

BACKGROUND

Perceived loneliness is a powerful stressor that tends to increase with age and predicts cognitive decline and risk for Alzheimer's disease in elderly individuals^{1,2}. Although a growing body of literature supports the relation between feelings of loneliness and cognitive outcomes³, potential mechanisms of this relationship remain largely unexplored.

Study Aims:

- To explore two potential mechanisms of the association between loneliness and cognitive outcomes using a behavior genetics-based approach by:
 - Testing whether loneliness moderates genetic and environmental influences on cognitive performance.
 - Comparing patterns of etiological moderation to those described by Shanahan & Hofer (2005)⁴ (i.e., social context as trigger or control):

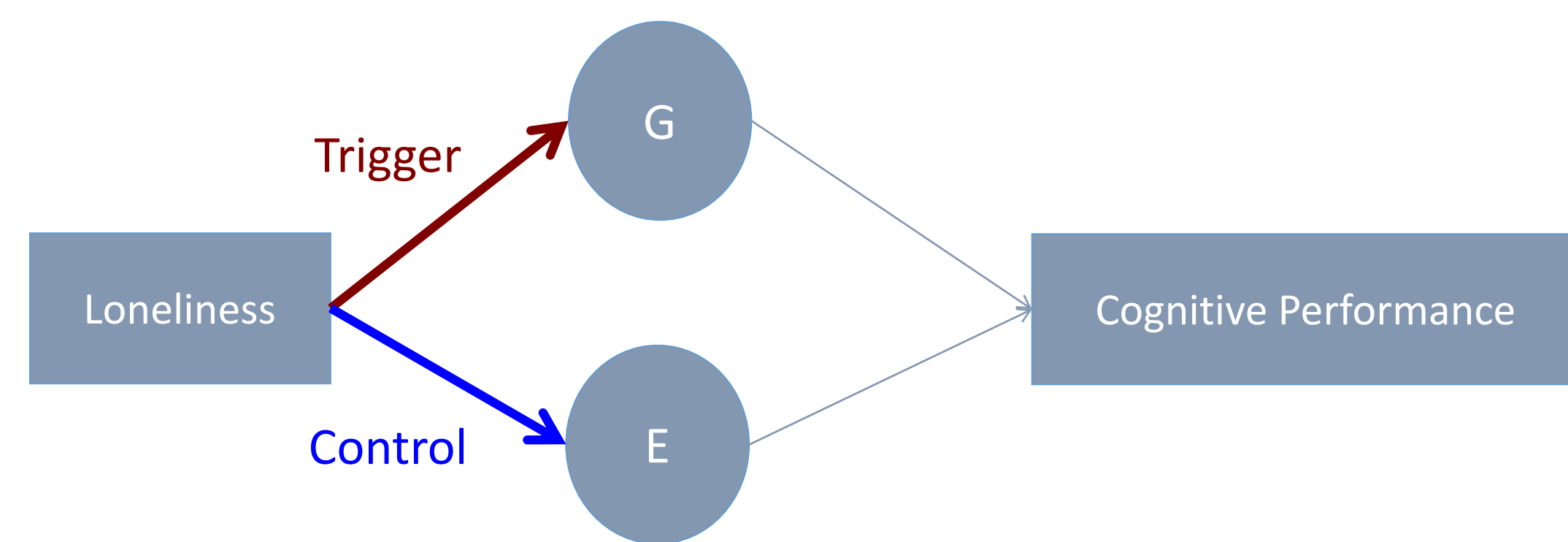


Figure 1. Potential pathways by which loneliness may moderate the relative contributions of genetic and environmental factors to variability in cognitive performance

SAMPLE

Participants 11,197 twins (1,883 MZ, 2,668 DZ complete pairs, age range 25-97, 50% female) from nine studies participating in the IGEMS consortium (SATSA, OCTO-Twin, GENDER, TOSS, LSADT, MADT, MTSADA, MIDUS, VETSA)⁵

MEASURES

Harmonized Loneliness:

- CES-D (I felt lonely)^{6,a}
- CAMDEX (Have you felt lonely lately?)^{7,b}
- 72.6% Not Lonely
- 24.9% Occasionally Lonely
- 2.5% Often/Always Lonely

Cognitive Performance:

- Verbal ability (Synonyms, $N = 4,170$, $M = 47.84$ (10.4))^c
- Processing speed (Symbol Digit, $N = 6,864$, $M = 45.78$ (11.8))^d
- Spatial ability (Block Design, $N = 2,192$, $M = 43.83$ (11.4))^e
- Working memory (Digits Back, $N = 8,342$, $M = 48.85$ (9.9))^f

DESCRIPTIVE STATISTICS & ANALYSES

Table 1. Polyserial correlations between loneliness and performance in the four cognitive domains

	Verbal Ability	Processing Speed	Spatial Ability	Working Memory
Full Sample	-.04	-.15***	-.15***	-.09***
<i>N</i>	2135	3449	1116	4212
<50 years	.01	-.05	-.14	-.07
<i>N</i>	650	523	117	464
50-59 years	-.08	-.07	-.19*	-.05
<i>N</i>	895	1163	214	1775
60-69 years	-.09	-.13*	-.15 [†]	-.05
<i>N</i>	131	1035	264	931
70+ years	.05	-.14**	-.11*	-.11*
<i>N</i>	459	728	521	1042

*** $p < .0001$, ** $p < .01$, * $p < .05$, [†] $p < .10$

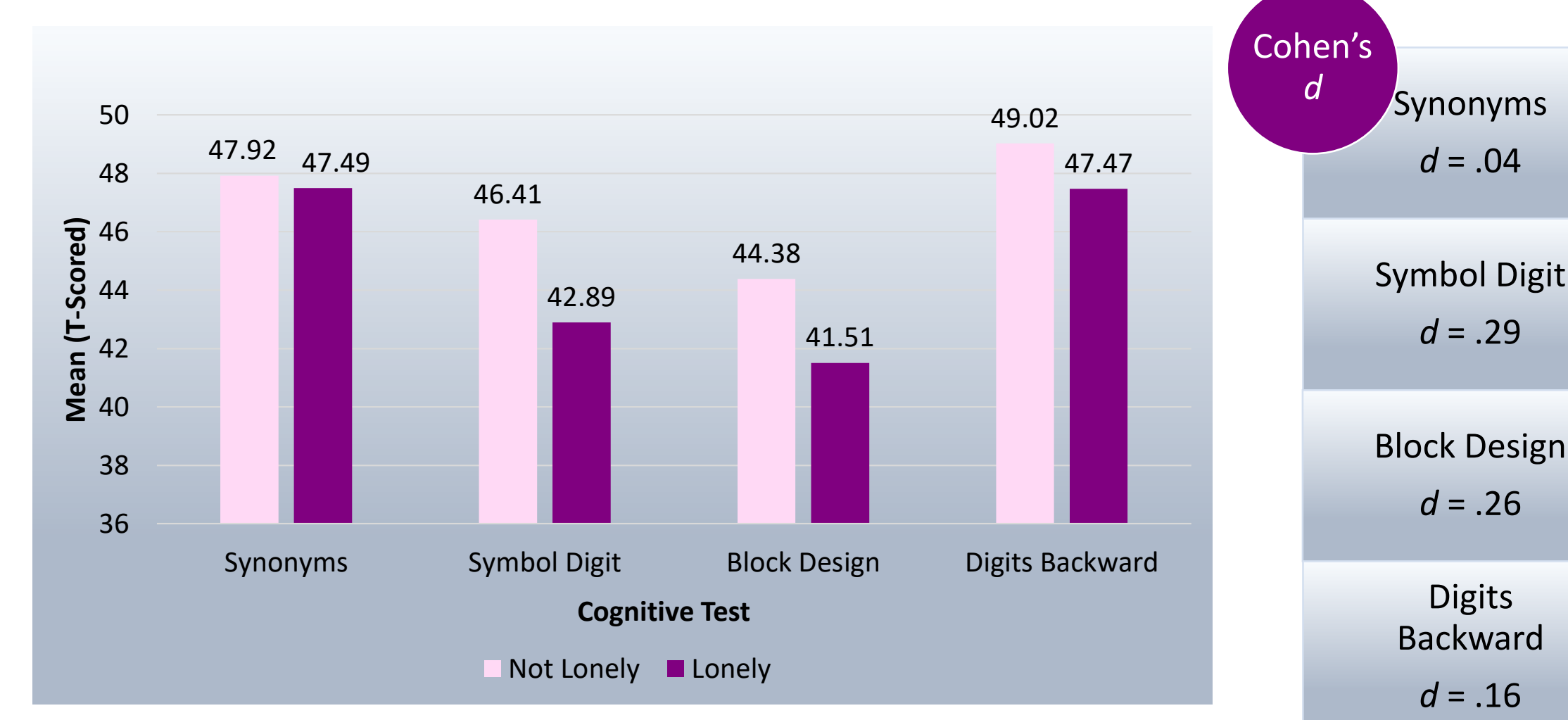


Figure 2. Mean scores on each cognitive measure by loneliness category

As the relation between loneliness and cognitive performance was strongest for processing speed (Symbol Digit) and spatial ability (Block Design), these cognitive measures were used in subsequent model-fitting analyses.

Biometrical Model Fitting. Tested for moderation of the etiology of processing speed (Symbol Digit) and spatial ability (Block Design) by loneliness after accounting for age moderation

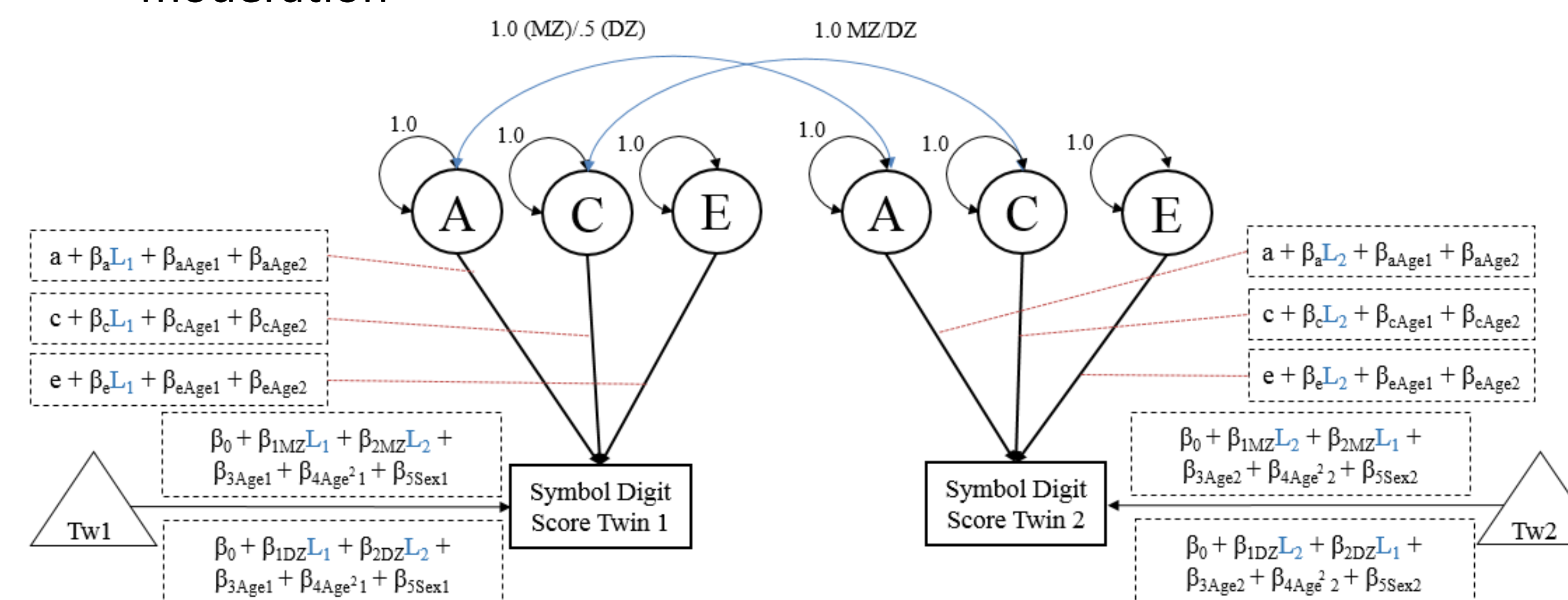


Figure 3. Biometrical ACE models used to examine moderation of the etiology of cognitive performance by loneliness (shown above for Symbol Digit; adapted from van der Sluis et al., 2012)⁸

RESULTS

Processing Speed (Symbol Digit):

- Significant moderation by loneliness of non-shared environmental variance (V_E) was found.
- Although significant moderation of additive genetic (V_A) and common environmental (V_C) variances was not found, a pattern of lower influence for these familial factors emerged for lonely compared to non-lonely participants.

	Lonely β	tLonely β	Age β	Age ² β	Sex β
MZ	-2.67	-1.76	-0.57	-0.00	1.07
DZ	-2.56	-1.49	-0.57	-0.00	1.07

Model	$\Delta\chi^2$	Δdf	<i>p</i>
Full ACE Model	-----	-----	-----
Drop A Lonely Moderation	.57	1	.449
Drop C Lonely Moderation	.45	1	.501
Drop E Lonely Moderation	3.92	1	.048

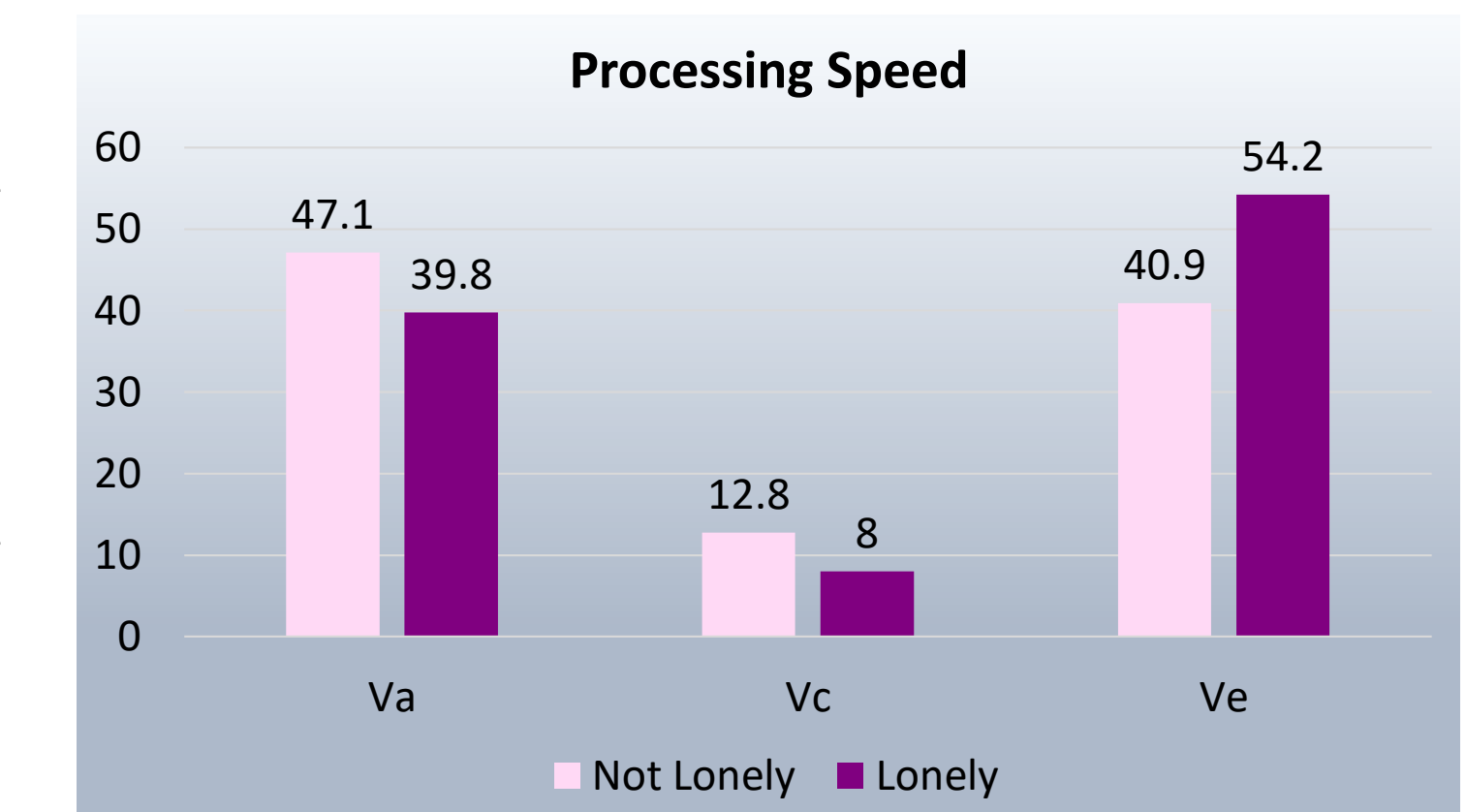


Figure 4. Variance estimates for Symbol Digit (processing speed) by loneliness

Spatial Ability (Block Design):

- No significant moderation by loneliness was observed.

	Lonely β	tLonely β	Age β	Sex β
MZ	-3.09	-2.10	-.41	1.37
DZ	-2.38	-1.47	-.41	1.37

Model	$\Delta\chi^2$	Δdf	<i>p</i>
Full ACE Model	-----	-----	-----
Drop A Lonely Moderation	.23	1	.631
Drop C Lonely Moderation	1.44	1	.230
Drop E Lonely Moderation	.003	1	.959

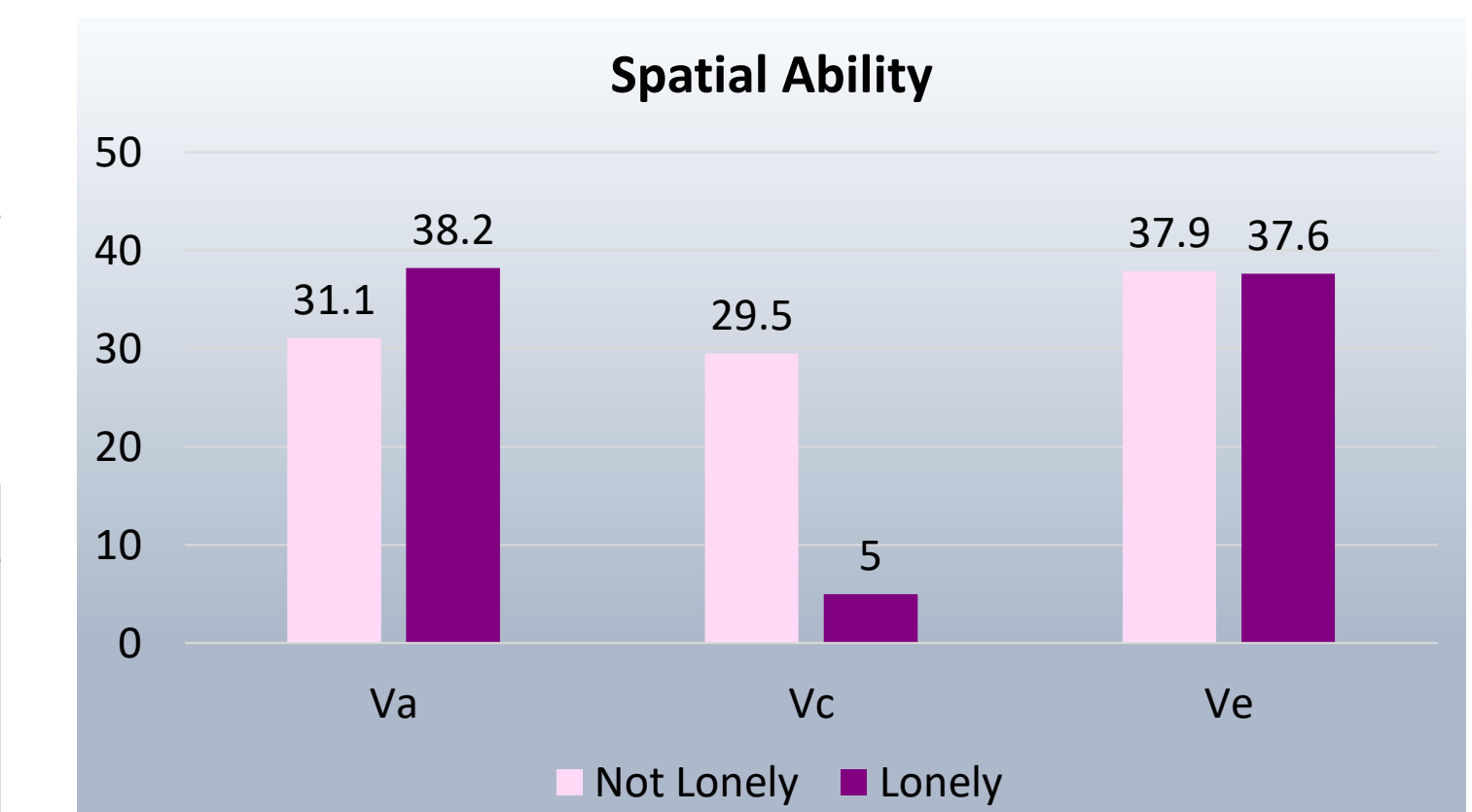


Figure 5. Variance estimates for Block Design (spatial ability) by loneliness

CONCLUSIONS

- The observed pattern of moderation for processing speed by loneliness was consistent with **loneliness as a suppressor of genetic influences** on processing speed performance, suggesting that environmental conditions involving perceived loneliness play an important role in processing speed.
- As decline in processing speed is a key predictor of decline in other cognitive processes⁹ and risk of dementia¹⁰, the observed link between loneliness and variability in processing speed suggests that interventions aimed at reducing loneliness may confer cognitive benefits in late life.
- The different findings for these domains suggest potentially distinct etiological pathways for different domains of cognitive functioning in relation to loneliness.