x̄	*SE*	*t*	*p*
					Heart Rate						
Control	23	68.9	10.1	23	68.9	10.9	23	0.0	.52	0.0	1.00
Experimental	23	68.7	11.9	23	69.1	10.5	23	−.4	1.06	−.4	.71
					State Anxiety						
Control	23	31.3	8.00	23	27.8	6.67	23	3.5	1.55	2.26	.03
Experimental	23	31.9	7.62	23	26.5	5.55	23	5.4	1.02	5.28	.0001

Table 2
Trait Anxiety Subjects: Mean Change in STAI State Anxiety Score Between Pre- and Posttests for Experimental and Control Groups and Comparison of Mean Changes

	High Trait Anxiety Subjects					Low Trait Anxiety Subjects				
	N	x̄	*SD*	*t*	*p*	*N*	x̄	*SD*	*t*	*p*
Control group	10	2.9	2.66	1.09	.30	13	4.0	1.93	2.07	.06
Experimental group	10	6.2	1.13	5.47	.0004*	13	4.7	1.60	2.98	.01*
Difference between groups	—	3.3	2.69	1.23	.25	—	.7	2.12	.36	.72

* Significant at .05.

thighs or legs and would have preferred experiencing additional pressure on their chest and shoulders. Others stated that they would have liked even more pressure than could be imposed by the rope and pulley system. (These and other comments in Table 4 provide valuable feedback for the design of future studies in this area.) Other variables that were eliminated as possible sources of change in STAI state anxiety and heart rate were sex and race.

Subjects' Remarks

At the close of this study, subjects completed a short questionnaire in writing. Their remarks, summarized in Table 4 provide evidence of the similarities and differences between experimental and control procedures.

Discussion

Although both hypotheses were rejected, there are several findings that deserve some discussion because they may direct future investigators toward an improved research design and a more definitive study of the effects of DPT.

Confinement, indeed, had a calming effect. This is supported by the significant decrease in STAI state anxiety between pre- and posttest control procedures (see Table 1) and verified by ANOVA. This finding is in agreement with Gellhorn (1958), whose work with animals illustrates that confinement reduces proprioceptive flow to the central nervous system and, in turn, decreases mental and physical arousal through elaborate neurophysiological pathways and mechanisms. As discussed earlier, Kumazawa's study (1963) of immobilized animals also supports this argument. Thus, one can conclude that confinement is an inherent element contributing favorably to the DPT response. While the effects of confinement were previously acknowledged, the extent to which confinement could influence DPT was underestimated. Confinement thus appears to be inappropriate as a control condition for DPT study; it may better be regarded as an important variable for future research.

It seems worthy to note that the DPT (and confinement) in the experimental session produced a greater decrease in subjective anxiety than did confinement in the control session. Thus, one could argue that DPT may facilitate subjective relaxation. Establishing the DPT link to subjective relaxation and determining its magnitude may require more highly aroused subjects, more precise measurement tools, and a different control condition.

Although there were no significant differences between the responses of high and low trait anxiety subjects to DPT, it is interesting that *t* test results showed a significant reduction of subjective anxiety in the high trait anxiety group under experimental, but not under control, procedures. Although the same phenomenon occurs in the low trait anxiety group, the difference is not nearly so dramatic. Further research involving more precise measurement tools, a larger sample, etc., may elucidate this conundrum.

Regarding the population sample as a whole, several errors in the design of the study are apparent. In the control group, subjects' prestudy state anxiety scores ranged from 20 to 49. Only three subjects, however, had a prestudy score above 40, a score used earlier to define the lower limits of high trait anxiety. In the experimental group, prestudy state anxiety scores ranged from 21 to 51, but only four subjects had a prestudy score above 40. Although the prestudy state anxiety means for both groups were slightly above the score of 30, established earlier as the upper limit of low trait anxiety, neither group as a whole exhibited high state anxiety on the pretest. The assumption made at the outset of this experiment, that high trait anxiety subjects would exhibit a baseline state anxiety score approximately equal to their trait anxiety score, thus allowing representation of both high and low state anxiety levels in the experiment, proved erroneous. Data collection during relatively low stress times, i.e., late afternoon, weekends, or after an exam, instead of before an exam or in midmorning, may account for the majority of low state anxiety scores in the high trait anxiety subjects. It was

Table 3
ANOVA (Split Plot Design)

Source	*df*	*SS*	*MS*	*F*	*p*
Group	1	0.3	0.3	0.00590	>.9
Within group (error)	21	1068.6	50.89	—	—
Treatment	1	44.0	44.0	1.36	>.3
Treatment X group	1	21.1	21.1	0.654	>.5
Error	21	677.4	32.26	—	—

Table 4
Range of Subjects' Responses to Hug'm and Control Procedure (from Poststudy Questionnaire)

Hug'm	Control
"What does this air mattress apparatus remind you of?"	
a. feeling of floating on a cloud	a. sleeping on pillows
b. mummy sleeping bag	b. floating
c. being under a hot pack	c. being in a small tent
d. being in a hammock	d. soft bed or water bed
e. sleeping under a thick comforter	e. being caged in
f. sleeping in a featherbed with lots of quilts and covers	f. lying in a hospital bed, unable to move
g. winter clothes, hot and tightly wrapped around the body; this experiment made me feel closed-in and alone	g. being in a coffin
h. floating on a raft	
i. being in a swimming pool	
"Can you think of any possible uses for this apparatus?"	
a. calm down excited people	a. sleeping
b. cure insomnia	b. aid relaxation
c. unwind after a hard day's work	
d. relieve body and mental tension	
e. relieve stress and anxiety	
"Any general or specific comments?"	
a. not a frightening experience	a. not as emotionally satisfying as the [Hug'm]
b. very relaxing, toasty, and warm	b. I liked the [Hug'm] better and felt less confined in it.
c. I felt relaxed and secure	c. I felt more relaxed after the [Hug'm].
d. I was frustrated and tense from studying when I arrived; now I feel much more calm and relaxed	d. comfortable
e. I would have liked to experience even more pressure; it almost put me to sleep and I'm not the type of person who falls asleep easily	e. the [Hug'm] made me more drowsy than this experience
f it felt like there was no pressure at all until you took the air mattress off	f. psychologically, I felt closed off from everything
g. an enjoyable, restful experience; I could have fallen into a deep sleep	g. not as soothing as the [Hug'm]
h. I really enjoyed it; I was relaxed and in another world and forgot I was in an experiment	h. I enjoyed the "pressure" better than "no pressure," but both were comfortable

also assumed, perhaps erroneously, that the novelty of the Hug'm and control apparatus would create heightened state anxiety. In retrospect, the population represented in this study may be more accurately described as a low state anxiety group.

Even if a significant decrease in subjective anxiety via DPT would have been possible in this population, a large reduction of state anxiety in an already low state anxiety population was unlikely because of the construction of the STAI test itself The minimum possible score on the test is 20. Some subjects scored 20 on their pretest; had they experienced further relaxation in experimental procedures, this test could not have measured the decrease.

The value of wrist pulse as a measurement of objective anxiety in this experiment is questionable. Although it is an easy measurement to make, it lacks the precision and sensitivity of psychological measurements such as an electromyogram, finger pulse, an electrocardiogram, respiration rate, or biochemical stress indices (e.g., plasma cortisol, adrenaline), which indicate whether one's autonomic response to procedures increased, decreased, or did both throughout the procedures. Further and multiple continuous monitoring of autonomic responses to DPT seems necessary.

Thus, the unplumbed role of confinement, the measurement tools employed, and the ultimate nature of the population sample may help to explain the rejection of both research hypotheses. Yet, because several significant intragroup differences in the experimental group were found, the research questions raised in this study warrant further investigation. Perhaps by collaborating with a psychologist or physiologist, a more sophisticated, precise research design could be developed and more precise, reliable measurements could be made.

Conclusions

This experiment represents an initial effort to identify variables and investigate responses to DPT. Although the application of DPT enhanced subjective relaxation more than did the confining condition alone, in the final analysis it did not significantly decrease objective or subjective anxiety more than the confinement condition in the generally low state anxiety of the college students sampled. Analysis and interpretation of the data suggest that both hypotheses were rejected, at least in part, because the pretest state anxiety of subjects was low and changes therefore could not be detected and because DPT and confinement variables remain intertwined.

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