Regression On Dummy Variables

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Why

- Discrete valued predictor variables like `Breed`
- Assignment of numeric codes to different breeds creates dependencies between expected values of different breeds

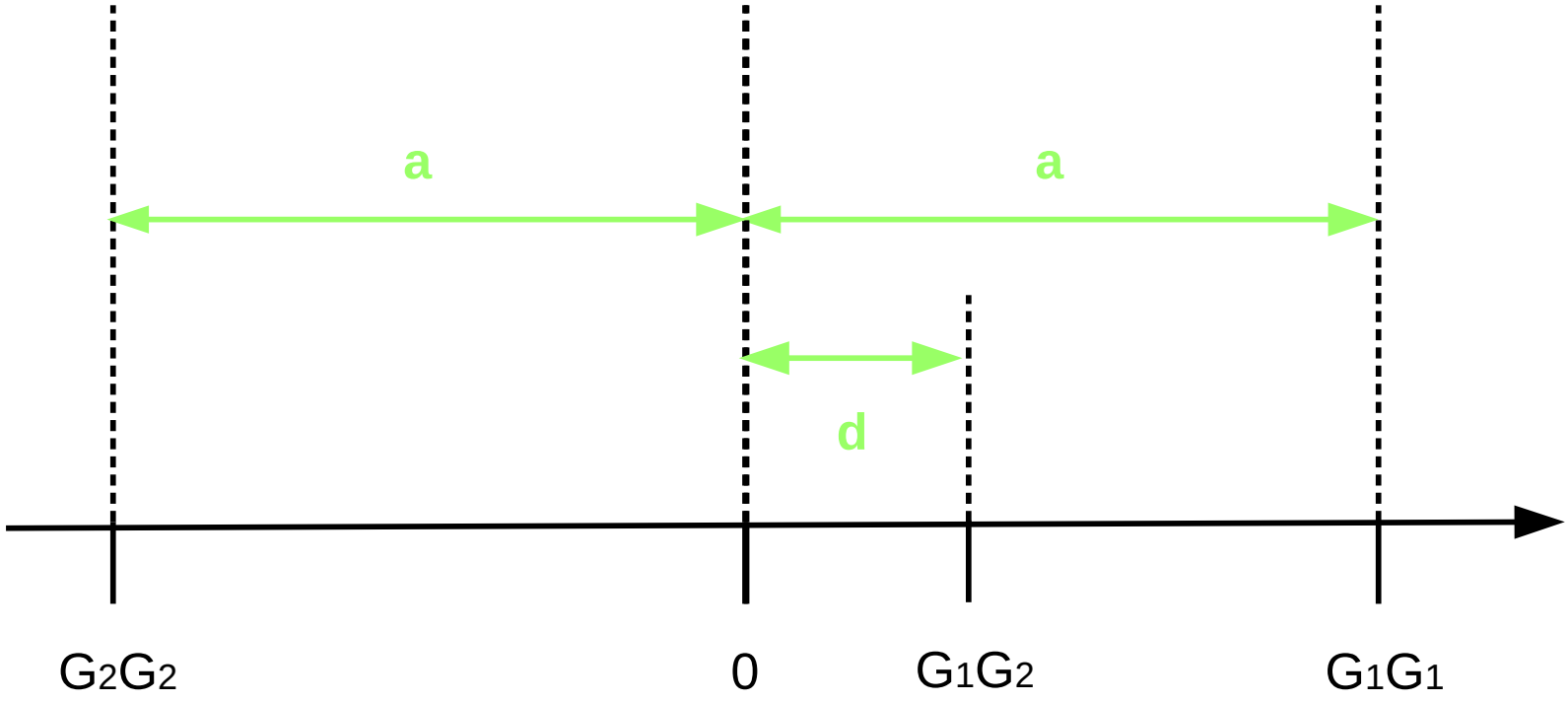
$$
\begin{aligned}
E(\text{BW Angus}) &= b_0 + b_1 \\
E(\text{BW Limousin}) &= b_0 + 2b_1 \\
E(\text{BW Simmental}) &= b_0 + 3b_1
\end{aligned}
$$

- Only estimates are b_0 and b_1
- Usually unreasonable, with one exception

Linear Regression in Genomic Analysis

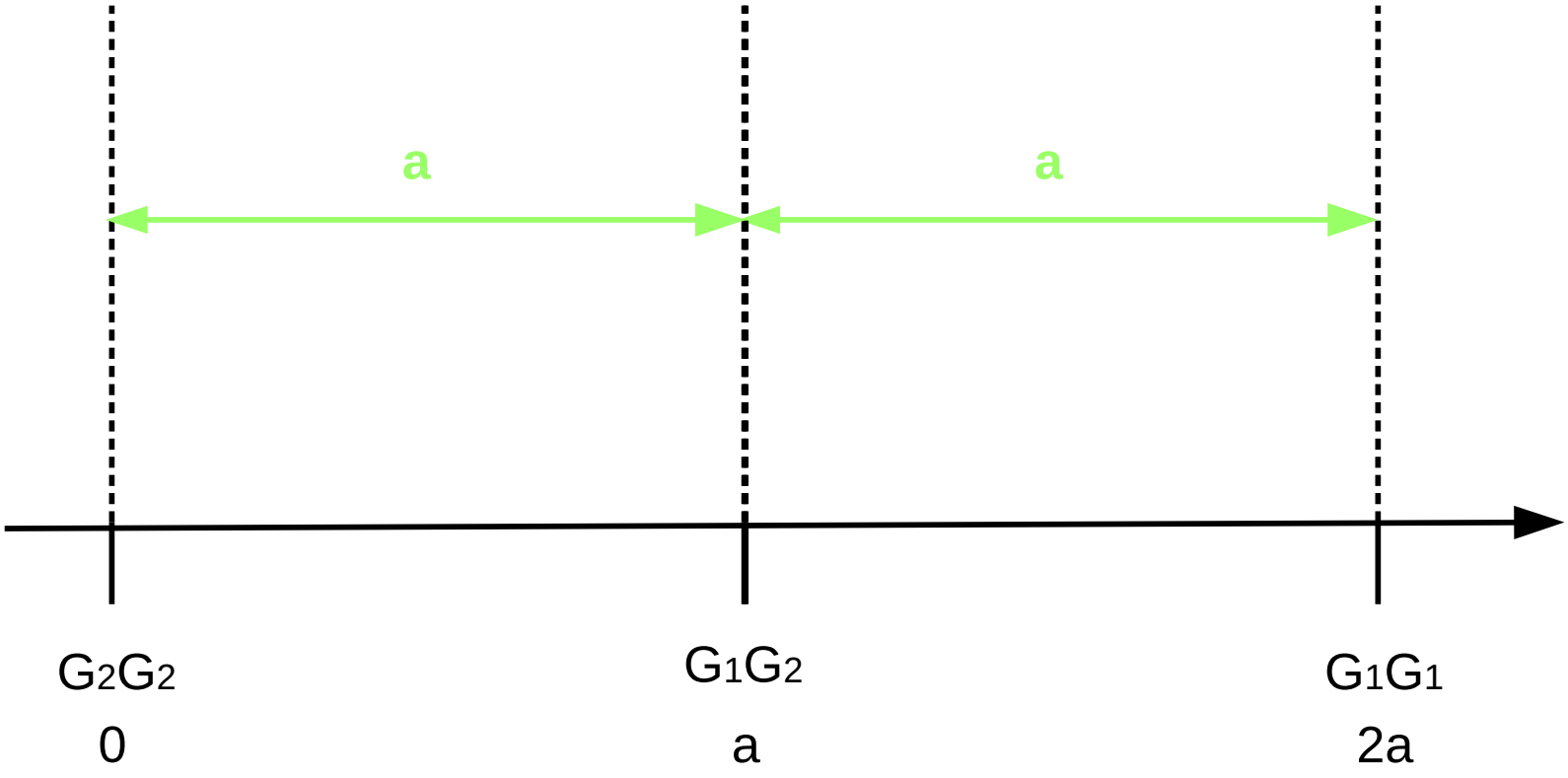
- Regression on the number of positive alleles
- Estimate for slope b_1 corresponds to estimate of marker effect
- Review single-locus model from Quantitative Genetics

Single Locus Model



- Assuming $d = 0 \rightarrow$ genotypic value of $G_1 G_2$ between homozygotes

Modified Single Locus Model



- Transformation of regression on genotypes to regression on number of "positive" alleles (G_1)
- Relationships imposed by regression are meaningful

Relationships

- Expected value for observation for a given genotype

$$E(G_2G_2) = b_0 + 0 * b_1$$
$$E(G_1G_2) = b_0 + 1 * b_1$$
$$E(G_1G_1) = b_0 + 2 * b_1$$

- Differences

$$E(G_1G_2) - E(G_2G_2) = E(G_1G_1) - E(G_1G_2) = b_1$$
$$E(G_1G_1) - E(G_2G_2) = 2b_1$$