GxE and GxG interactions

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Boulder Workshop March 6 20

Background I

Various kinds of E and G
- Latent/Observed

GxG interaction
- Observed x Observed
- Latent x Latent
- Latent x Observed

Background II

Latent Genotype x Measured Environment Interact

- Kendler, KS & Eaves, LJ 1986 Models for the jo genotype and environment on liability to psychia *Psychiat* **143**:279-89
- Heath, AC, Cates, R, Martin, NG, Meyer, JM, He MC & Eaves, LJ (1993) Genetic contributions to initiation: Comparisons across cohorts and acros *Journal of Substance Abuse* **5**: 221-246
- Neale, MC & Cardon, LR (1992) Methodology fo Studies of Twins & Families. Dordrecht, NL: Klu

Background III

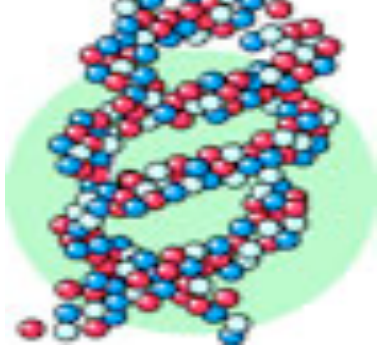
1994: Definition variables in Mx

– Enables ‘continuous’ version of multiple group a

Purcell, S (2002). Variance components models fo
environment interaction in twin analysis. *Twin Res*,

– Useful framework: do A/C/E change as a functio
measured ‘environmental’ variable?

– Often regress out main effects of moderator on t

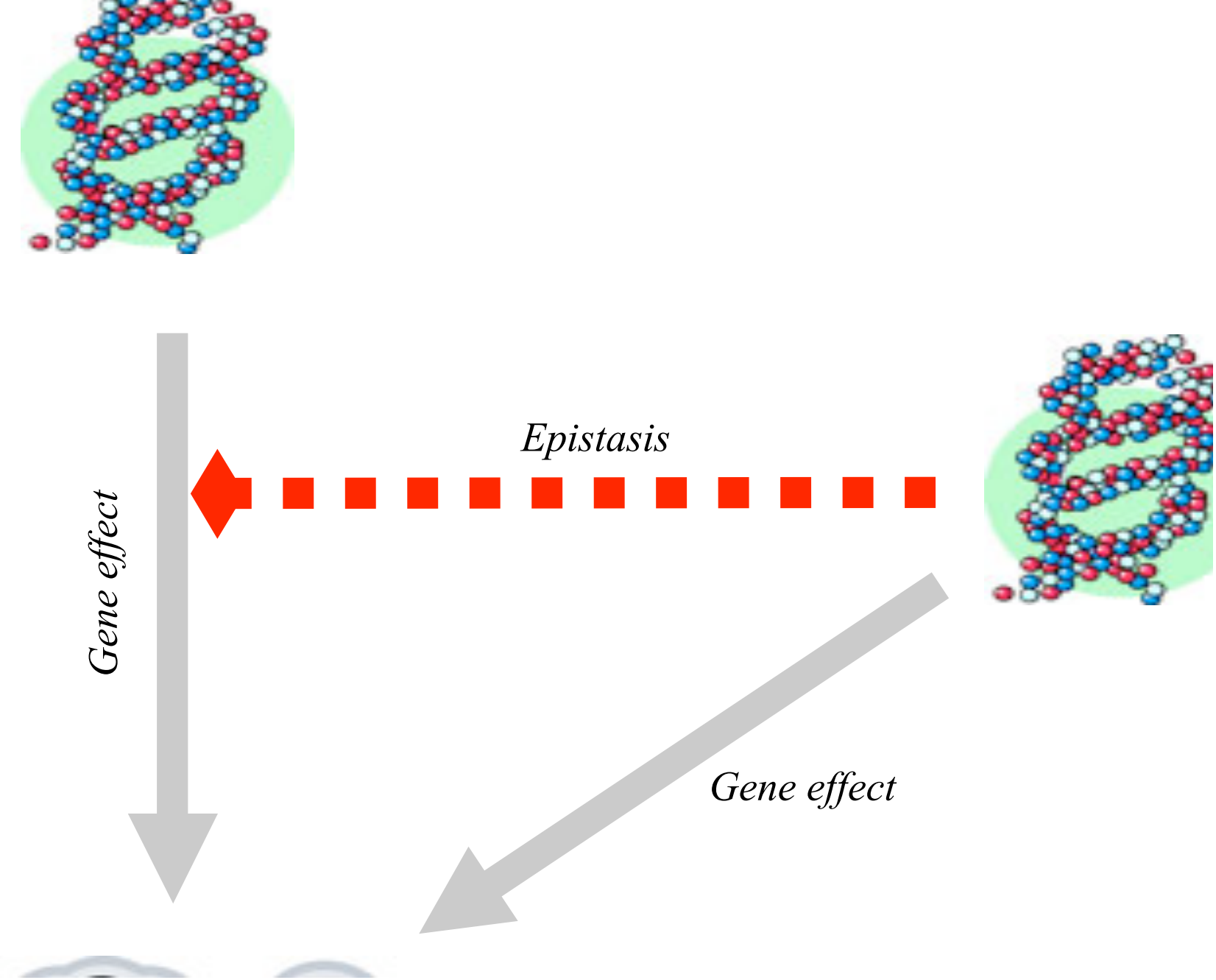


Gene effect

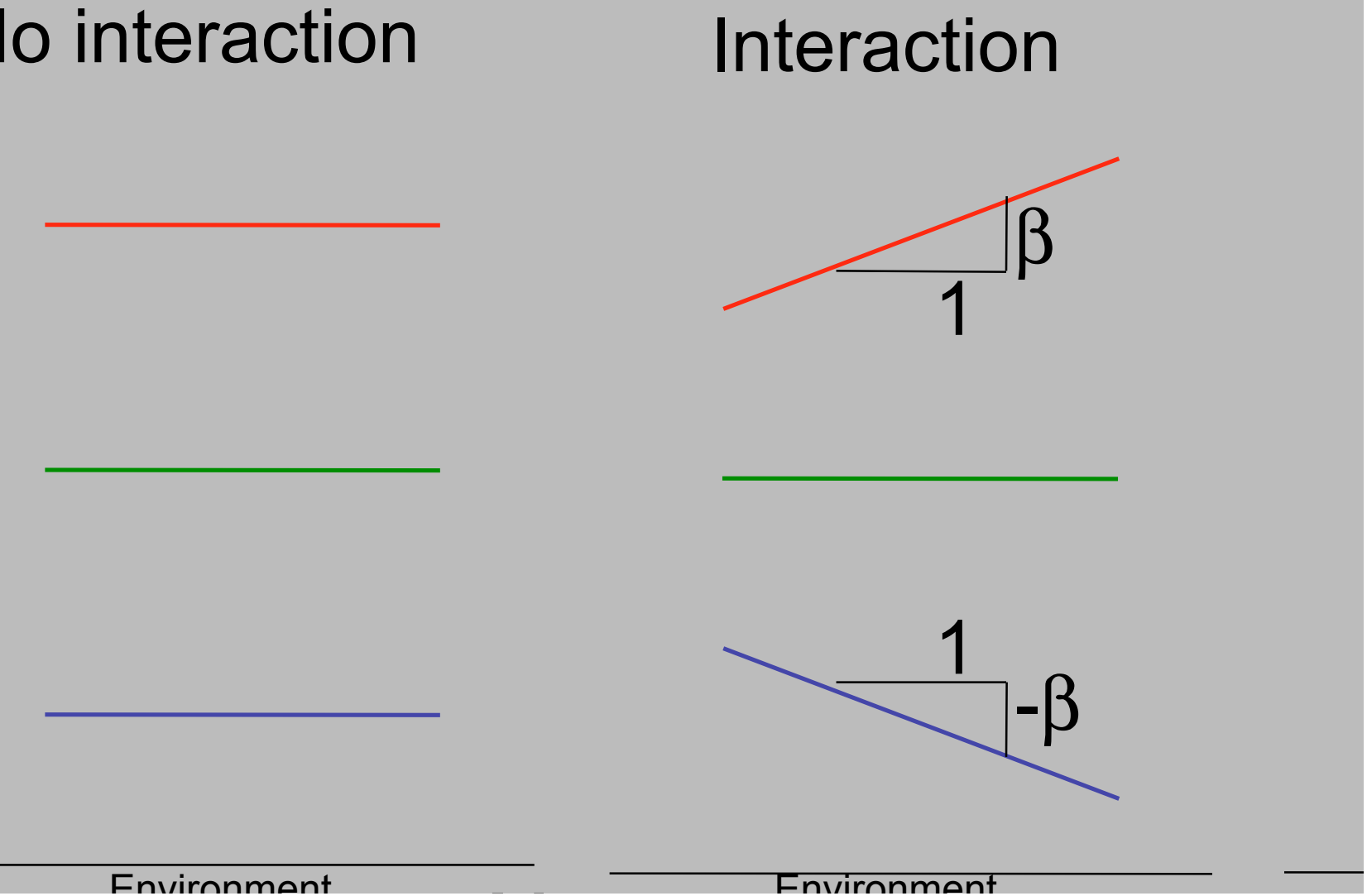
Gene-environment interaction

?

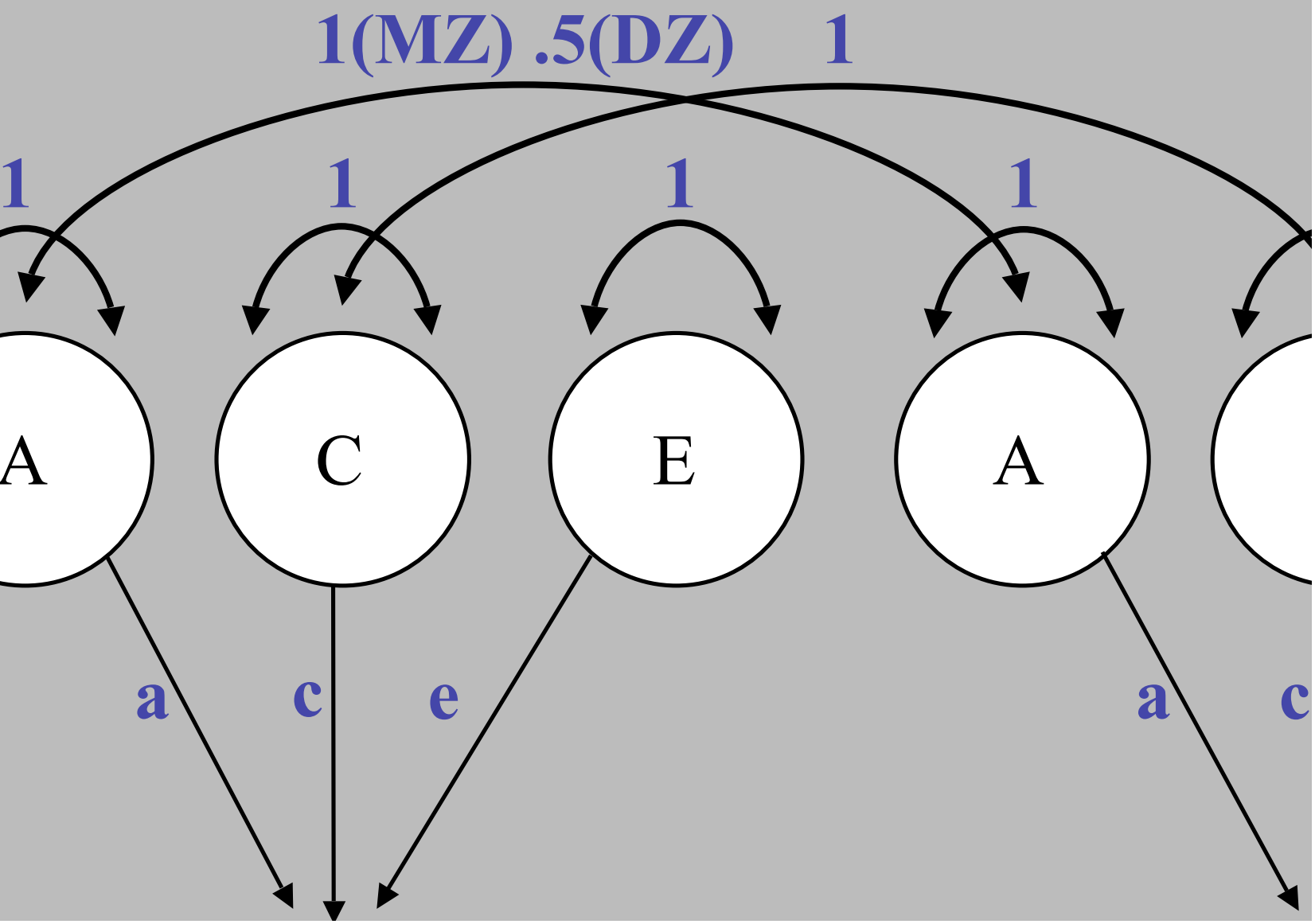
Environmental effect

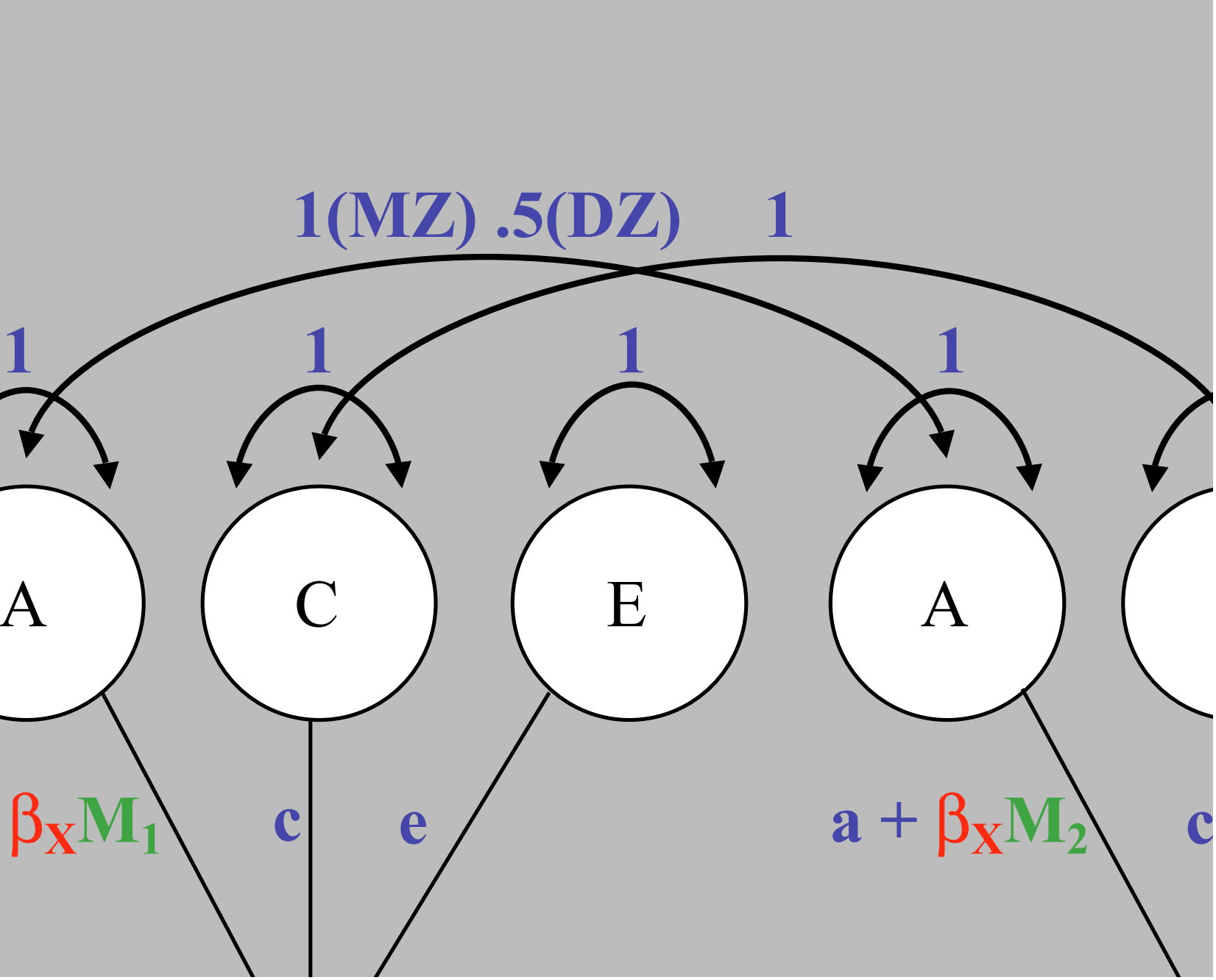

Epistasis
Gene effect
Gene effect

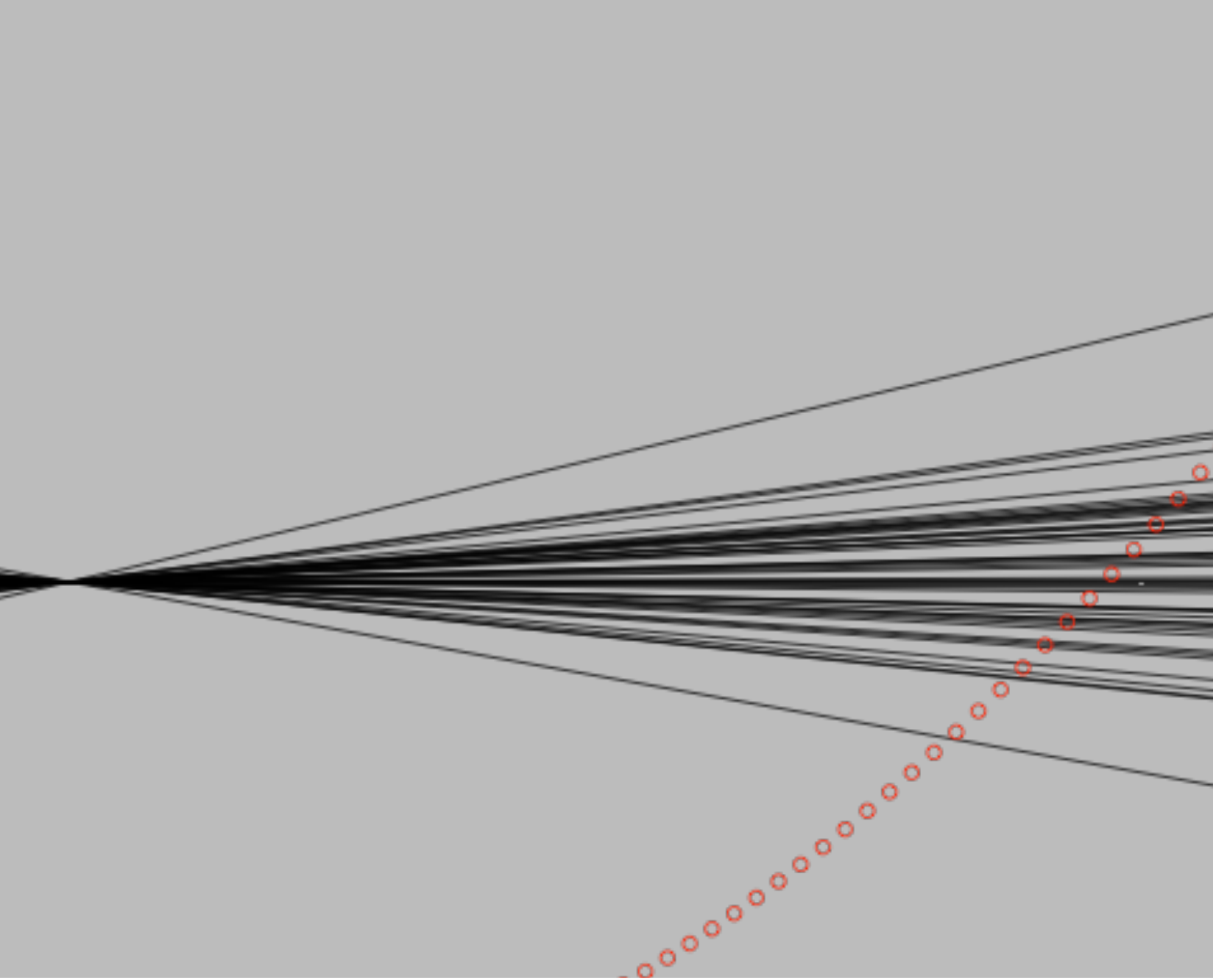
Biometrical G · E model



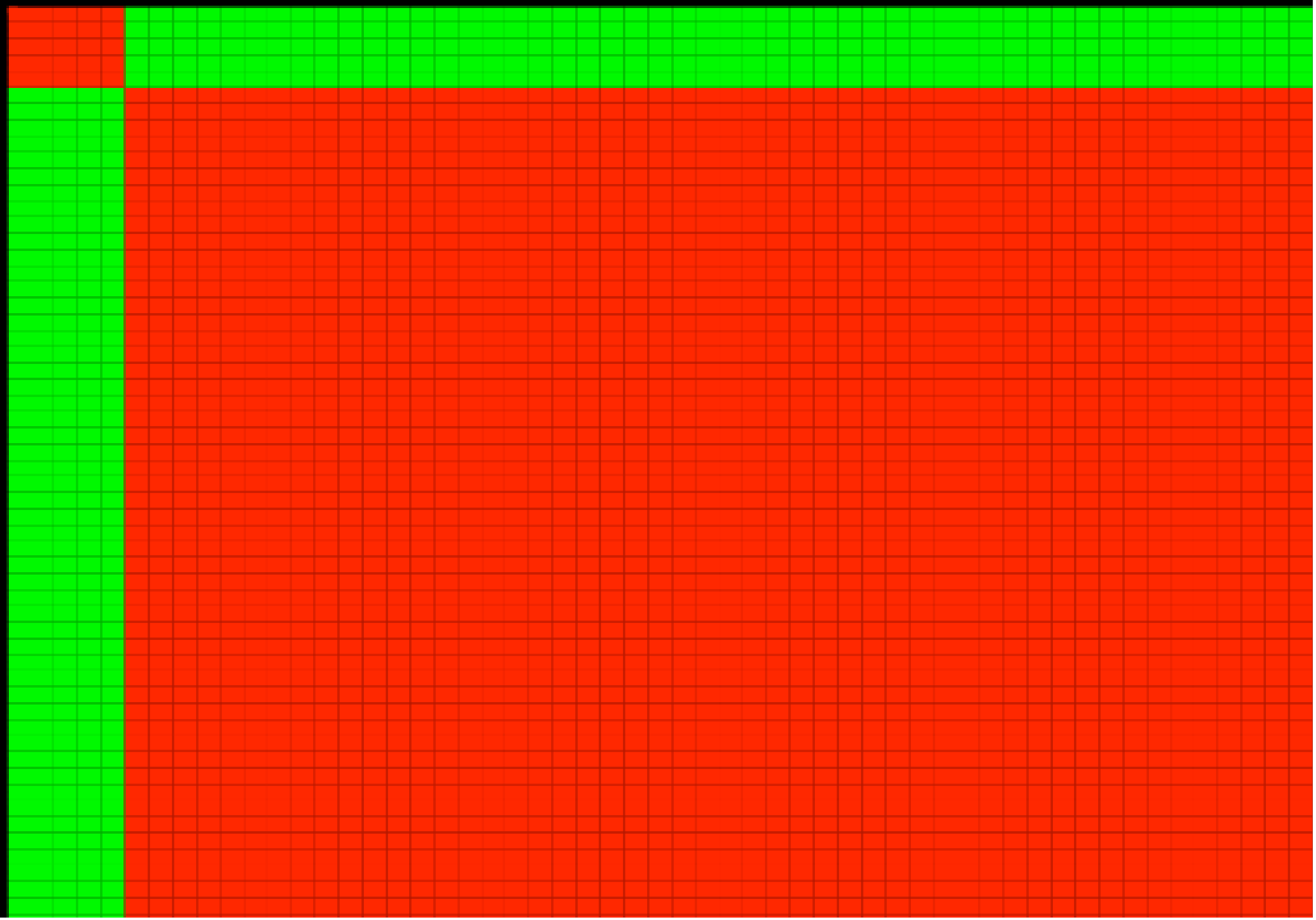
Standard ACE model for twin rese



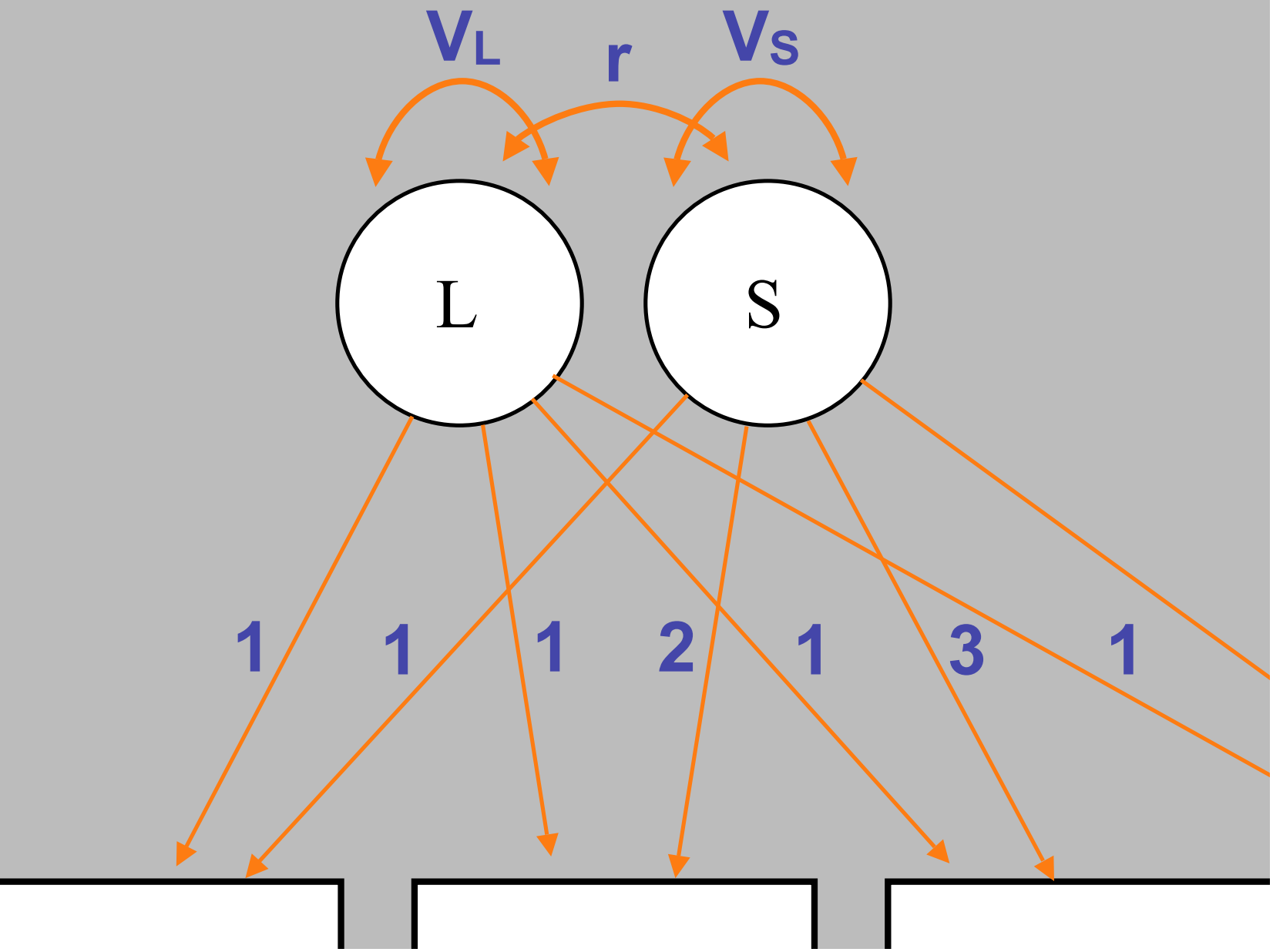

1(MZ) .5(DZ) 1
1
1
1
1
A
C
E
A
βXM1
c
e
a + βXM2
c



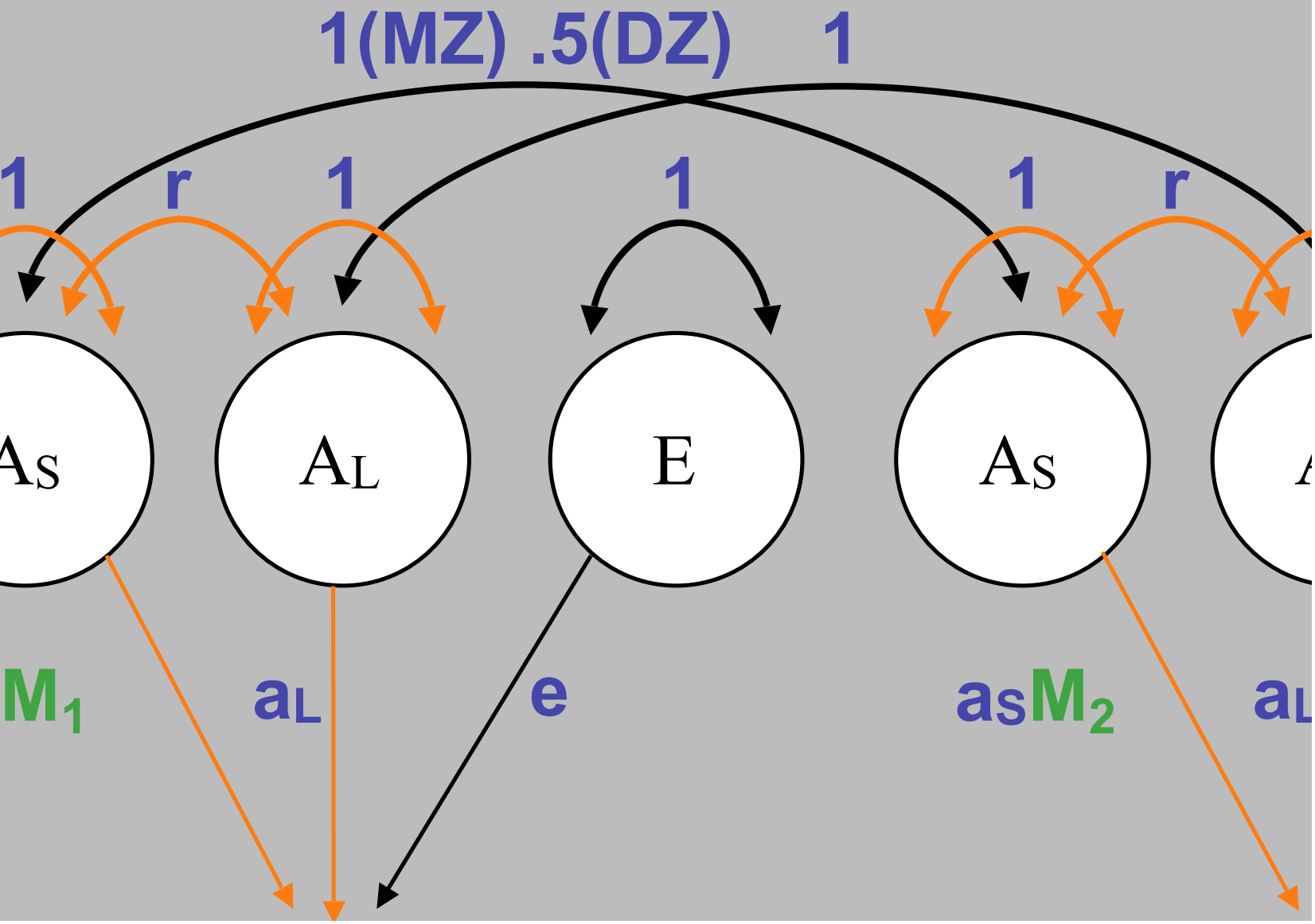
Single-factor model (r=1

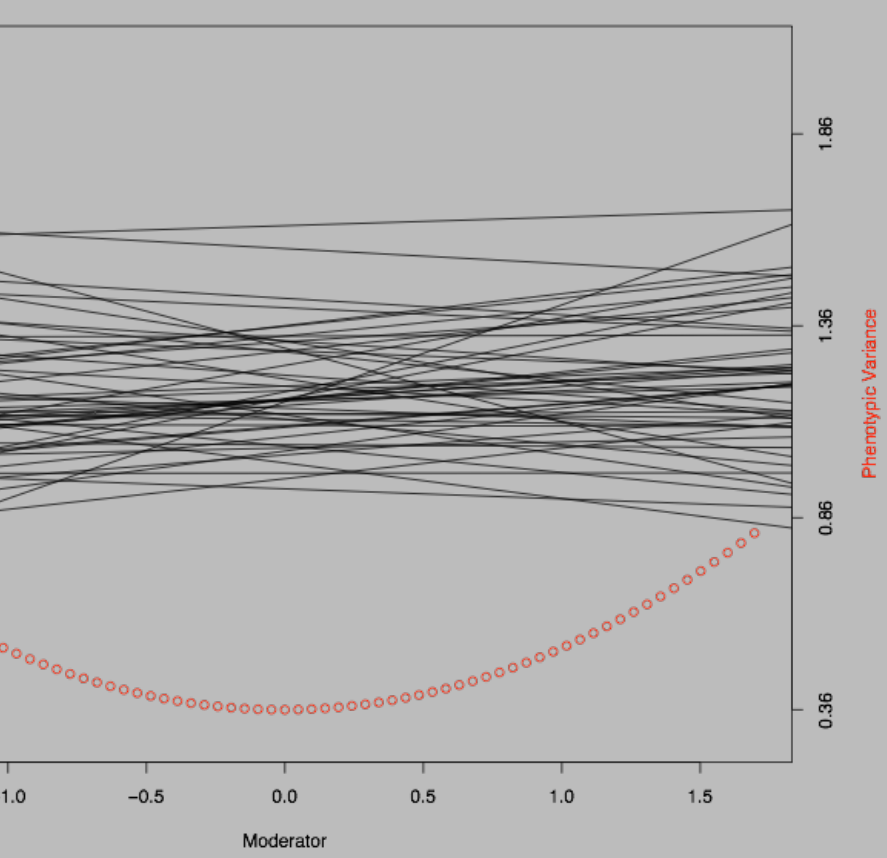


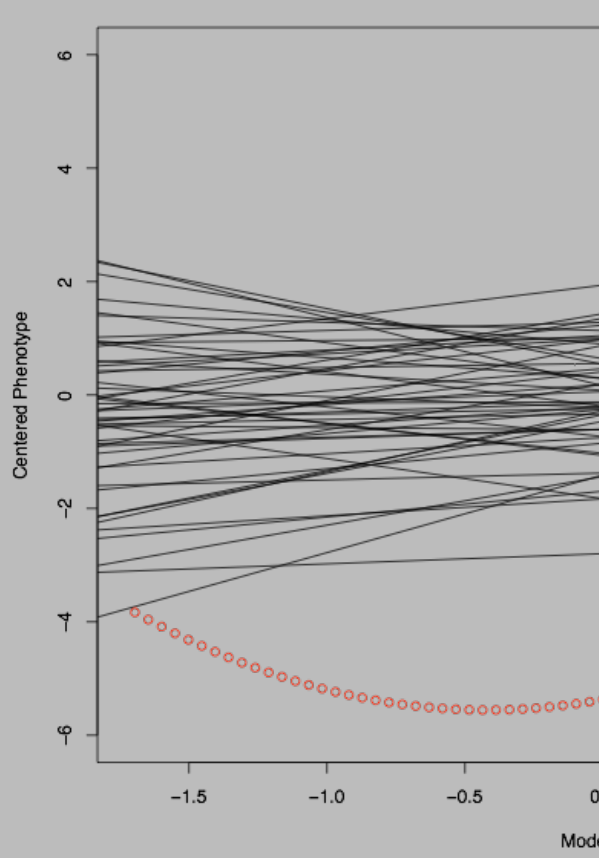
Growth Curve Model



Enhanced Moderated AE

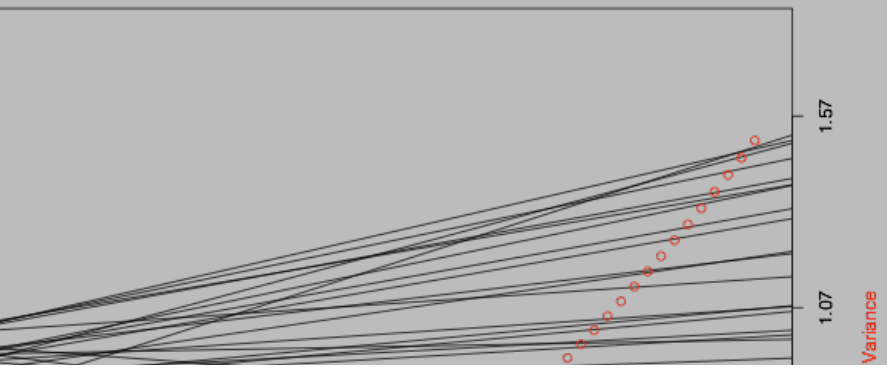


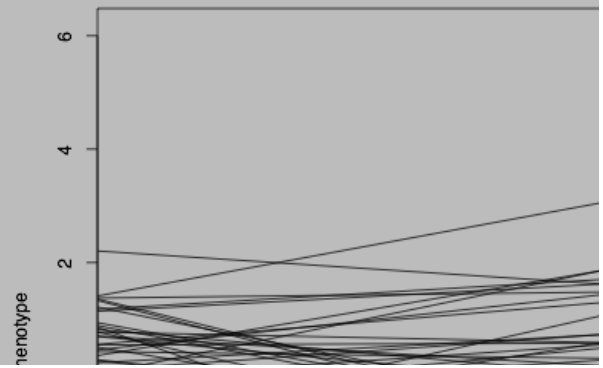


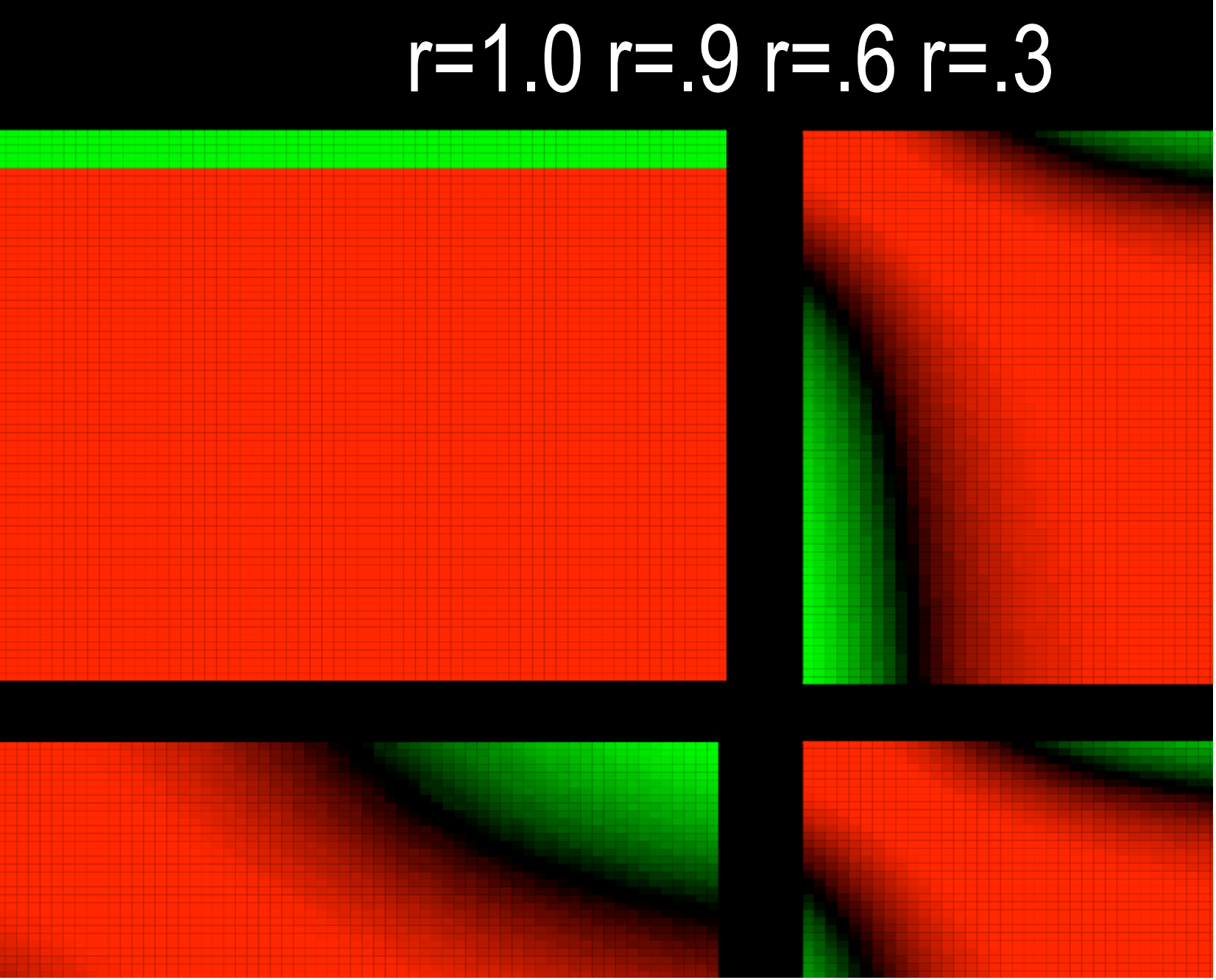


Enhanced Interactions given r=.9

Enhanced Intera






r=1.0 r=.9 r=.6 r=.3

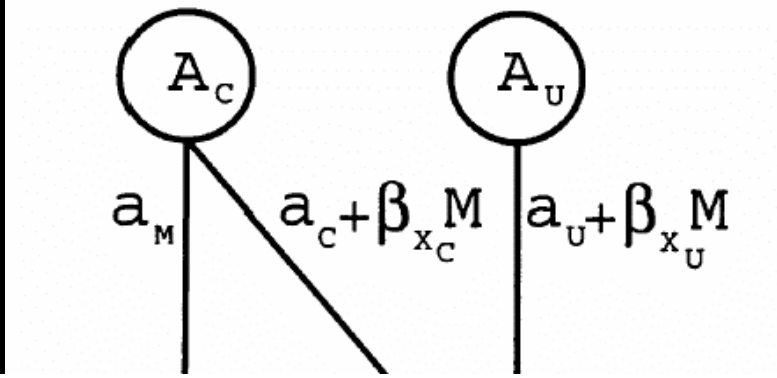
model: 1 Twin

Variance Components Models for Gene–Environment Interaction in Twin Analysis

Shaun Purcell

Social, Genetic and Developmental Psychiatry Research Centre, Institute of Psychiatry, King's College, London, UK

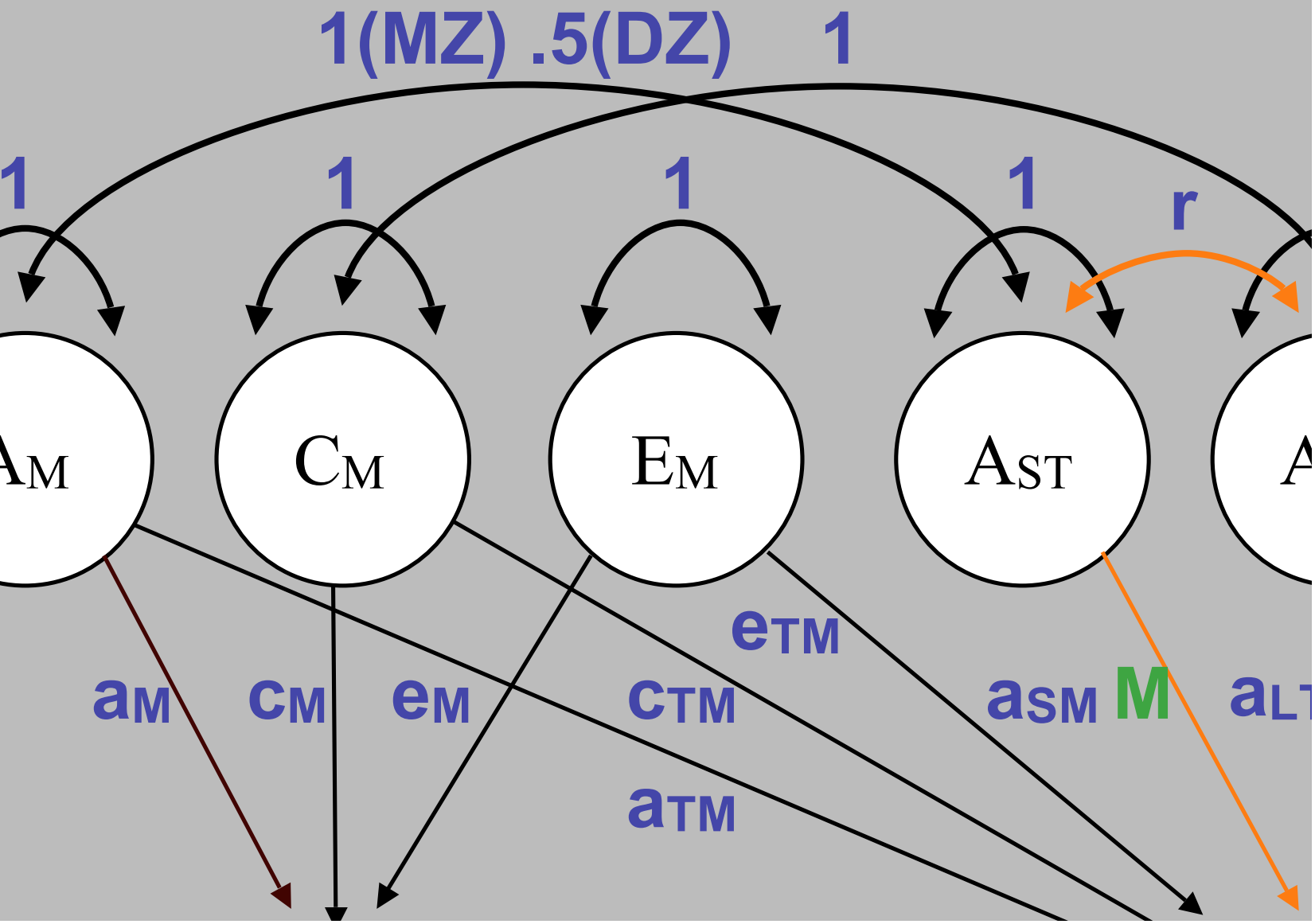
Twin Research Volume 5 Number 6 pp. 554–571



Perhap
across
compo

Volume

ivariate Moderated AE mode



Research Design Considerat

No variation in Age(M) at measurement

1. Estimation of parameters via mixture modeling due to anything)

Variation in age, but twins measured once at same

1. Know variance, MZ and DZ covariance @ differ
2. Don't know if same genes/envt at different ages

Variation in age, twins measured once at different

1. Know 2.1 plus MZ & DZ covariances as f(Age d have pairs concordant & discordant wrt Age

Greg Carey Arti

- Genotype-Environment Interaction and a Multivariate Solution
  - "Please do not cite until I'm ce the whole thing right."
- Definition variables
- Conditional Distributions

Necessary backgro

- "For example, if the ACE model in general population assumes that A are uncorrelated, then A, C, and E poor environmental group will be u correlated when home environmen correlated with ASB"
- Conditional distributions
  - Distribution of Phenotype, conditi

Pearson Aitken Sel

e a set of random variables, $\mathbf{z}$, partitioned such that

$$\mathbf{z} = \begin{pmatrix} \mathbf{x} \\ \mathbf{y} \end{pmatrix}.$$

sumed that the relationship among all variables is linea

e the mean vector of the variables as

$$\mu = \begin{pmatrix} \mu_x \\ \mu_y \end{pmatrix},$$

Pearson Aitken Sel

that selection changes mean vector $\boldsymbol{\mu}_x$ to $\tilde{\boldsymbol{\mu}}_x$. Then the

les after selection will equal

$$\tilde{\boldsymbol{\mu}}_y = \boldsymbol{\mu}_y + \mathbf{C}_{yx}\mathbf{V}_x^{-1}(\tilde{\boldsymbol{\mu}}_x - \boldsymbol{\mu}_x).$$

lection process changes the covariance matrix among the

n the covariance matrix will change from $\mathbf{V}$ to

$$\tilde{\mathbf{V}} = \begin{pmatrix} \tilde{\mathbf{V}}_x & \tilde{\mathbf{V}}_x\mathbf{V}_x^{-1}\mathbf{C}_{xy} \\ \mathbf{C}_{yx}\mathbf{V}_x^{-1}\tilde{\mathbf{V}}_x & \mathbf{V}_y - \mathbf{C}_{yx}(\mathbf{V}_x^{-1} - \mathbf{V}_x^{-1}\tilde{\mathbf{V}}_x\mathbf{V}_x^{-1})(\end{pmatrix}$$

...eral with measure...

Example item response probability curves