

# Genetics of cognition: an international collaborative twin study

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## Aims

- 1) To characterize the etiology of variation in human cognitive abilities as indexed by psychometric IQ
- 2) To determine the association of IQ, processing speed and working memory
- 3) To establish the basis of this association in terms of shared genetic or shared environmental factors

## Method

Genetic epidemiological approach using monozygotic (MZ: 100% genetically identical) and dizygotic twins (DZ) and their siblings (both groups 50% genetically identical)

## Participants

Twin families from The Netherlands (771 Ss), Australia (1012 Ss), Japan (606 Ss)

## Phenotypic assessment

	Netherlands	Australia	Japan
<i>Psychometric IQ</i>	WAIS: - verbal (5) - performance (4)	MAB - verbal (3) - performance (2) WAIS-R subtests Japanese IQ Test	WAIS - verbal (2) - performance (2) Ravens' matrices Japanese IQ Test
<i>Processing speed</i>	Reaction times: - simple & choice - inspection time	Reaction times: - choice - inspection time	Reaction times: - choice - inspection time
	EEG: - alpha peak (DR) - P3 latency (oddball) - LRP (Flanker task)	EEG: - alpha peak (DR)	
<i>Working memory</i>	- DR task *: performance measures and EEG (EEG slow wave, power, coherence, (de-) synchronisation) - Sternberg digit span - Japan: spatial and verbal storage and executive tests		

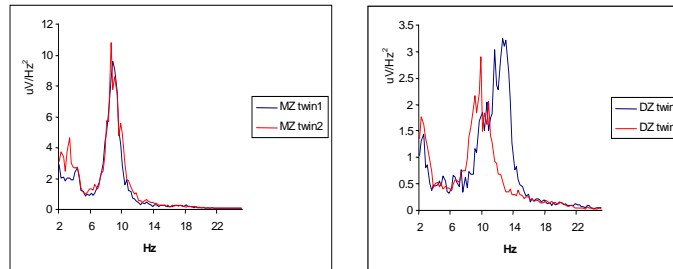
LRP= Lateralized Readiness Potential

\*DR task =delayed response task during memory and sensory condition

## Results

For nearly all phenotypes resemblances in MZ twins were higher than in DZ twins, indicating the importance of genetic factors

Example: EEG power spectra in an MZ and a DZ twin pair (alpha peak frequency)

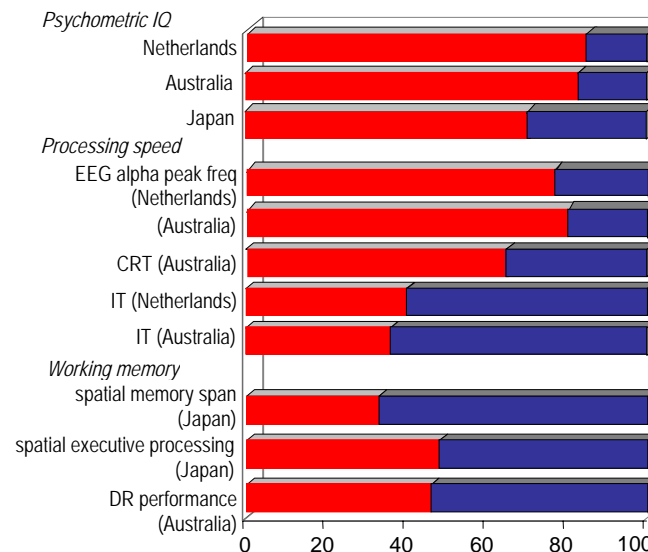


Bivariate correlations of processing speed and working memory with IQ

Domain		Correlation	Country
<i>Processing Speed</i>	Simple reaction time	-0.36	Netherlands
	Choice reaction time	-0.38	Australia
	Inspection time	-0.28	Netherlands
	Inspection time	-0.33	Australia
<i>Working Memory</i>	Spatial memory span	0.31	Japan
	Spatial executive	0.37	Japan
	DR performance	0.25	Australia

All correlations significant at .01 level (1-tailed); DR=delayed response

Proportion of variance explained by genetic (red) and unique environmental (blue) factors



## Conclusions

The contribution of genotypic differences to IQ variance is large (80%)

Heritability of processing speed and working memory performance is lower (40-80%)

We found significant associations between IQ, processing speed and working memory indices

Bivariate genetic analyses indicate that both the association of IQ and processing speed, and of IQ and working memory is due to shared genes rather than shared environmental factors