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Measures of Timed Performance and Intelligence*

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The question of an association between IQ and measures of timed performance derived from inspection time and reaction time was examined in a sample of 182 adults and by reanalyzing data involving 48 adults from a previously published study. Multiple regression analysis found that measures of timed performance accounted for as much as 25% of IQ variance in the normal population, but that the inclusion of borderline and mildly retarded subjects resulted in much higher correlation coefficients because of the markedly less efficient performance of these persons in tasks of this kind. This outcome raised doubts about the validity of combining data from retarded and nonretarded subjects. Results ran counter to claims that tasks of the kind used are largely uninfluenced by cognitive variables, so that findings are not necessarily explained satisfactorily in terms of a mental speed factor. It was concluded that these measures of timed performance do not, at this time, provide a basis from which a reliable culture-fair measure of intelligence might be devised.

Attempts to test intuition that there is an association between some kind of mental speed and intelligence date from the very beginnings of experimental psychology. Although much of the early research did not appear promising, Jensen (1979) has argued that this in part reflected the shortcomings of experimental methodology available at the time. Certainly, throughout the history of mental testing, such an association has been widely held to exist; most tests of intelligence allow credit for faster performance. There is, indeed, evidence for some degree of association between speed and intelligence. Removing or reducing time constraints within the testing situation does not appreciably influence test outcome for either children (Heim, Watts & Simmonds, 1974), young to middle-aged adults (Heim, 1947; Heim & Batts, 1948), or elderly subjects (Dibner & Cummins, 1961); those persons who work more rapidly tend to gain higher test scores whether time limits apply or not. However, the strength of correlations supporting this conclusion have varied widely.

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Eysenck (1953; 1967) has given particular prominence to mental speed as a major source of individual differences in intelligence. His theoretical formulation derives largely from research by Furneaux (summarized by Furneaux, 1960). This research suggests that, if accuracy and persistence of performance are taken into account, intellectual differences might be described predominantly in terms of the speed of some hypothetical basic cognitive process, assumed to be related in some way to the biological efficiency of nerve conduction, like a scanning mechanism. More recently, Jensen (1979) has begun to develop a similar idea, inferred from the outcome of multiple regression analyses involving measured intelligence (IQ) and various parameters of reaction time (RT). These measures have been obtained from samples of university and college students, school children, and mentally retarded adults following procedures derived from Hick (1952), Sternberg (1966), and Posner (1969). (Jensen, 1980a and b; Jensen & Munro, 1979; Jensen, Schafer & Crinella, 1981).

It is clear that Jensen has consistently found evidence for a negative correlation between IQ and various aspects of RT. The strength of this association has varied across studies and with different parameters of RT, but would seem to account for between about 10% to 40% of the variance in Jensen's investigations. However, at this time an adequate interpretation of these results faces a number of difficulties, as Jensen (1979) has recognized. First, apparent differences in parameters of RT obtained from groups with different average IQ cannot be evaluated; the groups are from various studies following the same procedures, but the age of subjects has not been controlled so that data cannot be compared directly.

Second, Jensen's attempt to separate "decision" and "movement" components of RT may not have been successful. Contrary to initial predictions, he has found strong correlations in some samples between IQ and "movement time". This is defined as the time required to make a simple movement from a "home" button after a choice decision has been made, in order to turn off a stimulus light. Interdependence between decision and movement components would not markedly influence an overall description of a general relationship among IQ and RT variables, since both aspects have been included in the multiple regression analyses applied, but an interaction of this kind does pose obvious problems for interpretation.

A third and most important area of difficulty relates to an apparent contradiction between Jensen's recognition, on the one hand, that RT measures can be relatively unstable under some circumstances, and his confidence, on the other, that RT tasks are sufficiently simple to exclude complex learning and memory processes as important determinants of responding. Certainly, however, a wide body of evidence provides grounds for doubting this latter assertion, attesting to the influence of practice (Teichner & Krebs, 1974), sequential arrangements among stimuli (Kirby, 1980), criterial factors (Pachella, 1974), and level of subject confidence (Vickers, 1979) on adaptive strategies for responding. Thus, effects plausibly attributable to the influence of relatively complex cognitive processes have been found in RT tasks like those employed by Jensen, even where stimulus occurrence is equiprobable. Indeed, Jensen (1979) has reported that correlations between IQ and RT increase with increasing stimulus alternatives and hence task "complexity". Such effects may be of particular importance where the performance of mentally retarded subjects is under consideration (Nettelbeck & Brewer, 1981).

A recent suggestion, arising from renewed research interest in an association between mental speed and intelligence, is that a "culture-fair" test of intelligence might be devised to supplement traditional IQ tests where it was suspected that educational, social, or cultural disadvantage could influence test performance (Brand, 1980; 1981; Brand & Deary, 1982). This development derives from experiments in which a backward masking procedure is used by the experimenter to limit and control the exposure duration of stimuli in tasks requiring relatively simple discriminations. The theoretical framework for this work is a temporal summation model of discrimination developed by Vickers (1970; 1979). The aim is to establish the minimum exposure duration at which different individuals can make correct judgements on virtually every trial. Providing that the discrimination required is sufficiently "easy", i.e., well beyond levels of "noise" in the information processing system, this minimum stimulus exposure duration is held to provide an estimate of the rate at which some hypothetical sampling mechanism conveys information from preliminary storage to subsequent processing. This index has been termed "inspection time" (Vickers, Nettelbeck & Willson, 1972). It has been measured in various discrimination tasks involving two lines side-by-side and of markedly different length (Nettelbeck, 1982), tones of different pitch (Brand & Deary, 1982), and lights illuminated in different positions, or response buttons which vibrate against the finger tips, as described below.

The appropriate application of the inspection time measure to the purpose envisaged by Brand is dependent upon two assumptions; first, that inspection time provides a valid index of mental speed that is not readily influenced by socio cultural factors, and second, that the construct of mental speed provides a sufficient explanation for the psychological basis of intelligence. There are, however, grounds for doubt concerning the admissibility of both assumptions.

In the first place, although individual estimates of inspection time have been found on the whole to be fairly stable, test-retest correlation coefficients have varied considerably from study to study (Nettelbeck, 1982). Furthermore, weighted means of the coefficients obtained from several studies are no higher than reliability measures for the least reliable of the Wechsler Adult Intelligence Scale (WAIS) subtests. Moreover, as Nettelbeck (1982) points out, very large performance differences between mentally retarded and nonretarded subjects in the inspection time tasks can be interpreted in terms of cognitive strategies, which at this time have not been identified. Although inspection time has been found to correlate highly with IQ, most samples have included both mentally retarded and nonretarded subjects (Brand, 1980; Brand & Deary, 1982; Lally & Nettelbeck, 1977; Nettelbeck & Lally, 1976), the correlations appearing to have been substantially inflated because of the extremely disparate range of performance introduced to relatively small samples by this kind of comparison (Mackintosh, 1981; Nettelbeck, 1982). This has not invariably been the case, however; Brand and Deary (1982) refer to three studies, not including mentally retarded subjects, but in which significant negative correlations between inspection time and IQ have been found.

To date, no investigation has used a reasonably large representative sample of IQ in the general population in order to address the issues raised by Jensen and by Brand. For the second study reported here, we attempted to obtain such a sample, and to test relationships between IQ, inspection time, and RT, reproducing the apparatus described by Jensen and Munro (1979). In the event, the many difficulties encountered in selecting a representative sample for IQ were not altogether overcome, although extremes of IQ were certainly much less over-represented than has been the case in previous work of this kind. In addition to a report on this study, we have also included a reanalysis of data from an investigation published by Lally and Nettelbeck (1977), comparing this outcome with that from the main study.

LALLY AND NETTELBECK (1977)

Group characteristics were as summarized in Table 1. Inspection time (λ) was estimated and 2, 4, 6, and 8 choice RT measured, as described in detail in the original article. Correlations between IQ, λ, and various parameters of RT are shown in Table 1 for the three groups separately, the two nonretarded groups combined, and overall.[1] Correlations between IQ and RT at different levels of

TABLE 1
Pearson r Correlations Between WAIS Performance IQ, λ, Slope, and Intercept of the Linear Regression of CRT on Bits, and Root Mean Square of Variance Within Bits (VAR): $^{**}p < .01$, $^{*}p < .05$ (One-Tailed). Multiple R is for IQ and λ, Slope, Intercept, Slope and Intercept for Regression of SD on Bits, and VAR.

		Mean	Correlations between IQ and				Multiple
Group	*N*	IQ	λ	Slope	Intercept	VAR	R
Retarded	16	69	−.45*	−.53*	−.24	−.34*	.71
Nonretarded	16	105	−.54*	−.37	+.18	−.29	.76
Above average nonretarded	16	120	−.17	−.31	+.34	−.06	.79
All nonretarded	32	113	−.25	−.35*	+.39	−.28*	.56
Overall	48	98	−.80**	−.77**	−.10	−.56**	.89

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[1] The first author is indebted to Professor L. J. Kamin for drawing attention to an omission in the Lally and Nettelbeck (1977) paper, and for suggesting that reanalyses be done for all nonretarded subjects without the inclusion of retarded subjects.

choice (i.e., within bits) are included in the Appendix, but are adequately summarized by the regression parameters shown in Table 1. Similarly, correlations were calculated between IQ and the within-subject standard deviation (SD) of RT at each level of choice, as well as the slope and intercept of SD regression functions. Only variability at various levels of choice RT showed any significant relationship and this has been summarized in Table 1 by using the square root of the mean square of individual variances among trials within bits (VAR), as suggested by Jensen (1980b).

Multiple regression analyses proceeding stepwise from the variable accounting for the most variance in IQ were carried out for each of the groups and combinations, as shown in Table 1. For each group, separate entries subsequent to the initial entry did not account significantly for unexplained variance. For the overall combination, an increase in multiple R to .86 ($\lambda \times$ slope) was statistically significant ($p < .001$). This outcome reflects a fair degree of association between the various independent variables, the details of which, however, are not included here due to space constraints.

Planned comparisons were made between the nonretarded and above-average nonretarded groups, and between the retarded group and both nonretarded groups combined for the following variables: λ, slope, intercept, slope SD, intercept SD, VAR. With the exception of slope SD, for which the outcomes from both comparisons were not statistically significant, these analyses established differences between retarded and nonretarded subjects that were highly significant (at least $p < .01$) due to the much slower and more variable performance of the retarded subjects. (Details of these differences are to be found in Lally & Nettelbeck, 1977.) However, there were no significant statistical differences between the two nonretarded groups ($t < 1$ in every instance).

In summary, these analyses suggested that, overall, there was a marked association between IQ and λ and the various parameters of RT. However, no single measure provided a more clearly reliable index of association than any other, although there was a fair degree of inter-relationship between the various measures. Moreover, the strength of association between IQ and these measures was largely attributable to marked differences between the performance of retarded and nonretarded subjects. Further discussion of these findings is left until results from the main study have been presented.

THE MAIN STUDY

Subjects

Subjects were 182 adults (127 males and 55 females[2]), either university undergraduates in third-year psychology, trainees in trade apprenticeship courses at

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[2] Females represented approximately two-thirds of university cases, one-third of handicapped workers, with only a single case among apprentices. Analyses for sex differences in the university group confirmed earlier findings that this variable is not relevant in this context.

colleges of post-secondary education, or employed at a work-training center for handicapped persons. Mentally retarded participants had no physical disabilities likely to affect their performance in the tasks used, had no specific brain damage diagnosed, and were not being treated with drugs. IQ was estimated using Raven's Advanced Progressive Matrices (APM) Set II (1962 revision) for university undergraduates, the Standard Progressive Matrices (SPM) for apprentices, and the full-scale score from the WAIS for handicapped workers.[3] Respective sample characteristics are summarized in Table 2. The overall proportions of cases corresponding to IQ ranges defined by + − 1 and 2 *SD*s are compared in Table 3 with expected proportions, assuming a normal distribution of IQ with mean = 100 and *SD* = 15 for the general population. Table 3 also includes a reduced sample of 91 subjects, made by retaining all subjects with IQ between 86

TABLE 2
Number, Age (Years and Months), and IQ of Subjects Sampled from Three Sources

Variable	University Undergraduates	Trade Apprentices	Handicapped Workers	OVERALL
Number	59	82	41	182
Age $\bar{X}$	23–6	17–11	20–6	20–6
SD	6–9	1–7	2–7	4–10
IQ $\bar{X}$	124	109	68	105
SD	7	10	10	23

TABLE 3
Obtained Proportions Categorized According to IQ in the Total Sample of 182 Subjects and a Reduced Sample of 91 Subjects, Compared with Expected Proportions, Assuming a Normal Distribution for IQ

IQ	Total Sample Proportions	Reduced Sample Proportions	Expected Proportions
< 70	.10	.02	.02
71–85	.12	.15	.14
86–100	.09	.17	.34
101–115	.26	.49	.34
116–130	.37	.15	.14
> 131	.06	.02	.02

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[3] IQ has been estimated from APM raw scores by converting these to *Z* scores, having first estimated the SD of the appropriate normative sample published for different ages (Tables APM XII and APM XIV, ACER Manual for APM: available from Australian Council for Educational Research, Frederick St., Hawthorn, Victoria, 3122.). We are grateful to Dr. Glen Smith for drawing attention to this possibility and for demonstrating that deviations from normal in the available normative samples result in only minor variations in estimated IQ. This method resulted in a maximum IQ of 135 corresponding to a raw score of 35, and for the single subject scoring higher an IQ of 136 has been used. For SPM, IQ has been taken as the midpoint of the IQ range published in score conversion tables (ACER Manual for SPM). WAIS scores were used for handicapped workers following an unsuccessful attempt to use SPM; more than half of the group scoring below the minimum for which IQ conversions can be estimated reliably.

and 115, but reducing numbers above and below these scores so as to achieve an approximately normal distribution.

Apparatus and Procedure

Following an IQ testing session, subjects attended two individual sessions. At the first, an estimate of λ was made for both the visual and tactile modalities, as described below. These estimates followed sufficient practice during which performance met strict criteria for learning; estimates were balanced for order. At the second session, subjects were first practiced in an 8 choice RT task, and then completed 2, 4, and 8 choice RT tasks, balanced for order. Details are:

Inspection Time.

For the estimate in the visual modality (λ_v), stimuli were eight lens-topped neon bulbs mounted in a horizontal row and divided into two groups of four lights by a vertical white line at the center of the display, as described in detail by Nettelbeck (1982). For any trial, the light immediately to the left or right of the line was exposed for a short variable duration, following which all eight lights were switched on simultaneously for a 2 sec duration, thereby serving as a backward mask. Responses were made by one of two keys, located directly in front of the subject so that these could be pressed comfortably using the index fingers of both hands. A response terminated the trial and triggered the next stimulus after an interval of 2 sec. On the first trial stimulus exposure duration before the mask was 250 msec. Thereafter, exposure duration was determined according to the accuracy of responding by a sequential estimation procedure derived from the method of limits (Taylor & Creelman, 1967). This procedure was computer controlled, raising or lowering exposure duration as response accuracy fell below or increased beyond an 85% level of accuracy. Thus, the subject completed as many trials as was necessary to determine the stimulus exposure duration for which response accuracy was 85%.

The estimate in the tactile modality (λ_t) involved a set of eight keys arranged in two arcs of four so that the subject could comfortably rest one finger on each. These keys were perspex cylinders, 13 mm in diameter, dished on top to fit finger tips, and projecting up 5 mm through a base board. A rod 3 mm in diameter that could be vibrated up and down at 100 Hz, independently from the rest of the key, passed through the center of each key. Vibration of either of the keys under the index fingers constituted the initial discrimination task, following which all eight vibrators were switched on simultaneously. Responses required a pressure of about 140 g. Other parameters to this task were the same as for the lights discrimination, so that it was exactly analogous to the visual task.

Reaction Time (RT).

The RT apparatus reproduced the specifications provided by Jensen and Munro (1979), but was under computer control. Stimuli were arrays of either 2, 4, or 8 lights arranged in a semicircle with the associated response button immediately adjacent to each light. A single "home" button was located equidistant from every other button. A trial began with the onset of a stimulus light and a response was made by releasing the home button, then moving to depress the appropriate response button. Decision time (DT) was recorded in msec as the interval between stimulus onset and the release of the home button. Movement time (MT) was measured as the interval between the release of the home button and the depression of a response button. The index finger of the preferred hand was used for all responses. Subjects completed 64 trials at each choice level, the mean intertrial interval being 3 sec. Within each task, lights appeared in random order, except that frequency was equiprobable within blocks and the probability of each stimulus following every other stimulus was equal.

Results

Correlations between IQ, two estimates of λ, and parameters of both DT and MT are shown in Table 4 for the three subject samples and for various combinations which either include or exclude borderline retarded and mildly retarded subjects. Any RT errors have been excluded from analyses but these were extremely rare, amounting to less than 0.5% for each group. As in the previous analysis, the parameters shown adequately summarize correlations between IQ and DT and MT at different levels of choice (included in the Appendix).

Multiple regression analyses were made for each of the three groups and six combinations in Table 4. Analysis proceeded stepwise, from the variable accounting for most variance in IQ, through the remaining seven timed performance variables included in the Table. As was the case for the reanalysis of Lally and Nettelbeck's (1977) data, entries subsequent to the first did not account significantly for unexplained variance within any of the three groups. For different combination groups, entries to the third and fourth level made statistically significant contributions ($p < .05$), although the order of entries was different for each group and such entries accounted for no more than between 2% to 6% of the variance. Once again, these results reflect significant interaction between the various independent variables. Some of these, like positive correlations within groups between the intercepts and slopes of DT and MT regression functions, are to be expected. However, others would not be predicted by Hick's Law, nor whether processes reflecting decision and movement components of RT were independent. Those relationships important to subsequent discussion are summarized in Table 5.

Planned comparisons between, first, undergraduates and apprentices and, second, between these groups combined and the handicapped group, were made for the eight timed performance variables. For the former comparisons, all were nonsignificant with the exception of a weak difference for λ_t ($p < .05$). However, the latter comparisons found highly significant differences ($p < .001$) in every instance. Relative performance within the three groups is summarized in

TABLE 4

Pearson *r* Correlations Between IQ λ_v, λ_t, Slope and Intercept of the Linear Regression of Both DT and MT on Bits, and Root Square Mean of Variances Within Bits (VAR) for Both DT and MT: $^{**}p < .01$, $^{*}p < .05$ (One-Tailed). Multiple R is for IQ and the Eight Timed Performance Variables Shown

				Correlations Between IQ and						
Group	*N*	λ_v	λ_t	Slope DT	Intercept DT	VAR DT	Slope MT	Intercept MT	VAR MT	Multiple R
Handicapped workers	41	–.26*	–.27*	+.01	–.02	+.04	+.13	–.24	+.24	.44
Trade apprentices	82	–.23*	–.22*	+.17	–.12	+.07	+.05	–.23	+.07	.44
University undergraduates	59	–.20	–.17	–.06	–.05	+.29*	+.01	–.07	–.04	.41
Apprentices and undergraduates combined	141	–.31**	–.37**	–.04	–.19*	+.21*	–.02	–.19*	+.10	.52
Apprentices and handicapped workers combined	123	–.45**	–.68**	–.53**	–.36**	–.70**	+.31	–.60**	–.35**	.82
Overall	182	–.48**	–.71**	–.56**	–.40**	–.66**	+.25	–.59**	–.17*	.83
Normally distributed reduced sample	91	–.50**	–.67**	–.41**	–.36**	–.74**	+.36	–.53**	–.13	.83
Reduced sample excluding IQ > 85	76	–.35**	–.33**	+.09	–.22*	–.18	+.07	–.26*	+.06	.51
Reduced sample excluding IQ > 115	75	–.44**	–.69**	–.43**	–.24*	–.78**	+.40	–.52**	–.07	.78

Table 6, from which it is clear that the main differences are attributable to the much slower and more variable performance among those subjects with IQ below 85 (i.e., those in the handicapped group).

Discussion

Estimates for λ_v are consistent with a body of data for retarded and nonretarded subjects collated by Nettelbeck (1982).[4] Estimates for λ_t have not previously been made and, in view of the generally faster simple RT in the touch modality (Brebner & Welford, 1980), the values found here are unexpectedly long. Subjects reported that, compared with the light discrimination task, the tactile discrimination was the more difficult task and that their finger tips became numbed by the vibrotactile stimulation. Although correlations between λ_v and λ_t were statistically significant at the .01 level (.75, .37, .32 for handicapped, apprentice, and university groups, respectively), the vibrotactile task does not appear promising as a method for estimating rate of information processing.

Measures from the RT tasks seem consistent with the summary data reported

TABLE 5
Pearson *r* Correlations Between Pairs of RT Variables for Samples from Three Sources: ** $p < .05$ (Two-Tailed)

Variable Pairs	Handicapped Workers	Trade Apprentices	University Undergraduates
Slope DT—Intercept DT	–.38**	–.66**	–.68**
Slope MT—Intercept MT	–.38**	–.55**	–.49**
Slope DT—Intercept MT	–.40**	–.16	–.07

TABLE 6
Parameters of λ, DT, and MT for Samples from Three Sources

Variable (msec)	Handicapped Workers	Trade Apprentices	University Undergraduates
λ_v $\bar{X}$	185	102	89
SD	133	31	26
λ_t $\bar{X}$	396	152	115
SD	199	56	34
DT intercept	374	300	278
slope	112	52	44
VAR	337^2	102^2	122^2
MT intercept	352	226	215
slope	– 7	12	8
VAR	144^2	86^2	113^2

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[4] In order to compare estimates of λ in the study with those in previous work, the stimulus exposure duration at which a judgement would be correct on 97.5% of trials is extrapolated directly from normal curve tables.

by Jensen (1979, Figure 6). Although the slope and intercept for his group G appear somewhat less steep and higher, respectively, than those parameters shown in Table 5 for the handicapped group (IQ $<$ 85), the general findings from both studies are clearly very similar. Again, the patterns of regression functions resemble those found with a similar procedure by Lally and Nettelbeck (1977, Experiment 2), although the values here are considerably higher overall, presumably reflecting the larger size of the RT apparatus used both by Jensen and in the present investigation.

Taken together, the evidence suggests that these measures of timed performance are associated with IQ to some degree, accounting for as much as perhaps 25% of variance in IQ. However, that previous research has failed to recognize the extent to which any association is inflated by the inclusion of even borderline retarded subjects within samples is made quite clear by an examination of Tables 1 and 4. Thus, multiple R values of approximately .8 for combined groups including subjects with IQ $<$ 85 are, in each instance, reduced substantially to about .5 when these subjects are excluded from analyses. This follows, irrespective of the proportional representation of such subjects in the overall sample, which here ranges from .33 (Lally & Nettelbeck, 1977) to .17 (normally distributed reduced sample). The same effect is not found when IQ scores $>$ 115 (predominantly university graduates) are excluded from analyses. The very large differences between the performance of retarded and nonretarded subjects in these tasks must raise considerable doubts about whether it is legitimate to combine data as if these belonged to a single population. Among the many comparisons made between the nonretarded samples, on the other hand, only one outcome (λ_t) was statistically significant, and this might reasonably be attributed to the complete inexperience of the apprentices in a task that all subjects found difficult, but that is from a type of research with which most third-year psychology undergraduates would be familiar.

The demonstration here of an association between IQ and measures of timed performance does not, of itself, establish that mental speed provides a predominant explanatory construct for differences in intelligence. That the rate of some kind of basic information processing is being measured in these procedures seems a reasonable inference. It is not necessarily the case, however, that the outcome from such procedures is independent from all strategies for responding, in the way envisaged by Jensen (1979) or Brand (1980). There are aspects to these data which are concordant with the possibility that certain strategies for responding have influenced outcome. In the first place, the strong negative correlations between the slope and intercept of regression functions for DT and MT within all three groups raise doubts about whether the regression of RT on bits can reliably distinguish rate of processing from fundamental delays in the subject's response system, as Hick's Law proposes. If it were the case that both variables were interacting with a third, like intelligence, then one would expect a positive correlation between slope and intercept. The negative relationship suggests instead that some subjects have applied different criteria for responding at different levels for choice. One plausible possibility is that some responses have been disproportionately more carefully made when eight stimulus alternatives were involved, although other explanations are equally viable. The important consideration here is that strategies of this kind could increase the slope while decreasing the intercept of the regression function. Furthermore, at least within the handicapped group, we have found evidence that subjects may not have followed instructions to make a movement only after first deciding on a particular response. The significant negative correlation between slope DT and intercept MT (a flat function) is consistent with subjects making a movement after detecting only the presence of a signal, but then delaying movement so as to permit a further decision during movement about which alternative was involved.

A notable finding has been that no single index of timed performance has consistently been correlated strongly with IQ across a wide range. In this regard, the inspection time measure, which is designed to reduce criterial influence, is perhaps the most promising since it has consistently indicated a negative association and has achieved statistical significance in the greatest number of instances. However, at this point in time, we are aware of procedural inadequacies associated with post-masking cues which must reduce the reliability of the method. Thus, with the visual task used in this study, some subjects have reported that they became aware of slight changes in brightness coincident with the correct stimulus when the mask first appeared. In earlier studies employing a line discrimination task, occasional subjects have reported attending to cues associated with apparent movement that permitted them to improve performance (Nettelbeck, 1982). Moreover, as has been demonstrated here, one can obtain differences between procedures that are not consistent with the assumptions from which those procedures have been derived. Thus, slower measures of λ_t were unexpected and cannot be explained in terms of modality differences in sensory transmission. Our findings provide grounds for caution concerning the use of measures of timed performance to supplement standard tests of intelligence.

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APPENDIX

(i) Lally and Nettelbeck (1977): Pearson r Correlations Between WAIS Performance IQ and Choice RT: ** $p < .01$, *$p < .05$ (One-Tailed)

Group	2CRT	4CRT	6CRT	8CRT
Retarded	–.45*	–.52*	–.53*	–.61**
Nonretarded	–.24	–.31	–.34	–.48*
Above-average nonretarded	+.26	+.18	+.10	–.05*
All nonretarded	–.19	+.18	+.06	–.15*
Overall	–.55**	–.63**	–.67**	–.76**

(ii) Main Study: Pearson r Correlations Between IQ and Both Choice DT and Choice MT: ** $p < .01$; *$p < .05$ (One-Tailed)

Group	2CDT	2CMT	4CDT	4CMT	8CDT	8CMT
Handicapped workers	–.05	–.30*	+.05	–.28*	–.03	–.31*
Trade apprentices	–.09	–.27**	–.02	–.18	+.09	–.20*
University undergraduates	–.08	–.07	–.16	–.09	–.12	–.05
Apprentices and undergraduates combined	–.30**	–.26**	–.26**	–.18*	–.24**	–.25**
Apprentices and handicapped workers combined	–.64**	–.65**	–.61**	–.62**	–.69**	–.60**
Overall	–.68**	–.66**	–.66**	–.61**	–.73**	–.61**
Normally distributed reduced sample	–.63**	–.56**	–.65**	–.53**	–.67**	–.45**
Reduced sample excluding IQ < 85	–.23*	–.31**	–.18	–.20*	–.10	–.24*
Reduced sample excluding IQ > 115	–.64**	–.53**	–.69**	–.52**	–.70**	–.40**