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RESEARCH REPORT

# Familial Resemblance, Citizenship, and Counterproductive Work Behavior: A Combined Twin, Adoption, Parent–Offspring, and Spouse Approach

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Given the well-documented importance of counterproductive workplace behavior and organizational citizenship behavior (together nontask performance), it is important to clarify the degree to which these behaviors are attributable to organizational climate versus preexisting individual differences. Such clarification informs where these behaviors stem from, and consequently has practical implications for organizations (e.g., guiding prioritization of selection criteria). We investigated familial resemblance for nontask performance among twins, nontwin and adoptive siblings, parents and offspring, and midlife and late-life couples drawn from two, large-scale studies: the Minnesota Twin Family Study and the Sibling Interaction Behavior Study. Similarity among family members' (e.g., parents–offspring, siblings) engagement in nontask performance was assessed to estimate the degree to which preexisting individual differences (i.e., genetic variability) and the environment (i.e., environmentality) accounted for variation in counterproductive and citizenship behavior. We found that degree of familial resemblance for nontask performance increased with increasing genetic relationship. Nonetheless, genetically identical individuals correlated only moderately in their workplace behavior ($r$ = .29–.40), highlighting the importance of environmental differences. Notably, family members were more similar in their counterproductive than citizenship behavior, suggesting citizenship behavior is comparatively more environmentally influenced. Spouse/partner similarity for nontask behavior was modest and did not vary between midlife and late-life couples, suggesting spousal influence on nontask performance is limited. These findings offer insight to organizations regarding the degree of nature (individual differences) and nurture (including organizational factors) influences on nontask performance, which has implications for the selection of interventions (e.g., relative value of applicant selection or incumbent interventions).

*Keywords:* counterproductive work behavior, organizational citizenship behavior, familial resemblance, heritability

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Counterproductive workplace behavior (CWB) and organizational citizenship behavior (OCB), together referred to as nontask performance, are recognized as crucial components of the multidimensional construct job performance. CWB can be defined as behaviors that harm, or have the potential to harm, the legitimate interests of an organization and its members (e.g., Gruys & Sackett, 2003; Ones & Dilchert, 2013). CWB can range from extended breaks, to theft and the physical assault of coworkers, and has been conservatively estimated to cost U.S. organizations billions of dollars a year (see Bennett & Robinson, 2000; Mercado et al., 2018). The economic benefits of OCB (i.e., positive behaviors outside of core job tasks that contribute to maintenance or improvement of the organization's social and psychological environment; Borman & Motowildo, 1993; Lee & Allen, 2002; Organ, 1997, 2018; Sackett et al., 2006) have not been similarly estimated. Nonetheless, citizenship behaviors which include supporting colleagues and the organization above and beyond organizational requirements, are associated with increased unit-level performance and decreased turnover (Podsakoff et al., 2009). Additionally, supervisors can give a theoretical dollar value to nontask performance when asked (Orr et al., 1989), and CWB and OCB are included in global ratings of job performance (Rotundo & Sackett, 2002). In fact, a succinct definition of job performance was given by Rotundo and Sackett (2002), who specified an employee's contribution as $\omega 1 *$ task performance + $\omega 2 *$ OCB – $\omega 3 *$ CWB, where

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the individual weights (ω) are determined by organizational values and the values of individual raters (Rotundo & Sackett, 2002; see also Laczo, 2002; Lievens et al., 2008).

## Understanding Origins

Although the importance of nontask performance to organizational success has been well documented, the degree to which organizational context and preexisting individual differences contribute to nontask performance has long been debated in the I/O literature (e.g., Davis-Blake & Pfeffer, 1989; Konovsky & Organ, 1996). Research has shown that a range of specific factors that includes both contextual (e.g., organizational justice and ethical leadership) and employee personality (e.g., conscientiousness and self-esteem) contribute to nontask performance (Avey et al., 2011; Mercado et al., 2018; Sackett et al., 2006). Understanding the total contributions of contextual factors and preexisting individual differences to nontask performance (i.e., the combination of counterproductive work behavior, CWB, and organizational citizenship behavior, OCB) can lend key insight into how such variation in behaviors arise. One approach to making this determination would be aggregating the effect of known influences, although this would seem to require that all relevant influences on CWB and OCB were known a priori. We propose an alternative approach based on the analysis of twin and family data. In essence, we seek to investigate the importance of preexisting differences be estimating the degree to which different family members have similar levels of nontask performance. Although analysis of familial resemblance is not without its own limitations, it does have the advantage of providing a lower bound estimate of the contribution of preexisting individual differences to nontask performance.

Behavioral genetics is the subdiscipline within psychology concerned with the analysis of family resemblance data to draw conclusions about the aggregate contributions of genetic and environmental factors to individual differences in behavior. Arvey et al. (2016) discussed the importance of behavior genetics in understanding the role of the person and environment in work-related outcomes and encouraged use of this methodology among organizational researchers. There have, nonetheless, been only a few applications of behavioral genetics in applied psychology including studies of job satisfaction (Li et al., 2016), entrepreneurship (see Arvey et al., 2016, for a review), and a single study of CWB (Stanek et al., 2017). These studies used the analysis of familial resemblance to decompose the variance in a specific trait into its genetic and environmental components. Since variance indexes the degree of individual differences in a trait, these analyses effectively quantified the contribution of genetic and environmental factors to individual differences. The basic analytical model that has been used in most twin studies (Polderman et al., 2015) assumes that trait variance can be decomposed into three components: additive genetic effects (designated as A and known as the trait's heritability or $a^2$ when expressed as a proportion of trait variance), shared environmental effects (C, which are the effects of environmental factors shared by reared-together relatives and a source of their behavioral similarity, or $c^2$ when expressed as a proportion of trait variance), and nonshared environmental effects (E, which are the effects of environmental factors that are not shared by reared-together relatives and so are a source of their behavioral dissimilarity, or $e^2$ when expressed as a proportion of trait variance; Arvey & Bouchard, 1994).

Behavioral genetic studies can provide insight into the contribution of preexisting individual differences to traits like OCB and CWB by showing that they are heritable. Specifically, the importance of preexisting individual differences would be strongly implicated by finding that genetically related individuals engage in similar levels of OCB and CWB even when employed by different organizations. Existing behavioral genetic research leads to the strong expectation that both OCB and CWB will be heritable to some degree. Behavioral genetic studies of a wide range of behavioral traits (i.e., traits that are marked by fairly consistent behaviors, attitudes, beliefs, or values) have repeatedly shown that the resemblance between any two family members is proportional to the degree to which they are genetically related, implicating the importance of genetic influences (Plomin et al., 2016). For instance, fraternal (i.e., dizygotic) twins on average have half the genetic overlap as identical (i.e., monozygotic) twins, and fraternal twins are less similar in their behavioral traits than identical twins are. Indeed, the consistency with which genetic influences on behavior have been found has led to what has been called the First Law of Behavior Genetics: "All human behavioral traits are heritable" (Turkheimer, 2000). Even though existing research consequently leads us to expect both OCB and CWB will be heritable, and by implication that preexisting individual differences are important, that research does not tell us the magnitude of heritability nor whether one trait is more heritable than the other. Heritability can markedly differ across physical and psychological traits, with genetic variation accounting for relatively small proportions of variance (less than 10%), moderate proportions of variance (~30%–50%), or large proportions of variance (upwards of 60%), depending on the trait (Polderman et al., 2015). For example, heritability estimates of 50% for OCB but only 10% for CWB would strongly implicate the contribution of preexisting individual differences to the former but nongenetic factors, including organizational factors (e.g., coworker or manager influences), to the latter. In this example, an individual predisposed to OCB would likely engage in prosocial work behaviors under a variety of environmental contexts (e.g., with or without encouragement from the organization). Simultaneously, about half the variation in OCB would stem from environmental influences such as ethical leadership and coworker influences, and potentially nonwork-related environmental factors (e.g., family stressors, nonwork social norms). Correspondingly, a lower heritability in CWB would indicate that environmental influences account for the majority of the variance in CWB. In either case, it is important to recognize the additive nature of the environmental and genetic effects—variation in both genetics and environmental experiences contribute to differences in individuals' behavioral traits, including CWB and OCB.

## Predictors of Nontask Behavior Guiding Predictions for Nontask Behavior

### Insights Into Heritability

While there has been limited research on familial resemblance for nontask performance, behavioral genetic research on correlates of OCB and CWB provides a basis for hypotheses about the magnitude of genetic and environmental contributions to these two traits. Both CWB and OCB are correlated with individual difference traits well established as heritable in the behavioral genetic literature including general cognitive ability (Briley & Tucker-Drob, 2013;

Gonzalez-Mulé et al., 2014) and personality (Chiaburu et al., 2011; Matteson et al., 2013; Mercado et al., 2018). In addition, the general externalizing factor of which CWB may be an indicator—and its established indicators including antisocial behavior and substance abuse (Krueger et al., 2005)—has been shown in multiple studies to be moderately to strongly heritable, $a^2 = .60–.80$ (e.g., Burt, 2009; Hicks et al., 2004; Kendler et al., 2011; Krueger et al., 2002). Of interest is the study by Hicks et al. (2013), which found significant resemblance in externalizing among both biological and adoptive (i.e., nongenetically related) siblings, suggesting both genetic and shared environmental influences on externalizing. Similar findings have been identified for criminal behavior (Kendler et al., 2015). Although there have been few behavioral genetic studies of prosocial behavior, of which OCB might be an indicator, twin studies have found significant heritable effects for social responsibility, altruism, and childhood prosocial behaviors (Knafo & Plomin, 2006; Koenig et al., 2007; Rushton, 2004). Such findings lead us to hypothesize that:

> *Hypothesis 1:* Like most behavioral traits, OCB and CWB will be heritable.

## Differential Heritability

We expect to find that both OCB and CWB are heritable; we do not, however, expect them necessarily to be equally heritable. Engagement in CWB has been consistently seen in the face of organizational injustice, suggesting that this behavior is to some degree reactive (see Mercado et al., 2018). Analogously, supportive and ethical leadership seem to enhance the expression of OCB (Podsakoff et al., 2000; Rockstuhl et al., 2012). Although organizational factors are consequently seen to play a role with both OCB and CWB, the literature suggests that OCB may be more strongly tied to the work environment than CWB. Unfortunately, our confidence in this conclusion is limited by the few studies to have directly compared the prediction of OCB and CWB (i.e., O'Brien & Allen, 2007). O'Brien and Allen (2007) found that in univariate models, organizational factors (i.e., perceived organizational justice, perceived organizational support, and job satisfaction) accounted for consistently more variance in self-reported OCB (ranging from 8.3% to 18.5%) than self-reported CWB (ranging from 1.1% to 7.0%). In contrast, personality traits (i.e., Conscientiousness, trait anger, and locus of control) accounted for similar amounts of variance in CWB (ranging from 1.5% to 20.7%) and OCB (0.0%–19.3%). These findings suggesting that organizational factors matter more for OCB than CWB, lead us to the hypothesis that:

> *Hypothesis 2:* The contribution of unique environmental factors will be greater for OCB than for CWB, such that family members will be more similar in their engagement of CWB than OCB.

Although we have emphasized the importance of heritability in implicating preexisting individual differences, the long-term consequences of common rearing (what behavioral geneticists call the twins' shared environment), would also implicate preexisting individual differences. Unlike heritable influences, which are pervasive, there is limited evidence of shared environmental influences on behavioral phenotypes (Plomin et al., 2016; Turkheimer, 2000), so that we might expect limited contribution of the shared environment to nontask performance. Nonetheless, behavioral geneticists have found that some traits are influenced by the shared environment (e.g., cognitive ability) even though the shared environmental influence appears to wane with age (Tucker-Drob & Briley, 2014). Importantly, one of the exceptional behavioral genetic traits showing an effect of common rearing is externalizing psychopathology and its indicators (Han et al., 1999; Hicks et al., 2013). Given the previously cited study by Stanek et al. (2017) linking CWB with externalizing psychopathology, we hypothesize that:

> *Hypothesis 3:* There will be enduring effects of the shared rearing environment in CWB but not OCB.

## Nature of Spousal Similarity

It appears that all (or nearly all) complex behavioral traits are to some degree heritable. None is, however, completely heritable. The environment is always important, although the nature of environmental influence appears to be predominantly of the nonshared rather than shared variety (Turkheimer, 2000). One source of nonshared environmental influence would be the previously discussed organizational factors, but nonshared influences need not be restricted to workplace factors. To investigate one possible nonworkplace factor within our familial resemblance framework, we also analyzed spousal similarity for CWB and OCB. Spouses may show similarity on traits because of assortative mating (i.e., the "tendency for individuals to select partners resembling them based on certain characteristics"; Humbad et al., 2010, p. 827; see also Eaves et al., 1984). Alternatively, spousal similarity may be a consequence of the behavior of one spouse influencing that of the other. While correlation should not be taken for causation, the convergence of spousal similarity on a trait over time implies some degree of spousal influence rather than, or in addition to assortative mating. Under assortative mating, we expect spousal similarity to be maximal at the time of mating and to be stable or modestly wane with age. Alternatively, under the spousal influence model, we expect spouses to grow in similarity over time, a phenomenon known as spousal convergence (Humbad et al., 2010).

While spousal similarity on most personality traits tends to be low (Plomin & Deary, 2015), there is evidence for spousal similarity on Aggression (Humbad et al., 2010), which appears to increase with the length of marriage, suggesting spousal convergence. Spouses, like other nuclear family member pairs, are also similar in externalizing (Galbaud du Fort et al., 2002; Taylor et al., 2000), criminal behavior (van de Weijer & Beaver, 2017), and traits such as Alienation and Traditionalism (Humbad et al., 2010). In a sample of Dutch spouses spanning two generations, van de Weijer and Beaver (2017) identified similarity on criminal behavior prior to marriage, which suggested assortative mating, as well as increased similarity between spouses on criminal offending after marriage, suggesting spousal influence. Interestingly, Leikas et al. (2018) found no spousal similarity on benevolence values, values for improving the welfare of the in-group (Schwartz, 2012), suggesting individuals neither select a partner on such values, nor become more similar on such values over time. This leads us to the hypothesis that:

*Hypothesis 4:* Spousal/partner similarity will be greater for CWB than OCB, and late-life couples will be more similar on CWB than midlife couples will be.

## Summary of the Present Study

We investigated the nature of familial resemblance in CWB and OCB among monozygotic (MZ, i.e., identical) twins, dizygotic (DZ, i.e., fraternal) twins, nonadoptive (i.e., biologically related) siblings, adoptive siblings, adoptive and nonadoptive parents and offspring, midlife couples, and late-life couples. Data came from the Minnesota Center for Twin and Family Research, which includes a series of studies that follow adolescents into adulthood, their rearing parents, and their later spouses/partners. Biometric analyses of twin and adoptive/nonadoptive sibling data were used to estimate degree of heritability and environmentality of OCB and CWB by taking advantage of degree of genetic relatedness and rearing environment overlap. Similarity among adoptive siblings and adopted offspring and their rearing parents would implicate the contribution of shared environmental factors from childhood or adolescence. Greater MZ than DZ correlations would implicate genetic variation. Similarity between spouses was also assessed. Greater similarity among late-life than midlife couples would suggest spousal influence rather than, or in addition to, assortative mating.

# Method

## Sample and Nontask Performance Measures

The research draws from two ongoing studies from the Minnesota Center for Twin and Family Research (MCTFR): The Minnesota Twin Family Study (MTFS) 11- and 17-year-old cohorts and the Sibling Interaction and Behavior Study (SIBS). Both studies involve longitudinal assessment of two siblings beginning in adolescence and extending through early adulthood, along with their rearing parents. Sibling pairs included both MZ and same-sex DZ twins, and adoptive (i.e., genetically unrelated), nonadoptive (i.e., full biological siblings), and mixed adopted/nonadopted sibling pairs. Inclusion criteria at the intake assessment included living within driving distance of the University of Minnesota and having no physical, intellectual, or behavioral disabilities that would preclude completion of in-person assessments. In the SIBS sample, adoptive sibling pairs were required to be genetically unrelated to each other.

The University of Minnesota Institutional Review Board (IRB) approved both studies. The IRB study title and protocol number for the twin and twin-spouse/partner study were “Adolescent drinking and midlife outcomes: A prospective cotwin control study” and 9109M04330. The IRB study title and protocol number for the sibling and parent study were “Free will, determinism, and the development of character: An adoption study” and STUDY00001118. Research using data from these ongoing studies has been published in a variety of journals (e.g., Iacono & McGue, 2002; McGue et al., 2007).

### *Twins and Their Romantic Partners*

The initial twin’s sample included 2,764 male and female MZ and same-sex DZ twins that were first assessed at the target age of either 11 or 17 (see Iacono & McGue, 2002). Twin families were recruited via publicly available birth records of twins born between 1972 and 1984 in Minnesota. The Minnesota-statewide sample reflects the state’s population for the birth years sampled, with 95.8% participants being White. Data for this study come from the fourth follow-up to the initial assessment, which started in 2017 and remains ongoing. One thousand and ninety-five twins (466 males and 629 females) were assessed and 1,012 of these twins (433 males and 579 females) met the criteria to be included in the analyses reported here: They were employed and had a valid CWB or OCB score. In this twin sample, there were 261 MZ twin pairs, 130 DZ twin pairs, and 230 unmatched (i.e., singleton) twins. Twins had a mean age of 40.9 years ($SD = 2.5$). In some cases, education level was not available for the twins at the most recent follow-up. In these cases, education was backfilled with previous reports of education, and age at which education was assessed ranged from 24.4 to 47.5 years (mean = 34.4, $SD = 6.4$). Spouses/partners of twins were also recruited to answer a series of questionnaires at this follow-up assessment if they were living with the twin partner. Five hundred and eighty-six spouses/partners met our inclusion criteria (i.e., employed and had a matched spouse who met the twin inclusion criteria) and were included in this study. Spouse/partners had a mean age of 41.8 years ($SD = 4.7$). The majority of the twin–spouse/partner pairs reported being married (89.6%), and 16 were same-sex couples. Follow-up data collection remains ongoing and additional information on recruitment and sample details can be found in Iacono et al. (1999), Iacono and McGue (2002), and McGue et al. (2017).

### *Sibling Pairs and Their Rearing Parents*

The original SIBS sample included 1,234 offspring from 409 adoptive (from 124 mixed families and 285 adoptive families) and 208 nonadoptive sibling pairs and their rearing parents. Initiated in 1998, the families were systematically ascertained from three large adoption agencies in Minnesota for adoptive siblings or from Minnesota state birth records for nonadopted sibling pairs. Adoptions were closed, and no data was collected from adoptive offspring’s birth parents. Additional details concerning the recruitment of the SIBS sample can be found in McGue et al. (2007). At the intake assessment, a total of 613 (99% of the target sample of 617) mothers and 551 (89%) fathers were assessed. Among the 1,234 assessed offspring in the 617 families, two (from different adoptive families) were judged to be ineligible after they had completed their intake assessment (one adopted participant was found to be biologically related to their participating sibling and a second adopted participant had an IQ that suggested mild intellectual disability, a study exclusion criterion).

Data for this study come from SIBS follow-up three, which started in 2018 and continued through 2021. Parental data broadly reflect the state’s population in racial demographics, with almost all rearing parents being White, but not in socioeconomic status (SES; measured via a combination of educational attainment, income, and occupational status), adoptive parents have higher than average SES. Adoptive offspring were primarily East Asian (66%), with approximately 21% of adoptive offspring White, and the remaining 13% another ethnicity. Seven hundred and sixty-nine offspring and 587 parents completed the follow-up three assessment. Among these, 708 offspring (280 males and 428 females, mean age = 31.8 years, $SD = 2.7$) and 536 parents (mean age = 64.8 years,

$SD = 4.8$) also met the inclusion criteria for the present study: They were employed, or had been employed in the case of the parents, and had a valid CWB or OCB score. An additional inclusion criterion was required of the parents, that they had a participating offspring or spouse.

### *Nontask Work Behavior Measures*

Self-report was used for all measures and samples in this study. The items and prompts for nontask work performance were the same for the twins, twin–spouse/partners, and sibling pairs, but slightly different for parents to allow responses from parents whose most recent employment occurred more than 3 years before the time of assessment. Twins, twin–spouse/partners, and siblings pairs were asked to rate the extent to which they engaged in the behaviors over the past 3 years if they had been employed or self-employed full or part time at any time in past 3 years. Sibling rearing parents were asked if they were currently or previously employed, and asked to answer nontask performance items based on their current job or most recent job if they had been, but were not currently, employed. The full scales can be found in the Supplemental Table S9 and Table S10, and item level descriptives can be found in the Table S23. To minimize the effect of extreme scores, all scores were winsorized at three standard deviations above and below the mean within each sample (twins, twin–spouse/partners, siblings, and parents) for CWB, OCB, and their facets. This affected less than 2% of the scores for each scale in each sample (vs. an expected .3% if the data were normally distributed). Distributions of scores before and after winsorization can be found in Supplemental Table S12. While there is evidence that performance is generally normally distributed, nonnormality can become an issue when noncomparable jobs are examined (Beck et al., 2014), as may be the case in our community sample where occupation is not controlled for.

**OCB Measure.** OCB was measured via an adapted version of Laczo's (2002) 15-item scale (see also Sackett et al., 2006), which measures Coleman's and Borman's (2000) three-factor model of OCB: interpersonal support (e.g., helping and motivating others), organizational support (e.g., loyalty in times of hardship, complying with rules and procedures), and conscientiousness initiative (i.e., persisting with additional effort, taking initiative). Items were rated on a 5-point frequency scale (0 = *Never*, to 4 = *Always*), whereas in Laczo (2002), the items were rated on a 4-point scale. Some questions were also slightly reworded (see supplement for a comparison between the original and MCTFR items). An overall OCB score was created by summing all 15 items to assess an overall tendency toward prosocial workplace behavior. OCB facets (i.e., conscientious initiative, organizational support, interpersonal support) were each the sum of five items in order to assess familial similarity in specific domains of prosocial workplace behavior. Internal consistency reliabilities for the total OCB score were $\alpha = .85$ and .84 in combined twins/partners and siblings/parents samples respectively, and similarly high for the five-item conscientious initiative and organizational support OCB facet scales ($\alpha$ from .78 to .80). Internal consistency reliability was, however, modest for the five-item interpersonal support OCB facet scale ($\alpha$ from .54 to .57; see Table 1 and Supplemental Table S2). For completeness, we report results for this latter facet scale but encourage care in interpreting its results given its low reliability.

**CWB Measure.** CWB was measured via an adapted version of Bennett and Robinson's (2000) 19-item scale. Their scale consists of seven counterproductive work items targeted toward individuals (i.e., interpersonal deviance, CWBI) and 12 items targeted toward the organization (i.e., organizational deviance, CWBO). Items were rated on a 5-point frequency scale (0 = *Never*, to 4 = *Always*), whereas in Bennett and Robinson (2000), the items were rated on a 7-point scale, minor rewording also occurred for some questions. For instance, exchanging "took" for "taken," or adding "when not allowed" to the end of the item "Used an illegal drug or consumed alcohol on the job" (see supplement for a comparison between the original and MCTFR items). An overall CWB score was calculated by summing all 19 items, and facet-level scales for CWBI and CWBO computed by summing the 7 and 12 items, respectively. Internal consistency reliabilities for overall CWB were .84 and .86 in the twins-spouse/partners and siblings-parents samples respectively, and the two facets ranged from $\alpha = .78$ to .82 across two samples (see Supplemental Table S2).

## Familial Resemblance Analysis

Our analysis of familial resemblance began with the computation of correlations among all possible relative pairings including: MZ twins, DZ twins, adoptive siblings, nonadoptive siblings, nonadoptive parent–offspring, adoptive parent–offspring, the twins and their spouse/partners (i.e., midlife couples), and the SIBS mother–father pairs (i.e., late-life couples). For twins, intraclass correlations were estimated using the *psych* package in R with unmatched twins included to be consistent with the full-information maximum-likelihood method used in the biometric analysis. For nontwin siblings, groups were formed by older versus younger siblings for interclass correlations analyzed in the *stats* package. Interclass correlations were also used for parent–offspring, midlife couple, and late-life couple correlations. For parent–offspring correlations, the average of the two parents' CWB and OCB scores was used after correcting for differences by sex. When only one parent provided a CWB or OCB score that sex-corrected value was used. The significance level was set at $p < .05$.

## Biometric Model Analysis

The second stage of our analysis involved the fitting of biometric models. Raw CWB and OCB scores were adjusted using regression for age and sex separately in the two samples and the residuals used in the biometric analyses (see Supplemental Table S3, for regression results; twin and nontwin sibling correlations by sex can be found in Table S17). Twin pairs and unmatched twins and siblings (i.e., singletons; cotwin or cosibling not present) were included in these models. Full-information maximum-likelihood was used to employ all available data including the nonpaired twins and siblings, who provide information with respect to the means and variances of the phenotypes. The standard biometric method (Neale & Cardon, 1992) decomposes variance in a quantitative phenotype (P) into additive genetic factors (A; used to estimate heritability), shared environmental factors (C; the contribution of environmental factors shared by reared-together relatives), and unique environmental factors (E; the contribution of environmental factors unique to members of a family). Variance due to measurement error is included in the E component.

In the standard biometric formulation (see Neale & Cardon, 1992), the variance in a quantitative phenotype, $P$ (e.g., CWB), can be represented as:

**Table 1**
*Descriptive Statistics*

| Sample[a] | Twin sample | Spouse/Partners of twins | SIBS sample | Parents of SIBS |
|---|---|---|---|---|
| Overall *N* | 1,012 | 528 | 708 | 536 |
| Female *N* (%) | 513 (58.1%) | 220 (41.7%) | 336 (54.7%) | 306 (57.0%) |
| Age *M* (*SD*) | 40.9 (2.5) | 41.8 (4.7) | 31.8 (2.7) | 64.8 (4.8) |
| Range | 35.8–47.8 | 29.4–59.7 | 25.7–40.6 | 52.5–77.5 |
| College degree or higher *N* (%) | 533 (54.6%) | 289 (54.7%) | 496 (70.1%) | 351 (65.5%) |
| Workplace behavior | | | | |
| OCB *M* (*SD*) | 44.9 (7.0) | 44.2 (7.2) | 44.2 (6.8) | 46.0 (6.2) |
| Range | 24–60 | 24–60 | 24–60 | 28–60 |
| α | .85 | | .84 | |
| Range possible 0–60 | | | | |
| OCB Conscientious Initiative *M* (*SD*) | 14.3 (3.2) | 14.0 (3.3) | 14.2 (3.2) | 14.5 (2.8) |
| Range | 5–20 | 4–20 | 5–20 | 6–20 |
| α | .80 | | .79 | |
| Range possible 0–20 | | | | |
| OCB Organizational *M* (*SD*) | 14.5 (3.2) | 14.3 (3.2) | 14.3 (3.1) | 15.1 (2.9) |
| Range | 5–20 | 5–20 | 5–20 | 6–20 |
| α | .78 | | .78 | |
| Range possible 0–20 | | | | |
| OCB Interpersonal *M* (*SD*) | 16.1 (2.2) | 15.9 (2.3) | 15.7 (2.2) | 16.4 (2.1) |
| Range | 10–20 | 9–20 | 9–20 | 10–20 |
| α | .54 | | .57 | |
| Range possible 0–20 | | | | |
| CWB *M* (*SD*) | 6.7 (5.4) | 7.0 (5.5) | 8.3 (6.1) | 6.0 (4.9) |
| Range | 0–24 | 0–24 | 0–28 | 0–21 |
| α | .84 | | .86 | |
| Range possible 0–76 | | | | |
| CWB Interpersonal *M* (*SD*) | 2.7 (2.8) | 2.9 (3.1) | 3.3 (3.2) | 2.0 (2.3) |
| Range | 0–12 | 0–13 | 0–14 | 0–9 |
| α | .82 | | .82 | |
| Range possible 0–28 | | | | |
| CWB Organizational *M* (*SD*) | 4.0 (3.4) | 4.0 (3.6) | 5.0 (3.9) | 3.9 (3.4) |
| Range | 0–15 | 0–15 | 0–18 | 0–14 |
| α | .78 | | .80 | |
| Range possible 0–48 | | | | |

*Note.* CWB = Counterproductive work behaviors; OCB = Organizational citizenship behaviors; *M* = Mean; *SD* = Standard deviation.
[a] Sample size ranges from 1,011 to 1,012 in the Twins sample, 516 to 528 in the Twin-Spouse/Partners sample, 704 to 708 in the Parents sample, and 535 to 536 in the SIBS Offspring sample. See Supplemental Table S15, for complete breakdown of missingness. Alpha calculated for combined twins–partners sample and sibling–parents sample.

$$P = A + C + E \tag{1}$$

This model is frequently referred to as the ACE model. The expected similarity among relatives can be derived for this model under standard biometric assumptions (Plomin et al., 2013). Such assumptions include that the environment functions the same for all sibling pairs (e.g., twins do not have more similar environments than nontwin siblings) and that assortative mating is not present. Both assumptions were examined in this article—assortative mating via analysis of spousal similarity and equal environmental similarity of sibling pairs by estimating a twin-specific environment parameter in the ACE model, which was made possible by inclusion of the nontwin sibling data as explained below. An additional assumption is that genetic effects are additive (i.e., no additional increase for a phenotype due to interactions between genes—the sum of the parts *is* equal to the whole). A substantial meta-analysis of over 2,700 twin studies of more than 17,000 different traits by Polderman et al. (2015) concluded that the additive genetic assumption generally held.

Reared-together MZ twins share a genome and a rearing environment, while reared-together DZ twins share half of the additive genetic effect and a rearing environment, giving:

$$\begin{gathered}\text{Expected MZ Covariance} = A + C \\ \text{Expected DZ Covariance} = .5\ A + C\end{gathered} \tag{2}$$

Similarly, the expected similarity among adopted (who are genetically unrelated but reared together) and nonadopted siblings is given by:

$$\begin{gathered}\text{Expected Nonadoptive Siblings Covariance} = .5A + C \\ \text{Expected Adoptive Offspring Covariance} = 0.0\ A + C\end{gathered} \tag{3}$$

*A*, *C*, and *E* can be estimated for this model from the observed variances/covariances using standard statistical techniques (Neale & Cardon, 1992; Neale et al., 2003).

Estimates of the additive genetic variance, shared environmental variance and unique environmental variance components can then be standardized by dividing by the total phenotypic variance, such that

$$a^2 + c^2 + e^2 = 1 = \text{Total Standardized Variance of the Phenotype} \quad (4)$$

The availability of both the twin and adoption samples allowed us to test a key assumption of the twin method by determining whether the shared environment operated more strongly in twins than nontwin siblings. Specifically, the *A*, *C*, and *E* parameters can be estimated independently in the twin and nontwin sibling samples. Alternatively, we can test whether these parameter estimates are statistically homogeneous in a combined analysis of the twin and nontwin sibling samples in which the ACE estimates are constrained to be equal. If this combined model fits more poorly than when the parameters are estimated separately, we can further test whether adding a *T* parameter (representing a twins-specific environmental influence) to the expected covariance of both MZ and DZ twins but not to the similarity of the nontwin sibling pairs can account for the lack of model fit (Matteson et al., 2013). In addition to poor model fit in a twin/nontwin combined model, Matteson and colleagues point out that if twin-specific environmental influences are present, the classical twin design will overestimate $c^2$.

We followed the strategy presented by Matteson et al. (2013) for assessing genetic and environmental variance in both twin and adoption samples by fitting three models to each measure. We first fit a model in which the ACE parameters were fit separately in the two samples. We designate this model the *free* model. Second, we constrained the ACE parameters to be the same in the two samples, which we designate the *constrained* model. Finally, we fit a model in which the ACE parameters were the same in the two samples but greater twin than sibling resemblance was accounted for by a *T* parameter. This model is designated the *combined* model. Models were fit by maximizing a multivariate normal likelihood and compared using a likelihood ratio test.

## Transparency and Openness

We have described sample recruitment, inclusion and exclusion criteria, all manipulations, and all measures used in the study. We have aligned reporting to the *Journal of Applied Psychology* methodological checklist. Research materials are available in the online supplement. Due to privacy issues, we are unable to make the data public, however, analysis code is available upon request from the first author. Data were analyzed in R Studio, Version 3.5.2 (RStudio Team, 2020). Analyses were run using the *psych* package, Version 2.1.3 (Revelle, 2016), the *stats* package, Version 3.5.2, (RStudio Team, 2020), the *Hmisc* package, Version 4.2.0 (Harrell & Dupont, 2021), the *cocor* package, Version 1.1.3 (Diedenhofen & Musch, 2015), and the *OpenMx* package, Version 2.17.2 (Boker et al., 2021). The study design, analysis, and hypotheses were not preregistered.

## Results

Descriptive statistics for demographics and nontask behaviors are presented in Table 1. Correlations among the demographics and nontask behaviors are presented in Tables 2 and 3 for the twins and spouse/partners, and nontwin sibling pair offspring and parents, respectively. Moderate and negative correlations were identified between CWB and OCB in the four samples ($r = -.32$ to $-.37$), and moderate-to-strong intercorrelations were identified among the OCB facets ($r = .41$–$.58$) and CWB facets ($r = .31$–$.52$). It is important to note that the male twin cohort was sampled 3 years in advance of the female twin cohort, leading to an inflated association between age and sex in the twin sample. Differences in nontask performance by sex can be found in the Supplemental Table S5, nonwinsorized means and standard deviations in Table S6, and nontask performance regressed on education in Table S4. Education, which may act as a proxy for employment type, consistently showed negligible correlations with OCB and its facets ($r = -.01$–$.10$), as well as with organizational deviance ($r = -.05$–$.02$). On the other hand, interpersonal deviance showed a generally moderate, negative association with educational attainment ($r = -.26$ to $-.08$).

Familial correlations for OCB and CWB, and their facets are presented in Table 4 (familial correlations using nonwinsorized scores can be found in the Supplemental Table S7). MZ twins were consistently more similar than other offspring pairs, implicating the importance of genetic factors. Although pairwise correlation differences between MZ and other offspring groups were not

**Table 2**

*Correlations in Twins (Lower Diagonal) and Partners (Upper Diagonal)*

| Variable | SEX[a] | Age[a] | Edu. | CWB | CWB-ID | CWB-OD | OCB | OCB-CON | OCB-OC | OCB-IC |
|---|---|---|---|---|---|---|---|---|---|---|
| SEX[a] | | −.14 | .13 | −.25 | −.31 | −.12 | .11 | .07 | .04 | .21 |
| AGE[a] | −.43 | | .00 | −.01 | .01 | −.04 | .01 | −.01 | −.00 | .05 |
| Edu. | .14 | −.13 | | −.13 | −.21 | −.00 | .06 | .05 | .07 | .02 |
| CWB | −.27 | .16 | −.16 | | .77 | .84 | −.34 | −.26 | −.23 | −.37 |
| CWB-ID | −.27 | .18 | −.23 | .83 | | .31 | −.18 | −.08 | −.11 | −.31 |
| CWB-OD | −.21 | .09 | −.05 | .88 | .48 | | −.37 | −.34 | −.28 | −.30 |
| OCB | .11 | −.05 | .09 | −.32 | −.19 | −.35 | | .85 | .87 | .73 |
| OCB-CON | .08 | −.02 | .05 | −.23 | −.10 | −.28 | .86 | | .58 | .42 |
| OCB-OC | .07 | −.04 | .08 | −.23 | −.11 | −.27 | .86 | .58 | | .51 |
| OCB-IC | .14 | −.08 | .09 | −.35 | −.30 | −.31 | .70 | .44 | .43 | |

*Note*. Edu = Education; CWB = Counterproductive work behavior; ID = Interpersonal deviance; OD = Organizational deviance; OCB = Organizational citizenship behavior; CON = Conscientiousness Initiative; OC = Organizational citizenship; IC = Interpersonal citizenship; SEX = biserial correlation; 1 = Male; 2 = Female. Twins *N* 1,010–1,012. Partners *N* 516–528.

[a] The male twin cohort was collected 3 years in advance of the female twin cohort, such that there is an inflated association between age and variables associated with sex in the twin sample. Standard error no greater than .001 in the twins sample and .002 in the partner sample. Twin correlations with a magnitude equal to or greater than .07 are statistically significant at $p < .05$. Partner correlations with a magnitude equal to or greater than .09 are statistically significant at $p < .05$.

**Table 3**

*Correlations in SIBS Offspring (Lower Diagonal) and SIBS Parents (Upper Diagonal)*

| Variable | SEX | Age | Edu. | CWB | CWB-ID | CWB-OD | OCB | OCB-CON | OCB-OC | OCB-IC |
|---|---|---|---|---|---|---|---|---|---|---|
| SEX | | −.17 | −.08 | −.22 | −.27 | −.14 | .17 | .14 | .08 | .19 |
| AGE | .10 | | .30 | −.06 | −.11 | −.03 | −.02 | −08 | .04 | −.03 |
| Edu. | .19 | .05 | | −.02 | −.08 | .02 | .05 | −.01 | .10 | .01 |
| CWB | −.31 | −.04 | −.15 | | .81 | .92 | −.37 | −.28 | −.26 | −.37 |
| CWB-ID | −.33 | −.02 | −.26 | .83 | | .52 | −.28 | −.17 | −.18 | −.35 |
| CWB-OD | −.21 | −.05 | −.02 | .89 | .50 | | −.36 | −.30 | −.26 | −.31 |
| OCB | .16 | .01 | .03 | −.33 | −.17 | −.40 | | .82 | .83 | .72 |
| OCB-CON | .13 | −.03 | .05 | −.26 | −.10 | −.33 | .83 | | .50 | .41 |
| OCB-OC | .09 | .04 | .01 | −.21 | −.06 | −.28 | .83 | .50 | | .43 |
| OCB-IC | .19 | .02 | .02 | −.36 | −.30 | −.34 | .72 | .42 | .45 | |

*Note.* Edu = Education; CWB = Counterproductive work behavior; ID = Interpersonal deviance; OD = Organizational deviance; OCB = Organizational citizenship behavior; CON = Conscientiousness Initiative; OC = Organizational citizenship; IC = Interpersonal citizenship; SEX = biserial correlation 1 = Male; 2 = Female. Offspring *N* 703–708. Parents *N* 535–536. Standard error no greater than .001 in the SIBS offspring sample and .002 in the parent sample. Sibling correlations with a magnitude equal to or greater than .08 are statistically significant at $p < .05$. Parent correlations with a magnitude equal to or greater than .09 are statistically significant at $p < .05$.

always statistically significant (Supplemental Table S25), pairwise correlation comparisons are an inefficient way of analyzing familial correlations compared to biometric methods, which optimally weight all available information (Boker et al., 2011). DZ twins and nonadoptive siblings showed intermediate and generally similar levels of correlation (e.g., OCB $r = .17$ and .15, while CWB = .20 and .23, respectively). Adoptive sibling correlations were generally the lowest and in no case statistically significant. Parent–offspring correlations for both adoptive and nonadoptive offspring were significant for CWB ($r = .15$ and .16, respectively) but not for OCB. At the OCB facet level, there was a significant correlation between parents and their nonadoptive offspring on conscientious initiative ($r = .12$). At the CWB facet level, there were significant correlations between parents' organizational CWB and their adoptive ($r = .18$) and nonadoptive ($r = .20$) offspring's, but not for interpersonal CWB. Midlife (twin-spouse/partner) couples were significantly but modestly correlated on CWB, OCB, and their facets ($r = .11$– .19), while late-life (mother–father) couples were only significantly correlated on CWB and organizational CWB ($r = .16$). However, in no case did midlife and late-life couple correlations differ statistically significantly from each other. Additionally, CWB correlations were not statistically significantly different from their respective OCB correlations in any pair type (Supplemental Table S24).

We compared the fit of ACE models in which parameters were freely estimated across twin and adoption samples (referred to as Free in Table 5), to models where the A, C, and E parameters were constrained equal (referred to as Constrained in Table 5) in the two

**Table 4**

*Familial Correlations on Nontask Performance [95% Confidence Intervals]*

| (*N* Pairs) | OCB | OCB-CON | OCB-OC | OCB-IC | CWB | CWB-ID | CWB-OD |
|---|---|---|---|---|---|---|---|
| Siblings | | | | | | | |
| MZ Twins (261–260) | .34<br>[.25, .43] | .31<br>[.22, .39] | .29<br>[.20, .38] | .32<br>[.23, .41] | .40<br>[.32, .48] | .40<br>[.32, .48] | .36<br>[.27, .44] |
| DZ Twins (130) | .17<br>[.04, .30] | .04<br>[−.09, .17] | .20<br>[.08, .33] | .10<br>[−.03, .23] | .20<br>[.07, .32] | .36<br>[.24, .47] | .01<br>[−.12, .14] |
| Nonadoptive Siblings (88) | .15<br>[−.06, .35] | .13<br>[−.08, .33] | .12<br>[−.09, .32] | .09<br>[−.12, .29] | .23<br>[.02. .42] | .24<br>[.04, .43] | .25<br>[.04, .44] |
| Adoptive Siblings (138–137) | .12<br>[−.05, .28] | .12<br>[−.04, .29] | −.00<br>[−.17, .16] | .13<br>[−.04, .29] | −.09<br>[−.25, .08] | −.13<br>[−.29, .04] | −.02<br>[−.18, .15] |
| Parent–offspring | | | | | | | |
| Nonadoptive Parent and Offspring (203) | .14<br>[.00, .27] | .22<br>[.08, .35] | .07<br>[−.06, .21] | .10<br>[−.03, .24] | .16<br>[.02, .29] | .11<br>[−.03, .24] | .20<br>[.06, .33] |
| Adoptive Parent and Offspring (263) | −.01<br>[−.13, .11] | −.02<br>[−.14, .10] | −.00<br>[−.12, .12] | −.03<br>[−.15, .09] | .15<br>[.03, .26] | .05<br>[−.07, .17] | .18<br>[.06, .30] |
| Couples | | | | | | | |
| Midlife Couples (528–527) | .16<br>[.08, .24] | .14<br>[.05, .22] | .16<br>[.08, .25] | .13<br>[.04, .21] | .18<br>[.09, .26] | .11<br>[.02, .19] | .19<br>[.11, .27] |
| Late-Life Couples (201–200) | .11<br>[−.03, .24] | .13<br>[−.01, .27] | .12<br>[−.02, .25] | .02<br>[−.12, .16] | .16<br>[.03, .29] | .07<br>[−.07, .20] | .16<br>[.02, .29] |

*Note.* OCB = Organizational citizenship behavior; CON = Conscientious initiative; OC = Organizational citizenship; IC = Interpersonal citizenship; CWB = Counterproductive work behaviors; ID = Interpersonal deviance; OD = Organizational deviance. To account for sex differences, spouse/partner pairs are set up to as males/females. In the midlife pairs, there were 16 same-sex couples and one spouse choose not to answer, in these cases the partners were placed in the opposite sex group of their respective twin partners.

samples separately for CWB, OCB, and their facets. Moving from the free model to the constrained model increases the degrees of freedom by three. Table 5 shows that model fit was not significantly reduced in OCB or OCB facet models, but a reduction in fit was observed for CWB, $\Delta\chi^2(3) = 10.1$, $p = .02$, interpersonal deviance, $\Delta\chi^2(3) = 10.1$, $p = .02$, and organizational deviance, $\Delta\chi^2(3) = 13.5$, $p < .01$. The constrained models were then compared to combined models that included the twin-specific environmental parameter, T, decreasing degrees of freedom by one. None of the combined models showed increased fit with the additional parameter, suggesting differences between sample parameter estimates were not due to twins having more similar environments than nontwin siblings. Given that reduced fit from free to constrained models was not due to twin-specific environmental influences, follow-up analyses were conducted for CWB and its facets to see if the discrepancy in fit was due to differences in phenotypic variance (i.e., the raw ACE estimates might differ simply because the trait variance differs in the two samples). This was done by constraining the standardized parameter estimates to be equal in the twin and nontwin sibling samples but allowing the overall variance to be free, increasing degrees of freedom by two compared to the free models. Model fit did not significantly change compared to the free models, $\Delta\chi^2 < 2$ in all three models, and standardized estimates shifted by not more than .04 from those in the free models (see Table S14, for fit statistics and standardized parameter estimates for CWB and its facets). This suggests that drop in fit from the free to the constrained models was due to differences in phenotypic variance (see Table 1) between samples rather than to differences in proportion of variance in a phenotype accounted for by genetic and environmental variance. Taken as a whole, such findings in model fit suggest the constrained model standardized variance component estimates are acceptable, and that the combined model including twin-specific environmental variance does not improve model fit for CWB and OCB phenotypes.

Table 6 presents the standardized ACE parameter estimates and confidence intervals: the twin sample, the SIBS sample, the constrained twins and SIBS samples, and the combined twin and nontwin sibling samples with the twin-specific effects. Twin-specific effects (T) and shared environment (C) were not different from zero for either CWB, OCB, or their facets. Given the model fit described above, we focus on the constrained estimates (i.e., estimates derived using both the twin and nontwin sibling sample and including estimates for additive genetic, shared environment, and unique environment effects). In constrained models, additive genetic influences ranged from .21 to .41, with larger estimates for CWB (.39 [.24, .48]), and its interpersonal (.41 [.27, .50]), and organizational (.34 [.18, .45]) deviance facets, than for OCB (.22 [.03, .39]), and its conscientious initiative (.21 [.02, .36]), organizational (.26, [.07, .37]), and interpersonal (.22 [.02, .37]) facets.

**Table 5**

*Fit Statistics When ACE Estimated Separately and Constrained Equal in Twin and Adoption Samples*

| Phenotype | −2LL | DF | AIC | $\Delta\chi^2$ (3) free constrained | $\Delta\chi^2$ (1) constrained combined | *p* |
|---|---|---|---|---|---|---|
| OCB | | | | | | |
| Free (ACE) | 11464.3 | 1,711 | 8042.3 | | | |
| Constrained (ACE) | 11465.6 | 1,714 | 8037.6 | 1.3 | | .73 |
| Combined (ACET) | 11465.6 | 1,713 | 8039.6 | | 0.0 | 1.0 |
| OCB conscientious initiative | | | | | | |
| Free (ACE) | 8824.1 | 1,712 | 5384.7 | | | |
| Constrained (ACE) | 8825.6 | 1,715 | 5395.6 | 1.5 | | .68 |
| Combined (ACET) | 8825.6 | 1,714 | 5397.3 | | 0.0 | 1.0 |
| OCB organizational | | | | | | |
| Free (ACE) | 8808.2 | 1,712 | 5384.7 | | | |
| Constrained (ACE) | 8810.2 | 1,715 | 5380.2 | 2.0 | | .57 |
| Combined (ACET) | 8809.7 | 1,714 | 53,817 | | 0.5 | .48 |
| OCB interpersonal | | | | | | |
| Free (ACE) | 7469.3 | 1,711 | 4047.3 | | | |
| Constrained (ACE) | 7471.2 | 1,714 | 4043.2 | 1.9 | | .59 |
| Combined (ACET) | 7471.2 | 1,213 | 4045.2 | | 0.0 | 1.0 |
| CWB | | | | | | |
| Free (ACE) | 10679.4 | 1,712 | 7255.4 | | | |
| Constrained (ACE) | 10689.5 | 1,715 | 7259.5 | 10.1 | | .02 |
| Combined (ACET) | 10689.5 | 1,714 | 7261.5 | | 0.0 | 1.0 |
| CWB interpersonal | | | | | | |
| Free (ACE) | 8427.3 | 1,712 | 5003.3 | | | |
| Constrained (ACE) | 8437.4 | 1,715 | 5007.4 | 10.1 | | .02 |
| Combined (ACET) | 8436.6 | 1,714 | 5008.6 | | 0.8 | .37 |
| CWB organizational | | | | | | |
| Free (ACE) | 9162.4 | 1,711 | 5740.4 | | | |
| Constrained (ACE) | 9175.9 | 1,714 | 5747.9 | 13.5 | | <.01 |
| Combined (ACET) | 9175.9 | 1,713 | 5749.9 | | 0.0 | 1.0 |

*Note.* AIC = Akaike information criterion; OCB = Organizational citizenship behavior; CWB = Counterproductive workplace behavior; Free models: Twin and adoption ACE components estimated separately such that twins and SIBS may have different A, C, and E estimates; Constrained: Twin and adoption ACE components estimated simultaneously such that the A, C, and E, estimates are constrained to be the same in both samples. Combined: A, C, E components are estimated simultaneously such that these estimates are constrained to be the same in both samples, and a *T* parameter is added in the twin sample for twin-specific environmental variance.

**Table 6**

*Biometric Estimates in Two Samples with Phenotypes Adjusted for Age and Sex*

| Model | A (additive genetic) | C (shared environment) | E (unique environment) | T (twin-specific environment) |
|---|---|---|---|---|
| Organizational citizenship behavior | | | | |
| Twins | .31 [.00, .42] | .01 [.00, .34] | .68 [.58, .79] | |
| SIBS | .12 [.00, .62] | .11 [.00, .25] | .77 [.36, .99] | |
| Constrained | 22 [.03, .39] | .09 [.00, .23] | .69 [.60, .80] | |
| Combined | .22 [.00, .39] | .09 [.00, .23] | .69 [.60, .80] | .00 [.00, .24] |
| OCB conscientious initiative | | | | |
| Twins | .27 [.05, .38] | .00 [.00, .19] | .73 [.62, .84] | |
| SIBS | .10 [.00, .61] | .11 [.00, .24] | .79 [.36, 1.0] | |
| Constrained | .21 [.02, .36] | .05 [.00, .19] | .74 [.63, .85] | |
| Combined | .21 [.00, .36] | .05 [.00, .19] | .74 [.63, .85] | .00 [.00, .15] |
| OCB organizational | | | | |
| Twins | .12 [.00, .38] | .16 [.00, .34] | .72 [.62, .83] | |
| SIBS | .24 [.00, .60] | .00 [.00, .16] | .76 [.40, 1.0] | |
| Constrained | .26 [.07, .37] | .02 [.00, .16] | .72 [.63, .83] | |
| Combined | .17 [.00, .37] | .01 [.00, .16] | .72 [.63, .83] | .10 [.00, .32] |
| OCB interpersonal | | | | |
| Twins | .29 [.00, .39] | .00 [.00, .26] | .71 [.61, .82] | |
| SIBS | .00 [.00, .42] | .11 [.00, .43] | .89 [.55, 1.0] | |
| Constrained | .22 [.02, .37] | .06 [.00, .19] | .73 [.62, .84] | |
| Combined | .22 [.00, .37] | .06 [.00, .19] | .73 [.62, .84] | .00 [.00, .24] |
| Counterproductive work behavior | | | | |
| Twins | .35 [.09, .45] | .00 [.00, .24] | .65 [.55, .76] | |
| SIBS | .40 [.00, .80] | .00 [.00, .13] | .60 [.20, 1.0] | |
| Constrained | .39 [.24, .48] | .00 [.00, .09] | .61 [.52, .73] | |
| Combined | .39 [.15, .48] | .00 [.00, .09] | .61 [.52, .73] | .00 [.00, .20] |
| CWB interpersonal | | | | |
| Twins | .16 [.00, .46] | .20 [.00, .41] | .64 [.54, .79] | |
| SIBS | .42 [.00, .81] | .00 [.00, .09] | .58 [.19, 1.0] | |
| Constrained | .41 [.27, .50] | .00 [.00, .08] | .59 [.50, .70] | |
| Combined | .28 [.00, .49] | .00 [.00, .08] | .59 [.50, .70] | .12 [.00, .39] |
| CWB organizational | | | | |
| Twins | .30 [.13, .40] | .00 [.00, .12] | .70 [.60, .82] | |
| SIBS | .47 [.00, .91] | .03 [.00, .18] | .50 [.09, .99] | |
| Constrained | .34 [.18, .45] | .00 [.00, .10] | .66 [.55, .78] | |
| Combined | .34 [.17, .45] | .00 [.00, .10] | .66 [.55, .78] | .00 [.00, .11] |

*Note*. OCB = Organizational citizenship behavior; CWB = Counterproductive workplace behavior. Free models: Twin and SIBS ACE components estimated separately such that twins and SIBS may have different A, C, and E estimates; Constrained: Twin and SIBS ACE components estimated simultaneously such that the A, C, and E, estimates are constrained to be the same in both samples. Combined: A, C, E, and T components are estimated simultaneously such that these estimates are constrained to be the same in both samples. Given fit model fit (see Table 5), we focus on the results of the Constrained model.

## Discussion

Our analysis of familial resemblance in OCB and CWB found that: (a) OCB and CWB were modestly to moderately heritable ($a^2 = .21$ to .41); (b) there was no evidence of the shared environment contributing to either OCB or CWB; (c) CWB was more heritable than OCB; and (d) couples were minimally similar in their nontask behavior. The finding that OCB and CWB were heritable supported Hypothesis 1, consistent with a large body of research showing at least some degree of heritability in a wide range of behavioral traits (Polderman et al., 2015). However, as noted earlier, how heritable traits are varies, and the effect sizes have implications for how behavioral traits and their origins are viewed (Plomin et al., 2016). Even though a high heritability does not mean that a behavioral (or even physical) trait is not malleable (e.g., using eyeglasses to correct for poor vision), it may be that highly heritable traits are more difficult to change than weakly heritable traits. Consistent with this view, Tesser (1993) showed experimentally that less heritable attitudes were more easily swayed by social influence than highly heritable social attitudes. Personality traits such as Conscientiousness have been shown to be moderately to strongly heritable (Matteson et al., 2013; Vernon et al., 2008) and such traits can be difficult to change (Hudson et al., 2018; Roberts et al., 2017). Our findings of moderate heritability for CWB ($a^2 = .39$) might suggest that CWB would be challenging to change via organizational factors (e.g., norms and values). The comparatively weak heritability estimates identified for OCB ($a^2 = .22$) would then imply that OCB might be more easily changed through organizational initiatives (e.g., a program to implement organizational justice). We found support for our second hypothesis, that CWB would be more heritable than OCB, though our CWB heritability estimates were lower than those found by Stanek et al. (2017). That environmental factors accounted for more variance in OCB than CWB is also consistent with research showing greater organizational influences on OCB than CWB (O'Brien & Allen, 2007). From a practical standpoint, in the presence of organizational constraints, selecting on the predictors of behaviors less amenable to external influence during applicant selection may be a strategic course of action (e.g., integrity testing for CWB; Ones & Viswesvaran, 2001).

For both CWB and OCB nonshared environmental factors contributed more than genetic factors did. Although our results do not tell us what the specific environmental contributors are, previous research has shown that positive and negative experiences with coworkers (Miner et al., 2005), job characteristics (Chiu & Chen, 2005), perceptions of fairness (Konovsky & Organ, 1996), and experiences of workplace incivility (Penney & Spector, 2005) are associated with nontask performance. Any of these experiences might lead to the lack of sibling similarity (i.e., nonshared environmental variance) identified in the present study. Factors that lead siblings to engage in different rates of nontask performance may also extend outside the work environment to social norms among friends, norms in their affiliated groups (e.g., engagement with religious groups and their accompanying mores), or other nonwork pressures (e.g., stressful home environment). However, no evidence of spousal influence operating through the nonshared environment was identified in the present study.

It is important to clarify that applicants' preexisting individual differences and organizational factors that influence employee behavior (e.g., company culture, managerial practices, promotions, or demotions) coexist and operate additively (or in some cases interactively; see Fine et al., 2016). Thus, the heritability of an organizationally relevant behavioral trait, whether it be CWB, OCB, or job satisfaction, in no way suggests that organizational intervention does not influence employee behavior. Supporting this, even genetically identical MZ twins do not engage in the same degree of CWB or OCB.

Hypothesis 3 was not supported—we found no effect of the shared environment for OCB and only limited evidence for CWB. Some phenotypes, such as college attainment (Anderson et al., 2020; Freese & Jao, 2017; McGue et al., 2017), alcohol misuse (Stanek et al., 2017), and externalizing behaviors (Hicks et al., 2013; Plomin et al., 2016) have been consistently found to be influenced by shared environmental factors. However, many traits appear largely uninfluenced by the shared environment (Turkheimer, 2000), and for traits where there is evidence of shared environmental effects in childhood these effects appear to largely diminish by adulthood (Knafo & Plomin, 2006; Tucker-Drob & Briley, 2014). While adoptive siblings were not similar on their nontask performance ($r = -.13$ to $-.02$) and biometric estimates of the proportion of variance attributable to the shared environment were zero or near-zero, adoptive parent–offspring resemblance suggested the possibility of minor shared environmental effects. Specifically, we observed a small but significant association between parents and their adoptive offspring on CWB ($r = .15$) but not OCB ($r = -.01$). This parent–offspring effect was specific to organizational deviance ($r = .18$) rather than interpersonal deviance ($r = .05$). Note that a parent–offspring correlation of .18 is not inconsistent with biometric estimates for $c^2$ that are not significantly different from zero. This is because the parent–offspring contribution to $c^2$ is given by the square of the parent–offspring correlation, which in this case would only be $.18^{*}.18 \sim 3\%$, a value that would be difficult to detect statistically given the size of our samples. Regardless, it appears that parental behaviors or attitudes can have a small effect on the CWB of their adult offspring. Further support for the minimal environmental effect associated with growing up together comes from our finding no evidence of a twin environmental effect in nontask behavior. Twin-specific environment effects show a mixed presence in the literature. Phenotypes such as cognitive ability (Koeppen-Schomerus et al., 2003) and substance use (Rhee et al., 2003) have been partially accounted for by twin-specific effects. However, Matteson et al. (2013) found little to no effect for twin-specific environment in a number of personality traits.

We hypothesized that late-life couples (mother–father pairs who on average should be married longer than the midlife twin-spouse/partner pairs) would be more similar in their nontask behavior than midlife couples (who on average should be partnered or married more recently than the late-life mother–father pairs). However, Hypothesis 4 was not supported. Similar effect sizes in late-life and midlife couples did not suggest that spouses/partners influenced each other such that they became more similar to each other. The correlations between partners and spouses are consistent with assortative mating. This has several implications to our interpretation of the biometric modeling results. First, as spouses/partners do not become more like one another over time, the partner or spouse does not appear to be a source of the notable nonshared environmental influences identified for both OCB and CWB. Second, an assumption of the biometric model is that assortative mating is not present, but we find small spouse/partner correlations. The existence of assortative mating typically results in an overestimate of the shared environment, however little to no evidence was found for the shared environment for CWB or OCB, limiting any concerns assortative mating may have had on the model estimates.

Educational attainment showed inconsequential associations with OCB and organizational deviance, but a moderate and negative association with interpersonal deviance. If educational attainment can be used as a proxy to occupational attainment, then our findings suggest that nontask performance is not strongly tied to a specific level of occupational attainment. Such findings suggest that community samples are appropriate for studying CWB and OCB in general (i.e., when not focusing on specific forms of CWB, such as cyberloafing, expense falsification).

Several limitations to our research design and sample should be taken into account when interpreting the results and considering the generalizability of this study. First, our sample was drawn from Minnesota, a U.S. state with lower unemployment rates and higher rates of educational attainment than many other U.S. states (Minnesota Department of Employment & Economic Development, 2021; United States Census Bureau, n.d.). The occupational distribution of our participants may not be representative of the larger United States. There may also be differences in familial resemblance by U.S. state (e.g., if high outbound moving in some states leads to greater likelihood family members moving to different states, which in turn leads to lower levels of familial resemblance) that are not captured by this sample. We did not have access to the number of years spouses were married or partners were together. It is possible that spousal or partner effects occur early in marriage or cohabitation, such that effects would only be seen by comparing newly partnered couples against mid- or long-term couples. Unfortunately, the data available in this study are unable to test this.

Internal consistency reliability was acceptable for the CWB and OCB composite measures and for the majority of the facets, but interpersonal citizenship (OCB-I) had low reliability ($\alpha = .54$ in the twins-spouse/partners sample and .57 in the SIBS offspring-parents sample) Unreliability can lead to inflated estimates of the unique environment (E, which includes measurement error), and correspondingly attenuate estimates of both the additive genetic effects (A) and shared environmental effects (C). Correcting for measurement unreliability would have a limited impact on the findings that CWB was more heritable than OCB at the composite level, but it would increase the point estimates for A and C. In addition to point estimate shifts, correction for measurement unreliability would also make OCB-I the most heritable facet of OCB.

Participants reported on their work behaviors outside of a workplace setting, such that they should have had limited motivation to inaccurately report their behaviors (e.g., self-presentation; Schlenker, 2012). Additionally, meta-analytic studies have shown little difference in mean self- versus other-OCB ratings (Carpenter et al., 2014), and slightly higher self-reported CWB than other-reported CWB means (Berry et al., 2012). Inaccurate reporting could occur due to distorted remembrance or inaccurate weighting (e.g., putting more emphasis on more recently engaged in behaviors) of nontask performance. Parents reporting on more distant work history may be at particular risk for misremembrance. Issues of low base rate and limited variance in CWB have been a point of discussion (e.g., Greco et al., 2015). CWB ranges in severity (e.g., Bragg & Bowling, 2018; Gruys & Sackett, 2003) and behaviors are not endorsed at equal rates. For instance, Spector et al. (2006) reported a high endorsement for taking extended breaks (61.6%) but low endorsement for threatening coworkers with violence (2.8%). Similarly, in the present study, the item assessing misuse of time had a significantly higher mean than the item about using substances at work in all four samples (Supplemental Table S23). The present study does not address whether the degree of CWB severity (see Fine & Edward, 2017) has an impact on the heritability. Future research is encouraged to examine whether severe CWB is more heritable (e.g., similar to psychopathology; see Hicks et al., 2013), while minor offenses (e.g., extended breaks) are more strongly related to company norms or lack of consequences.

It is important to highlight the possibility of gene–environment correlation. Gene–environment correlation is “the differential exposure of genotypes [i.e., the genetic code of individuals] to environments” (Plomin et al., 1977, p. 310), or, less formally, when individuals with certain genetic predispositions (e.g., a genetic predisposition toward leadership) are exposed to environments that enhance the presentation (i.e., phenotype) of that genetic predisposition (e.g., management places the individual in a leadership role; the individual seeks out leadership positions in an organization). In the case of CWB, it is possible that individuals predisposed to engaging in counterproductive behavior select working environments with lax enforcement policies and little supervision. Alternatively, the naturally helpful employee whose OCB is rewarded through praise or promotion may increase their OCB because of such reinforcement. Unfortunately, the present study does not model possible gene–environment correlations and thus we cannot say if, or to what degree, gene–environment correlations impact nontask performance, which, if present, would increase reported heritability (see Beam & Turkheimer, 2013, for simulation example).

Sample attrition from intake to later follow-ups may limit representativeness of the sample to the larger employed population. Twins who participated in follow-up four were similar to twins who did not participate in this follow-up in their initial trait Aggression and (self) Control (Cohen’s $d = .04$ and .09 respectively; see Supplemental Table S18), but had slightly fewer externalizing symptoms (Cohen’s $d = .17$). Nontwin siblings showed more marked differences between the intake scores of those who participated in follow-up three compared to those who did not. Siblings who participated had higher Control (Cohen’s $d = .26$), lower Aggression (Cohen’s $d = .29$) and fewer symptoms of externalizing (Cohen’s $d = .27$) at their initial assessment than siblings who did not participate in follow-up three. We expect differences between the employed and nonemployed population (e.g., employed individuals may be more conscientious than nonemployed individuals). Twins who reported being employed in the last 3 years in follow-up four had slightly higher Control scores (Cohen’s $d = .04$), and slightly lower Aggression and Externalizing (Cohen’s $d = .08$ and .14, respectively) at their initial assessment than twins who were not employed at follow-up four. Employed, nontwin siblings reported a similar pattern of higher Control (Cohen’s $d = .20$), lower Aggression (Cohen’s $d = .02$), and lower externalizing (Cohen’s $d = .20$) at their initial assessment compared to nonemployed siblings. These findings suggest that, in general, attrition effects appear to be minimal.

It is worth stating that heritability is not static (Plomin et al., 2016). Heritability and environmentally are proportions of variance that account for variance in a phenotype. Thus, a lack of variance in either the genotype or the environment (e.g., environment X is the same for all individuals within a population), means that the other will be entirely responsible for variance in that phenotype (e.g., any differences observed in the phenotype will be due to variance in the genotype). When a population experiences more shared experiences over time, environmental variance decreases. Within the same phenotype (e.g., cognitive ability, Plomin & Deary, 2015) heritability can increase over time, or, in the case of job satisfaction, decrease over time (Li et al., 2016). Heritability may also differ by groups or populations. For instance, there have been male and female differences in the additive genetic estimate of entrepreneurship (e.g., van der Loos et al., 2013, see Arvey et al., 2016 for a review). Nonetheless, while there is no direct reason to believe that heritability should increase or decrease with new to seasoned employees—especially as development in individual differences such as personality stabilize into adulthood (Caspi et al., 2005; Hopwood et al., 2011; Roberts et al., 2001)—it is possible and deserves to be examined in future research.

Previous family studies have looked at counterproductive and prosocial behaviors in nonwork contexts, such as criminal behavior (Kendler et al., 2015), antisocial behavior (Hicks et al., 2013; Koenig et al., 2007), aggressiveness (Rushton et al., 1986), and altruism (Koenig et al., 2007; Rushton et al., 1986). However, counterproductive or prosocial behaviors within a work setting, where behaviors may be constrained by organizational influences such as security cameras or promotion metrics, may be driven from very different degrees of genetic and environmental variance. Interestingly, our estimate of heritability for CWB ($a^2 = .39$) is near the range of estimates for aggression and antisocial behavior ($a^2 = .40$ to .50s; Hicks et al., 2013; Koenig et al., 2007; Rushton et al., 1986). Such findings along with previous work (e.g., Stanek et al., 2017) suggest that CWB is related to other forms of aggressive or antisocial behavior, and that application of the nonwork counterproductivity literature to workplace behavior may be appropriate. Heritability estimates for altruism differed notably between Koenig et al. (2007) and Rushton’s et al. (1986) studies ($a^2 = .10$ and .56, respectively), making comparisons challenging. The present study adds to the literature by directly assessing the heritability and environmentality of CWB and OCB. These results place CWB and OCB within the larger nomological net of prosocial and counterproductive behaviors by providing a comparable set of statistics (i.e., $a^2$, $c^2$, $e^2$) to use in traits across work and nonwork domains, and by providing insight into the degree to which differences in nontask performance are due not to organizational factors, but to individual differences in a tendency toward these behaviors.

The goal of this article was to gain insight into possible sources of the individual differences in nontask performance. Our findings, alongside previous research, provide evidence for stable, genetically rooted variation in the engagement in both counterproductive and citizenship behaviors at work. The importance of nonshared experiences has also been highlighted here—individuals with the same genome and raised in the same household are far from identical in their nontask performance. The influence of friends, colleagues, organizational practices, or values may drive such differences in behavior between related individuals. These findings offer additional insight for theory and practice regarding the differential nature (individual differences) and nurture (including organizational factors) influences on counterproductive and citizenship behavior. Given the importance of nontask performance in organizational success, understanding the origins of such behaviors has implications for how organizations may choose to promote or discourage such behavior sets via selection or organizational modification.

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