


exp-rated knx, performance
change score

attends or
studies
test



OK

clear single bet
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$(\text{Sand bed}) = 3?$

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31 comp - 1 $P_1, P_2, P_3, P_4, P_5, P_6$

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31 comp - 1 $P_1, P_2, P_3, P_4, P_5, P_6$

A hand-drawn diagram illustrating a concept. It features a large oval labeled 'NEW'. Inside this oval, on the left side, is a smaller circle labeled 'NOT'. The 'NOT' circle is crossed out with a large 'X' drawn over it. This visualizes the idea of 'NOT NEW' or 'NOT' being a subset of 'NEW'.

exp-rated anxiety, p9, 2

8b self-imp IAT

9b STAI (incl), (SOC desire scale)

10b ~~personality~~ 24b diff session! (1), p22

11b 21 ang p21 25b diff session! (1) p22

12b self (3) p9, p21 26b 3 SD, p9, p21

13b self (3) p21 27b 3 SD, p21

14b obs (1) p21 28b ~~control~~ control = 2, p21

15b obs (5) p21 29b 4 ? p9, p21

16b logs (11) p9, p21 30b 5 4, p21

17b words (0) p9, p21 31b 1 complement only, p9, p21

18b 7 IAT (1) p9, p21 32b Non-race (0), p9, p21

19b IAT p22 33b dual (2) p9, p21

20b EM p22

21b Beh p22

22b bet (1), p22

23b bet (1), p22

Note: but make order under "proced"

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Abstract

(10)
(10b)

The Implicit Association Test (IAT; A. G. Greenwald, D. E. McGhee, & J. L. K. Schwartz, 1998) was adapted to measure anxiety by assessing associations of self (vs. other) with anxiety-related (vs. calmness-related) words. Study 1 showed that the IAT-Anxiety exhibited good internal consistency and adequate stability. Study 2 revealed that the IAT-Anxiety was – in contrast to an explicit anxiety test – not affected by a faking instruction. Study 3 examined the predictive validity of implicit and explicit measures and showed that the IAT-Anxiety was related to changes in experimenter-rated anxiety and performance decrements after failure. Study 4 found that several behavioral indicators of anxiety during a stressful speech were predicted by the IAT. Taken together, these studies show that the IAT-Anxiety is a reliable implicit measure that is able to predict criterion variables over and above questionnaire measures of anxiety and social desirability.

Key words: IAT, anxiety, implicit measurement, predictive validity, behavior, social desirability

Procedure. As part of a larger project, the IAT-Anxiety was administered twice with a time lag of one week. Participants responded to the IAT in individual experimental sessions. In session 2, questionnaire measures of trait anxiety and social desirability were completed in addition to the IAT.⁴

Explicit measures. Trait anxiety was assessed by means of the trait form of the State-Trait-Anxiety-Inventory (STAI; Spielberger, Gorsuch, & Luchene, 1970; German version: Laux, Glanzmann, Schaffner, & Spielberger, 1981). This widely used questionnaire contains 20 items that assess enduring symptoms of anxiety on a 4-point Likert scale (1 = Almost never, 4 = Almost always). The revised form of the Social Desirability Scale-17 (SDS-17R; Stöber, 2001) was used to measure social desirability. This scale contains 16 items and provides an update of the approach introduced by Crowne and Marlowe (1960) by using socially desirable but infrequent or socially undesirable but frequent behaviors to which the respondent answers on a true-false format.

IAT. The IATs were administered on PC-type computers with the program FIAT for Windows 2.3 (Farnham, 1998) by presenting stimuli from self (e.g., me, my) and other (e.g., they, your) categories as well as items from anxiety (e.g., nervous, afraid) and calmness (e.g., relaxed, balanced) categories (see Appendix for the complete stimulus set that consisted of five items per category). The IAT procedure comprises five blocks (see Figure 1). Participants practiced the discrimination of self and other items (target discrimination) in the first block that comprised 20 trials (each item was presented twice). The same was done for the attribute discrimination by sorting items into anxiety and calmness categories in Block 2 and for practicing the switched key assignment in Block 4 (20 items each). The critical Blocks 3 and 5 consisted of 20 practice trials and 60 critical trials. In these trials, participants categorized items into two combined categories, each including the attribute and the target concept that were assigned to the same key.

Participants were told they would be making a series of category judgements. On each trial, a stimulus word was displayed in the center of a computer screen. Category labels were displayed on the left and right sides of the window. Participants used the letter "A" on the left side of the keyboard and the number "5" of the right-side numeric keypad for their responses. They were told, "Please try to be as accurate as possible, while also going as quick as possible. If your selection is incorrect, you will see a red "X". To continue to the next judgement, you must make the correct selection." Participants

12	12b
16	16b
17	17b
18	18b
26	26b
29	29b
31	31b
32	32b
33	33b

Participants. Sixty-two students (35 women, 27 men) of Johannes Gutenberg-University Mainz participated in this study in exchange for research participation credit. Their average age was 24.2 years ($SD = 5.2$).

Measures. The IAT-Anxiety used in this study was identical to that of Studies 1 and 2. In addition, participants completed three explicit trait anxiety measures: (a) the German version (Laux et al., 1981) of the trait form of the STAI (Spielberger et al., 1970), (b) an anxiety thermometer ("How anxious are you? Please indicate your anxiety on a scale from 0 [not at all] to 100 [very high]"), and (c) an explicit rating of the five anxiety and the five calmness stimuli of the IAT ("Please indicate on a scale from 0 [not at all] to 5 [very high] the extent to which the following attributes apply to you").

The five calmness items were reverse scored. Thus, the explicit rating of the IAT stimuli could vary between 0 (no anxiety) and 50 (high anxiety). Furthermore, participants completed the German version (Musch, Brockhaus, & Bröder, in press) of the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1998). This inventory assesses two components of socially desirable responding, self-deceptive enhancement and impression management, with ten items each. We used the BIDR in this study to examine the possibility that it was just one component of social desirability (rather than the composite score) that shared variance with the IAT, the explicit anxiety measures, and the criteria.

Participants indicated their state anxiety at baseline and after the stress induction on an 8-item scale (e.g., worry, nervous, tense) ranging from 0 (not at all) to 5 (very). Both experimenters rated the apparent anxiety of the participants on a 2-item scale (worried, tensed) ranging from 0 (not at all) to 5 (very). Item averages of the state measures are reported throughout this article.

Performance was measured by means of the d2 Test (Attention-Stress Test, Brickenkamp, 1994). In this test, participants are required to perform a simple discrimination task by crossing out relevant stimuli and by ignoring irrelevant stimuli. Relevant stimuli consist of the letter "d" and two lines above or below the letter. Thus, there are three relevant stimuli: ds with two lines above the letter, ds with two lines below the letter and ds with one line above and one line below the letter. Participants are required to ignore ds with more or less than two lines as well as the letter "p" (irrespective of the number of lines and their location). Stimuli are presented on a piece of paper in 14 rows of 47 stimuli each. A d2 test performance index was calculated by subtracting errors (misses and

26 29
33 32 31 12 16 17 18

Singh
EMS
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30 29
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false alarms) from the total number of processed stimuli. We computed change scores for self-rated state anxiety, experimenter-rated state anxiety, and performance by subtracting baseline values from those after the stress induction.

Procedure. Upon arrival at the laboratory, participants were greeted by two experimenters and completed the IAT-Anxiety and the explicit trait measures. Then participants indicated their state anxiety. Furthermore, apparent anxiety of the participants was rated by the experimenters who were blind regarding explicit and implicit anxiety measures. Afterwards, participants received the instructions of the d2 test. It was emphasized that this test constitutes a performance test that measures how well one is able to concentrate on a task. Then participants worked on some practice stimuli and emerging questions were answered to assure that everyone understood the nature of this test.

Participants were told that they would work on this task for two minutes. They were instructed to work "as fast and as accurate as possible". After having completed the task, participants received a negative feedback about their performance to induce stress: After an inspection of the results, an experimenter told them that their performance was "not very well. In average, participants get two rows further."

Participants were then told that they will work on the same task for a second time. The experimenters rated the participants' apparent anxiety during this second trial. Additionally, participants retrospectively indicated their state anxiety during the second task.

An elaborate debriefing was carried out for every participant. They were informed in detail about the purpose of the study. Specific care was taken to reassure that every participant understood the deceptive nature of the negative feedback. It was particularly emphasized that they actually had not failed. All participants seemed satisfied with this explanation. The experimenters then asked the participants' cooperation in not discussing the study with others.

Results

Descriptive statistics. Means, standard deviations, and internal consistencies of the trait measures are displayed in Table 2. The correlation matrix of these measures can be seen in Table 3. The pattern of results can be described as follows: (a) The IAT-Anxiety was independent of all explicit anxiety measures as well as of both components of social desirability, (b) the explicit anxiety measures

19-25
19

implicit anxiety measure would predict behavioral anxiety indicators even when questionnaires measures were controlled for.

Method

Participants. Thirty three introductory psychology students (29 women, 4 men) of Johannes Gutenberg-University Mainz participated in this study in exchange for research participation credit. Their average age was 22.0 years ($SD = 3.1$).

Measures. The IAT-Anxiety used in this study was identical to that of the other three studies.

In addition, participants completed the German version (Laux et al., 1981) of the trait form of the STAI (Spielberger et al., 1970) and the SDS-17R (Stöber, 2001). State anxiety at baseline and during the speech was assessed by means of a 3-item scale (anxious, nervous, uncertain) ranging from 0 (not at all) to 3 (very). We report item averages of this state anxiety measure throughout this article.

Behavioral measures of anxiety were obtained by means of two trained, blind judges who rated the videotapes of the speeches on five behavioral expressions of anxiety: Number of nervous mouth movements, number of eye blinks, hand position and movements, speech dysfluency, and a global rating of anxiety. These indicators of anxiety have been validated in previous studies (e.g., Dow, 1985; Fydrich, Chambless, Perry, Buerchner, & Beazley, 1998; Monti et al., 1984). The judges started by counting the number of nervous mouth movements, defined as lip biting, lip licking, twitches of the mouth, and pressing of the lips. In a second trial, the number of eye blinks was counted. Then judges were coding for hand position and movements by rating on a 5-point scale the amount of anxiety that was signaled through this channel (1 = not at all, 5 = extremely). We used a rating scale (rather than counting hand movements) because a high number of hand movements can indicate high anxiety (e.g., nervous face or hair touching) or low anxiety (expressive but relaxed underpinning of the speech). Similarly, no hand movements can indicate all levels of anxiety, depending on the position of the hand (e.g., pressed on the legs or put under the legs versus a relaxed position). Speech dysfluency was defined as number of pauses, length of pauses, and number of verbal dysfluencies (1 = not at all dysfluent, 5 = extremely dysfluent).⁹ In the last trial, judges rated their overall impression of the speaker's anxiety. Interrater reliabilities were satisfactory (see Results section) and, thus, means of the two raters were used for subsequent analyses.

IAT +
EMS

27b
30b

10b

12b
16b, 17b, 18b
20b, 22b
33b, 32b
31b

Behavior

29b
30b

28b

13b

14b

15b

11b

✓

19-25

Procedure. The three trait measures (IAT, STAI, and SDS-17R) were assessed in a separate session that was ostensibly unrelated to the speaking task. At Session 2, participants first worked on some questionnaires not relevant to this research to get accustomed to the laboratory. Then they indicated their state anxiety (baseline score). Afterwards, participants received the following instructions for the speech: "This experiment analyzes how well you are able to comprehend and present a scientific text under time pressure. This ability is an important prerequisite for a successful completion of your courses and the oral examinations during the pre-diploma and diploma. The experiment will proceed as follows: You will first read and prepare a scientific text for 10 minutes. Then you will orally present the content of this text for 3 minutes. Your speech will be videotaped and later scored by a panel of judges who will rate and compare your speech to others given under the same circumstances. Please try to deliver a comprehensive and well-structured speech, talking for the full 3 minutes." The scientific text was concerned with the composition and the function of the blood and was compiled from a physiology textbook (Schmidt & Thews, 1987). Pretests had shown that it was a very difficult task to deliver a speech based on the contents of this text because of the number of details and technical terms as well as due to the time constraints. Participants were told that they were not allowed to use the text or their notes during the speech. A video camera was positioned directly in front of the participants, and care was taken to maximize the evaluative nature of this task. The experimenter remained behind the camera during the speaking task. Participants remained seated throughout the complete task. After delivering their speech, participants indicated their state anxiety during the speech.

anx
dunn
Speech

An elaborate debriefing was carried out for every participant. They were informed in detail about the purpose of the study. Participants were told that this study was not concerned with analyzing the ability to successfully complete courses and pre-diploma or diploma. Specific care was taken to reassure that every participant understood that the performance on the speech task was actually not an indicator of this ability. It was further emphasized that the videos of the speech would only be viewed by trained coders for scientific purposes. The experimenter then asked the participants' cooperation in not discussing the study with others.

Results