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Brief report
Detection of malingering on Raven's Standard Progressive Matrices: A cross-validation

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A formula for detecting faked Raven's Standard Progressive Matrices profiles was cross-validated on 46 experimental malingerers and 381 people from the standardization sample. The formula yielded a cross-validated 26% false-negative rate and a 5% false-positive rate.

David Faust (Faust, 1996; Faust, Ziskin & Hiers, 1991) and Richard Rogers (Rogers, Harrell & Liff, 1993) have documented the need for detection of neuropsychological malingering. To solve the problem, Gudjonsson & Shackleton (1986) validated a formula using Raven's Standard Progressive Matrices (Raven, 1958). The formula has the distinct advantage of being usable on protocols given in the past, as it requires no special administration procedures.

The validation group consisted of 29 experimental malingerers (mean age 24 years), 56 normal participants (mean age 23 years), and 25 forensic patients (mean age 29 years) who had been referred for neuropsychological evaluation. The formula compares the number of correct answers for the first 24 items against the number of correct answers for the last 24 items (the 'rate of decay'), using a set of cut-off numbers derived from the expected, theoretical rate of decay. Of the 29 malingerers, 5 (17%) were missed (i.e. were false-negatives). Of the 81 honest patients and normals, 4 (5%) were incorrectly classified as faking (false-positives).

However, malingering formulas have had a disappointing record of maintaining adequate accuracy on cross-validation (e.g. McKinzey & Russell, 1997*a*; McKinzey & Russell, 1997*b*). The formula was therefore replicated with a much larger, varied sample.

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Method, results and discussion

Participants

All 427 participants came from the community. Women comprised 56% of the sample. The age range was 17–91 years ($M = 44$ years, SD = 17 years). The normal group consisted of 381 people drawn from the Dumfries standardization sample (Raven, Raven & Court, 1998); their ages ranged from 17 to 91 years, ($M = 45$ years, SD = 17 years). Women comprised 57% of the standardization sample.

The standardization sample used socioeconomic status (SES) as measured by the Hall–Jones Scale of Occupational Prestige for Males. This scale ranks occupations on a 1–8 scale, with professionals ranked 1 and executives, skilled non-manual workers, skilled and semi-skilled manual workers, and unskilled manual workers ranked progressively lower. Using this scale, the normal group's SES range was 1–8 ($M = 5.24$, SD = 1.84).

The malingering group consisted of 46 adults, age range 18–70 years, ($M = 38$ years, SD = 14 years). Their level of education was 4–20 years, ($M = 14$, SD = 3). Women comprised 52%.

Procedure

All participants were given the Raven Standardized Progressive Matrices, using the 1998 norms (Raven *et al.*, 1998). The test was administered according to standard instructions. The additional instructions given to the fakers were:

> Pretend you have suffered head injuries in an accident caused by another person or persons. Assume that you are involved in litigation to determine how much financial compensation you will obtain from the people responsible for the accident and/or from the insurance companies involved. Imagine that your everyday functioning in and outside of school and/or work has been much worse since your accident, that your potential earning power has been substantially reduced, and that you deserve all the money that the courts will allow you. The results of this test will help to determine how large your settlement will be, so fake the most severe disability that you can without making it obvious to the examiner that you are faking.

The Raven answers were applied to the formula $(2A + B) - (D + 2E)$, where A, B, D, and E refer to the number of correct responses in each of the Raven subsets (Gudjonsson & Shackleton, 1986). The result of the formula is termed the 'rate of decay', and is compared with the rate of decay by total score cut-offs (Table 1) validated in the original study. As the current study has a larger, more varied sample than in the original study, a gradual tapering was performed on the originally abrupt cut-offs at the extremes of the total score range: the original study's cut-offs suggested that any perfect score (which gets a rate of decay of 0) must be a fake.

Age, education, and total score were not significantly correlated with the formula's accuracy. The formula's classifications are presented in Table 2. The formula replicated Gudjonsson & Shackleton's false-positive rate of 5%. The false-negative rate changed from 17% to 26%, as expected for a cross-validation. If the base rate of malingering in a given population is assumed to be 10% (as it is in this sample), then a formula-based result of normal has a 97% chance of being correct, and a formula-based result of faked has a 63% chance of being correct. If the base rate is

Table 1. Cut-off values for each total score

Total score	Cut-off	Total score	Cut-off
2	1	32	12
3	2	33	10
4	3	34	10
5	4	35	10
6	5	36	10
7	6	37	10
8	7	38	8
9	7	39	8
10	7	40	8
11	7	41	8
12	7	42	8
13	9	43	7
14	9	44	7
15	9	45	7
16	9	46	7
17	9	47	7
18	10	48	6
19	10	49	6
20	10	50	6
21	10	51	6
22	10	52	6
23	11	53	2
24	11	54	2
25	11	55	2
26	11	56	2
27	11	57	0
28	12	58	0
29	12	59	−1
30	12	60	−1
31	12		

Note. The rate of decay is calculated by comparing the number of correct answers in each subset according to the formula ((2*A)+B)−(D+(2*E)). The cut-off is determined by the total score. The Raven is considered invalid if the rate of decay is below the cut-off listed for each total score.

assumed to be truly unknown, and therefore assumed to be 50%, then a normal result has a 78% chance of being correct, and a faked result has a 93% chance of being correct. The hit rate would be 84%. Although the formula will miss some people, a formula result of 'faked' should be given considerable interpretive weight.

The false-negative rate was not artificially elevated by the participants' inability to fake the test. Other studies (e.g. Heaton, Smith, Lehman & Vogt, 1978; McKinzey, Podd, Krehbiel, Mensch & Trombka, 1997) have found that some participants are unable to fake a given test sufficiently to produce abnormal results, a problem referred to as a 'threat to external validity' (Rogers & Cruise, 1998). This problem can only be corrected when the test has a clear measure of abnormality, such as the

Table 2. Cross-validation of the formula: Classifications

	Formula result		
	Raven faked *N* (% of row)	Raven not faked *N* (% of row)	Totals
Malingering group	34 (73.9)	12 (26.1)	46 (100)
Normal group	20 (5.25)	361 (94.75)	381 (100)
	54	373	427

Note. Percentages are rounded. The χ^2 statistic is highly significant: $\chi^2 = 175$ (1), $p < .0001$.

Halstead Impairment Index. Such ineffectual faking attempts are of little consequence in interpretation, as the difference between the true and actual scores will be minimal. However, all of the 12 faking participants missed by the formula (false-negatives) yielded IQ scores in the 65–95 range, with seven of the 12 getting scores below 70. On the other hand, all but 4 of the 20 false-positives coming from the standardization sample contained IQ scores in the 98–135 range, with only one below 74. Any extremely low score should therefore be consistent with the available history and testing before being considered valid, even when the formula is negative.

There are few methods of detecting faked IQ test results. Other, more accurate, methods are available to detect malingering of neuropsychological deficits: the Test Of Malingered Memory, a commercial product designed to detect neuropsychological malingering, is a stand-alone measure with a 2% false-negative rate (Rees, Tombaugh, Gansler, & Moczynski, 1998). The Luria–Nebraska Neuropsychological Battery is a comprehensive neuropsychological test, the malingering formula of which has a 17% false-negative rate (McKinzey *et al.*, 1997); however, neither is an IQ test, and neither have the same place in a battery as the Raven.

There are many identifiable groups that were not included in the cross-validation. For example, there were no neurologically-impaired patients, developmentally delayed participants, or forensic samples. The current participants are all English-speaking, although the Raven is widely used with non-English speaking people. In addition, no malingering formula is as yet available for children. The faking formula should be cross-validated with such groups in future research, and interpretive caution employed until such research is carried out.

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