

Genes, Rule-breaking, & Popularity: Evidence of an Evocative Gene-Environment Correlation



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Gene-environment interplay

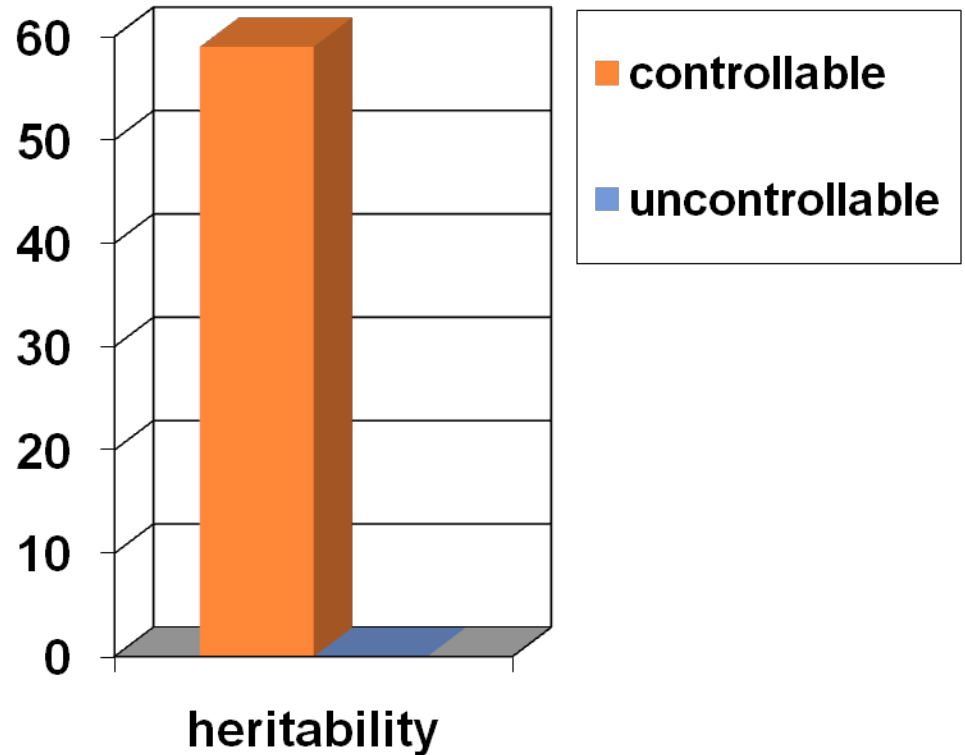


- **Gene-environment interactions are a hot topic**
 - Elucidating environmental activation/suppression of genetic predispositions

Environment



- However, the “environment” is not always independent of the person
 - Understood via the concept of **gene-environment correlations (rGE)**



Billig et al. (1996)

rGE



- **Evocative**
 - Individuals **evoke reactions** from others consistent with their genotypes, reactions that further activate their genotypes

An example



- **Delinquency and rebellion against authority are encouraged among adolescents**
 - Those who follow adult rules are viewed as socially undesirable by their peers (Allen et al., 1989; Bukowski et al., 2000)
- **Should evocative rGE impact this process...**
 - Genes → Behaviors → Social Consequences

The problem...



- **Difficult to explicitly test**
 - characteristics of individual, genetic risk, and social experiences are very difficult to disentangle using traditional methods
- **BUT, there is robust support for evocative person-environment correlations in social selection**

“Person”-environment correlations



- **Raleigh et al. (1991) created settings of uncertain social status**
 - Dominant males removed from monkey troops
 - Treated two remaining males with serotonergic-enhancing or serotonergic-reducing drugs
- **Male treated with the serotonergic-enhancing drug became dominant in every case**
 - Increased socially-affiliative behaviors which in turn led to higher social status

Person-environment correlations



- **Knutson et al. (1998) administered SSRI's or a placebo to normal volunteers for 4 weeks**
 - Measured observer-rated socially-affiliative behavior in a task-controlled setting
 - ✦ Increased with SSRI administration
 - ✦ Correlated .65 with plasma SSRI levels

Is evocative rGE “real”?



- Such findings offer strong support for person-environment correlations
- However, no one has yet to directly test the core proposition of evocative rGE
 - Are particular environmental experiences indirectly evoked by one’s genetic predispositions?

Current study (Burt, 2008, *Psyc Science*)



- Sought to explicitly identify an evocative rGE process using a novel design that combined molecular genetic and social psychology experimental techniques

Sample #1



- **Previously unacquainted college students assessed in groups of 3-5 (n=127 men in 32 groups)**
 - ✦ 19 years of age on average (SD=1 year)

Group activity



- **Participants completed a group party-planning activity and brain teasers**
 - Encouraged to be creative and have fun
 - Participants were unknown to each other prior to assessment
- **Activity designed to elicit social interactions**

The catch...



- After 45-60 minutes, we returned them to their individual rooms, where they completed a sociometric scale
 - Ranked each other ordinally (1, 2, 3,...) and relative to their friends (1-10)
 - ✦ Referred to as a “round-robin” design
- Collected DNA via saliva collection kits

Polymorphism under study



- **5HT2A -G1438A**
 - Polymorphism with promoter region of 5HT2A serotonin receptor gene
 - Chosen because:
 - ✦ The 5HT2A serotonin receptor, including the G-allele in -G1438A, is associated with response to SSRI's (Choi et al., 2005, Kato et al., 2006; Zanardi et al., 2001)
 - ✦ -G1438A is the most widely studied polymorphism within the 5HT2A serotonin receptor gene

Analyses



- **Social Relations Model**

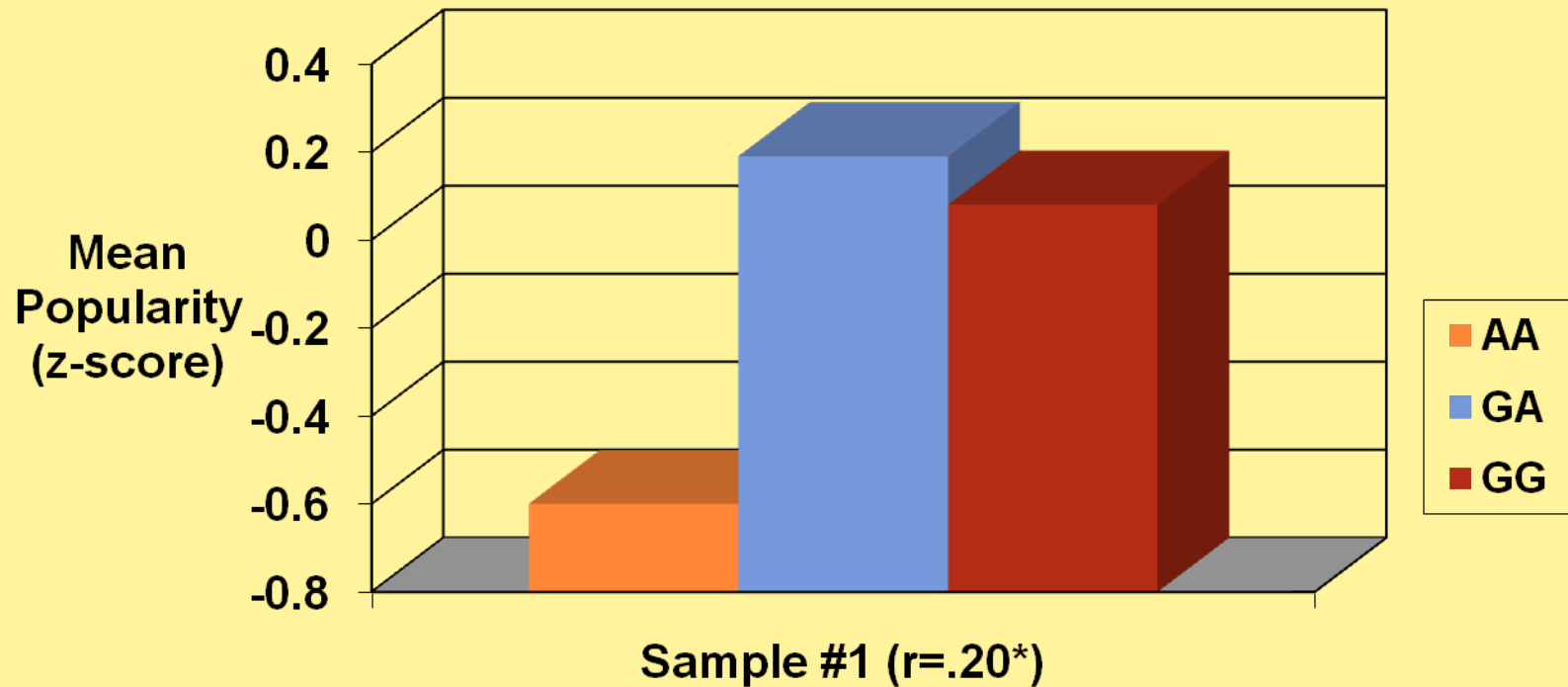
- A two-way random effects model that decomposes sociometric data into 4 components
 - ✦ Constant effect
 - average amount of liking within each group
 - ✦ Actor effect (liking)
 - general tendency of each subject to like others
 - ✦ **Partner effect (likeability)**
 - **general tendency of each subject to be liked by others**
 - ✦ Relationship effect (residual)
 - unique relationship between two subjects (and error)

Analyses



- These individual-level partner effects explicitly capture evocative processes – referred to here as “popularity”
 - ✦ How well-liked is each person in general?
 - Can be estimated for each individual
- Primary question:
 - Is 5HT2A -G1438A associated with one’s popularity?

Is -G1438A associated with popularity?

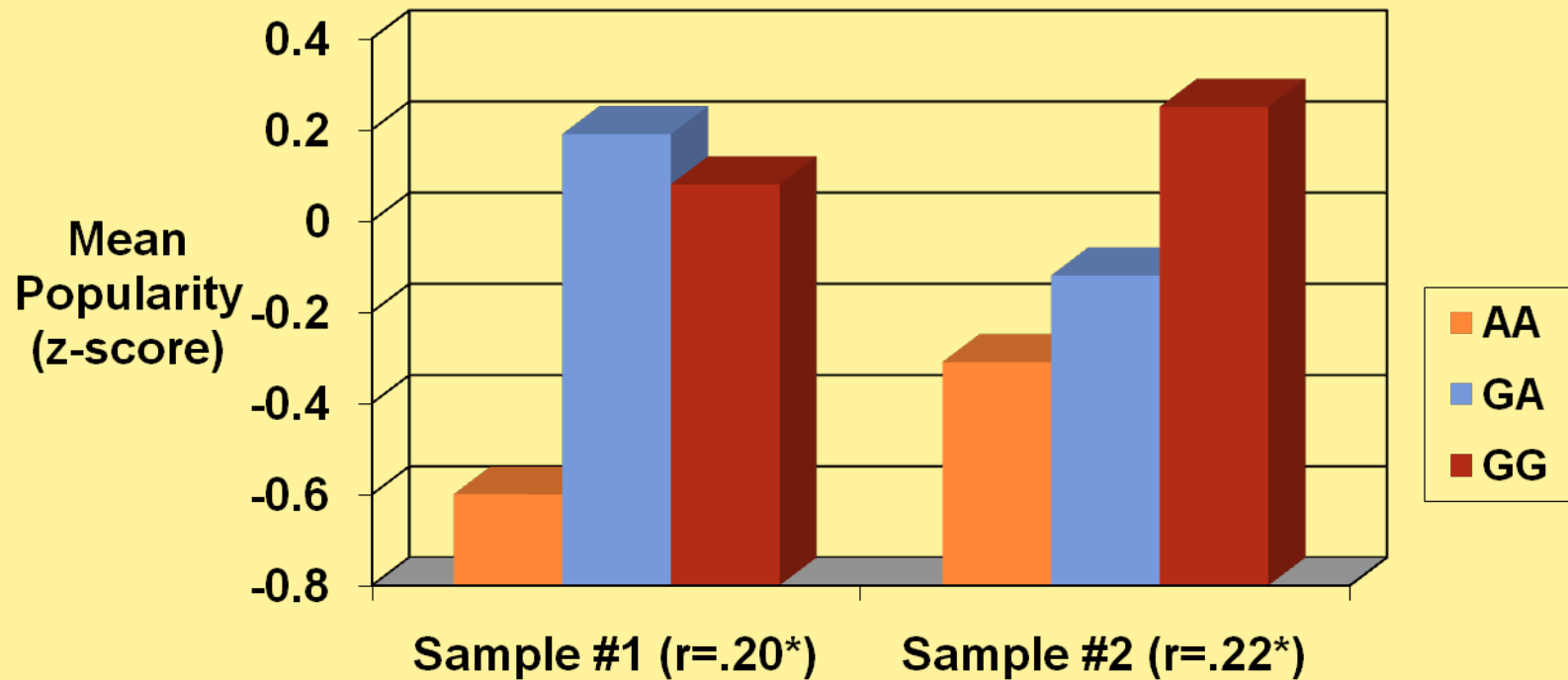


Is -G1438A associated with popularity?



- **YES**
- But would this replicate in another sample??
- Collected a second sample
 - Previously unacquainted college students assessed in groups of 3-5 (n=82 men in 23 groups)
 - Same procedure and analyses

Is -G1438A associated with popularity?



Is -G1438A associated with popularity?



- **YES**
 - Across two independent samples, suggesting the effect is robust to sampling variation
- **Offers first clear empirical evidence of an evocative rGE**

What are the mediating behaviors? (Burt, 2009, *JPSP*)



- It is not biologically feasible for 5HT2A –G1438A to code directly for others' social preferences
 - Any legitimate association should be mediated via participants' attributes/behavior
- Identification of mediating behaviors would provide additional empirical support, and begin to explicate the rGE processes involved

What are the mediating behaviors?



- I focused on rule-breaking (RB) as a possible mediator
 - Adolescents who follow adult rules are viewed as socially undesirable by their peers
 - Impulsivity is associated with higher RB, and has a well-documented association with serotonin

Measurement of RB



- **Indices of RB**
 - Self-reported rule-breaking questionnaires
 - ✦ Capture general tendencies
 - Observer-ratings of antisocial discussion, suggestions, and encouragement of peers by each participant during the group interactions
 - ✦ Capture behaviors upon which sociometric rankings were based
 - Composite of questionnaires and observer-ratings

Associations with RB?



Both samples	Popularity	5HT2A – G1438A
RB_composite	.26**	.19**
RB_ques	.21**	.16*
RB_video	.23**	.16*

Association between popularity and -G1438A



Sobel Z = 2.15 (p = .032)	Unstandardized Effect Estimates	%
Mediated via RB_composite	.043*	21.2
Unidentified mediation	.161*	remainder

Does RB mediate association between -G1438A and popularity?



- **YES (well, partially)**
 - Even so, most of the socially-relevant mediating behaviors remain unidentified

Conclusion



- These findings thus serve as the first “direct” and explicated evidence of an evocative rGE
 - One’s genes appear to induce (albeit indirectly) exposure to particular environmental experiences

Implications & Considerations



- We would expect this evocative process to further activate genetic predispositions for RB
 - Being well-liked is typically experienced as emotionally-reinforcing
 - ✦ Should reinforce tendency to “break the rules”, allowing genetic predispositions to more fully manifest themselves
- rGE should be meaningfully considered when examining GxE

Implications & Considerations



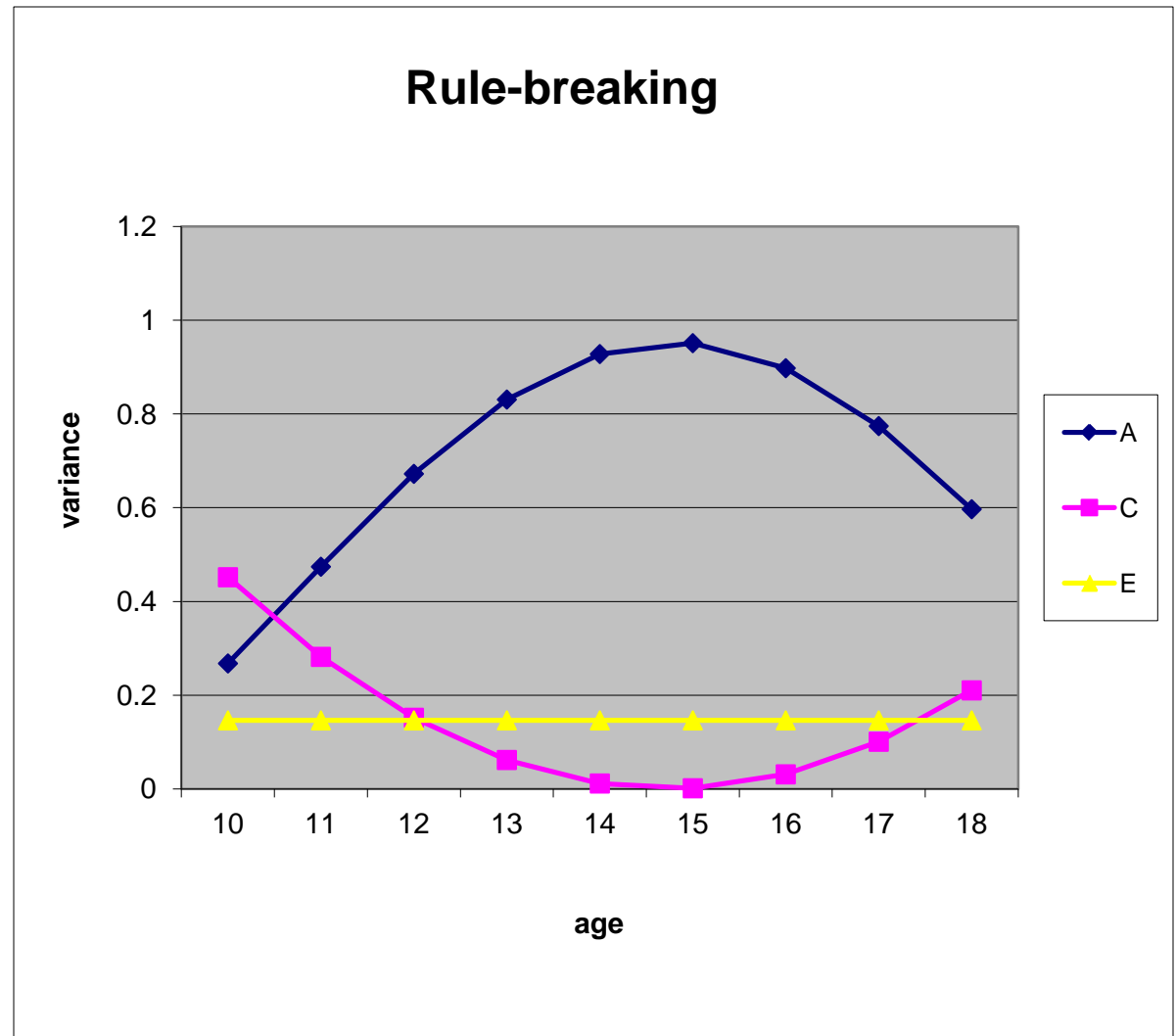
- GxE and rGE processes likely to vary with development
 - Scarr & McCartney (1983), *Child Development*
- Specificity of these findings to emerging adulthood
 - RB isn't "cool" in childhood



Developmental Implications

Genetic influences on RB are expressed most strongly during adolescence

Burt & Neiderhiser (2009)



Implications & Considerations



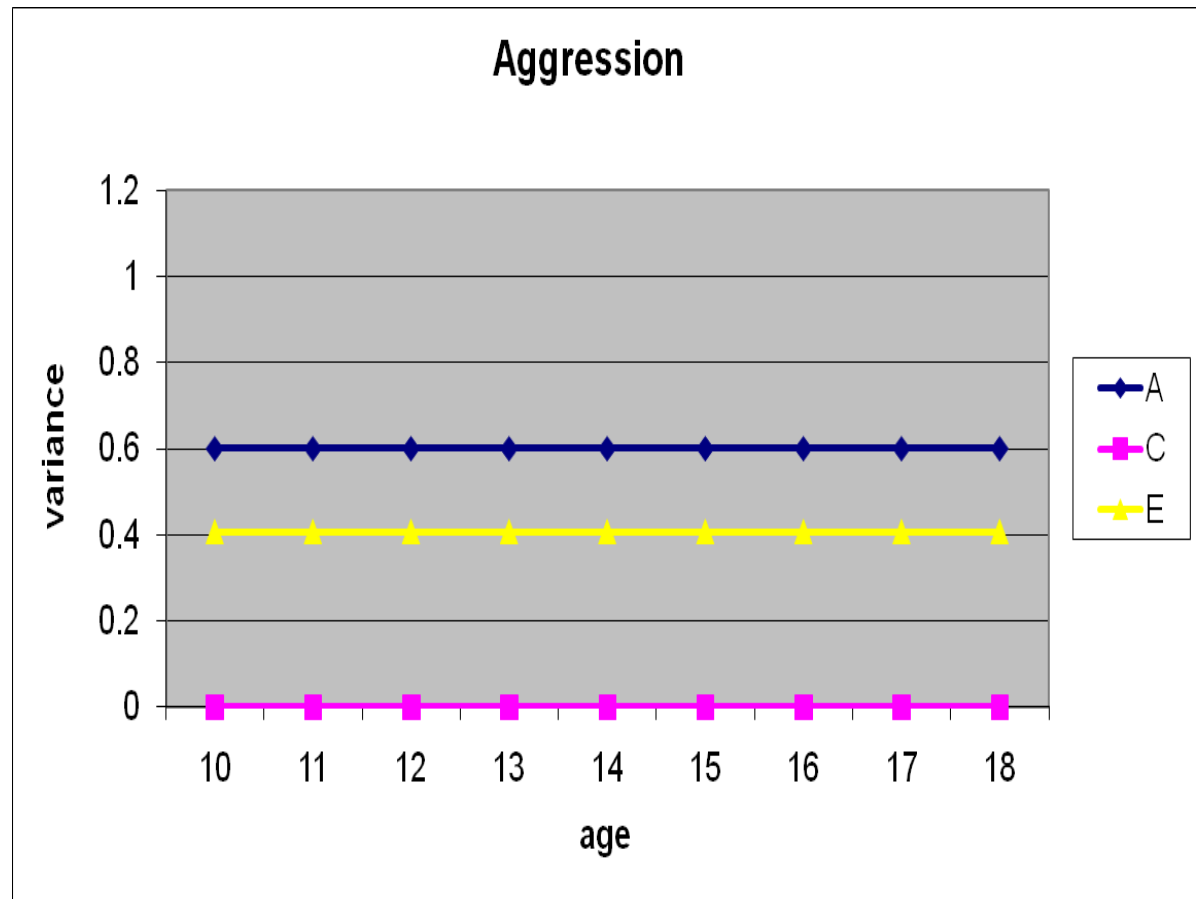
- GxE and rGE processes likely to vary across phenotypes as well
 - e.g., aggression versus rule-breaking



Phenotypic Implications

Aggression is etiologically stable during adolescence

Burt & Neiderhiser (2009)



A few caveats...



- Findings apply only to “first impressions”
- Findings apply only to men

The end

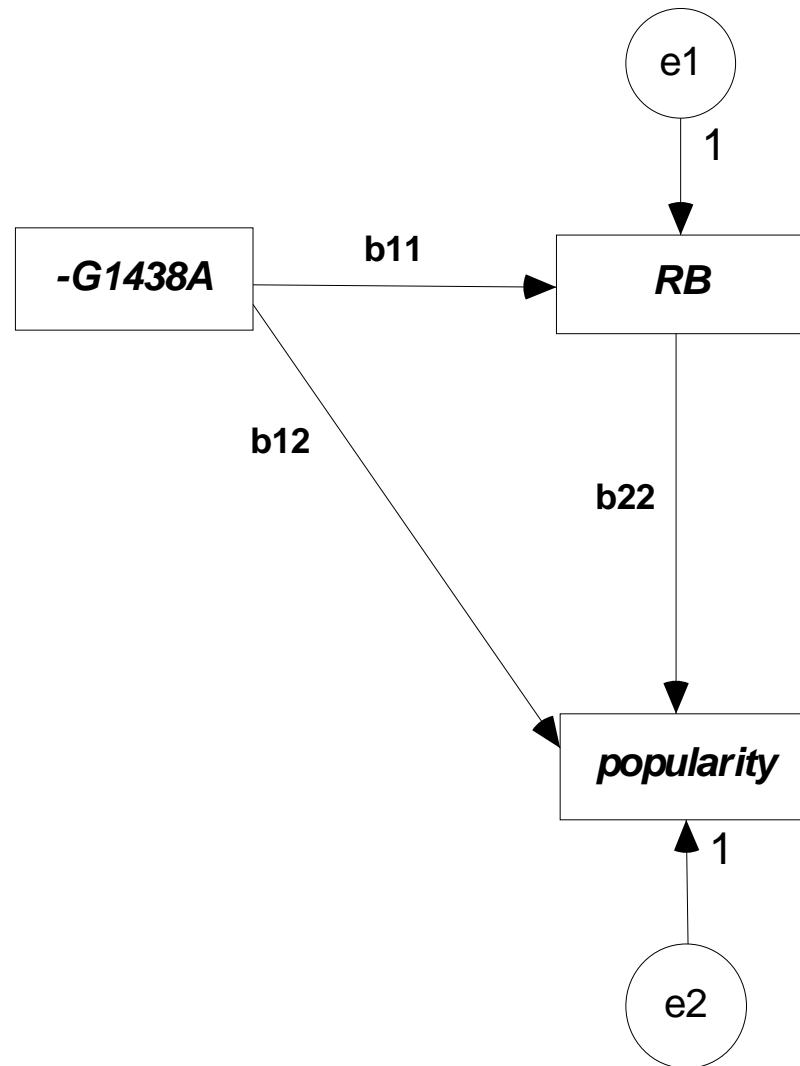


THANKS!

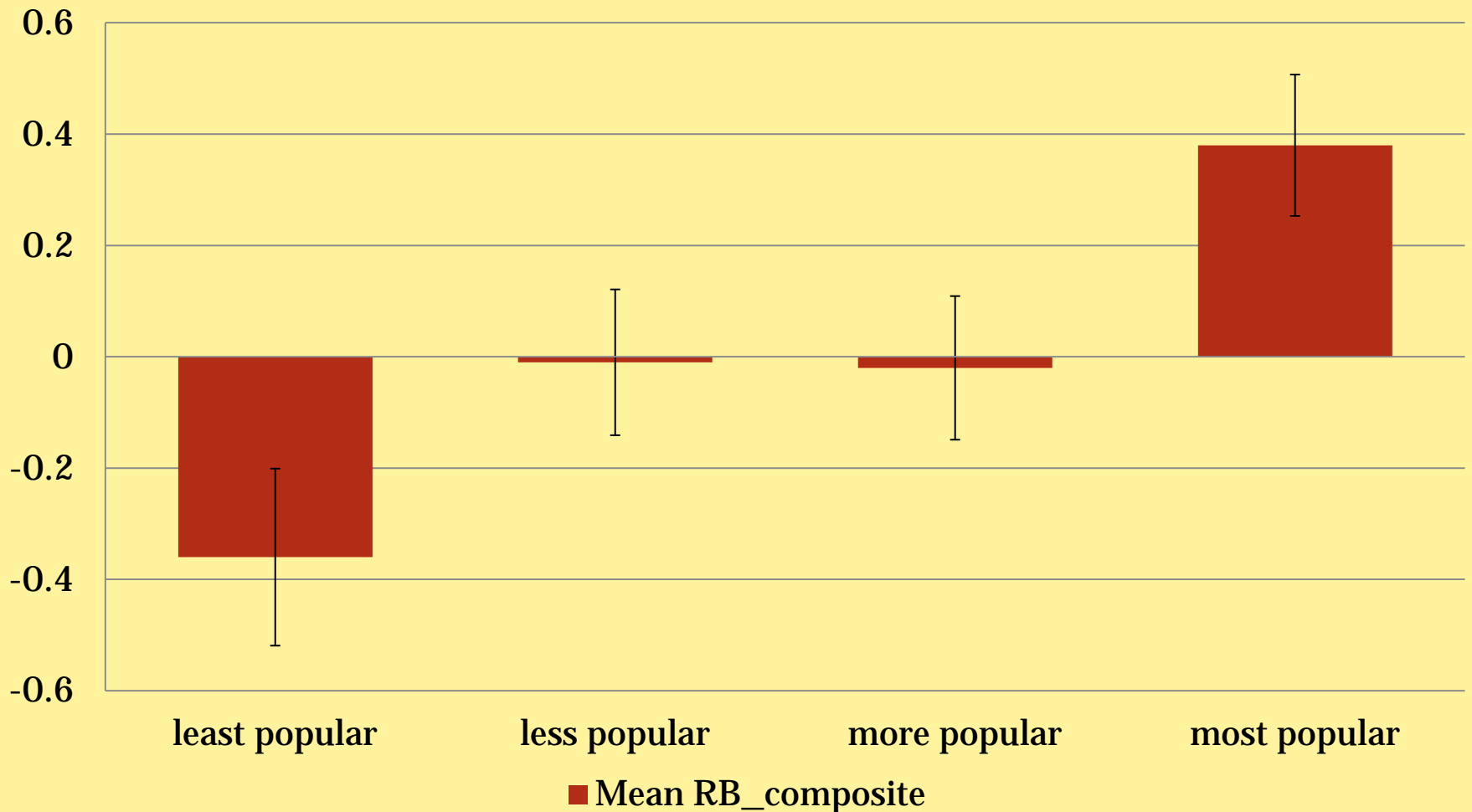
Two sets of analyses

1) SEM to evaluate whether mediational associations were different across the two samples

2) Made use of standard Baron & Kenny (1996) tests of mediation, extended to a multilevel framework (Krull & MacKinnon, 2001)



Association between RB and popularity



HLM regression results



Sobel Z = 2.15 (p = .032)	Estimate (SE)	<i>p</i>-value
Step 1: -G1438A predicts popularity	.206 (.066)	.002
Step 2: -G1438A & RB predict popularity	.161 (.066) .100 (.030)	.016 .001
Step 3: -G1438A predicts RB	.433 (.154)	.006