



An Extended Twin-pedigree Study Of Voluntary Exercise Behavior In The Netherlands

van der Zee, M.D. ^{*1}, Helmer, Q.¹, Boomsma, D.I.¹ & de Geus, E.J.C¹.

^{*}. Corresponding author: Matthijs D. van der Zee: m.d.vander.zee@vu.nl

¹. Department of Biological Psychology, Behavioral and Movement Sciences, Vrije Universiteit; Amsterdam Public Health research institute, Amsterdam University Medical Centers, the Netherlands

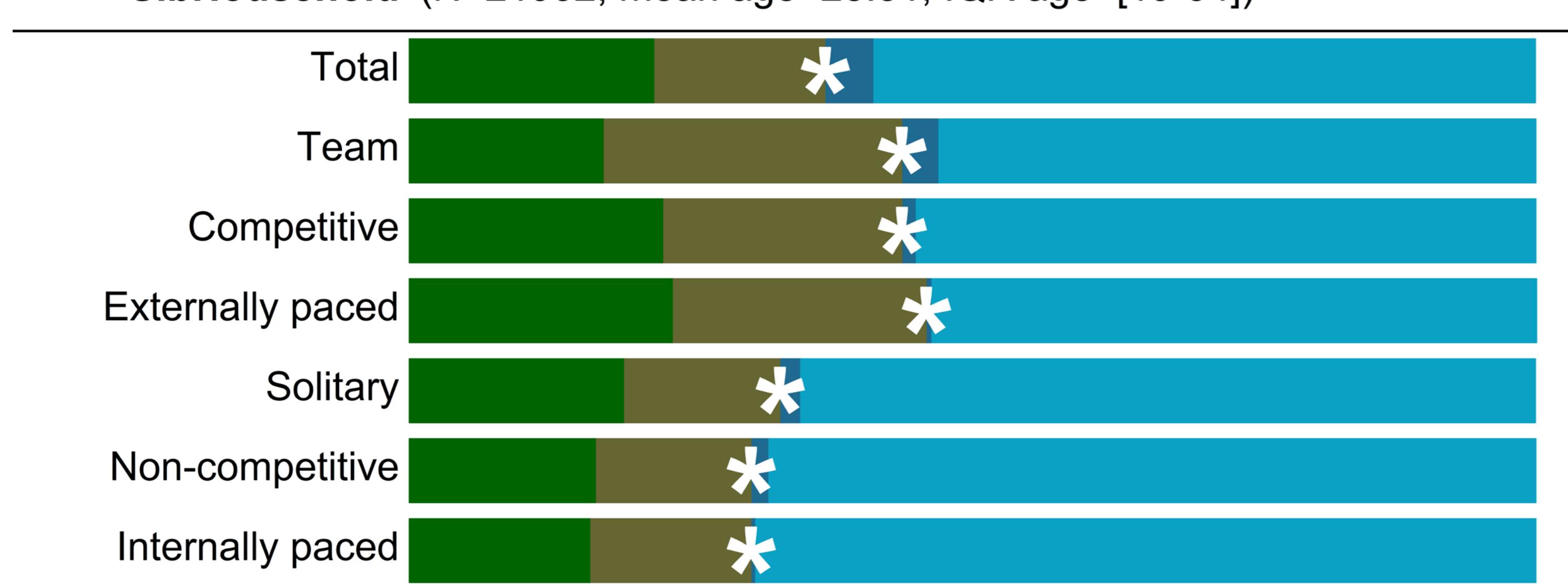
Introduction

We estimated the genetic and environmental contribution to individual differences in different classes of voluntary regular exercise behavior in extended twin-family pedigrees. In contrast to much of the earlier work based on twin data only, this allowed us to simultaneously estimate the contribution of shared household effects (C), additive (A) and non-additive genetic effects (D) to the resemblance in exercise behaviour of family members. It additionally allowed us to test for phenotypic assortment, social homogamy and marital interaction as causes for spousal resemblance.

Methods

A total of 51,108 NTR participants (age \geq 16) in 19,842 families from the Netherlands Twin Register (NTR) provided data on their voluntary exercise behavior. Total weekly MET hours spent on leisure time exercise were computed across all activities and across exercise activities in specific classes: team-based and solitary exercise, competitive and non-competitive exercise and internally paced and externally paced exercise.

SibHousehold (N=21932, mean age=28.51, IQR age=[19-34])



SpouseHousehold (N=32021, mean age=45.39, IQR age=[40-51])

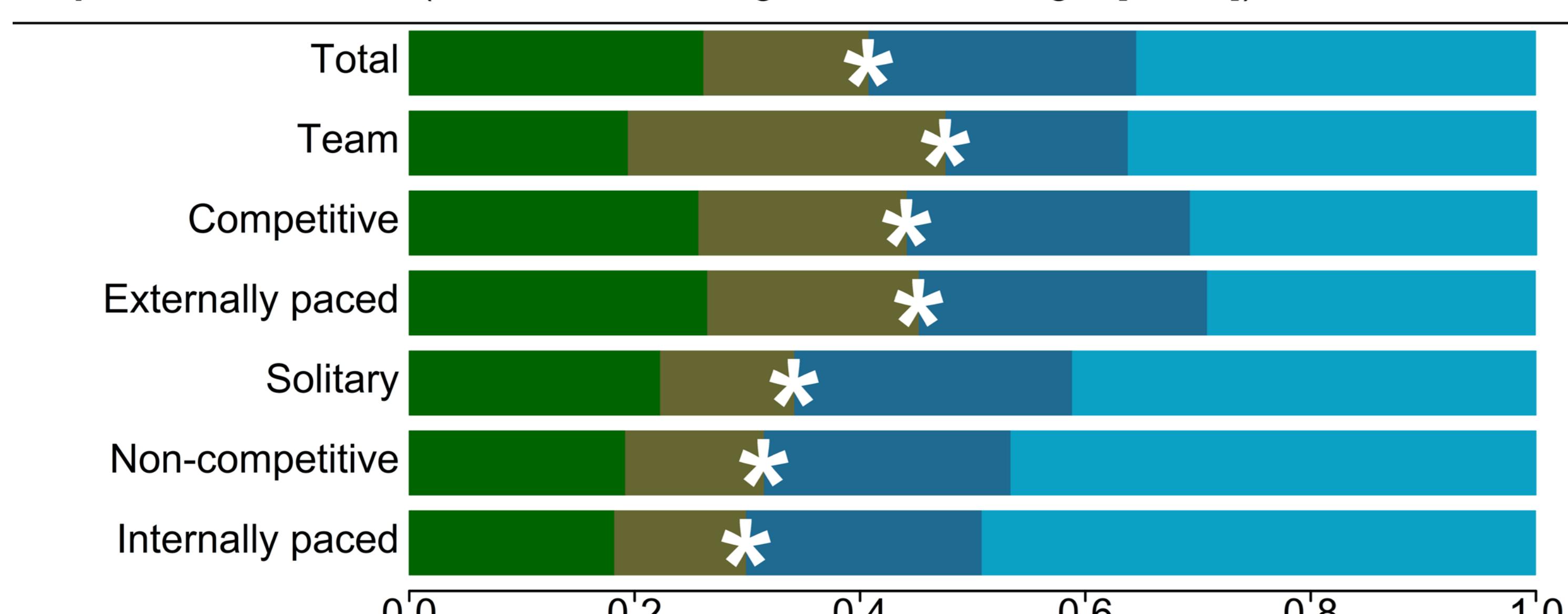


Figure 1: Proportion of variance explained by additive genetic (A), non-additive genetic (D), shared environmental (C), unique environmental (E) factors and broad sense heritability (*) for different classes of exercise. The C component in the sibling household (Upper) is the traditional C from twin-studies, being the environment shared by siblings in their youth. The C in the spouse household (Lower) reflects the environment shared by spouses.

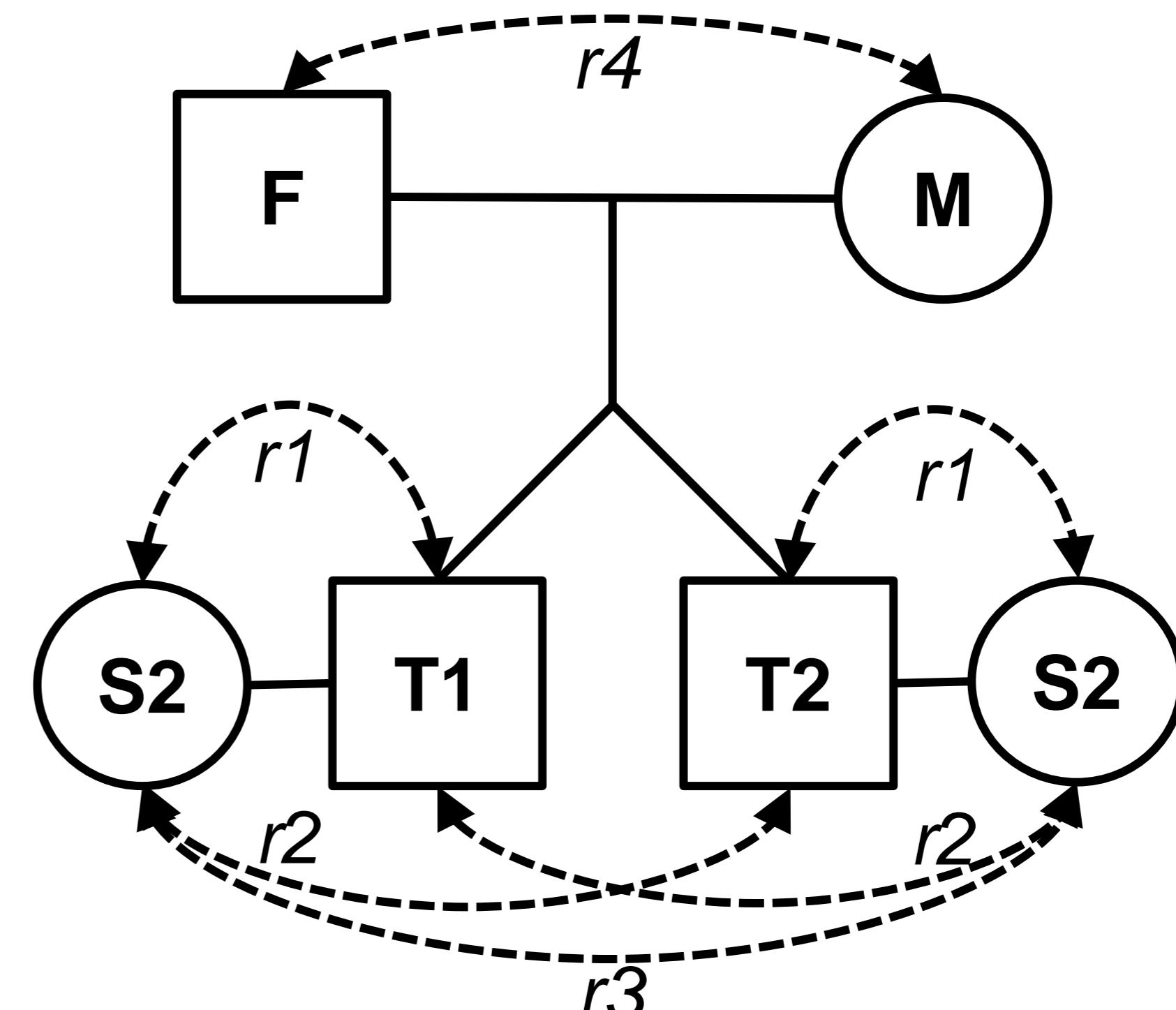


Figure 2: An overview of the different correlations used to test for sources of spousal resemblance (see column 2, table 1).

		Total	Team	Competitive	Ext Paced	Solitary	Non-competitive	Int Paced
Spousal resemblance	$r1 > 0$	✓	✓	✓	✓	✓	✓	✓
	$r4 > 0$	✓	✓	✓	✓	✓	✓	✓
Phenotypic assortment	$r1 > r2$	✓	-	-	-	✓	-	-
	$r2 > r3$	-	-	-	-	-	-	-
Social Homogamy	$r2_{MZ} > r2_{DZ}$	-	-	-	-	-	-	-
	$r3_{MZ} > r3_{DZ}$	-	-	-	-	-	-	-
Marital interaction	$r1 = r2$	-	✓	✓	✓	-	✓	✓
	$r2 = r3$	✓	-	-	-	✓	-	-
	$r2_{MZ} = r2_{DZ}$	✓	✓	✓	✓	✓	✓	✓
	$r3_{MZ} = r3_{DZ}$	✓	✓	✓	✓	✓	✓	✓
	$r4 > r1$	✓	✓	✓	✓	✓	✓	✓

Table 1: Tests for sources of spousal resemblance (✓: $p < .05$)

Results

Figure 1 shows the contribution of genetic and shared environmental factors to familial resemblance. Results confirm the influence of genetic factors throughout the life-span with broad sense heritability ranging from 37% to 41% in total volume of exercise (22-26% A, 15% D). Engaging in team-based, competitive, externally paced activities (e.g. soccer) is ~15% more heritable than engaging in non-competitive, solitary activities (e.g. jogging). Figure 2, and Table 1 show that social homogamy and marital interaction drive spouse resemblance.

Conclusion

In young adults, genetic and unique environmental factors are the main sources of variation in volume and type of voluntary exercise behaviour. In middle-age, the environment shared by spouses plays an additional role and causes substantial spousal resemblance in exercise behaviour. We find more support for social homogamy than for phenotypic assortment but power for this comparison was low.