INTELLIGENCE **19**, 79–92 (1994)

Odd-Man-Out and Intelligence

MATTHEW N. DIASCRO
NATHAN BRODY
Wesleyan University

The relationship between odd-man-out reaction time (RT) tasks and intelligence is examined. The first experiment supports previous findings that the odd-man-out task is more highly correlated with intelligence than performance on standard choice RT tasks. The advantage high-IQ subjects have over low-IQ subjects in performing the odd-man-out task is eliminated when subjects are forced to take account of a cue stimulus. The second experiment indicates that increasing the complexity of the odd-man-out discrimination by making subjects compare the distances between three pairs of stimuli, as opposed to just two, increases the correlation between odd-man-out performance and intelligence.

Odd-man-out reaction time (RT) tasks presents subjects with an array of three stimuli and require them to indicate whether the first or third stimulus is more distant from the second. The more distant stimulus constitutes an odd-man-out in the array of three stimuli. Frearson, Barrett, and Eysenck (1988) and Frearson and Eysenck (1986) found that the correlation between odd-man-out RT and IQ was higher than the correlation between choice RT and IQ. Reed and Jensen (1993) found that an index formed by subtracting choice RTs from odd-man-out RTs was negatively correlated with IQ.

The experiments reported in this article were designed to provide additional information about the relationship between odd-man-out performance and IQ. The first experiment introduces a cue control condition in order to test its effect on correlations between IQ and reaction time tasks.

Roberts, Beh, and Stankov (1988) found that performance on a card sorting task was correlated with intelligence. Roberts et al. then introduced a dual competing task in which subjects were required to classify words. Under the dual task conditions, correlations between card sorting times and intelligence exhibited large increases.

The dual task used in this experiment was a sequential cued task similar to the category cue task used by Matthews and Dorn (1989). In this task, different letters cued which of three choice RT tasks would be presented. Matthews and Dorn found that the more complex versions of RT tasks, such as the category cue task, did not have higher correlations with IQ than the basic control tasks. This

Correspondence and requests for reprints should be sent to Nathan Brody, Department of Psychology, Wesleyan University, Middletown, CT 06459.

experiment attempted to replicate the result and to examine whether or not it extended to odd-man-out tasks. It is possible that the combination of a cue creating a dual task condition with the additional information processing component contained in the odd-man-out task might increase the correlation between odd-man-out RT and intelligence.

Spilsbury, Stankov, and Roberts (1990) suggested that combining response time and the number of correct responses made by subjects could increase the predictive value of RT tasks. They found that using the natural logarithmic transformation of the ratio of mean number correct to mean response time allowed the experimental conditions to be ordered for difficulty in a psychologically meaningful way. They interpreted this statistic to be a measure of efficiency in solving problems, because it increases as the number correct increases and decreases with increasing response times. In addition, this efficiency measure yielded higher correlations with a measure of general intelligence than either the number correct or the response times.

Errors are an aspect of RT studies that need to be more closely examined. In accordance with the work of Spilsbury, this experiment was designed to examine errors and to test the hypothesis that obtaining a measure of efficiency incorporating both the number correct and RT would account for more variance in IQ than is accounted for by either of the two measures considered alone.

EXPERIMENT 1

Method

Subjects. Subjects were 45 students in an Introductory Psychology class who participated in the experiment for class credit. The subjects had a mean Cattell Culture-Fair IQ of 122.6 (SD = 11.52, range = 88 to 149).

Stimuli. The stimuli were three boxes of red or green color. All three boxes in a specific trial were of the same color, which was determined randomly before each trial, with each having an equal probability of occurring.

The boxes were arranged in an odd-man-out design (see Frearson & Eysenck, 1986) with two levels of difficulty defined by the difference in distance between the shortest and the longest distance. The stimuli were divided at the median into relatively easy and difficult discriminations. There were eight possible locations on the horizontal axis of the screen that the stimuli could occupy. Examples of the array of possible odd-man-out displays are shown in Figure 1.

In addition to the odd-man-out configuration, one of the three boxes had a gap in its top. This manipulation is based on an inspection time (IT) study that obtained very large correlations with IQ (Zhang, 1991). Subjects were briefly shown a square that had one side missing and were told to indicate the missing side. The correlation between IT and IQ was −.713 (after removing outlying

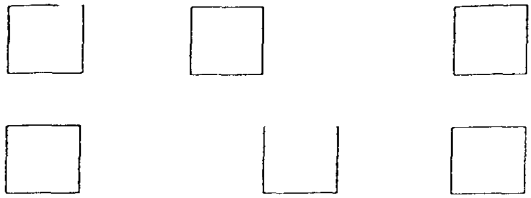

Figure 1. Examples of stimuli used in Experiment 1.

subjects, this correlation fell to −.595). Our inclusion of the gap condition used Zhang's stimuli in a RT task. Again, there were two levels of difficulty. In the easy gap condition, the entire top line was missing from the box. In the difficult gap condition, only one third of the box's top line was missing. Any one of the three boxes could contain the gap.

The individual boxes were squares of 10 mm per side and subtended 1.13 × 1.13 degrees of visual angle. The display size was a possible 130 mm wide but was only 95 mm wide for each individual trial. The total display subtended 14.38 × 1.13 degrees of visual angle. Subjects viewed the stimuli from a distance of 500 mm with their heads in a chin rest.

Procedure. Each subject responded to each of three different experimental conditions. In the first condition, subjects were told to search for the odd-man-out box. In the second condition, they searched for the box with a gap. In these two conditions they were told to ignore the color of the boxes and to disregard the alternative condition.

The third condition was a dual-cued task. The target stimulus was not specified before the trial. The color of the boxes in each trial determined the target stimulus. If the boxes were red, the subject was to find the box with the gap. If the boxes were green, the subject was to find the odd-man-out box. This color-cued scheme was the same for all dual trials.

Each trial began with the presentation of a fixation point, which remained on for 2,000 ms and was immediately followed by the stimulus, which remained on for 100 ms. Subjects were given 5,000 ms to respond. The next trial began following a response or after the 5,000 ms had elapsed.

Subjects indicated their responses by pressing one of three keys. They were instructed to rest their right index, middle, and ring fingers on the 1, 2, and 3 keys of the numerical keypad, respectively. Subjects were told to press the key corresponding to the location of the correct stimulus on the screen: 1 for left stimulus, 2 for middle stimulus, and 3 for right stimulus. Because subjects' fingers rested on the response keys, this experimental arrangement did not allow for the separate measurement of RT and movement time.

There were a total of 400 trials, 16 blocks of 25 trials per block. There were four blocks of odd-man-out trials, four blocks of gap trials, and eight blocks of dual color-cued trials. The order of the blocks was determined by a latin square and was the same for all subjects.

Following presentation of the stimuli, subjects were given the Cattell Culture-Fair IQ Test, Scale 3, Form A (Cattell, 1973). The test is a speeded one of fluid intelligence. Subjects are given 12 min to solve a series of abstract reasoning problems.

Results

Median RTs and the interquartile ranges for correct responses were obtained for each subject for each condition. The number of errors per subject per condition was also tabulated. An efficiency measure, as suggested by Spilsbury et al. (1990), was computed. It was defined as the ratio of the number of correct trials to the median RT per condition.

Table 1 presents the mean of the median RTs and the standard deviation of RTs for each experimental condition. The difficulty level of the discrimination, small versus large gap or easy versus difficult odd-man, affected RT. In nearly every case, RTs for the difficult trials were slightly longer than for the easy trials. There was little difference between RTs for gap and odd-man-out trials. RTs for the dual task were clearly larger than for either of the two single conditions.

Table 2 presents means and standard deviations for number of errors across subjects for all conditions. In general, subjects made fewer errors in the simple gap conditions than the odd-man-out task. Subjects made more errors in the dual conditions than either of the singular conditions, with more errors occurring in

TABLE 1
Mean of Median RTs and Standard Deviations

Condition	Mean of Median RT	*SD*
Gap Trials		
Easy gap	529	76
Hard gap	563	86
Odd Trials		
Easy odd	514	112
Hard odd	591	152
Dual Trials		
Gap task		
Easy gap	767	173
Hard gap	799	166
Odd task		
Easy odd	794	179
Hard odd	906	244

Note. $N = 45$.

TABLE 2
Means and Standard Deviations for Errors

Condition	*M*	*SD*	Range
Gap Trials			
Easy gap	.78	1.44	0–9
Hard gap	2.38	2.28	0–12
Odd Trials			
Easy odd	2.49	5.95	0–29
Hard odd	5.62	9.15	0–41
Dual Trials			
Gap task			
Easy gap	1.82	1.42	0–6
Hard gap	4.53	3.20	0–13
Odd task			
Easy odd	3.04	6.97	0–35
Hard odd	6.44	7.96	0–34

Note. $N = 45$.

the dual-odd trials. Median RT and interquartile range for correct trials, number of errors, and efficiency were correlated with IQ for all conditions and difficulty levels. There were no differences in correlation as a function of difficulty level of the task in either the single or dual tasks. This was true of both RT measures and error measures. These conditions were collapsed in the final analyses.

Table 3 presents correlations between median RT, interquartile range, number of errors, efficiency, and IQ for gap, odd-man-out, dual-gap, dual-odd, and dual-total conditions. Performance in the gap conditions was not significantly related to intelligence, although median RT, interquartile range, and number of errors were all negatively correlated with IQ. On the odd-man-out tasks, median RT,

TABLE 3
Correlations Between RT Data and IQ

Condition	Median RT	Interquartile Range	Errors	Efficiency
Gap	−.05	−.02	−.12	.13
Odd-man-out	−.32*	−.29*	−.37*	.38*
Dual-gap	.21	.07	.02	−.16
Dual-odd	.05	−.12	−.41**	.22
Dual-total	.12	.04	−.39**	.07
Aggregate	−.06	−.15	−.41**	.23

Note. $N = 45$.
$*p < .05$. $**p < .01$.

interquartile range, and number of errors correlated with IQ −.32, −.29, and −.37, respectively. The corresponding correlations for the dual-total condition were .12, .04, and −.39, respectively. The correlations between median RT and intelligence were significantly different for gap versus dual-gap, $t(42) = -2.72$, $p < .01$, and for odd-man-out versus dual-odd, $t(42) = -3.36$, $p < .01$ conditions. The correlations between error and IQ were significant, even though most subjects made only a few errors per condition.

Discussion

There was no evidence that increasing the difficulty level of the task had any effect on the relationship with IQ. Although RTs for difficult trials were longer than those for easy ones within the same task, easy and difficult gap or odd-man-out discriminations were not differentially related to IQ.

Although simple RT tasks consistently show small negative correlations with tests of general intelligence, the odd-man-out task developed by Frearson & Eysenck (1986) is correlated more highly with IQ. It is, therefore, important to understand why this is so.

The odd-man-out tasks involve comparing the ratio of two distances, the distance between the two stimuli that are close together, and the distance between the two that are far apart. The relationship between IQ and performance on the odd-man-out task seems, therefore, to be mediated by the ability to rapidly perceive differences in relationships, as opposed to being one of simple discrimination. In the gap condition, subjects are required to note that one stimulus is different from another. In the odd-man-out procedure, subjects are required to note relationships between pairs of stimuli. The gap and the odd-man-out conditions contrast discrimination with discrimination between ratios among pairs. The odd-man-out task adds an element of relational complexity to the discrimination task. The relational complexity that is added appears to be perceptual rather than cognitive. That is, it is easily apprehended by subjects and does not appear to require an extended process of reasoning to infer the correct solution.

Although a significant correlation was found between RT for the odd-man-out task and IQ, the demands of the dual task eliminated this relationship. The correlation became zero or even slightly positive, indicating that individuals with higher IQ had RTs for the dual task that were essentially equivalent to RTs from subjects with lower IQ. Subjects with high IQ seemed to have an advantage over low-IQ subjects, being able to immediately perceive the odd-man-out relationship and process it rapidly. When they performed the dual task, however, they slowed their responding to take account of the cue stimulus. This eliminated the correlation between performance on the odd-man-out task and intelligence.

There are two possible explanations for the elimination of the correlation between RT and intelligence under the dual-cued conditions. The first involves IQ-related differences in planning of tasks. Sternberg (1981) gave subjects analogy problems that had one to three terms of the analogy missing. These were presented in either blocked or mixed form. In the blocked condition, all of the problems had a common format involving the same number of terms missing in the analogy. In the mixed condition, the format of problems varied from trial to trial. Sternberg assumed that global planning was involved in the solution of analogies under mixed-block conditions. He obtained a significant positive correlation between his measure of global planning and intelligence. The positive sign of the correlation implies that high-IQ subjects spent more time in global planning of the tasks. The slightly positive correlation between RT on the dual tasks and intelligence in the present study may be the result of longer global planning on the part of high-IQ subjects.

Sternberg (1981) did not, however, differentiate the time to perform the task under the two conditions. In the mixed-block condition it is impossible to determine when global planning stops and performance of the task begins. Sternberg assumed that the time to perform the task after the completion of global planning was the same as the time to complete the task when global planning was not present. The mixed-block arrangement may alter the time required to perform the task after the end of a global planning process.

A second possible explanation for the elimination of the negative relationship between RT and intelligence under the dual task is that high-IQ subjects have an advantage over low-IQ subjects in performing these tasks. They are able to perceive the relationship among the stimuli immediately and perform the discrimination rapidly. Having to take account of the cue under the dual condition, however, interferes with the ability to immediately perceive this relationship and perform the task. Either of the explanations presented is plausible.

The correlation between errors and IQ for the dual odd-man-out task became slightly more negative than that for the odd-man-out alone. Although high-IQ subjects were not different from low-IQ subjects, as measured by their RTs, high-IQ subjects were more frequently correct in their responding. In fact, in all conditions, errors were more highly correlated with IQ than with median RT.

EXPERIMENT 2

There are still some unanswered questions regarding the relationship between IQ and the odd-man-out task. The first experiment found errors and efficiency measures to be important components of RT tasks requiring further study. Stressing subjects' information-processing skills by causing them to make more errors could possibly further separate high-IQ subjects from low-IQ ones, thereby increasing the correlation with IQ. In this experiment, several stimulus presentation times were included that were faster than those used in previous studies, in an effort to elicit more errors.

The first experiment, as well as other studies, found that the odd-man-out task is a better measure of general intelligence than simple RT measures. The odd-man-out task requires subjects to make rapid judgments regarding the ratio of two distances. By increasing the complexity of the task, it may be possible to increase the correlation with IQ. One way to increase the difficulty of the task is to force subjects to compare more than two distances. Varying the difficulty within the task by changing the ratio of the distances, as was done in the first experiment, had no effect on the correlation with IQ. In this case the task was unchanged; subjects were only asked to compare two distances. The present study required subjects to compare three distances. If the odd-man-out is better than the simple RT task because the simple task involves discrimination, whereas the odd-man-out involves the comparison of two ratios, it is possible that a task involving a comparison of three ratios would exhibit a more substantial relationship with intelligence than a task requiring a comparison of two ratios.

Method

Subjects. Subjects were 34 students enrolled in an Introductory Psychology class who participated in the experiment for class credit. They were drawn from the same subject pool as those used in the first experiment. No subject who participated in the first experiment participated in the second experiment. The subjects had a mean Cattell Culture-Fair IQ of 123.1 (SD = 12.45, range = 96 to 149).

Stimuli. In the three-distance comparison task, the stimuli were four boxes of equal size arranged in a horizontal line. There were 10 possible locations that the stimuli could occupy. The distance between one set of stimuli was always larger than the distance between the other two sets of stimuli. Examples of the stimuli are presented in Figure 2. The stimuli for the simple odd-man-out were the same as those used in the first experiment. The individual boxes were squares of 10 mm per side and subtended 1.13×1.13 degrees of visual angle. The display size was 165 mm wide and subtended 17.89×1.13 degrees of visual angle. Subjects viewed the stimuli from a distance of 500 mm with their heads in a chin rest.

Procedure. In the three-distance comparison task, subjects were instructed to find the distance between the boxes that was greatest. This distance was between the first and second boxes, the second and third boxes, or the third and fourth boxes. The placement of the correct distance was determined randomly prior to each trial, with each location having an equal probability of being the correct one.

Subjects responded by pressing one of three keys corresponding to the three locations on the screen. The subjects were instructed to rest their index, middle, and ring fingers of their right hand on the 1, 2, and 3 keys of the numerical keypad, respectively.

Presentation time was varied throughout the experiment. In the three-distance-comparison task, the four boxes for each trial were presented simul-

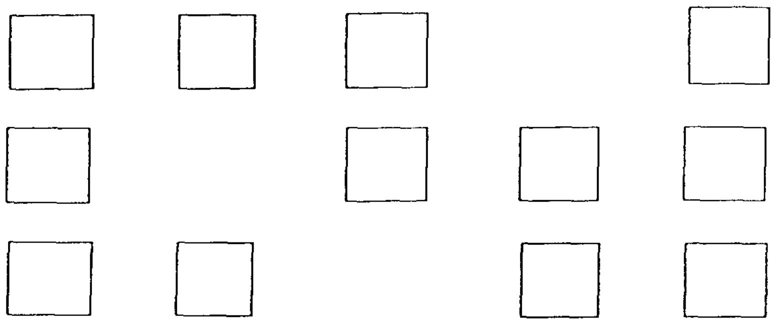

Figure 2. Examples of stimuli used in Experiment 2, each consisting of four horizontally arrayed boxes. There are three different stimulus arrays depicted in the figure. The correct response for the first stimulus array presented in the top row of the figure would be "3," indicating that the distance between the third pair of adjacent stimuli is farther than the distance between the first two pairs. The correct response for the stimulus array in the second row is "1," and the correct response for the stimulus array in the third row is "2."

taneously for either 20, 40, or 60 ms. The presentation times for the odd-man-out task were either 20 or 40 ms. Time of presentation was determined randomly prior to each trial. There was an equal number of trials for each of the three presentation times.

Each trial began with the presentation of a fixation point that remained on for 2,000 ms and was immediately followed by the stimulus. The stimulus remained on for a predetermined amount of time, as described before. Subjects were given 5,000 ms to respond. The next trial began following a response or after the 5,000 had elapsed.

The experiment consisted of 411 presentation trials. There were 15 trial blocks, and the task did not change within a block of trials. There were 27 individual trials per block in the three-choice condition and 28 trials per block in the two-choice condition. There were nine blocks of the three-choice task and six blocks of the two-choice odd-man-out task. There were 243 total trials of the three-choice condition with 81 trials for each of the three presentation times (20, 40, and 60 ms). There were 168 total trials of the two-choice condition, with 84 trials for each of the two presentation times (20 and 40 ms). Following presentation of the stimuli, subjects were given the Cattell Culture-Fair IQ test Scale 3, Form A (Cattell, 1973).

Results

Median RTs and the interquartile range for correct responses were obtained for each subject for each condition. The number of errors per subject per condition was tabulated. An efficiency measure, defined as the ratio of number of correct trials to median RT, was also computed for each condition.

Table 4 presents the mean of the median RTs and standard deviations for all

TABLE 4
Mean of Median RTs and Standard Deviations for Experiment 2

Condition	Mean RT	*SD*
Two-choice odd-man-out		
20 ms	466	88
40 ms	463	95
Aggregate	465	91
Three-choice odd-man-out		
20 ms	516	88
40 ms	515	87
60 ms	508	84
Aggregate	513	86
Total aggregate	494	83

Note. $N = 34$.

subjects organized by condition. RTs for the aggregate of the two-choice odd-man-out task were significantly shorter than those for the aggregate of the three-choice task, $t(33) = -4.98$, $p < .01$. RTs for the 20 ms condition were not significantly different from RTs for the 40 ms condition, nor were reaction times for the different times of presentation of the three-choice task significantly different.

Table 5 presents means, standard deviations, and ranges for the number of errors across subjects for each condition. Subjects made significantly fewer errors in the two-choice task than in the three-choice task for the 20 ms and 40 ms

TABLE 5
Means and Standard Deviations for Errors for Experiment 2

Condition	*M*	*SD*	Range
Two-choice odd-man-out			
20 ms	1.50	1.76	0–8
40 ms	1.47	1.69	0–7
Aggregate	2.97	3.06	0–14
Three-choice odd-man-out			
20 ms	2.44	1.93	0–9
40 ms	2.32	1.93	0–7
60 ms	1.76	1.50	0–6
Aggregate	6.53	3.92	0–19
Total aggregate	9.50	5.68	1–24

Note. $N = 34$.

conditions, $F(1, 99) = 5.36$, $p < .01$. The time of presentation had no significant effect on the number of errors made by subjects.

Median RT and interquartile range for correct trials, number of errors, and efficiency were correlated with IQ for all conditions. Table 6 presents these correlations for the two-choice and three-choice tasks, as well as the collapsed conditions. Performance on each task, as measured by median RT and the interquartile range, was negatively correlated with intelligence in all conditions. The correlation between median RT and IQ collapsed across presentation time for the two-choice task was less than the corresponding correlation in the three-choice task (−.15 vs. −.29).

The correlations between the number of errors per condition and intelligence did not follow a clear pattern. On average, subjects made very few errors, even in the most rapid presentation time conditions. Generally, errors correlated negatively with IQ, indicating that there was no speed–accuracy tradeoff. High-IQ subjects tended to make more rapid responses and fewer errors.

In two conditions, the two-choice task at 20 ms and the three-choice task at 60 ms, errors were positively correlated with IQ (.02 and .10, respectively). In all other conditions for both the two-choice task and the three-choice task, there were negative correlations between errors and IQ, ranging from −.10 to −.32. Collapsed across all conditions, the number of errors correlated with intelligence −.17.

Correlations between the efficiency measure and IQ were slightly larger than any other single correlation with intelligence in all but one condition: the 60 ms three-choice task. All the correlations were positive and, therefore, in the ex-

TABLE 6
Correlations Between RT Data and IQ for Experiment 2

Condition	Median RT	Interquartile Range	Errors	Efficiency
Two-choice odd-man-out				
20 ms	−.16	−.14	.02	.19
40 ms	−.14	−.21	−.19	.22
Aggregate	−.15	−.17	−.10	.21
Three-choice task				
20 ms	−.29*	−.31*	−.10	.32*
40 ms	−.29*	−.34*	−.32*	.35*
60 ms	−.29*	−.27	.10	.28*
Aggregate	−.29*	−.31*	−.17	.32*
Total aggregate	−.26	−.27	−.17	.28*

Note. $N = 34$.
$^*p < .05$.

pected direction. The efficiency measure increased with increasing number of correct trials and with shorter RTs. High-IQ subjects tended to have more correct responses and shorter RTs, again confirming that there was no speed–accuracy tradeoff.

Table 7 presents the results of a hierarchical regression analysis to predict IQ. The first variable added to the regression was RT for the two-choice odd-man-out task. It accounted for 2% of the variance in intelligence. Adding errors in the two-choice task to the regression did not increase the predictive value significantly. RT on the three-choice odd-man-out task contributed significantly to the variance predictive of IQ (F to enter = 4.23, $p < 0.05$). Errors on the three-choice task did not add significantly to the predictive value of the regression analysis.

Discussion

The correlations obtained in Experiment 2 between IQ and the four measures of performance derived from the odd-man-out RT task (median RT, interquartile range, errors, and efficiency) were somewhat lower than the correlations obtained between these measures and IQ in Experiment 1. None of the four correlations between IQ and performance measures derived from the odd-man-out task in Experiment 2 were significantly different from the comparable correlations obtained in Experiment 1. Because the correlations are not significantly lower than those previously obtained, the differences in magnitude of correlations between IQ and odd-man-out measures is reasonably attributable to chance variations in correlations obtained from small samples. The correlations between odd-man-out performance and IQ obtained in Experiments 1 and 2 are comparable to other correlations reported in the literature. For example, Jensen and Reed (1990) obtained a correlation of −.19 between IQ and odd-man-out performance for a combined sample of 213 college students, a value intermediate between the comparable correlations obtained in Experiments 1 and 2.

Increasing the complexity of the odd-man-out task by making subjects compare three distances increased the correlation between performance and intel-

TABLE 7
Hierarchical Regression Analysis Predicting IQ for Two-Choice and Three-Choice Odd-Man-Out for Experiment 2

Variable	R	R^2	F to Enter
Two-choice RT	.15	.02	< 1
Errors	.19	.04	< 1
Three-choice RT	.39	.16	4.23*
Errors	.42	.17	< 1

*$p < .05$.

ligence. In the two-choice odd-man-out similar to that developed by Frearson and Eysenck (1986), median RT was negatively correlated with intelligence. In this task, subjects were required to identify the odd-man-out stimulus by comparing two distances. In the more complex variant presented here, subjects were required to compare three distances and choose the one that was largest. This three-choice task was more difficult. RTs for this task were longer and errors were more frequent than in the two-choice task.

Although the correlation between the three-choice task and intelligence was stronger than the relationship between odd-man-out performance and intelligence for the within-subject comparisons tested in Experiment 2, the correlation between three-choice performance and intelligence obtained in Experiment 2 was not larger than the correlation between odd-man-out performance and intelligence obtained in Experiment 1. Although the within-subject test is a more appropriate test than the between-subject comparisons of odd-man-out performance in the two experiments, the conclusion that performance on the three-choice task is a better predictor of intelligence than performance on the odd-man-out task needs to be replicated with a larger sample in order to make sure that it is not dependent on results obtained from a small sample that may have yielded nonrepresentative results.

The odd-man-out task measures the ability to compare distances rapidly. If subjects are required to compare three distances rather than two, the increase in the complexity of the perceptual judgment increases the correlation with IQ. If subjects were required to compare four, or even five, distances, the correlation between performance and intelligence might increase for each successive increase in the difficulty and complexity of the task. It is possible that measures of the speed of apprehension of inferred relationships among elements of a visually presented stimulus may be correlated with IQ.

As in the first study, the interquartile range was related to fluid intelligence. In three of the five conditions, the correlation between IQ and the interquartile range was larger than the corresponding correlation for median RT. High-IQ subjects were not only slightly faster but also less variable in their responding. These results are in agreement with previous findings (see Jensen, 1992).

Decreasing the stimulus presentation times in this study did not substantially increase errors. Even at a presentation time of 20 ms, subjects made very few errors. With such a restricted range of errors, the correlations with intelligence are not very reliable. Although it can be asserted that errors are an important aspect of RT studies to be further examined, it is premature, based on the present findings, to make the claim that they consistently account for a larger portion of the variance in IQ than measures of the median RT and the interquartile range of RTs. RT studies using a backward mask and more rapid presentation of stimuli than those used here are necessary to increase errors in RT tasks. Under these conditions, error measures and efficiency measures might be related to IQ.

The two experiments presented here indicate that tasks that assess the ability to rapidly perceive relationships among stimuli are good measures of general intelligence. Although tasks that require subjects to merely notice a difference between stimuli relate to intelligence, increasing the complexity of the discrimination and forcing subjects to make judgments about relationships among elements of a stimulus array increases the correlation with IQ.

REFERENCES

Cattell, R.B. (1973). *Culture Fair Intelligence Test Manual.* Champaign, IL: Institute for Personality and Ability Testing.

Frearson, W., Barrett, P., & Eysenck, H.J. (1988). Intelligence, reaction time and the effects of smoking. *Personality and Individual Differences, 9,* 497–517.

Frearson, W.M., & Eysenck, H.J. (1986). Intelligence, reaction time (RT) and a new "odd-man-out" RT paradigm. *Personality and Individual Differences, 7,* 807–817.

Jensen, A.R. (1992). The importance of intraindividual variation in reaction time. *Personality and Individual Differences, 13,* 869–881.

Jensen, A.R., & Reed, T.E. (1990). Simple reaction time as a suppressor variable in the chronometric study of intelligence. *Intelligence, 14,* 375–388.

Matthews, G., & Dorn, L. (1989). IQ and choice reaction time: An information processing analysis. *Intelligence, 13,* 299–317.

Reed, T.R., & Jensen, A.R. (1993). Choice reaction time and visual pathway nerve conduction velocity both correlate with intelligence but appear not to correlate with each other: Implications for information processing. *Intelligence, 17,* 191–203.

Roberts, R.D., Beh, H.C., & Stankov, L. (1988). Hick's law, competing-task performance, and intelligence. *Intelligence, 12,* 111–130.

Spilsbury, G.A. (1992). Complexity as a reflection of the dimensionality of a task. *Intelligence, 16,* 31–45.

Spilsbury, G.A., Stankov, L., & Roberts, R.D. (1990). The effects of a test's difficulty on its correlation with intelligence. *Personality and Individual Differences, 11,* 1069–1077.

Sternberg, R.J. (1981). Intelligence and nonentrenchment. *Journal of Educational Psychology, 73,* 1–16.

Zhang, Y. (1991). Inspection time correlation with IQ in Chinese students. *Personality and Individual Differences, 12,* 217–219.