GENETIC AND ENVIRONMENTAL CONTRIBUTIONS TO THE PERSONALITY TRAIT OF NEUROTICISM IN 3301 DUTCH ADOLESCENT TWINS

David C. Rettew[1], M.D. Jacqueline M. Vink[2], Ph.D., Gonneke Williamsen[2], Ph.D., Dorret I. Boomsma[2], Ph.D., James J. Hudziak[1], M.D.

[1]University of Vermont College of Medicine, [2]Dept of Biological Psychology, Vrie University, The Netherlands

Objective

To estimate the magnitude of genetic and environmental influences to variation in adolescent neuroticism as a function of age and sex.

Background

•The personality trait of neuroticism refers to the relative tendency to experience negative emotions such as fear, sadness, and anger.

•Studies in adults have demonstrated moderate influences of additive genetics and unshared environment, with little evidence for shared environmental effects (Viken et al., 1994; Lake et al., 2000).

•Studies on child and adolescent neuroticism are fewer and smaller (Gillespe et al., 2004) and some may have been influenced by contrast effects.

Sample

Data for this study comes from the Netherlands Twin Registry (Boomsma et al., 2000), a large prospective study of Dutch twins.

Total number of individuals was 3301. Average age 15.5 years. Range 12-17

N for complete twin pairs:	Monozygotic male	277
	Monozygotic female	382
	Dizygotic male	240
	Dizygotic female	257
	Dizygotic opposite sex	470

Measures

Amsterdamse Biografische Vragenlijst (ABV): A self-report personality questionnaire similar to the Eysenck Personality Questionnaire.

Neuroticism scale comprised of 30 items which respondent rates as true or false or don't know.

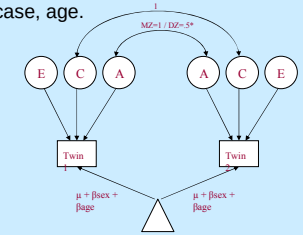
Sample Items:
Do you think you are a nervous or intrinsically tense person?
Are your feelings easily hurt?
Do you take things too personally?

Zygosity

Zygosity was based on DNA typing (33.4% of the same sex twin pairs) or on questions concerning similarity. Agreement between zygosity based on questionnaire data and zygosity based on DNA is 97% in the total sample.

Analyses

Genetic modelling was performed using Mx (Neale, 1997). A model designed to test interactions of a latent genetic variable with a measured continuous moderator variable (Purcell, 2002) was used for the total sample. In this model, the phenotypic variance (in neuroticism score) is not only partitioned into the usual genetic (a), common environmental (c) and non-shared environmental (e) components, but also incorporates the interaction between these components and a measured moderator variable, in this case, age.



A: Additive Genetics –Influence of many genes whose effects tend to "add up."
C: Common Environment – Influence of shared environmental events that tend to make people in the same family more similar.
E: Unshared Environment – Influence of unique environmental events that tend to make people in the same family different from each other.
D: Non-additive or Dominant Genetics – The influence of genes who effects do not work linearly and tend to make monozygotic twins more than twice as similar as dizygotic twins. Ex. Dominant/recessive genes

Results

Correlational analyses

Zygosity	n	Correlation Age=15.5 yrs
MZM	277	.58 (.49 - .65)
DZM	240	.32 (20 - .43)
MZF	382	.60 (.54 - .66)
DZF	257	.36 (.24 - .46)
DOS_MF	237	.16 (.03 - .28)
DOS_FM	233	.21 (.09 - .33)

Results

Model	Versus model:	$\Delta\chi^2$	df	p (α=.05)
1. ACE ♂ and ♀, $ß_x$, $ß_{y\ and}$ $ß_z$ for ♂and ♀, $ß_m$ for ♂and ♀. R_g free.			3235	
2. ACE ♂ and ♀, $ß_{x\ and}$ $ß_z$ for ♂and ♀, $ß_m$ for ♂and ♀. R_g free. -Drop $ß_y$ for ♂ and ♀	1	0.726	3237	ns
3. AE ♂ and ♀, $ß_{x\ and}$ $ß_z$ for ♂and ♀, $ß_m$ for ♂and ♀. R_g free. -Drop c for ♂ and ♀	2	1.289	3239	ns
4. AE ♂ and ♀, $ß_z$ for ♂and ♀, $ß_m$ for ♂and ♀. R_g free. -Drop $ß_x$ for ♂ and ♀	3	3.534	3241	ns
5. E ♂ and ♀, $ß_z$ for ♂and ♀, $ß_m$ for ♂and ♀. R_g free. -Drop a for ♂ and ♀	4	255.969	3243	.000
6. AE ♂ and ♀, $ß_x$ for ♂and ♀. Rg free. -Drop $ß_z$ for ♂ and ♀	4	2.854	3243	ns
7. AE ♂ and ♀, $ß_m$ for ♀. Rg free. (Best fitting model) -Drop $ß_m$ for ♂	**6**	**.413**	**3244**	ns
8. AE ♂ and ♀. R_g free. -Drop $ß_m$ for ♀	7	22.480	3245	.000
9. AE ♂=♀, $ß_m$ for ♀. Rg free. -no sex dif AE	7	7.663	3246	.022
10. AE ♂ and ♀, $ß_m$ for ♀. Rg .5 -R_g fixed	**7**	18.130	3245	.000

Conclusions

Neuroticism in adolescence appears to be influenced by
Additive Genetics – 59% (95% CI 54-63)
Unshared Environment – 41% (95% CI 37-45)
Shared Environment – 0%

No sex differences in magnitude of effects BUT evidence for involvement of some different genes between girls and boys.

Genetic influences may be larger than in adults.

References

Boomsma, D. I., Beem, A. L., van den Berg, M., Dolan, C. V., Koopmans, J. R., Vink, J. M., de Geus, E. J., & Slagboom, P. E. (2000). Netherlands twin family study of anxious depression (netsad). *Twin Res, 3*, 323-334.

Gillespie, N. A., Evans, D. E., Wright, M. M., & Martin, N. G. (2004). Genetic simplex modeling of Eysenck's dimensions of personality in a sample of young Australian twins. *Twin Res, 7*, 637-648.

Lake, R. I., Eaves, L. J., Maes, H. H., Heath, A. C., & Martin, N. G. (2000). Further evidence against the environmental transmission of individual differences in neuroticism from a collaborative study of 45,850 twins and relatives on two continents. *Behav Genet, 30*, 223-233.

Neale, M. C. (1997). *Mx: Statistical Modeling.* Richmond, VA: Department of Psychiatry, Medical College of Virginia.

Viken, R. J., Rose, R. J., Kaprio, J., & Kosenvuo, M. (1994). A developmental genetic analysis of adult personality: Extraversion and neuroticism from 18 to 59 years of age. *Journal of Personality and Social Psychology, 66*, 722-730.

Acknowledgements

This work was supported by the Netherlands Organization for Scientific Research (NWO 985-10-002 and NWO 900-562-137) and by grants K08 MH069562, MH58799 and MH52813 from the National Institute of Mental Health, Rockville, MD.