Validation of the Holtzman Anxiety Scale by Vasomotor Biofeedback

WILEY MITTENBERG and JERRY D. PETERSEN
The Chicago Medical School and Northern Arizona University

Abstract: The Holtzman Inkblot Technique (HIT) and the State-Trait Anxiety Inventory were administered to 81 undergraduates who later received biofeedback training for increases in index finger skin temperature. The Holtzman anxiety measure correlated significantly with voluntary temperature increase and the High Anxiety Group, identified by the HIT, was able to achieve significant increases in digital temperature. No significant relationships were found between State-Trait Anxiety measures and either Holtzman anxiety scores or vasomotor control, nor were there significant increases in temperature among State-Trait anxiety groups. The results supported the validity of the HIT as a measure of anxiety, but failed to characterize this anxiety as either state or trait in nature.

A variety of measurement procedures (e.g., Hama, Kawamura, Mine & Matsuyama, 1977; Holtzman, 1961; Taylor, 1953) have been devised to define anxiety operationally. Anxiety level may be inferred from an individual's ability to learn certain physiological responses (Martin, 1976; Spence, 1964). Several studies have shown that it is possible to learn control of finger skin temperature when subjects receive temperature information feedback (Lynch, Hamma, Kohn, & Miller, 1976; Ohno, Tanka, Takeya, & Yujiro, 1977; Roberts, Kewman, & MacDonald, 1973). Increasing anxiety levels were shown to facilitate biofeedback mediated decreases (Hama, Kawamura, Mine, & Matsuyama, 1977) and increases (Bass, Mittenberg, & Petersen, 1981) in cutaneous digital temperature. The control of peripheral vasodilation, therefore, constitutes an operational definition of anxiety.

Objective, or self-report measures of anxiety include the Taylor Manifest Anxiety Scale (Taylor, 1953), the Institute for Personality Ability Testing Anxiety Scale (Cattell & Scheier, 1961) and the State-Trait Anxiety Inventory A-Trait Scale (STAI, Spielberger, Gorsuch, & Luschene, 1971). These measures assess relatively stable individual differences in anxiety proneness or traits (Levitt, 1967). Trait anxiety is not directly observable, but is a predisposition to respond to situations as threatening or dangerous (Spielberger, 1972). Transitory situation specific emotional reactions, on the other hand, have been termed anxiety states (Spielberger, 1972). The A-State scale of the STAI measures situational anxiety states.

The Holtzman Inkblot Technique (HIT, Holtzman, Thorpe, Swartz, & Herron, 1961) is a projective test which is presumed to measure anxiety (A\textsubscript{x}) at the unconscious or fantasy level (Hill, 1972). Research on the external validity of A\textsubscript{x} using induced situational anxiety (Auerbach & Edinger, 1977; Iacino & Cook, 1974), cross validation employing various self-report inventories (Cook, Iacino, Murray & Auerbach, 1973; Fehr, 1976; Holtzman, 1961; Megargee & Swartz, 1968; Rimoldi, Insua, & Erdman, 1975; Swartz & Swartz, 1968) and peer ratings (Barger & Schrest, 1961) have yielded contradictory results. The A\textsubscript{x} score may reflect anxiety as a long term personality characteristic rather than a transitory reaction to stress (Hill, 1972) and unconscious anxiety that is not related in any direct, simple way to overt behavior that may be judged anxious (Holtzman, 1961). Equivocal findings do suggest (e.g., Iacino & Cook, 1974) that HIT A\textsubscript{x} is related to trait anxiety as measured by the STAI. Unconscious anxiety is a more controversial concept which requires physiological validation (Lader, 1975). The ability to control peripheral vasodilation is related to anxiety (Bass et al., 1981; Hama et al., 1977) and is therefore promising
for validation purposes. The present study employed this procedure in an attempt to validate HIT Ax.

Method

Subjects
Eighty-one undergraduate students chosen from psychology classes at Northern Arizona University served as subjects in this study. The students participated as part of course requirements or as volunteers, and ranged from 18 to 39 years of age. The sample was composed of 32 males and 49 females.

Procedure
Each subject received a consent form before testing. Administration proceeded according to the standard HIT group method (Swartz & Holtzman, 1963). Subjects viewed HIT Form A slides in groups of approximately 30. Immediately after completing the HIT, a schedule was circulated and each subject assigned himself to a second 30-minute testing time within the following two days. Subjects were instructed to abstain from heavy exercise, food, and cigarettes prior to the biofeedback session. Laboratory temperature was maintained constant at 80°F. During a 15-minute acclimatization period, each subject completed a hand dominance questionnaire and the STAI. A thermistor was then taped to the index finger of the dominant hand and the subject was asked to recline. After establishing baseline temperature, audio feedback was demonstrated and the subject was instructed to increase hand temperature by concentrating on warming it. Baseline, 5, 10, and 15 minute temperature recordings were made. Following biofeedback, each subject was asked what they did to increase their temperature. After the last subject was tested, the experimenter scored the HIT and STAI using a single blind procedure.

Materials
A set of 35 mm slides of the 47 inkblots comprising HIT Form A were made on 400 ASA Ektachrome film, as outlined in Swartz and Holtzman (1963). The slides were projected on a 5'×5' white screen by means of a Kodak slide projector from a distance of 30 feet. All HIT testing was conducted in the same classroom. Subjects recorded their responses on HIT group booklets. Protocols were scored by reference to the standard scoring procedure specified in the Administration and Scoring Guide (Holtzman, 1961).

State and trait anxiety was measured by the STAI. The subject's dominant hand was determined (for thermistor placement) by use of a revised Raczkowski, Kalat, and Nebes (1974) handedness questionnaire. An Autogen 1000b Biofeedback Thermometer with temperature thermistor was used to monitor cutaneous digital temperature and provide feedback. Auditory feedback was transmitted through an 8" by 4" oval speaker placed 36" from the subject's head. The feedback thermometer was factory calibrated to an accuracy of ±1°F. Room temperature was kept constant by an electric heater.

Design
Pearson product-moment correlations were employed to determine the relationships between HIT Ax, A-Trait, A-State and baseline and increase in digital skin temperature. Low, medium, and high anxiety groups were formed by a posteriori reference to normative percentile tables for both instruments. Divisions were made at the 33rd and 66th percentile ranks. All effects were tested using one-tailed, .05 level of significance.

A one sample runs test was used to determine if systematic relationships existed between HIT Ax levels and the temporal sequence of experimental sessions. Randomization was tested using a two-tailed, .05 level of significance.

Results
HIT Ax level related positively to temperature increase (r(80) = .328, p = .001). There were no significant relationships among HIT Ax levels or temperature increases and levels of state or trait anxiety. State and trait anxiety were related (r(81) = .439, p = .001). No
**Table 1**  
Paired *t* Tests for Temperature Increase by Anxiety Levels

<table>
<thead>
<tr>
<th></th>
<th><em>A</em>x Group</th>
<th><em>n</em></th>
<th><em>t</em></th>
<th>State Group</th>
<th><em>n</em></th>
<th><em>t</em></th>
<th>Trait Group</th>
<th><em>n</em></th>
<th><em>t</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td>25</td>
<td>.429</td>
<td>Low</td>
<td>27</td>
<td>.244</td>
<td>Low</td>
<td>25</td>
<td>1.43</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td>28</td>
<td>.066</td>
<td>Medium</td>
<td>26</td>
<td>1.00</td>
<td>Medium</td>
<td>26</td>
<td>.642</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>28</td>
<td>1.85*</td>
<td>High</td>
<td>28</td>
<td>.577</td>
<td>High</td>
<td>29</td>
<td>2.03</td>
</tr>
</tbody>
</table>

*p < .05.*

Significant differences in baseline temperature were observed among high, medium, and low *A*x groups (*F* = 1.89, *p* = .05).

Paired *t* tests were performed to determine whether any temperature increases were observed between baseline and final temperature in each group. A significant increase (*X* = .785) was observed only in the high *A*x group (*t* (27) = 1.85, *p* = .038). The results are shown in Table 1.

A one sample runs test was used to determine whether high and low anxiety subjects were assigned to biofeedback treatment at random. The median *A*x score (9.31) was used to dichotomize high and low anxiety subjects into two groups. No significant relationship was observed between HIT *A*x level and the temporal sequence of experimental sessions (*Z* = -.121, *p* = .921).

Thirty-seven subjects participated just prior to midterms and spring break, while the remaining subjects were tested after the week’s vacation. This fact suggested a post-hoc analysis to determine whether HIT *A*x was sensitive to situational anxiety differences, potentially induced by midterm exams. There was no significant difference between *A*x measures taken before and after midterms (random *t* (79) = 1.00, two-tailed *p* = .316).

**Discussion**

**HIT A*x as a Predictor of Temperature Increase**

The coefficient of determination between HIT *A*x and temperature increase indicates that the HIT *A*x accounts for about 11 percent of the variance in subjects’ ability to acquire vasomotor control. This result suggests that HIT *A*x is a valid measure of anxiety, since the magnitude and direction of the observed relationship is consistent with the relationships observed between autonomic conditioning and a variety of anxiety measurements (Bass et al., 1981; Bitterman & Holtzman, 1952; Cattell, 1963; Hama et al., 1977; Herron, 1965; Mednick, 1957; Spence, 1964) as well as predictions based on theoretical formulation (Levitt, 1967; Spence & Spence, 1966).

An alternate explanation of the relationship between cutaneous temperature and anxiety is that temperature increase was a result of relaxation rather than vasomotor conditioning. For example, Ackner (1955) demonstrated greater finger pulse volume increase in anxious subjects (when compared to controls) during Seconal induced sleep. This explanation is an unlikely account of the present results, however. In a posttreatment inquiry, only three subjects (4%) reported the use of relaxation to produce temperature increase, and in fact these subjects were among those who failed to do so. The remaining subjects reported employment of either imagery (74%) or verbal mediation (22%). Therefore, the success of the HIT *A*x measure in predicting biofeedback mediated temperature increases may be due, in part, to the imaginal process which both measures share.

A significant increase in temperature was observed only in the high *A*x group. This difference could not be attributed to differences in baseline temperature. Similarly, a lack of relationship between baseline and *A*x score mitigates against an argument that differential baselines
could have caused the observed relationship between $A\chi$ and temperature increase.

**HIT $A\chi$ as a Measure of Trait Anxiety**

The results failed to confirm the hypothesis that $A\chi$ reflects trait anxiety. The lack of a significant relationship between $A\chi$ and STAI A-Trait scores contradicts several previous studies (Fehr, 1976; Iacino & Cook, 1974; Kamen, 1969) while confirming the results of others (Cook et al., 1973; Holtzman, 1961; Zuckerman, Persky, Eckman, & Hopkins, 1967). Cook et al. suggested that HIT $A\chi$ was a confounded measure of both state and trait anxiety. Another possible explanation (Holtzman et al., 1961) is that $A\chi$ taps unconscious anxiety, which may or may not be accessible for conscious report at any point in time. Since $A\chi$ was able to predict temperature increase while A-Trait was not, the results lend tentative support for this conclusion.

**HIT $A\chi$ as a Measure of State Anxiety**

State anxiety was not related to temperature increase, and there were no significant temperature increases within state anxiety groups. These findings support those previously reported (Bass et al., 1981; Hama et al., 1977).

No relationship was found between HIT $A\chi$ and STAI A-State, in agreement with the preponderance of related research (Auerbach & Edinger, 1977; Herron, 1964; Iacino et al., 1974; Kamen, 1969; Zuckerman et al., 1967). In view of the majority of findings, the relationship between $A\chi$ and A-State reported by Cook et al. (1973) may have been due to chance. The observed relationship between A-State and A-Trait ($r = .439$) concurs with earlier results (Bass et al., 1981; Spielberger et al., 1971), and suggests the possibility that the relationship reported by Cook et al. (1973) may have been confounded by the trait component of state anxiety.

HIT $A\chi$ was not sensitive to an anxiety state that may have been induced by midterm exams, in agreement with previous test anxiety studies (Herron, 1964; Lavit, 1971; Swartz, 1965; Swartz & Swartz, 1968). The results support the conclusion that HIT $A\chi$ is not a measure of transient, situationally induced anxiety.

The present findings confirm the validity of HIT $A\chi$ as a measure of anxiety. While $A\chi$ does not appear to measure anxiety state, it is not clear whether it reflects trait anxiety either. Further research is necessary to determine whether the state-trait dichotomy is useful in describing the anxiety tapped by projective methods.

**References**


Herron, E. W. (1965). Personality factors associated with the acquisition of the conditioned eyelid
The Holtzman Anxiety Scale and Vasomotor Biofeedback


