Available online at www.sciencedirect.com

ScienceDirect

Personality and Individual Differences 44 (2008) 535–551

PERSONALITY AND INDIVIDUAL DIFFERENCES

www.elsevier.com/locate/paid

Review

Intelligence and speed of information-processing: A review of 50 years of research

Leah D. Sheppard *, Philip A. Vernon

University of Western Ontario, Department of Psychology, 1151 Richmond street North, London, Ontario, Canada N6A 5C2

Received 13 August 2007; received in revised form 10 September 2007; accepted 18 September 2007
Available online 31 October 2007

Abstract

This study reports the results of a large scale literature review of research studying the relationship between intelligence and speed of information-processing. Data from 172 studies, with a total of 53,542 participants, were analyzed to find the mean correlations between a variety of intelligence and mental speed measures. Additionally, effect sizes representing group differences on speeded measures were calculated, and multivariate behavioral genetic (BG) studies reporting genetic correlations between speed of processing and IQ were reviewed. The results indicate that measures of intelligence are significantly correlated with mental speed and that for some measures this relationship shows a trend toward strengthening as the complexity of the speeded tasks increase. Additionally, there are various group differences on mental speed tasks: females and males are quicker than one another on different speeded tasks, and younger adults have shorter (faster) reaction time latencies than older adults and children. Reports comparing whites and blacks on mental speed yield inconsistent results. Finally, BG studies indicate that phenotypic correlations between IQ and mental speed are substantially attributable to correlated genetic factors.

Keywords: Intelligence; Speed of information-processing; Reaction time; Inspection time; IQ; Review paper

* Corresponding author. Tel.: +1 519 675 9681; fax: +1 519 675 3961.
E-mail address: lsheppa4@uwo.ca (L.D. Sheppard).

0191-8869/$ - see front matter
doi:10.1016/j.paid.2007.09.015

Since the second half of the 20th century, researchers have been interested in studying the relationship between mental speed and measures of intelligence. An extensive review of research in this field is detailed in the recent book *Clocking the mind: Mental chronometry and individual differences* by Jensen (2006). Past research has indicated that there is a significant correlation between measures of reaction time, inspection time, and other measures of speed of information-processing and intelligence (Deary, Der, & Ford, 2001; Nettelbeck, Edwards, & Vreugdenhil, 1986; Vernon, 1983). These findings have been supported by research that demonstrates faster speed of processing in gifted children or in individuals with higher aptitude (Cohn, Carlson, & Jensen, 1985; Jensen, Cohn, & Cohn, 1989; Kranzler, Whang, & Jensen, 1994; Rabbitt & Goward, 1994; Saccuzzo, Johnson, & Guertin, 1994). Research has also been conducted to investigate age, sex, and racial-group speed of processing differences. Such studies have revealed that processing speed tends to decrease as a function of an increase in age in adults (Briggs, Raz, & Marks, 1999; Bryan, Luszcz, & Crawford, 1997; Cerella, DiCara, Williams, & Bowles, 1986; Christensen et al., 2004; Hertzog, Raskind, & Cannon, 1986; Nettelbeck & Rabbitt, 1992; Ryan, Sattler, & Lopez, 2000; Salthouse, Fristoe, McGuthry, & Hambrick, 1998; West & Craik, 2001), and that mental speed quickens as a function of an increase in age throughout childhood (Anderson, Nettelbeck, & Barlow, 1997; Rose & Feldman, 1997). Some studies of sex differences in processing speed have revealed that males have faster processing speeds than females (Adam et al., 1999; Jorm, Anstey, Christensen, & Rodgers, 2004), while other studies have indicated the reverse (Burns & Nettelbeck, 2005; Doverspike, Cellar, Barrett, & Alexander, 1984). Research that has studied racial-group differences in processing speed appears to indicate that blacks, on average, have slower mental speed than do whites on various tasks (Jensen, 1993; Nunez, Corti, & Retschitzki, 1998), although not all studies have found this. Finally, multivariate behavioral genetics have reported moderate to very strong genetic correlations between measures of mental speed and IQ (e.g., Baker, Vernon, & Ho, 1991; Rijsdijk, Vernon, & Boomsma, 1998).

Given the large body of research in this area, it seemed an appropriate time for a comprehensive review of the findings of some 50 years of research and that is the goal of this report.

1. Method

An extensive literature search from 1955 to 2005 was completed with the assistance of electronic search engines PSYCARTICLES and PSYCINFO, as well as relevant scholarly books and journals. Paired combinations of the following search terms were used electronically: "reaction time", "response time", "mental speed", "speed of processing", "speed of short-term memory processing", "speed of long-term memory retrieval", "chronometric ability", "inspection time", "task complexity", "intelligence", "fluid intelligence", "crystallized intelligence", "mental ability", "IQ", "age", "gender", "sex", "race", "age differences", "gender differences", "sex differences", "race differences", "heritability", and "genetic correlation". Articles were retained for entry into the database only if they presented one or more correlations between a speeded task and intelligence, or if means or effect sizes regarding age, sex, or racial differences for speeded task performance were reported. Articles that utilized clinical samples were not retained. If articles were missing relevant information (e.g., sample sizes, ages of subjects, sex of subjects etc.), attempts were made to contact their authors via e-mail or regular mail. Those that responded and who were able to provide the relevant information were included in the analyses. With these restrictions in place, 172 articles were included in the actual review and analyses.

Correlations between intelligence and different measures of mental speed were entered into an SPSS spreadsheet to be analyzed. Due to a very large number of different measures of mental speed across studies, it was first necessary to attempt to sort and classify these measures into a smaller number of categories. It is acknowledged that there is a certain arbitrariness inherent to such a classification but an attempt was made to group tests together that were, in their original reports described as – or which were judged to be – measures of the same or similar cognitive processes. Under this classification scheme, mental speed measures were categorized as measuring *reaction time*, *general speed of processing*, *speed of short-term memory processing*, *speed of long-term memory retrieval*, or *inspection time*. Examples of the measures that were sorted into these categories are as follows:

Reaction time tasks refer to Hick paradigm-type tasks which measure participants' response latencies to a light appearing on a panel with anywhere from 1 to N lights exposed, corresponding to different numbers of *bits* of information-processing. Tasks of this sort were found reporting RTs for 1–8 bits. Studies were also found which presented correlations between IQ and overall RTs derived from a Hick-type task and these are reported separately. Finally, within this category results are reported separately for the odd-man-out task.

The g*eneral speed of information-processing* category includes tasks which measure how quickly participants can perform simple mental arithmetic or can connect numbers or letters scattered on a page in ascending order. This category does contain a number of apparently quite diverse tasks which could not easily be sorted into other categories, but which have in common the general ability to perform different mental operations quickly. Support for this category comes from studies which measured two or more of the tasks that are included in it and which reported high correlations between the different tasks.

Speed of short-term memory processing tasks include tests such as the Sternberg Task, in which participants indicate as quickly as possible whether an element (e.g., a digit or a letter) had been shown in an earlier set. Reports were found here with set sizes containing from 1 to 6 elements. Studies were also found which presented correlations between IQ and overall RTs derived from a Sternberg-type task and these are reported separately.

Speed of long-term memory retrieval tasks include measures of the difference between reaction times when deciding whether stimuli are semantically versus physically identical, and tasks in which subjects indicate whether pairs of words are synonyms or antonyms or belong to the same or different categories.

Inspection time tasks require participants to respond to (typically) pi-shaped stimuli and to indicate which end of the pi-shape is longer (or shorter in some studies). It is acknowledged that inspection time tasks are not reaction time tasks *per se* – there is no requirement for subjects to respond quickly in these tasks – but they do provide a measure of the speed with which subjects can encode information into short-term or working memory and, as such, inspection time tasks are considered to be as pertinent to this review as any other measure of mental speed.

Within the inspection time category results are also reported separately from tasks which measured *auditory inspection time*. An example of an auditory inspection time measure is a task in which a brief stereo sine-waveform with one channel phase-shifted by a number of degrees results in a tone stimulus appearing to the left or to the right of the midline, with a backward mask immediately following. Participants then indicate the laterality of the stimulus.

With respect to different measures of intelligence, these were also sorted into a number of different categories representing *general intelligence, fluid intelligence*, and *crystallized intelligence*. The *general intelligence* (g) category refers to first unrotated factor scores extracted from a battery of intelligence-type mental ability tests and also includes measures of full scale IQ from a test such as the Wechsler. *Fluid intelligence* (gf) involves tasks that measure novel problem-solving or reasoning, such as Raven's Matrices; performance IQ scores from a test such as the Wechsler are also included in this category. *Crystallized intelligence* (gc) includes measures of verbal IQ, general knowledge, and vocabulary.

Once correlations between measures had been sorted into the above categories, each correlation was weighted by its sample size to yield *n*-weighted average correlations. *N*-weighted average effect sizes were also calculated from reported means and standard deviations to estimate age, sex, or racial-group differences in mental speed. Unfortunately, correlations and effect sizes could not further be weighted by or corrected for differences in reliability because the majority of studies were lacking reliability information. In those studies that did report reliabilities for mental speed measures, however, these were typically high.

2. Results

The overall sample size of studies included in this review was 53,542. Individual study sample sizes ranged from ten to 10,535 participants, with 278.9 participants as the mean sample size ($s = 963.12$). The inter-quartile ranges were as follows: 25th = 49.25, 50th = 82, and 75th = 177. Of those studies that reported the sexes of their subjects, the average sample had between zero and 3811 female participants with a mean of 103.7 ($s = 341.38$), and between zero and 3674 male participants, with a mean of 113.5 ($s = 330.79$).

The results of the analyses of the average correlations between intelligence and mental speed are summarized in Tables 1–5. Tables 6–8 display the means, standard deviations, and ranges of the calculated effect sizes for age, sex, and racial-group mental speed differences, respectively.

Table 1
Mean reaction time and intelligence correlations

	g	gf	gc
RT	−.26(112)	−.21(142)	−.17(195)
Odd-man	−.36(31)	−.24(17)	−.21(38)
RT 1 bit	−.22(36)	−.20(21)	−.22(28)
RT 2 bit	−.28(35)	−.23(21)	−.22(28)
RT 3 bit	−.28(29)	−.26(21)	−.27(26)
RT 4 bit	−.38(1)		−.36(1)
RT 5 bit	−.28(2)		−.28(1)
RT 6 bit	−.34(2)		−.32(2)
RT 8 bit	−.40(1)		−.39(1)

Note. RT = overall reaction time, *g* = general intelligence, gf = fluid intelligence, gc = crystallized intelligence.
The number of correlations used in each cell is reported in parentheses.

Table 2
Mean general speed of processing (GSOP) and Intelligence Correlations

	g	gf	gc
GSOP	−.29(21)	−.35(13)	−.16(8)

Note. GSOP = general speed of processing, *g* = general intelligence, gf = fluid intelligence, gc = crystallized intelligence. The number of correlations used in each cell is reported in parentheses.

Table 3
Mean speed of processing in short-term memory (STM) and Intelligence Correlations

	g	gf	gc
STM	−.25(5)	−.15(20)	−.13(26)
STM set size 1	−.45(6)		
STM set size 2	−.33(2)		
STM set size 3	−.44(6)		
STM set size 4	−.38(2)		
STM set size 5	−.45(6)		
STM set size 6	−.32(2)		

Note. STM = overall speed of short-term memory processing, g = general intelligence, gf = fluid intelligence, gc = crystallized intelligence.
The number of correlations used in each cell is reported in parentheses.

Table 4
Mean speed of retrieval from long-term memory (LTM) and Intelligence Correlations

	g	gf	gc
LTM	−.10(17)	−.16(27)	−.27(35)

Note. LTM = speed of long-term memory retrieval, *g* = general intelligence, gf = fluid intelligence, gc = crystallized intelligence.
The number of correlations used in each cell is reported in parentheses.

Table 5
Mean inspection time (IT), auditory inspection time (AIT) and Intelligence Correlations

	g	gf	gc
IT	−.36(46)	−.29(45)	−.20(45)
AIT	−.31(15)	−.26(3)	−.35(5)

Note. IT = inspection time, AIT = auditory inspection time, *g* = general intelligence, gf = fluid intelligence, gc = crystallized intelligence.
The number of correlations used in each cell is reported in parentheses.

Table 6
Effect sizes for age differences on mental speed tasks

Finding	Effect size							
	RT		IT		GSOP		STM	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Old adults > young adults	1.84(103)	.69			1.35(23)	.72		
Middle-age adults > young adults	.55(10)	.36			.49(8)	.30		
Old adults > middle-age adults	1.07(4)	.31			1.09(11)	.67		
Children > adults	2.38 (25)	1.79	.32(1)		2.56(24)	.36		
Young children > older children	1.66(63)	.88	.38(3)	.21	.59(24)	.24	.57(18)	.33

Note. The number of effect sizes calculated for each pair of comparisons appears in parentheses.
>: Longer (slower) latencies.

Table 7
Effect sizes for sex differences on mental speed tasks

Finding	Effect size							
	RT		IT		GSOP		STM	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Men > women	.29 (19)	.32			.47 (2)	.13		
Women > men	.32 (12)	.45			.40 (5)	.15	.25 (4)	.20
Boys > girls	.35 (8)	.28	.16 (1)					
Girls > boys	.07 (4)	.05			.68 (4)	.30		

Note. The number of effect sizes calculated for each pair of comparisons appears in parentheses.
> = Longer (slower) latencies.

Table 8
Effect Sizes for racial-group differences on mental speed tasks

Finding	Effect size			
	RT		GSOP	
	M	*SD*	*M*	*SD*
Blacks > whites	.47(5)	.33	.18(7)	.13
Whites > blacks	1.1(1)		.003(1)	

Note. The number of effect sizes calculated for each pair of comparisons appears in brackets.
> = Longer (slower) latencies.

As can be seen in Table 1, mean correlations between general intelligence (*g*) and reaction time measures range from −.22 to −.40, mean correlations between gf and reaction times range from −.20 to −.26, and mean correlations between gc and reaction times range from −.17 to −.39. There is a trend for correlations with *g* and gc to be higher when reaction time tasks involve more *bits* of information-processing.

The results shown in Table 2 indicate that measures of general speed of processing have markedly higher correlations with gf than with gc, likely reflecting the novelty of these measures of speed of information-processing. Overall, however, the correlations in Table 2 are similar in magnitude to those in Table 1, suggesting that reaction time and general speed of processing tasks correlate in the .30–.40 (absolute) range with intelligence.

The results presented in Table 3 indicate that general intelligence correlates with speed of processing in short-term memory to a somewhat greater degree than it does with Hick RTs or general speed of processing: several of the correlations in Table 3 being greater than −.40. Correlations between STM processing speed are also higher with *g* than with either gf or gc. There is no apparent trend for correlations between STM processing speeds and g to increase as a function of set size.

Results reported in Table 4 demonstrate that speed of retrieval of information from long-term memory correlates to a greater degree with crystallized rather than fluid intelligence. This may reflect the fact that these mental speed tasks all require subjects to access and retrieve previously-acquired information.

The results presented in Table 5 demonstrate that inspection time and auditory inspection time correlate with *g* to about the same extent as do the other measures of mental speed. IT shows a marginally larger correlation with gf than with gc but the reverse trend is evident for AIT. There is no immediately obvious explanation for this but note that the average correlations for AIT are based on a substantially fewer number of reported values than are those for IT and, as such, may not represent a real effect.

To address the possibility of a file-drawer problem, the method suggested by Rosenberg (2005) was utilized. This method computes a weighted Rosenthal's statistic, which corresponds to the number of missing or unpublished reports, or studies reporting non-significant results, that would be required to reduce the significance of the average correlations that were computed to non-significance. It also corresponds to the sample size of a single study reporting a non-significant correlation that would need to be included in the meta-analysis to reduce the average correlation to non-significance. The significance level was set to .05. Applying this method to the average correlation of −.17 between reaction times and gc (Table 1), which was based on 195 reported correlations between these variables, revealed that a non-significant correlation from a sample of 58,158 participants would be required, or that over 58,000 missing reports with non-significant results would need to have been omitted from this review to reduce the significance of the average correlation to >.05. This result does not mean that the file-drawer problem has been circumvented but does indicate that it is extremely unlikely, at least for this correlation.

In order to address the potential effects of sample size and year of publication, correlations were computed between each of sample size, year of publication, and magnitude of correlations. For reaction times, a positive correlation (r−.13, $p < .01$) between sample size and year of publication was found, indicating that more recent publications had larger sample sizes. Publication year also had significant correlations with the absolute magnitude of correlations between several of the mental speed and intelligence measures: indicating a trend toward more recent studies reporting larger correlations between RTs and IQ. This may reflect the fact that more recent studies use more sophisticated equipment with more accurate and finer timers than older studies had access to. It may also be a function of the larger samples employed by more recent studies because sample size was itself also positively related to the magnitude of several mental speed-Intelligence Correlations.

With respect to group differences in mental speed, the results in Table 6 clearly demonstrate that mental speed is slower among elderly adults and young children, with effect sizes (standardized group mean differences) ranging from .63 to 2.67. Thus, the relationship between mental speed and age over time is curvilinear and parallels the development observed with measures of fluid intelligence. The effect sizes presented in Table 6 demonstrate that this effect is especially large when comparing children to adults and young adults to older adults.

The results for sex differences in mental speed – reported in Table 7 – are less clear. An equal number of studies reported females having somewhat faster mental speed than males as reported males having faster mental speed than females, both among adults and among children. Overall, the effect sizes are quite small – about one-third of a standard deviation – and it appears likely that males and females have advantages on different speeded tasks. For example, males tend to perform faster, on average, on reaction time and inspection time tasks, while females perform faster than males, on average, on perceptual speed tasks.

Studies of racial-group differences in mental speed are inconsistent. As reported in Table 8, 12 studies reported that whites were significantly faster than blacks but two other studies showed a larger effect in which blacks were faster than whites. Across all 14 studies the mean effect size was .18 ($s = .45$) in favor of whites which indicates a very small group difference. Moreover, there was no consistent difference between the tasks on which one group performed faster than the other and too few of these studies reported IQ data for it to be determined whether their samples differed or did not differ in mean IQ.

Finally, 13 behavioral genetic studies were found which reported either the extent to which individual differences in different measures of mental speed are attributable to genetic and/or environmental factors or which reported genetic correlations between measures of mental speed and measures of intelligence. Across these 13 studies, heritabilities of 33 measures of mental speed – including reaction times, inspection time, speed of processing in STM, and speed of retrieval from LTM – ranged from zero to .90, with an N-weighted mean of .48 ($s = .20$). Genetic correlations between mental speed and intelligence ranged from .42 to 1.0 (in absolute value) and averaged .73 ($s = .22$). There was a trend for more complex mental speed measures both to be more heritable and to be more highly correlated with measures of intelligence.

3. Discussion

The results of this review indicate that diverse measures of mental speed are significantly correlated with measured intelligence. There is a trend – among some mental speed tasks – for more complex measures to be more highly correlated with intelligence but this effect is not evident for all tasks. The results also reveal that mental speed often (though not always) correlates more strongly with gf than with gc. This is particularly evident for novel mental speed tasks – many of which fell into the general speed of processing category; tasks which require subjects to retrieve learned information from LTM, on the other hand, tend to correlate more highly with gc. The overall correlation between mental speed and intelligence is moderate but very consistent: across all the different studies and measures that were reviewed – which yielded a total of 1146 correlations – the mean correlation is $-.24$ ($s = .07$). Thus, individual differences in any single measure of speed of information-processing by no means accounts for a substantial amount of the variance in intelligence. However, a few studies were found that reported more substantial multiple correlations (up to .65) obtained from the regression of IQ on multiple measures of speed of processing (e.g., Vernon & Weese, 1993). Behavioral genetic studies, moreover, indicate that the phenotypic correlation that exists between speed of processing and intelligence is largely attributable to correlated genetic factors: i.e., there is substantial overlap between the genes that contribute to individual differences in both.

With respect to group differences in mental speed, these are by far the most pronounced in studies comparing children to adults (mean effect size of 2.67 standard deviation units in favor of adults) and in studies comparing older adults to young adults (mean effect size of 1.76 standard deviation units in favor of young adults). As noted, the curvilinear development of faster speed of processing parallels that of fluid intelligence: both develop from childhood through adolescence to young adulthood and both then begin to decline with advancing years. Insofar as mental speed correlates with gf, its decline in old age may be one factor that contributes to the decline in gf; or perhaps both are affected by other factors related to the aging process.

Sex differences in mental speed are both smaller than age differences and less consistent. Overall, it appears that males perform faster on some tasks than females (e.g., Hick reaction time and inspection time), while females perform faster than males on perceptual speed tasks. Reported white–black differences in mental speed are even less consistent and, overall, smaller than sex differences. Substantially fewer studies have examined race differences and, for any future studies, it will be important for them to report the groups' mean IQs in addition to their mean speed of processing.

References

Adam, J. J., Paas, F. G. W. C., Buekers, M. J., Wuyts, I. J., Spijkers, W. A. C., & Wallmeyer, P. (1999). Gender differences in choice reaction time: Evidence for differential strategies. *Ergonomics, 42*(2), 327–335.

Anderson, M., Nettelbeck, T., & Barlow, J. (1997). Reaction time measures of speed of processing: Speed of response selection increases with age but speed of stimulus categorization does not. *British Journal of Developmental Psychology, 15*(2), 145–157.

Baker, L. A., Vernon, P. A., & Ho, H. (1991). The genetic correlation between intelligence and speed of information processing. *Behavior Genetics, 21*(4), 351–367.

Briggs, S. D., Raz, N., & Marks, W. (1999). Age-related deficits in generation and manipulation of mental images I. The role of sensorimotor speed and working memory. *Psychology and Aging, 14*(3), 427–435.

Bryan, J., Luszcz, M. A., & Crawford, J. R. (1997). Verbal knowledge and speed of information processing as mediators of age differences in verbal fluency performance among older adults. *Psychology and Aging, 12*(3), 473–478.

Burns, N. R., & Nettelbeck, T. (2005). Inspection time and speed of processing: Sex differences on perceptual speed but not IT. *Personality and Individual Differences, 39*(2), 439–446.

Cerella, J., DiCara, R., Williams, D., & Bowles, N. (1986). Relations between information processing and intelligence in elderly adults. *Intelligence, 10*(1), 75–91.

Christensen, H., Mackinnon, A., Jorm, A. F., Korten, A., Jacomb, P., Hofer, S. M., & Henderson, S. (2004). The Canberra longitudinal study: Design, aims, methodology, outcomes and recent empirical investigations. Aging, Neuropsychology, and Cognition. Special issue: Longitudinal studies of cognitive aging. 11(2–3), pp. 169–195.

Cohn, S. J., Carlson, J. S., & Jensen, A. R. (1985). Speed of information processing in academically gifted youths. *Personality and Individual Differences, 6*(5), 621–629.

Deary, I. J., Der, G., & Ford, G. (2001). Reaction times and intelligence differences: A population-based cohort study. *Intelligence, 29*(5), 389–399.

Doverspike, D., Cellar, D., Barrett, G. V., & Alexander, R. (1984). Sex differences in short-term memory processing. *Perceptual and Motor Skills, 58*, 135–139.

Hertzog, C., Raskind, C. L., & Cannon, C. J. (1986). Age-related slowing in semantic information processing speed: An individual differences analysis. *Journal of Gerontology, 41*(4), 500–502.

Jensen, A. R. (1993). Spearman's hypothesis tested with chronometric information-processing tasks. *Intelligence, 17*(1), 47–77.

Jensen, A. R. (2006). *Clocking the mind: Mental chronometry and individual differences*. Amsterdam, The Netherlands: Elsevier.

Jensen, A. R., Cohn, S. J., & Cohn, C. M. (1989). Speed of information processing in academically gifted youths and their siblings. *Personality and Individual Differences, 10*(1), 29–33.

Jorm, A. F., Anstey, K. J., Christensen, H., & Rodgers, B. (2004). Gender differences in cognitive abilities: The mediating role of health state and health habits. *Intelligence, 32*(1), 7–23.

Kranzler, J. H., Whang, P. A., & Jensen, A. R. (1994). Task complexity and the speed and efficiency of elemental information processing: Another look at the nature of intellectual giftedness. *Contemporary Educational Psychology, 19*, 447–459.

Nettelbeck, T., Edwards, C., & Vreugdenhil, A. (1986). Inspection time and IQ: Evidence for a mental speed-ability association. *Personality and Individual Differences, 7*(5), 633–641.

Nettelbeck, T., & Rabbitt, P. M. (1992). Aging, cognitive performance, and mental speed. *Intelligence, 16*(2), 189–205.

Nunez, R., Corti, D., & Retschitzki, J. (1998). Mental rotation in children from Ivory Coast and Switzerland. *Journal of Cross-Cultural Psychology, 29*(4), 577–589.

Rabbitt, P., & Goward, L. (1994). Age, information processing speed, and intelligence. *Quarterly Journal of Experimental Psychology A: Human Experimental Psychology, 47A*(3), 741–760.

Rijsdijk, F. V., Vernon, P. A., & Boomsma, D. I. (1998). The genetic basis of the relation between speed-of-information processing and IQ. Behavioural Brain Research. Special issue: Behavioural neurogenetics, 95(1), pp. 77–84.

Rose, S. A., & Feldman, J. F. (1997). Memory and speed: Their role in the relation of infant information processing to later IQ. *Child Development, 68*(4), 630–641.

Rosenberg, M. S. (2005). The file-drawer problem revisited: A general weighted method for calculating fail-safe numbers in meta-analysis. *Evolution, 59*, 464–468.

Ryan, J. J., Sattler, J. M., & Lopez, S. J. (2000). Age effects on Wechsler Adult Intelligence Scale-III subtests. *Archives of Clinical Neuropsychology, 15*(4), 311–317.

Saccuzzo, D. P., Johnson, N. E., & Guertin, T. L. (1994). Information processing in gifted versus nongifted African American, Latino, Filipino, and White children: Speeded versus nonspeeded paradigms. *Intelligence, 19*(2), 219–243.

Salthouse, T. A., Fristoe, N., McGuthry, K. E., & Hambrick, D. Z. (1998). Relation of task switching to speed, age, and fluid intelligence. *Psychology and Aging, 13*(3), 445–461.

Vernon, P. A. (1983). Speed of information processing and general intelligence. *Intelligence, 7*(1), 53–70.

Vernon, P. A., & Weese, S. E. (1993). Predicting intelligence with multiple speed of information-processing tests. *Personality and Individual Differences, 14*(3), 413–419.

West, R., & Craik, F. I. M. (2001). Influences on the efficiency of prospective memory in younger and older adults. *Psychology and Aging, 16*(4), 682–696.

Further reading

These articles, while not cited in text, contributed statistics that were used in the various analyses conducted to obtain average correlations and effect sizes. While it is typical to present all of the data used in the analyses listed by study within a table, this was deemed too lengthy for the purposes of this article, as there would be well over 100 studies. Any readers interested in obtaining the list of articles and the data used from each article may contact the author at lsheppa4@uwo.ca.

Ackerman, P. L., Beier, M. E., & Boyle, M. D. (2002). Individual differences in working memory within a nomological network of cognitive and perceptual speed abilities. *Journal of Experimental Psychology, 131*(4), 567–589.

Alderton, D. L., & Larson, G. E. (1994). Cross-task consistency in strategy use and the relationship with intelligence. *Intelligence, 18*, 47–76.

Alves, J., & Martins, F. (2003). Information processing and intelligence: Inter-stimulus interval and uncertainty in the response. *International Journal of Sport Psychology, 34*(4), 329–339.

Anderson, M. (1988). Inspection time, information processing and the development of intelligence. *British Journal of Developmental Psychology, 6*(1), 43–57.

Anderson, M., Reid, C., & Nelson, J. (2001). Developmental changes in inspection time: What a difference a year makes. *Intelligence, 29*, 475–486.

Barrett, P., Eysenck, H. J., & Lucking, S. (1986). Reaction time and intelligence: A replicated study. *Intelligence, 10*(1), 9–40.

Bates, T. C. (2005). Auditory inspection time and intelligence. *Personality and Individual Differences, 38*(1), 115–127.

Bates, T. C., & Eysenck, H. J. (1993). Intelligence, inspection time, and decision time. *Intelligence, 17*(4), 523–531.

Bates, T. C., & Shieles, A. (2003). Crystallized intelligence as product of speed and drive for experience: The relationship of inspection time and openness to g and Gc. *Intelligence, 31*(3), 275–287.

Bates, T., & Stough, C. (1997). Processing speed, attention, and intelligence: Effects of spatial attention on decisions time in high and low IQ subjects. *Personality and Individual Differences, 23*(5), 861–868.

Bates, T., & Stough, C. (1998). Improved reaction time method, information processing speed and intelligence. *Intelligence, 26*(1), 53–62.

Beauducel, A., & Burkhard, B. (1993). Intelligence and speed of information processing: Further results and questions on Hick's paradigm and beyond. *Personality and Individual Differences, 15*(6), 627–636.

Berg, C., Hertzog, C., & Hunt, E. (1982). Age differences in the speed of mental rotation. *Developmental Psychology, 18*(1), 95–107.

Blanco, M. J., & Alvarez, A. A. (1994). Psychometric intelligence and visual focused attention: Relationships in nonsearch tasks. *Intelligence, 18*(1), 77–106.

Boomsma, D. I., & Somsen, R. J. M. (1991). Reaction times measured in a choice reaction time and a double task condition: A small twin study. *Personality and Individual Differences, 12*(6), 519–552.

Bors, D. A., & Forrin, B. (1995). Age, speed of information processing, recall, and fluid intelligence. *Intelligence, 20*(3), 229–248.

Botwinick, J., & Thompson, L. W. (1966). Components of reaction time in relation to age and sex. *Journal of Genetic Psychology, 108*(2), 175–183.

Bowling, A. C., & Mackenzie, B. D. (1996). The relationship between speed of information processing and cognitive ability. *Personality and Individual Differences, 20*(6), 775–800.

Brewer, N., & Smith, G. A. (1989). Developmental changes in processing speed: Influence of speed-accuracy regulation. *Journal of Experimental Psychology, 118*(3), 298–310.

Bryan, J., & Luszcz, M. A. (1996). Speed of information processing as a mediator between age and free-recall performance. *Psychology and Aging, 11*(1), 3–9.

Buckhalt, J. A. (1991). Reaction time measures of processing speed: Are they yielding new information about intelligence? *Personality and Individual Differences, 12*(7), 683–688.

Buckhalt, J. A., Reeve, T. G., & Dornier, L. A. (1990). Correlations of movement time and intelligence: Effects of simplifying response requirements. *Intelligence, 14*(4), 481–491.

Buckhalt, J. A., Whang, P. A., & Fischman, M. G. (1998). Reaction time and movement time relationships with intelligence in three different simple tasks. *Personality and Individual Differences, 24*(4), 493–497.

Burns, N. R., & Nettelbeck, T. (2003). Inspection time in the structure of cognitive abilities: Where does IT fit? *Intelligence, 31*(3), 237–255.

Burns, N. R., Nettelbeck, T., & Cooper, C. J. (1999). Inspection time correlates with general speed of processing but not with fluid ability. *Intelligence, 27*(1), 37–44.

Chaiken, S. R. (1994). The inspection time not studied: Processing speed ability unrelated to psychometric intelligence. *Intelligence, 19*(3), 295–316.

Charness, N., Kelley, C. L., Bosman, E. A., & Mottram, M. (2001). Word-processing training and retraining: Effects of Adult Age, Experience, and Interface. *Psychology and Aging, 16*(1), 110–127.

Codorniu-Raga, M. J., & Vigil-Colet, A. (2003). Sex differences in psychometric and chronometric measures of intelligence among young adolescents. *Personality and Individual Differences, 35*(3), 681–689.

Colom, R., Rebollo, I., Palacios, A., Juan-Espinosa, M., & Kyllonen, P. C. (2004). Working memory is (almost) perfectly predicted by g. *Intelligence, 32*, 277–296.

Danthiir, V., Wilhelm, O., Schulze, R., & Roberts, R. D. (2005). Factor structure and validity of paper-and-pencil measures of mental speed: Evidence for a higher-order model? *Intelligence, 33*(5), 491–514.

Deary, I. J. (1993). Inspection time and WAIS–R IQ subtypes: A confirmatory factor analysis study. *Intelligence, 17*(2), 223–236.

Deary, I. J. (1994). Intelligence and auditory discrimination: Separating processing speed and fidelity of stimulus representation. *Intelligence, 18*(2), 189–213.

Deary, I. J. (1995). Auditory inspection time and intelligence: What is the direction of causation? *Developmental Psychology, 31*(2), 237–250.

Deary, I. J., Caryl, P. G., Egan, V., & Wight, D. (1989). Visual and auditory inspection time: Their interrelationship and correlations with IQ in high ability subjects. *Personality and Individual Differences, 10*(5), 525–533.

Deary, I. J., & Der, G. (2005). Reaction time, age, and cognitive ability: Longitudinal findings from age 16 to 63 years in representative population samples. *Aging, Neuropsychology, and Cognition, 12*(2), 187–215.

Deary, I. J., Egan, V., Gibson, G. J., Austin, E. J., Brand, C. R., & Kellaghan, T. (1996). Intelligence and the differentiation hypothesis. *Intelligence, 23*, 105–132.

Deary, I. J., McCrimmon, R. J., & Bradshaw, J. (1997). Visual information processing and intelligence. *Intelligence, 24*(3), 461–479.

Der, G., & Deary, I. J. (2003). IQ, reaction time and the differentiation hypothesis. *Intelligence, 31*(5), 491–503.

Diascro, M. N., & Brody, N. (1994). Odd-man-out and intelligence. *Intelligence, 19*(1), 79–92.

Diehl, M., Willis, S. L., & Schaie, K. W. (1995). Everday problem solving in old adults: Observational assessment and cognitive correlates. *Psychology and Aging, 10*(3), 478–491.

Dougherty, T. M., & Haith, M. M. (1997). Infant expectations and reaction time as predictors of childhood speed of processing and IQ. *Developmental Psychology, 33*(1), 146–155.

Egan, V. (1994). Intelligence, inspection time and cognitive strategies. *British Journal of Psychology, 85*(3), 305–315.

Fink, A., & Neubauer, A. C. (2001). Speed of information processing, psychometric intelligence: And time estimation as an index of cognitive load. *Personality and Individual Differences, 30*(6), 1009–1021.

Fischbach-Kottman, Y., & Rastatter, M. P. (1984). The effects of age and sex on phonemic processing time during a picture recognition task. *Journal of Auditory Research, 24*(1), 1–8.

Frearson, W., & Eysenck, H. J. (1986). Intelligence, reaction time (RT) and a new "odd-man-out" RT paradigm. *Personality and Individual Differences, 7*(6), 807–817.

Frings, C., & Neubauer, A. (2005). Are masked-stimuli-discrimination-tests in masked priming studies measures of intelligence? An alternative task for measuring inspection time. *Personality and Individual Differences, 39*(7), 1181–1191.

Fry, A. F., & Hale, S. (1996). Processing speed, working memory, and fluid intelligence: Evidence for a developmental cascade. *Psychological Science, 7*(4), 237–241.

Hale, S. (1990). A global developmental trend in cognitive processing speed. *Child Development, 61*, 653–663.

Hartley, A. A., Speer, N. K., Jonides, J., Reuter-Lorenz, P. A., & Smith, E. E. (2001). Is the dissociability of working memory systems for name identity, visual-object identity, and spatial location maintained in old age? *Neuropsychology, 15*(1), 3–17.

Hemmelgarn, T. E., & Kehle, T. J. (1984). The relationship between reaction time and Intelligence in children. *School Psychology International, 5*, 77–84.

Hertzog, C., & Bleckley, M. K. (2001). Age differences in the structure of intelligence: Influences of information processing speed. *Intelligence, 29*(3), 191–217.

Hitch, G. J., Towse, J. N., & Hutton, U. (2001). What limits children's working memory span? Theoretical accounts and applications for scholastic development. *Journal of Experimental Psychology, 130*(2), 184–198.

Ho, H., Baker, L. A., & Decker, S. N. (1988). Covariation between intelligence and speed of cognitive processing: Genetic and environmental influences. *Behavior Genetics, 18*(2), 247–261.

Irwin, R. J. (1984). Inspection time and its relation to intelligence. *Intelligence, 8*(1), 47–65.

Jenkins, L., Myerson, J., Joerding, J. A., & Hale, S. (2000). Converging evidence that visuospatial cognition is more age-sensitive than verbal cognition. *Psychology and Aging, 15*(1), 157–175.

Jenkinson, J. C. (1983). Is speed of information processing related to fluid or to crystallized intelligence? *Intelligence, 7*(2), 91–106.

Jensen, A. R. (1987). Process differences and individual differences in some cognitive tasks. *Intelligence, 11*(2), 107–136.

Jensen, A. R., Larson, G. E., & Paul, S. M. (1988). Psychometric g and mental processing speed on a Semantic Verification Test. *Personality and Individual Differences, 9*(2), 243–255.

Jensen, A. R., & Munro, E. (1979). Reaction time, movement time, and intelligence. *Intelligence, 3*(2), 121–126.

Jensen, A. R., & Reed, T. E. (1990). Simple reaction time as a suppressor variable in the chronometric study of intelligence. *Intelligence, 14*(4), 375–388.

Juhel, J. (1993). Should we take the shape of reaction time distributions into account when studying the relationship between RT and psychometric intelligence? *Personality and Individual Differences, 15*(3), 357–360.

Kail, R., & Park, Y. (1992). Global developmental change in processing time. *Merrill-Palmer Quarterly, 38*(4), 525–541.

Kalb, R., Jansen, S., Reulbach, U., & Kalb, S. (2004). Sex differences in simple reaction tasks. *Perceptual and Motor Skills, 98*(3), 793–802.

Kane, H. D., Proctor, B. E., & Kranzler, J. H. (1997). Reliability and validity of a non-verbal measure of the speed and efficiency of long-term memory retrieval. *Personality and Individual Differences, 22*(1), 127–129.

Kemps, E., & Newson, R. (2005). Patterns and predictors of adult age differences in mental imagery. *Aging, Neuropsychology, and Cognition, 12*(1), 99–128.

Kirby, N. H., & Nettelbeck, T. (1989). Reaction time and inspection time as measures of intellectual ability. *Personality and Individual Differences, 10*(1), 11–14.

Kirby, N. H., & Nettelbeck, T. (1991). Speed of information processing and age. *Personality and Individual Differences, 12*(2), 183–188.

Kitzan, L. J., Ferraro, F. R., Petros, T. V., & Ludorf, M. (1999). The role of vocabulary ability during visual word recognition in younger and older adults. *Journal of General Psychology, 126*(1), 6–16.

Knorr, E., & Neubauer, A. C. (1996). Speed of information-processing in an inductive reasoning task and its relationship to psychometric intelligence. *Personality and Individual Differences, 20*(6), 653–660.

Kwong See, S. T., & Ryan, E. B. (1995). Cognitive mediation of adult age differences in language performance. *Psychology and Aging, 10*(3), 458–468.

Landauer, A. A., Armstrong, S., & Digwood, J. (1980). Sex difference in choice reaction time. *British Journal of Psychology, 71*(4), 551–555.

Lansman, M., Donaldson, G., Hunt, E., & Yantis, S. (1982). Ability factors and cognitive processes. *Intelligence, 6*(4), 347–386.

Larson, G. E. (1996). Mental rotation of static and dynamic figures. *Perception & Psychophysics, 58*(1), 153–159.

Larson, G. E., & Alderton, D. L. (1990). Reaction time variability and intelligence: A "worst performance" analysis of individual differences. *Intelligence, 14*, 309–325.

Larson, G. E., Merritt, C. R., & Williams, S. E. (1988). Information processing and intelligence: Some implications of task complexity. *Intelligence, 12*(2), 131–147.

Larson, G. E., & Saccuzzo, D. P. (1989). Cognitive correlates of general intelligence: Toward a process theory of g. *Intelligence, 13*, 5–31.

Lemke, U., & Zimprich, D. (2005). Longitudinal changes in memory performance and processing speed in old age. *Aging, Neuropsychology, and Cognition, 12*(1), 57–77.

Levav, M., Mirsky, A. F., French, L. M., & Bartko, J. J. (1998). Multinational neuropsychological testing: Performance of children and adults. *Journal of Clinical and Experimental Neuropsychology, 20*(5), 658–672.

Levine, G., Preddy, D., & Thorndike, R. L. (1987). Speed of information processing and level of cognitive ability. *Personality and Individual Differences, 8*(5), 599–607.

Lindley, R. H., Smith, W. R., & Thomas, T. J. (1988). The relationship between speed of information processing as measured by timed paper-and-pencil tests and psychometric intelligence. *Intelligence, 12*(1), 17–25.

Lindley, R. H., Wilson, S. M., Smith, W. R., & Bathurst, K. (1995). Reaction time (RT) and IQ: Shape of the task complexity function. *Personality and Individual Differences, 18*(3), 339–345.

Lobaugh, N. J., Cole, S., & Rovet, J. F. (1998). Visual search for features and conjunctions in development. *Canadian Journal of Experimental Psychology, 52*(4), 201–212.

Loring-Meier, S., & Halpern, D. F. (1999). Sex differences in visuospatial working memory: Components of cognitive processing. *Psychonomic Bulletin & Review, 6*(3), 464–471.

Lovett, D. J. W., Payne, W. D., & Podnieks, I. (1978). An ultradian rhythm of reaction time measurements in man. *Neuropsychobiology, 4*(2), 93–98.

Luciano, M., Smith, G. A., Wright, M. J., Geffen, G. M., Geffen, L. B., & Martin, N. G. (2001). On the heritability of inspection time and its covariance with IQ: A twin study. Intelligence. Special issue: Inspection time, 29(6), pp. 443–457.

Luciano, M., Posthuma, D., Wright, M. J., de Geus, E. J. C., Smith, G. A., Geffen, G. M., et al. (2005). Perceptual speed does not cause intelligence, and intelligence does not cause perceptual speed. *Biological Psychology, 70*(1), 1–8.

Luciano, M., Wright, M. J., Geffen, G. M., Geffen, L. B., Smith, G. A., & Martin, N. G. (2004). A genetic investigation of the covariation among inspection time, choice reaction time, and IQ subtest scores. *Behavior Genetics, 34*(1), 41–50.

Luciano, M., Wright, M. J., Smith, G. A., Geffen, G. M., Geffen, L. B., & Martin, N. G. (2001). Genetic covariance among measures of information processing speed, working memory, and IQ. *Behavior Genetics, 31*(6), 581–592.

Luciano, M., Wright, M. J., Smith, G. A., Geffen, G. M., Geffen, L. B., & Martin, N. G. (2003). Genetic covariance between processing speed and IQ. In R. Plomin, J. C. DeFries, I. W. Craig, & P. McGuffin (Eds.), *Behavioral genetics in the postgenomic era* (pp. 163–181). Washington: American Psychological Association.

Luo, D., & Petrill, S. A. (1999). Elementary cognitive tasks and their roles in g estimates. *Intelligence, 27*(2), 157–174.

Luo, D., Thompson, L. A., & Detterman, D. K. (2003). The causal factor underlying the correlation between psychometric g and scholastic performance. *Intelligence, 31*, 67–83.

Luszcz, M. A., Bryan, J., & Kent, P. (1997). Predicting episodic memory performance of very old men and women: Contributions from age, depression, activity, cognitive ability, and speed. *Psychology and Aging, 12*(2), 340–351.

Lynn, R., & Holmshaw, M. (1990). Black-white differences in reaction times and intelligence. *Social Behavior and Personality, 18*(2), 299–308.

Majeres, R. L. (1997). Sex differences in phonetic processing: Speed of identification of alphabetical sequences. *Perceptual and Motor Skills, 85*(3), 1243–1251.

Martin, M., Ewert, O., & Schwanenflugel, P. J. (1994). The role of verbal ability in the processing of complex verbal information. *Psychological Research, 56*(4), 301–309.

Matthews, G., & Dorn, L. (1989). IQ and choice reaction time: An information processing analysis. *Intelligence, 13*(4), 299–317.

McCabe, J., & Hartman, M. (2003). Examining the locus of age effects on complex span tasks. *Psychology and Aging, 18*(3), 562–572.

McCrory, C., & Cooper, C. (2005). The relationship between three auditory inspection time tasks and general intelligence. *Personality and Individual Differences, 38*(8), 1835–1845.

McGarry-Roberts, P. A., Stelmack, R. M., & Campbell, K. B. (1992). Intelligence, reaction time, and event-related potentials. Intelligence. Special issue: Biology and intelligence, 16(3–4), pp. 289–313.

McGeorge, P., Crawford, J. R., & Kelly, S. W. (1996). The relationship between WAIS–R abilities and speed of processing in a word identification task. *Intelligence, 23*(3), 175–190.

McGue, M. & Bouchard, T. J. (1989). Genetic and environmental determinants of information processing and special mental abilities: A twin analysis. In Sternberg, R. J. (Ed.), Advances in the psychology of human intelligence (Vol. 5, pp. 7–45).

Miller, L. T., & Vernon, P. A. (1992). The general factor in short-term memory, intelligence, and reaction time. *Intelligence, 16*(1), 5–29.

Miller, L. T., & Vernon, P. A. (1996). Intelligence, reaction time, and working memory in 4- to 6-year-old children. *Intelligence, 22*(2), 155–190.

Miller, L. T., & Vernon, P. A. (1997). Developmental changes in speed of information processing in young children. *Developmental Psychology, 33*(3), 549–554.

Morris, G. L., & Alcorn, M. B. (1995). Raven's progressive matrices and inspection time: P200 slope correlates. *Personality and Individual Differences, 18*(1), 81–87.

Naglieri, J. A., & Jensen, A. R. (1987). Comparison of black-white differences on the WISC-R And the K-ABC: Spearman's hypothesis. *Intelligence, 11*, 21–43.

Necka, E. (1992). Cognitive analysis of intelligence: The significance of working memory processes. *Personality and Individual Differences, 13*(9), 1031–1046.

Nettelbeck, T., & Lally, M. (1976). Inspection time and measured intelligence. *British Journal of Psychology, 67*(1), 17–22.

Neubauer, A. C. (1990a). Selective reaction times and intelligence. *Intelligence, 14*(1), 79–96.

Neubauer, A. C. (1990b). Speed of information processing in the Hick paradigm and response latencies in a psychometric intelligence test. *Personality and Individual Differences, 11*(2), 147–152.

Neubauer, A. C. (1991). Intelligence and RT: A modified Hick paradigm and a new RT paradigm. *Intelligence, 15*(2), 175–192.

Neubauer, A. C., & Benischke, C. (2002). A cross-cultural comparison of the relationship between intelligence and speed of information processing in Austria vs. Guatemala. *Psychologische Beitrage, 44*(4), 521–534.

Neubauer, A. C., & Bucik, V. (1996). The mental speed-IQ relationship: Unitary or modular? *Intelligence, 22*(1), 23–48.

Neubauer, A. C., & Freudenthaler, H. H. (1994). Reaction times in a sentence verification test and intelligence: Individual strategies and effects of extended practice. *Intelligence, 19*, 193–218.

Neubauer, A. C., & Knorr, E. (1998). Three paper-and-pencil tests for speed of information processing: Psychometric properties and correlations with intelligence. *Intelligence, 26*(2), 123–151.

Neubauer, A. C., Riemann, R., Mayer, R., & Angleitner, A. (1997). Intelligence and reaction times in the Hick, Sternberg and Posner paradigms. *Personality and Individual Differences, 22*(6), 885–894.

Neubauer, A. C., Spinath, Frank M., Riemann, R., Angleitner, A., & Borkenau, P. (2000). Genetic and environmental influences on two measures of speed of information processing and their relation to psychometric intelligence: Evidence from the German Observational Study of Adult Twins. *Intelligence, 28*(4), 267–289.

O'Connor, T. A., & Burns, N. R. (2003). Inspection time and general speed of processing. *Personality and Individual Differences, 35*(3), 713–724.

Osmon, D. C., & Jackson, R. (2002). Inspection time and IQ: Fluid or perceptual aspects of intelligence? *Intelligence, 30*(2), 119–128.

Petrill, S. A., Luo, D., Thompson, L. A., & Detterman, D. K. (2001). Inspection time and the relationship among elementary cognitive tasks, general intelligence and specific cognitive abilities. Intelligence. Special issue: Inspection time, 29(6), pp. 487–496.

Petrill, S. A., Thompson, L., & Detterman, D. (1995). The genetic and environmental variance underlying elementary cognitive tasks. *Behavior Genetics, 25*(3), 199–209.

Pfutze, E., Werner, S., & Schweinberger, S. R. (2002). Age-related slowing in face and name recognition: Evidence from event-related brain potentials. *Psychology and Aging, 17*(1), 140–160.

Phillips, Louise H., & Rabbitt, Patrick M. A. (1995). Impulsivity and speed-accuracy strategies in intelligence test performance. *Intelligence, 21*, 13–29.

Posthuma, D., de Geus, E. J. C., & Boomsma, D. I. (2001). Perceptual speed and IQ are associated through common genetic factors. *Behavior Genetics, 31*(6), 593–602.

Posthuma, D., Mulder, E. J. C., Boomsma, D. I., & de Geus, E. J. C. (2002). Genetic analysis of IQ, processing speed and stimulus-response incongruency effects. *Biological Psychology, 61*(1-2), 157–182.

Raz, N., Willerman, L., & Yama, M. (1987). On sense and senses: Intelligence and auditory information processing. *Personality and Individual Differences, 8*(2), 201–210.

Rindermann, H., & Neubauer, A. C. (2004). Processing speed, intelligence, creativity, and school performance: Testing of causal hypotheses using structural equation models. *Intelligence, 32*(6), 573–589.

Roberts, R. D., Beh, H. C., & Stankov, L. (1988). Hick's law, competing-task performance, and intelligence. *Intelligence, 12*(2), 111–130.

Rose, S. A., & Feldman, J. F. (1995). Prediction of IQ and specific cognitive abilities at 11 years from infancy measures. *Developmental Psychology, 31*(4), 685–696.

Ruchalla, E., Schalt, E., & Vogel, F. (1985). Relations between mental performance and reaction time: New aspects of an old problem. *Intelligence, 9*(2), 189–205.

Saccuzzo, D. P., Larson, G. E., & Rimland, B. (1986). Visual, auditory and reaction time approaches to the measurement of speed of information processing and individual differences in intelligence. *Personality and Individual Differences, 7*(5), 659–667.

Schaie, K. W., & Willis, S. L. (1993). Age difference patterns of psychometric intelligence in adulthood: Generalizability within and across ability domains. *Psychology and Aging, 8*(1), 44–55.

Schweizer, K. (1996). The speed-accuracy transition due to task complexity. *Intelligence, 22*(2), 115–128.

Schweizer, K. (1998). Complexity of information processing and the speed-ability relationship. *The Journal of General Psychology, 125*(1), 89–102.

Schweizer, K. (2001). Preattentive processing and cognitive ability. *Intelligence, 29*(2), 169–186.

Small, M., Raney, J. F., & Knapp, T. J. (1987a). Comparison of two reaction-time tasks and their relation to intelligence. *Perceptual and Motor Skills, 65*(3), 867–870.

Small, M. A., Raney, J. F., & Knapp, T. J. (1987b). Complex reaction time and general intelligence: A refinement. *Journal of Genetic Psychology, 148*(4), 405–414.

Smith, G. A., & Brewer, N. (1985a). Age and individual differences in correct and error reaction times. *British Journal of Psychology, 76*, 199–203.

Smith, G. A., & Brewer, N. (1995b). Slowness and age: Speed-accuracy mechanisms. *Psychology and Aging, 10*(2), 238–247.

Smith, G. A., & Stanley, G. (1983). Clocking g: Relating intelligence and measures of timed performance. *Intelligence, 7*, 353–368.

Smith, G. A., & Stanley, G. (1987). Comparing subtest profiles of g loadings and correlations with RT measures. *Intelligence, 11*(4), 291–298.

Spiegel, M. R., & Bryant, N. D. (1978). Is speed of processing information related to intelligence and achievement? *Journal of Educational Psychology, 70*(6), 904–910.

Stanford, M. S., & Barratt, E. S. (1996). Verbal skills, finger tapping, and cognitive tempo define a second-order factor of temporal information processing. *Brain and Cognition, 31*(1), 35–45.

Stough, C., Brebner, J., Nettelbeck, T., Cooper, C. J., Bates, T., & Mangan, G. L. (1996). The relationship between intelligence, personality and inspection time. *British Journal of Psychology, 87*(2), 255–268.

Stough, C., Nettelbeck, T., Cooper, C., & Bates, T. (1995). Strategy use in Jensen's RT paradigm: Relationships to intelligence? *Australian Journal of Psychology, 47*(2), 61–65.

Stringer, R., & Stanovich, K. E. (2000). The connection between reaction time and variation in reading ability: Unravelling covariance relationships with cognitive ability and phonological sensitivity. *Scientific Studies of Reading, 4*(1), 41–53.

Surnina, O. E., & Lebedeva, E. V. (2001). Sex- and age-related differences in the time of reaction to moving object in children and adults. *Human Physiology, 27*(4), 436–440.

Vernon, P. A. (1989). The heritability of measures of speed of information-processing. *Personality and Individual Differences, 10*(5), 573–576.

Vernon, P. A., & Mori, M. (1992). Intelligence, reaction times, and peripheral nerve conduction velocity. Intelligence. Special issue: Biology and intelligence, 16(3–4), pp. 273–288.

Vernon, P. A., & Jensen, A. R. (1984). Individual and group differences in intelligence and speed of information processing. *Personality and Individual Differences, 5*(4), 411–423.

Vernon, P. A., Nador, S., & Kantor, L. (1985a). Group differences in intelligence and speed of information-processing. *Intelligence, 9*(2), 137–148.

Vernon, P. A., Nador, S., & Kantor, L. (1985b). Reaction times and speed-of-processing: Their relationship to timed and untimed measures of intelligence. *Intelligence, 9*(4), 357–374.

Vickers, D., & McDowell, A. (1996). Accuracy in the frequency accrual speed test (FAST), inspection time and psychometric intelligence in a sample of primary school children. *Personality and Individual Differences, 20*(4), 463–469.

Vigil-Colet, A., & Codorniu-Raga, M. J. (2002). How inspection time and paper and pencil measures of processing speed are related to intelligence. *Personality and Individual Differences, 33*(7), 1149–1161.

Vigneau, F., Blanchet, L., Loranger, M., & Pepin, M. (2002). Response latencies measured on IQ tests: Dimensionality of speed indices and the relationship between speed and level. *Personality and Individual Differences, 33*(1), 165–182.

Walhovd, K. B., Fjell, A. M., Reinvang, I., Lundervold, A., Fischl, B., Salat, D., et al. (2005). Cortical volume and speed-of-processing are complementary in prediction of performance intelligence. *Neuropsychologia, 43*(5), 704–713.

Wickett, J. C., & Vernon, P. A. (2000). Replicating the movement time-extraversion link with a little help from IQ. *Personality and Individual Differences, 28*(2), 205–215.

Zheng, Y., Myerson, J., & Hale, S. (2000). Age and individual differences in visuospatial processing speed: Testing the magnification hypothesis. *Psychonomic Bulletin & Review, 7*(1), 113–120.

Zimprich, D., & Martin, M. (2002). Can longitudinal changes in processing speed explain longitudinal age changes in fluid intelligence? *Psychology and Aging, 17*(4), 690–695.