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Test anxiety and handedness

JOHN H. MUELLER
University of Calgary, Calgary, Alberta, Canada

TIM R. GROVE
Adams State College, Alamosa, Colorado

and

W. BURT THOMPSON
Niagara University, Nigara University, New York

Differences in test anxiety were examined in left- and right-handed subjects. Four different samples revealed no consistent handedness differences for either the worry or the emotionality component of test anxiety, and this was true for men and for women. There was little indication that high test anxiety was more detrimental for left-handers than for right-handers.

The relationship between anxiety and handedness has been explored by some investigators (e.g., Beaton & Mosely, 1991; French & Richards, 1990; Hicks & Pellegrini, 1978; Wienrich, Wells, & McManus, 1982). The grounds for suspecting such a relationship derive from an apparent lateral asymmetry of function in the brain, whereby emotional processing is more associated with right-hemisphere functioning than with the left hemisphere (e.g., Springer & Deutsch, 1989; Tyler & Tucker, 1982). This is likely an oversimplification, but it suggests that left-handers may be more influenced by the right hemisphere and thus could be more anxious than right-handers. However, recent investigations of handedness using Spielberger's (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) state-trait anxiety measures have not shown a consistent relationship (e.g., French & Richards, 1990), nor have other instruments shown the expected handedness differences (e.g., the Fear Questionnaire and the Maudsley Obsessive-Compulsive Inventory, as used by Merckelbach, de Ruiter, & Olff, 1989).

To the best of our knowledge, there has been no examination of handedness differences in test anxiety. The rationale for this would include the hemisphericity argument noted above, plus some reasons specific to test-anxious subjects. For example, because left-handers write from left to right on a page, their hand covers what they have just written, and many adopt an awkward-looking "inverted" or "hooked" writing style to deal with this (see Searleman, Porac, & Coren, 1984). In the context of an examination, this "cover-up" seems likely to stress working memory load in left-handers more than it does in right-handers. Furthermore, the regular "peeking" or lifting of the hand to review recent output likewise would hinder performance, because it is a classic "task-irrelevant" behavior (see, e.g., Mandler & Sarason, 1952; Mueller, 1992a). Being left-handed may thus create special writing problems that hinder performance, which in turn may increase ongoing test anxiety.

It seems that at least two different questions may be implied here. First, do left- and right-handed people differ in their *basal levels* of test anxiety? This is analogous to the question asked about general anxiety by French and Richards (1990) and others, and it is what we will address here primarily. In fact, with test anxiety, it is possible to ask about handedness differences in task-irrelevant thoughts or "worry" that are separate from the "emotionality" component of test anxiety (see, e.g., Morris, Davis, & Hutchings, 1981).

The second question is more involved. It concerns the *impact* of test anxiety—that is, whether high anxiety is more debilitating for left-handers than it is for right-handers. The expectation of a difference in this sense would follow from the differences in how the left-hander's writing style covers up material, and thus forces him/her to rely more on working memory than on direct perceptual access. This seems to be in line with the general characterization of left-handers as "vulnerable to anxiousness" (see, e.g., Merckelbach et al., 1989) rather than as more anxious per se—although this vulnerability is not cognitive or psychological, but more of a behavioral limitation.

For the present report, we examined the relationship between basal test anxiety and handedness in several existing data sets collected for other purposes. This post hoc strategy admittedly runs the risk that some other feature in the experiments may in some indirect fashion affect the conclusions about handedness and test anxiety, but such a preliminary inquiry seems warranted in view of the rather meager empirical support for any anxiety-handedness relationship.

Correspondence should be addressed to J. Mueller, Department of Educational Psychology, University of Calgary, Calgary, AB, Canada T2N-1N4 (e-mail: mueller@acs.ucalgary.ca).

METHOD

Sample 1

The first sample comprised all the subjects in five of the six experiments reported by Mueller, Grove, and Thompson (1991) for whom scores were available on the Test Anxiety Inventory (TAI; Spielberger, 1980). There were 620 subjects overall (131 men, 239 women, the balance unidentified), volunteers from introductory psychology courses at an American university. Handedness was determined by a single, self-report answer to one direct question: "Are you (a) left-handed, or (b) right-handed?" These subjects had all participated in some treatment in an experiment involving a mood induction (happy and/or sad) and a free recall memory task, with the TAI administered at the experiment's end. Therefore, evaluation apprehension from memory-experiment participation should have been in effect when the TAI was taken, along with any lingering effects from mood induction.

Sample 2

The second sample comprised the 259 subjects in an experiment assessing the relationship between study habits and test anxiety (Mueller, Lenhart, & Gustavson, 1989). The only experimental activities involved a Study Habits Questionnaire and the TAI, with handedness determined by the same single, self-report answer. There were 125 men and 134 women, all volunteers from introductory psychology at an American university.

Sample 3

The third sample comprised 361 subjects in another experiment (Mueller, 1992b) in which the Study Habits Questionnaire and the TAI were administered to introductory psychology students at an American university (180 men and 181 women). In this case, the subjects' cumulative grade-point averages (GPA) and college entrance scores (American College Test) were obtained subsequent to the surveys.

Sample 4

The fourth sample also comprised subjects who took the Study Habits Questionnaire and the TAI, but in this case they were 316 Canadian high-school students (164 men and 152 women). These subjects were a few years younger than those in Samples 2 and 3 (age range, 16-18 years) and were unselected for entrance to college, but otherwise the data collection procedures were similar to those for Samples 2 and 3. In this case, we were able to obtain each subject's grade average for the previous semester.

RESULTS AND DISCUSSION

Basal Test Anxiety Level

Sample 1. Table 1 summarizes the average scores on the TAI, for total score and the worry and emotionality subscales separately. There was no significant difference for total TAI, the worry subscale, or the emotionality subscale [$ts(617) < 0.61$]. For about two thirds of these subjects, we had gender information (131 men, 239 women), so we examined each test anxiety subscale in a handedness × gender analysis of variance (ANOVA). There was a significant gender main effect for both subscales, with women higher for worry [$Ms = 19.5$ and 17.6, $F(1,366) = 8.82$, $p < .01$] and for emotionality [$Ms = 22.4$ and 19.6, $F(1,366) = 21.81$, $p < .0001$], but there were no handedness × gender interactions ($Fs < 1$).

Table 1
Average Test Anxiety Inventory (TAI) Scores by Handedness for Each Sample

Handedness	Total TAI	Worry	Emotion	*N*
		Sample 1		
Left	49.2	18.3	21.2	64
Right	50.2	18.6	21.6	556
		Sample 2		
Left	43.6	15.4	19.3	28
Right	43.7	15.6	19.0	231
		Sample 3		
Left	50.0	18.5	22.1	40
Right	51.3	19.3	22.3	319
		Sample 4		
Left	46.7	18.1	19.2	34
Right	43.4	16.5	17.8	282

For reasons outlined in the original report, there were several other arousal-related measures in these experiments that can be considered in terms of handedness effects. For example, the Affect Intensity Measure (Larsen & Diener, 1987) did not show a difference for left- and right-handers ($Ms = 161.5$ and 162.9, $t < 1$). Nor were there any differences in Rated Mood at the outset of the experiment for left- and right-handers [$Ms = 4.0$ and 4.4, respectively, where 1 = *sad* and 7 = *happy*, $t(618) = 1.52$]. The General Activation subscale of the Thayer (1967) instrument showed the left-handers to have been slightly lower than the right-handers [$Ms = 9.7$ and 11.6, $t(199) = 1.63$, $p < .10$]; the other subscales revealed minor differences, but at even lower levels.

However, the Social Anxiety subscale of the Self-Consciousness Questionnaire (SCQ; Buss, 1980) showed left-handers to have been significantly lower in social anxiety [$Ms = 16.3$ and 18.2, $t(366) = 2.27$, $p < .01$], though the Private and Public Self-Consciousness subscales did not reveal handedness differences [$ts(366) < 1.22$]. Perhaps this could be construed as replicating the pattern found by Merckhelbach et al. (1989) for "social phobia." Finally, a Mood Awareness Questionnaire showed that left-handers had been somewhat less aware of their moods than right-handers [$Ms = 57.9$ and 60.5, $t(599) = 2.21$, $p < .01$].

Granted that the mood inductions might have some unknown moderating effect that differs/interacts with handedness, nonetheless the main result for test anxiety is consistent with other anxiety-handedness surveys—namely, not much difference between left- and right-handers. Some of the other "arousal" instruments did show an apparent handedness effect, but with left-handers *less* anxious rather than more, as has been argued for general anxiety. Fortunately we had access to other data sets, without the mood induction background to possibly complicate the interpretation.

Sample 2. Table 1 presents the results for a second sample, in which *t* tests again showed no difference in worry or emotionality for left- and right-handers ($ts < 1$). A handedness × gender ANOVA failed to show any significant effects on the worry subscale. The emotionality analysis revealed a main effect of gender, with women higher [$Ms = 45.2$ and 42.0, $F(1,25) = 5.81$, $p < .02$], but no handedness × gender interaction ($F < 1$). Thus again there was little to support the notion of a handedness difference in test anxiety for either subscale, and in this case it seems unlikely that the TAI scores would be

influenced by the other activities that the subjects performed (a study habits survey, with the content unrelated to mood).

Sample 3. The worry and emotionality scores in the third sample (Table 1) were analyzed in a 2×2 ANOVA for handedness × sex. There were no significant main effects for handedness [Fs(1,357) < 1], nor any handedness × sex interactions [Fs(1,357) < 2.06, $p > .15$], but the gender main effect again revealed women to be more worried (Ms = 20.2 and 18.3) and more emotional (Ms = 23.4 and 21.1) than men [Fs(1,357) = 10.42 and 12.24, ps < .001].

Sample 4. The fourth sample differed from Samples 2 and 3 primarily in the younger age of the subjects. However, presumably the breadth of the distribution of general ability also was greater in the fourth sample, because these subjects had not been screened for admission to college as yet. As Table 1 shows, compared with right-handers, left-handers were slightly higher in terms of worry and emotionality, but neither difference was statistically significant [ts(1,314) = 1.60 and 1.36, respectively, ps > .10]. The ANOVAs did not show any handedness × gender interactions for worry or emotionality [Fs(1,312) < 1], and although the women tended to be more worried (Ms = 17.1 and 16.4) and more emotional (Ms = 18.6 and 17.3), the gender main effects were not statistically significant [$F(1,312) = 1.16$ for worry, and $F(1,312) = 3.32$ for emotionality, $p < .07$].

Differential Impact

Overall, then, it does not appear that there is much evidence to support a handedness-test anxiety relationship—certainly nothing consistent nor robust. Some arousal-related measures appeared to show a handedness effect (i.e., social anxiety and mood awareness), and the fourth sample may suggest a test-anxiety effect, but collectively the data on *basal* test-anxiety level seem rather like those for handedness and state-trait anxiety—namely, minimal differences. Furthermore, the lack of a pattern was similar for men and women.

There is a secondary question, though, independent of any difference or lack of difference in basal test anxiety levels—namely, whether high test anxiety is more debilitating for left-handers than for right-handers. Although one test of this would be to select left- and right-handers, assess test anxiety, and then present them with some controlled task, it might be possible to get some leads in the performance data available in these data—specifically, the grade-point averages (GPA). The negative effect of test anxiety (worry) is generally clearer for more global measures of performance (see, e.g., Hembree, 1988) than on a limited laboratory task. For the GPA data in Sample 3, higher levels of worry were associated with lower GPA [Pearson $r(38) = -.33$, $p < .04$, and $r(315) = -.21$, $p < .001$, for left- and right-handers, respectively]. The correlations between emotionality and GPA were not significant for either left- or right-handers [$r(38) = -.16$, $r(315) = .02$].

We also had some grade information in Sample 4, and the correlations were again significant, with greater worry associated with lower grade averages for both left- and right-handers [$r(33) = -.52$, $p < .01$, $r(246) = -.32$, $p < .0001$]. Thus, as in Sample 3, the negative correlation was larger for left-handers, but again not significantly so. The correlations between emotionality and grade averages were not significant for left- or right-handers [$r(33) = -.21$, $r(246) = -.11$].

Conclusions

In sum, there was little evidence for a relationship between base levels of test anxiety and handedness. Although simple self-classifications of handedness like those used here may yield a few misclassifications, the failures to find anxiety differences extend beyond the present data sets, so it seems unlikely that a more elaborate definition of handedness is really the problem. As for the other issue, of whether test anxiety has a differential impact on left- and right-handers, there may have been some indication in the grade data that high test-anxious left-handers did a little worse than their right-handed counterparts. If this is the case, the underlying mechanism is unclear. Although we noted a "hooked" writing style at the outset, we did not collect information about writing style. This was not a large or significant effect in the present data, but it may be worth pursuing with a more articulated assessment of handedness and writing style.

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