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Genetic and Familial Influences on Self-Perception in Early Childhood and Self-Esteem in Adulthood: A Cross-Sectional Analysis

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Abstract

Self-perception in early childhood and self-esteem in adulthood are related to a variety of aspects of psychological wellbeing. The goal of the present study was to examine genetic and familial influences on self-perception and self-esteem in separate samples of children (153 twin pairs of 5-year-olds) and adults (753 twin pairs between the ages of 25–75 years). Genetic common factor modeling showed that three facets of self-perception (physical competence, peer acceptance, and maternal acceptance) loaded onto a single heritable factor in children. Multilevel modeling showed no effects of self or co-twin sex on self-perception, but authoritative parenting style was negatively related to self-perception in boys. Similarly, in Study 2, with the adult sample, five self-esteem items loaded on a single heritable factor with no effects of co-twin sex on adult self-esteem. Remembered maternal affection, paternal affection, and maternal discipline were positively related to self-esteem in adults; maternal affection was especially significant for women. The reversal in direction of parenting effects between early childhood and adulthood suggests that parents may play different roles in shaping how children and adults think of themselves. These results suggest that self-perception in childhood and self-esteem in adulthood are both influenced by genetic and environmental factors and that parenting is an important environmental factor for both children and adults.

Keywords: Self-perception; Self-esteem; Parenting

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Positive feelings about the self, including positive self-perception and high self-esteem, are related to low levels of psychopathology (Haas et al., 2015; Zeigler-Hill, 2011) and high levels of mental well-being (Neff et al., 2011). Thus, understanding the etiology and development of self-perception and self-esteem is critical for promoting psychological health and wellbeing. Genetic and nonshared environmental factors contribute to variability of self-esteem in adulthood (see Neiss et al., 2002, for review). However, little research has focused on the etiology of self-perception in early childhood. Additionally, although positive parenting has been linked to both self-perception in children (Pali et al., 2022) and self-esteem in adults (Bean et al., 2003; Bean & Northrup, 2009; Marshall et al., 2021), little research has explored these relationships utilizing a twin sample. Having a same-age sibling who likely shares physical attributes, personality traits, and cognitive abilities might make twins' self-esteem different than that of singletons. Thus, using a cross-sectional design, we examined genetic and familial influences on self-perception in childhood and self-esteem in adulthood employing two twin studies, which allowed for comparison of genetic mediation at different developmental stages (early childhood vs. adulthood).

Development of Self-Esteem

The development of the self has been an important area of research in developmental psychology, as self-understanding increases throughout the lifespan (Robins & Trzesniewski, 2005). A key aspect of the development of the self is the development of self-perception, which is an evaluation about one's abilities in a given domain. Children can typically describe themselves in terms of competencies by 2 years of age; this continues to develop throughout childhood (Harter, 1990b). Self-perceptions are both cognitive and affective in nature but are primarily based on cognitive assessments of one's abilities (Nobre & Valentini, 2019). Self-perception in young children is distinct from later self-esteem in that it is primarily based on self-evaluations of abilities and the quality of social relationships without incorporating feelings about the comparative importance of various domains or experiences, which are critical aspects for self-esteem. As such, we consider preschoolers' self-perceptions (i.e., self-competence and acceptance) rather than self-esteem in Study 1.

By middle childhood, children can incorporate both their understanding of their competencies and their feelings about the relative importance of those competencies into their self-concepts (Harter, 1990b). Thus, at this point, children are thought to have acquired a sense of self-esteem, which remains conceptually similar from middle childhood through the remainder of the lifespan (Harter, 1990a). Self-esteem consists of cognitions and affect about the self (Rosenberg, 1965). The cognitive component is often referred to as self-competence, and the affective component is

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referred to as self-liking. These two components may represent distinct factors (Goldsmith, 1986), although evidence is mixed (Rosenberg, 1965). Accumulated experiences may lead to increases or decreases in self-esteem (Orth & Robins, 2014) and their importance may change throughout development. For example, in adulthood, work experiences may be a more important component of self-esteem than are past school experiences. Self-esteem is related to a host of positive outcomes in adulthood, including better mental health (Zeigler-Hill, 2011) and general feelings of wellbeing (Kang *et al.*, 2003). Thus, it is important to understand the etiology of self-esteem and self-perception.

Genetic Influences on Self-Perception and Self-Esteem

In middle childhood, both genetic and environmental factors are critical for self-perceptions. For example, using an adoption design, Neiderhiser and McGuire (1994) showed that variability in scholastic competence at ages 9 and 10 was explained by genetic, shared, and nonshared environmental factors, whereas social acceptance was explained only by shared and nonshared environmental factors. However, although athletic competence was explained entirely by environmental factors at age 9 years, it was explained by genetic and environmental factors at 10 years. Thus, different components of self-competence appear to have different etiologies in middle childhood. It is possible that social acceptance at these ages is particularly susceptible to peer influences and comparisons (Giletta *et al.*, 2021), and therefore genetic influence on social acceptance may be negligible. However, little is known about self-perception in very young children. Examination of self-perception in early childhood will provide more information about early genetic influences prior to formalized education. As self-esteem is heritable later in life, (Neiss *et al.*, 2002), it is likely that self-perceptions in childhood are also heritable.

Studies of overall self-esteem in adulthood show that genetic and nonshared environmental influences are responsible for variability in self-esteem (see Neiss *et al.*, 2002, for review). For example, Jonassaint (2009) found that genetic and nonshared environmental influences were important for self-esteem throughout the transition from adolescence to young adulthood. Genetic influences decreased from 43% in adolescence to 13% in adulthood, accompanied by a corresponding increase in variability explained by the nonshared environment; however, genetic influences remained important into adulthood. Genetic and nonshared environmental influences on self-esteem are also found in samples that incorporate adults of various ages (Kendler *et al.*, 1998; Marshall *et al.*, 2021), suggesting that genetic and nonshared environmental factors are important across adulthood.

Familial Influences on Self-Processes

During toddlerhood and early childhood, when the sense of self is beginning to take shape (Harter, 1990a), children spend a great deal of time with family members. Thus, parents and siblings may play a critical role in shaping how children think of themselves (Borchet *et al.*, 2020; Kendler *et al.*, 1998). One description (Baumrind, 1968) includes three parenting styles characterized as varying in levels of warmth and limit-setting (or discipline). Permissive parenting is characterized by high levels of warmth and little to no discipline or limits. Authoritarian parenting involves very little warmth and high levels of harsh discipline or unrealistic limit setting. Authoritative parenting involves high levels of warmth and clear, consistent, and developmentally appropriate

discipline and limit setting. The authoritative parenting style has been associated with the most positive outcomes (Hayek *et al.*, 2022; Kang & Guo, 2022).

Although few studies have investigated parental effects on self-perception in early childhood, one study showed that maternal warmth and authoritative discipline are related to greater feelings of maternal acceptance and peer acceptance (Pali *et al.*, 2022). Similarly, Coplan *et al.* (2004) showed that children with more negative self-perceptions experienced more mother-reported authoritarian and permissive parenting and less authoritative parenting. Studies in older children (Pinquart & Gerke, 2019) also showed that authoritative discipline and parental warmth are related to increased self-esteem and authoritarian parenting is related to decreased self-esteem, particularly in individualistic cultures (Rudy & Grusec, 2006).

Parenting experiences remain an important influence on self-esteem throughout later childhood and early adulthood, even as adults gain independence from their parents. College students who reported more autonomy-granting and acceptance from their parents exhibited higher self-esteem (Zakeri & Karimpour, 2011). Behavioral control by parents is an additional predictor of high self-esteem in adolescence (Bean *et al.*, 2003). Overall, it appears that traits consistent with authoritative parenting, which includes warm and consistent discipline, are related to positive self-esteem in adulthood.

Limited evidence on genetic and environmental influences on the relationship between parenting and self-esteem in adulthood suggests that both genetic and nonshared environmental factors may be important. In a sample of adult twins reporting their own self-esteem and the parenting they remembered receiving, self-esteem was significantly correlated with both maternal and paternal affection (Marshall *et al.*, 2021). However, when controlling for shared genetic and environmental influences using an MZ twin differences design, only paternal affection (not maternal affection) remained significantly related to current ratings of self-esteem. These results suggest that both the environments that parents provide as well as the genes that parents and children share (at least for mothers) are critical for the development of self-esteem. To date, there have been no genetically informed investigations of the relationship between parenting and self-perception in childhood, which is one focus of the current investigation.

In addition to parenting, siblings may play a crucial role in self-esteem development (Milevsky, 2005), although little research has examined sibling effects on self-perception and self-esteem. In one qualitative analysis, adults who reported having been bullied by their siblings reported low self-esteem (deLara, 2022). Given that twins grow up with a same-age sibling with whom they may compare themselves, co-twins may have an especially strong influence on self-esteem. However, there is little research examining co-twin effects on self-perception and self-esteem. In one study of twins between the ages of 18 and 60 years, females who had a male co-twin had lower self-esteem than females who had a female co-twin (Kendler *et al.*, 1998), but this was not true for males. However, to our knowledge, this effect has not been replicated in adults or in young children.

Current Study

The current study was designed to address gaps in the literature regarding self-perception in childhood and self-esteem in adulthood. Specifically, we examined the genetic structure of

self-perception and self-esteem using a genetic factor analysis approach. We also examined familial factors, including effects of parenting and co-twin sex, that may contribute to self-perception in preschoolers and self-esteem in adults. In doing so, we provide a developmental account of self-perception and self-esteem. In Study 1, we address self-perception during the preschool period, and in Study 2 we address self-esteem in adulthood.

Study 1

Genetic and environmental influences on preschool self-perception have not been well investigated. We sought to fill this gap by examining heritability of self-perception as measured by the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA; Harter & Pike 1984). Additionally, we examined the influence of co-twins and parents on self-perception in preschoolers, as family represents a proximal influence in child development, particularly in early childhood before the transition to school (Bronfenbrenner, 1986). The initial conceptualization of early self-perception by Harter and Pike (1984) suggested separation of self-perception and acceptance by others, with similar separation of domains evident across the lifespan (Harter, 1990b; Harter & Pike 1984). However, a unitary construct has been demonstrated for self-esteem in adulthood, incorporating those competencies and social factors that are important to each individual person (Sinclair et al., 2010); thus, we hypothesized that self-perception in childhood would also comprise a single factor. Hypothesis 1 stated that the subscales on the self-perception measure would load on a single second-order factor that represented overall self-perception. Consistent with prior research on the heritability of self-esteem in middle childhood (Neiderhiser & McGuire, 1994) as well as developmental literature suggesting that very young children engage in less social comparison for their self-perceptions (Nobre & Valentini, 2019), hypothesis 2 stated that variability in the second-order factor was expected to be explained by both genetic and environmental factors. Third, although sibling sex has not been examined as a predictor of self-perception in children, limited research suggests that siblings are important for self-perception. Thus, hypothesis 3 asserted that girls with male co-twins would have lower self-perception scores than girls with female co-twins, whereas co-twin sex was not expected to be related to self-perception in boys, replicating the one study showing this in adults (Kendler et al., 1998). The final hypothesis was that observed measures of positive parenting and discipline were expected to predict children's scores on self-perception when controlling for child and parent sex, and effects might differ for boys versus girls.

Materials and Methods

Participants

This sample consisted of 306 children (172 girls, 134 boys; 58 monozygotic [MZ] twin pairs, 95 dizygotic [DZ] pairs) and their parents recruited from the longitudinal Southern Illinois Twins/Triplets and Siblings Study (DiLalla et al., 2013; DiLalla & Jamnik, 2019). Six pairs were part of a triplet set; for each, two of the children were chosen for all analyses according to a procedure that prioritized MZ and same-sex pairs but otherwise selected pairs at random. Mothers participated in the parent-child interaction for 122 families and fathers participated for 31 families. Participants were 90% white, 3% black, 6% biracial, and 1% Asian. Family income (reported in 2020 U.S. dollars) ranged from <\$3,000/year

to >\$100,000/year, with a mean of \$62,134/year. Families from the midwestern United States were recruited to the Southern Illinois Twins and Siblings Study (SITSS) through recruitment letters, flyers, and word of mouth from other participants. The children included in this sample had complete data from ages 4 and 5 years.

Procedure

The current sample was selected from a larger longitudinal study in which children came to a campus lab within 2–4 weeks of their birthday each year from ages 1 to 5 years. Parents were contacted yearly to set up an appointment for in-person testing and were mailed questionnaires to complete and bring to their appointment. Prior to testing, parents provided informed consent. Each child was tested individually for about 15 minutes, and then both children and one parent worked together for 10 minutes to complete a puzzle; this interaction was video-recorded. Videos were later coded for parenting and child behaviors by trained research assistants. Following testing, children were given \$10 worth of toys, and at age 5 parents were mailed a check for \$50 for their participation.

Measures

Parenting verbal warmth, sensitivity, positive affect, and parenting style. Verbal warmth, sensitivity, and affect were coded from the recorded parent-child interactions as the families worked on the 10-minute puzzle task. Coding by trained undergraduate research assistants was completed according to the Parent-Child Interaction Coding Scheme (PCIS; DiLalla et al., 2013). Behaviors were coded for each minute of the interaction on a 4-point Likert-type scale and then scores were averaged across the 10 minutes. *Verbal warmth* was measured as positive verbalizations towards the child (1 = no verbal warmth; 4 = 3+ instances of verbal warmth during the minutes). *Parent sensitivity* was measured as responsiveness to the child's attempt to interact with the parent (1 = insensitive, ignoring child or harsh responses to child overtures; 4 = positive responses to child's cues throughout the entire minute). *Parent positive affect* was measured as smiling, laughing, or speaking in a very positive tone to the child (1 = no positive affect; 4 = 3+ instances of smiling or laughing with child during the minute). Parent's behavior toward each child in a twin pair was coded by a different rater to minimize rater bias within pairs. These behaviors showed good interrater reliability: weighted Kappa (Cohen, 1968) $\alpha = .85$ for verbal warmth, $.84$ for sensitivity, and $.81$ for positive affect.

Parenting style was also coded from the parent-child interaction videos. For each minute, parenting style was coded as either authoritative, permissive, or authoritarian, based on the style that was exhibited the most during that minute. Authoritative style was defined as parents having reasonable demands for child compliance and warmth towards their child. A permissive style was defined as parents having few demands for their child, but includes the presence of warmth. Authoritarian style was coded if the parent showed cold and demanding behaviors during most of the minutes, but this style was rarely seen in this situation in the lab (only 3% of interactions included any minutes of this style). The total number of minutes that were coded as authoritative and permissive styles were summed to give a total for each. Good interrater reliability for these codes was demonstrated, with 85% agreement. For this study, only authoritative parenting style was included in analyses for two reasons: first, our focus was on positive

parenting; second, these two behaviors were redundant and correlated $-.99$, and so both could not be included in analyses.

Self-perception. Each child completed the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA; Harter & Pike, 1984) at age 5. This scale assesses four components of self-perception: *Cognitive Competence*, *Physical Competence*, *Peer Acceptance*, and *Maternal Acceptance*, with six items for each (note: one item was omitted for cognitive competence because it was about getting stars on papers and these children were not in school yet). During this task, children were shown 23 sets of pictures and told a story about them. Examples of stories include: ‘This kid’s mom plays with him/her a lot (pointing to one picture); this kid’s mom plays with him/her a little (pointing to the other picture)’ or ‘This kid has a lot of friends to play with; this kid only has a few friends to play with’. They were then asked to pick which child was more like them, and then asked to pick whether they were ‘really’ or ‘sort of’ like that child. This two-stage response scale allows for coding of values from 1 (very low perceived self-competence or acceptance) to 4 (very high perceived self-competence or acceptance). Scores were averaged for each scale, and a total score was created by averaging across all scales. Internal consistencies ranged from marginal to good: Cronbach’s $\alpha = .48$ for cognitive competence, $.70$ for peer acceptance, $.52$ for physical competence, $.73$ for maternal acceptance, and $.82$ for the total score. Because reliability for cognitive competence was below acceptable threshold, this scale was not included in analyses.

Results

Descriptive statistics and intercorrelations among the variables used for analyses are presented in Table 1.

ACE Model for Factor Structure for Self-Perception

The *umx* package (Bates et al., 2019) in R version 4.3.1 was used to estimate genetic and environmental influences on the three self-perception scales. Intraclass correlations and univariate ACE estimates for the PSPCSA variables are presented in Table 2. Model comparisons for univariate models can be found in Table S1. Genetic influences explained significant variability in physical competence (39%) and maternal acceptance (35%). All remaining variance in these variables was explained by the nonshared environment. The variability of peer acceptance was explained by shared environmental factors (23%) and nonshared environmental factors (77%).

A genetic common pathways model was used to examine the extent to which genetic and environmental factors explained variance in a common self-perception factor. Residuals for the three first-order scores were included, based on the best fits from the univariate analyses. Model comparisons are presented in Table 3, and the common pathways model is depicted in Figure 1. Genetic and nonshared environmental influences each explained 50% of the variance in the self-perception factor. Shared environment was not significant.

Familial Factors Contributing to Self-Perception

The single factor of self-perception was then used to examine the relationships between parenting and preschool children’s self-perception. We used mixed model multilevel linear regression modeling (MLM), which enabled inclusion of twins nested within

families, added as a random effect in each model. The variance components covariance structure was used as input because of the inclusion of random effects, and maximum likelihood estimation allowed comparisons across models. The amount of variance in preschoolers’ self-perception that was shared by twins was first evaluated using an initial, intercept-only model (see Table 4). As seen from the intraclass correlation in Table 4, 33% of the variance in self-perception was shared across twins, with the unexplained variance being significant ($p < .001$) for twin pairs (Level-2) and individual participants (Level-1).

Hypothesized sex differences. Sex of child and sex of co-twin were then added (see Table 4). As reflected by the increased Akaike’s Information Criterion (AIC) value relative to the baseline, intercept-only model, child sex did not explain significant variance in self-perception. The interaction between sex of child and co-twin was then included; this also did not significantly explain variance in child self-perception. Thus, there was no difference between boys and girls in mean self-perception scores, nor were scores influenced by having a male or female co-twin.

Relationship between parenting and self-perception. The four parenting variables (three parental warmth measures and parental style) were included in the next set of models (see Table 5) to predict children’s self-perception. The first model included only child and parent sex, neither of which were significant. The next model added the four parenting measures. Only parent positive affect was significant, but the effect was negative rather than positive as originally hypothesized, $AIC = 415.02$, $b = -0.25$, $t(290.83) = -2.29$, $p = .023$. We then examined interactions between child sex and each parenting variable. These were entered in separate models because of the relatively small sample size. The best-fitting model included a significant interaction between child sex and authoritative parenting style, $AIC = 411.65$, $b = -0.05$, $t(290.83) = -2.34$, $p = .020$. (Note that a single model including all four interactions simultaneously, as shown in Table 5, yielded the same result, although the AIC was slightly larger because of the loss of power due to a large number of interaction terms with a relatively small sample, $AIC = 415.49$.) The best-fitting model explained 5.40% of Level-1 variance and 8.45% of total variance in self-esteem relative to the Sex Effects model (see Table 5). The effect sizes associated with the parenting predictors correspond to medium or typical effect sizes for individual differences research (Gignac & Szodori, 2016).

The significant interaction was probed by running the MLM with only parent sex and authoritative style, separately for boys and girls. For boys, authoritative parenting style significantly predicted self-perception, $AIC = 190.01$, $b = -0.05$, $t(118.94) = -3.09$, $p = .003$, showing that boys who experience less authoritative parenting have higher self-perceptions. For girls, no variables were significant, $AIC = 228.14$, authoritative $b = 0.01$, $t(169) = 0.41$, $p = .69$.

Discussion

The results of this study indicated that for boys only, authoritative parenting was associated with lower self-perception. This contradicts previous research showing that authoritative parenting tends to be associated with the best outcomes for children even into adulthood and across cultures (Baumrind, 1968; Lavrič & Naterer, 2020; Sahithya et al., 2019). However, there is mixed evidence in which permissive parenting (in this study, the reverse of

Table 1. Descriptive statistics for preschool self-perception measures ($N = 306$)

	Peer acceptance	Physical competence	Maternal acceptance	Self-competence	Parent verbal warmth	Parent sensitivity	Parent positive affect	Authoritative style
Peer acceptance	1.0							
Physical competence	.42***	1.0						
Maternal acceptance	.50***	.46***	1.0					
Self-perception	.78***	.75***	.81***	1.0				
Parent verbal warmth	.01	-.15**	-.04	-.07	1.0			
Parent sensitivity	-.02	-.06	-.01	-.02	.14*	1.0		
Parent positive affect	-.11*	-.10	-.07	-.13*	.22***	.01	1.0	
Authoritative style	-.01	-.12*	-.06	-.07	.31***	.44***	.07	1.0
Mean	2.98	3.18	3.00	3.18	1.37	3.66	1.23	8.22
SD	0.64	0.54	0.64	0.42	0.33	0.35	0.28	2.45

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2. Univariate ACE estimates [CIs] for best models for self-perception scales

Self-perception subscale	Intraclass correlations		ACE estimates		
	ICC _{MZ}	ICC _{DZ}	A	C	E
Physical competence	.35	.22	.62 [.42, .75]	–	.78 [.66, .90]
Peer acceptance	.22	.25	–	.48 [.28, .62]	.88 [.79, .91]
Maternal acceptance	.35	.19	.59 [.38, .73]	–	.81 [.69, .92]

Note: ICC, intraclass correlation; A, additive genetic effects; C, shared (common) environmental effects; E, nonshared environmental effects.

Table 3. Model comparisons for genetic factor models of self-perception

	-2LL	Δdf	AIC	Model compared to
1. Full model	1476.56	–	–307.44	–
2. Full model + drop common C	1476.56	1	–309.44	1
3. Full model + drop common A	1487.32	1	–298.68	1
4. Full model + drop common A and common C	1487.32	1	–300.68	2

Note: AIC, Akaike Information Criterion; A, additive genetic effects; C, shared (common) environmental effects; E, nonshared environmental effects. Best model appears in bold.

authoritative parenting) is sometimes associated with positive outcomes in children, particularly when there is warmth rather than simply a lack of limits, as would be present in neglectful parenting (Pinquart & Gerke, 2019).

The finding that more authoritative parenting was associated with lower self-perception in boys but not girls could be related to autonomy development if the presence of warmth and the absence of limits helps preschool boys develop independence and a sense of accomplishment. Other studies have found that scaffolding of structure and sensitivity helps children develop a positive self-concept (Paulus et al., 2018). Although this study did not examine

scaffolding and its effects on the development of positive self-perception in preschoolers, scaffolding could be a mechanism of action through which positive self-perception can develop. It is possible that boys in particular may benefit from this scaffolding process throughout the preschool period, potentially due to boys' tendency to take longer to acquire social skills in preschool compared with girls (Maleki et al., 2019). Therefore, having parents who impose fewer limits may allow boys a more gradual acquisition of skills. It is also possible that parents' perceptions of gender roles influence how they parent boys versus girls, resulting in differential responses to authoritative parenting based on child sex. More research is needed to determine the processes that influence how children react differently to parenting styles based on sex and gender.

Study 2

The goal of Study 2 was to examine research questions parallel to those examined in Study 1 but with respect to adult self-esteem. As self-perception in childhood is conceptually related to self-esteem in adulthood (Tafarodi et al., 2002), we expected that results for adult self-esteem would parallel those found in Study 1. Hypothesis 1 was that the five self-esteem items identified in Marshall et al. (2021) would load on one self-esteem factor, and this factor would be influenced by both genetic and nonshared environmental

Table 4. Relationship between participant sex and co-twin sex on 5-year-old self-perception (N = 306)

Predictors	Model/Estimates (SE)		
	0. Intercept-only	1. Participant and co-twin sex main effects	2. Participant × co-twin sex interaction
Intercept	3.06*** (.03)	3.06*** (0.04)	3.08*** (0.05)
Participant sex	–	–0.06 (0.06)	–0.11 (0.08)
Co-twin sex	–	0.08 (0.07)	0.03 (0.09)
Participant sex × co-twin sex	–	–	0.12 (0.12)
Variance components			
Twin pairs (Level-2), τ	.0788	.0758	.0758
Individual participants (Level-1), σ^2	.1577	.1582	.1575
Total	.2365	.2340	.2433
ICC	.3332	.3239	.3115
AIC	415.18	416.98	417.97
Estimated parameters	3	5	6

Note: ICC, intraclass correlations; AIC, Akaike Information Criterion. Model 0 is best model. Participant and co-twin sex were dummy coded; the estimated coefficients represent the magnitude of the mean differences between males (1) and females (0) for participants and their co-twins. *** $p < .001$.

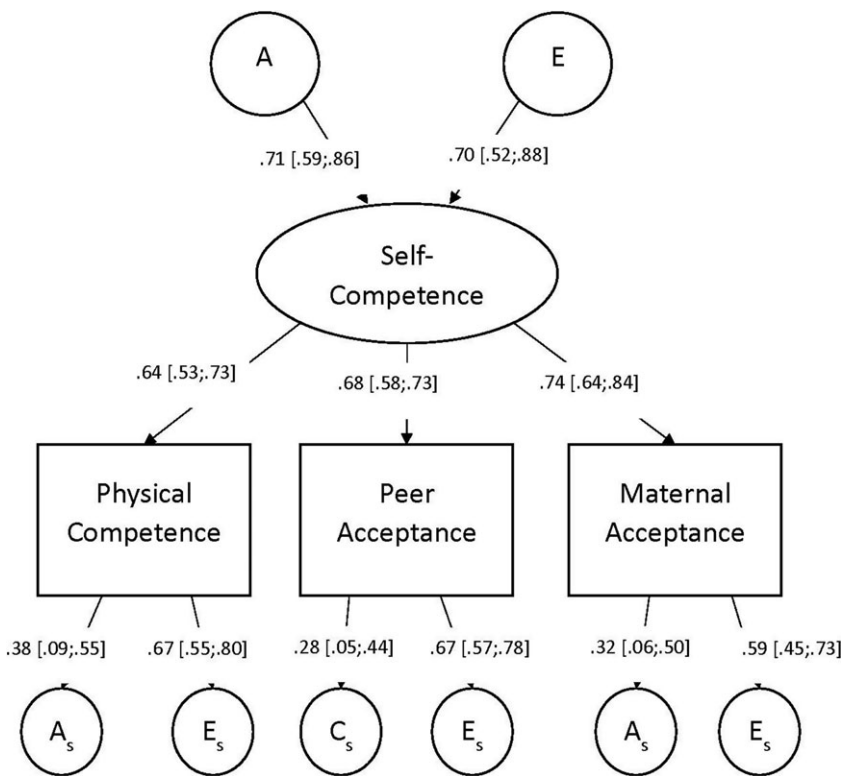


Figure 1. Final ACE model estimates for common pathways model of 5-year-old self-perception. Modeling of the residuals for the three PSCSA scales were taken from best univariate ACE models prior to running the common pathway model. Estimates are standardized.

Note: A, additive genetic effects; C, shared (common) environmental effects; E, nonshared environmental effects.

factors. Hypothesis 2 was that females with male co-twins would report lower levels of self-esteem than females with female co-twins, with males' self-esteem not related to co-twin sex (Kendler et al., 1998). Finally, Hypothesis 3 was that remembered maternal and paternal affection and discipline would be related to adult self-esteem when controlling for twin sex. We also examined interactions between parenting behaviors and participant sex.

The publicly available Midlife in the United States (MIDUS; Brim et al., 2007) dataset was used for the current investigation. The goal of the MIDUS was to investigate factors that contribute to

physical and mental health in midlife. An oversample of twin pairs was collected to facilitate genetically informed analyses. The full MIDUS sample includes 7108 individuals aged 20–75 years.

Materials and Methods

Participants

The present study made use of the twin oversample, which consisted of 753 twin pairs (304 MZ pairs, 260 same-sex DZ pairs, and 189 opposite-sex DZ pairs). Participants were excluded if they

Table 5. Relationship between observed parenting and 5-year-old self-perception ($N = 306$)

Predictors	Model/Estimates (SE)			
	3. Sex effects	4. Adding parenting	5. Adding sex \times parenting interactions	6. Including only significant interaction
Intercept	3.10*** (0.04)	3.10*** (0.04)	3.11*** (0.04)	3.11*** (0.04)
Child sex	−0.05 (0.06)	−0.04 (0.06)	−0.04 (0.06)	−0.04 (0.05)
Parent sex	−0.10 (0.07)	−0.14 (0.08)	−0.16* (0.07)	−0.15* (0.07)
Parent verbal warmth	–	−0.01 (0.09)	0.05 (0.12)	−0.02 (0.09)
Parent sensitivity	–	0.01 (0.09)	−0.04 (0.12)	0.003 (0.09)
Parent positive affect	–	−0.25* (0.11)	−0.34* (0.14)	−0.24* (0.11)
Parent authoritative style	–	−0.02 (0.01)	0.002 (0.02)	0.002 (0.02)
Child sex \times verbal warmth			−0.17 (0.17)	
Child sex \times sensitivity			0.11 (0.16)	
Child sex \times positive affect			0.23 (0.21)	
Child sex \times authoritative style			−0.05* (0.02)	−0.05* (0.02)
Variance components				
Twin pairs (Level-2), τ	.0766	.0799	.0731	.0745
Individuals (Level-1), σ^2	.1573	.1488	.1484	.1488
Total	.2439	.2287	.2215	.2233
ICC	.3141	.3494	.3300	.3336
AIC	416.55	415.02	415.49	411.65
Estimated parameters	5	9	13	10

Note: ICC, intraclass correlation; AIC, Akaike Information Criterion. Model 6 provides the best overall fit. For child and parent sex, 0 = female, 1 = male. Parenting variables were centered prior to entry; the intercept represents the expected self-esteem for a female participant who experienced mean levels of parenting.

* $p < .05$, *** $p < .001$.

did not complete the measures used in the present investigation, if their co-twins did not participate in the study, or if zygosity could not be determined. The final sample ranged in age from 25–75 years ($M = 45.52$ years, $SD = 12.14$ years) and was 55.8% female. Participants were predominantly white (92.70%), with the rest of the participants reporting their race as black (3.65%), Native American or Alaska Native (0.60%), multiracial (0.27%), another race (0.93%), or not reported (1.85%). Household income ranged from \$0–\$500,000 or more, with a median of \$100,000 (in 2020 U.S. dollars). The demographics of the twin subsample were comparable to the larger dataset.

Measures

Zygosity. Participants who had a same-sex co-twin completed a zygosity questionnaire over the phone. The questionnaire was developed for the MIDUS and contained items about perceived similarity and how often the twins were mistaken for one another. When co-twins' reports yielded the same zygosity diagnosis, that diagnosis was used. In cases of significant disagreement, zygosity was not able to be determined ($N = 24$); those twins were not included in the present study.

Self-esteem. The self-esteem variable developed for Marshall et al. (2021) was used to measure self-esteem in the current investigation. This variable consists of five items (e.g., 'Self-confident') taken from other scales within the MIDUS. Items used in the scale had a variety of response scales; as such, z scores for each item were used to ensure equal item weight. Internal consistency for this scale was adequate when estimated in a randomly selected participant from each twin pair (Sample 1:

$\alpha = .77$) and for a second subset comprised of the remaining participants (Sample 2; $\alpha = .76$). The scale is significantly correlated with the Rosenberg Self-Esteem scale administered in Wave 2 of the MIDUS (Marshall et al., 2021).

Remembered parenting. Remembered childhood parental affection and discipline were measured using scales developed for the MIDUS (Ryff & Keys, 1995). Participants reported their memories of their mothers' and fathers' parenting separately, and questions were identical with the exception of pronouns indicating gender. The affection scale included seven items (e.g., 'How much love and affection did she give you?'). Internal consistency of this scale was good for both maternal ($\alpha = .91$ in Sample 1, $\alpha = .91$ in Sample 2) and paternal parenting ($\alpha = .93$ in Sample 1, $\alpha = .92$ in Sample 2). The discipline scale included five items (e.g., 'How consistent was she about the rules?'). Internal consistency of this scale was adequate for both maternal ($\alpha = .75$ in Sample 1, $\alpha = .75$ in Sample 2) and paternal parenting ($\alpha = .83$ in Sample 1, $\alpha = .81$ in Sample 2).

Procedure

Twins were identified for participation in the MIDUS (Brim et al., 2007) by screening a random sample of 50,000 households for presence of a set of twins in the family. Of the 14.8% of participants who mentioned a pair of twins in their family, 60% gave permission for researchers to contact those twins. Participants completed a phone interview that contained questions about physical and mental health and social factors thought to contribute to health. Relevant to the current investigation, participants completed measures of their remembered parenting and a variety of measures

Table 6. Correlations between adult self-esteem and parental affection and discipline

	Self-esteem	Maternal affection	Maternal discipline	Paternal affection	Paternal discipline
Self-esteem	1.0				
Maternal affection	.28***	1.0			
Maternal discipline	.12***	.14***	1.0		
Paternal affection	.29***	.47***	.24***	1.0	
Paternal discipline	.06*	.12***	.46***	.24	1.0
Mean	0.00	3.20	3.01	2.77	3.04
SD	0.72	0.68	0.58	0.79	0.69
Usable <i>n</i>	1506	1506	1506	1426	1425

Note: * $p < .05$, *** $p < .001$.

Table 7. Univariate ADE estimates for best models for self-esteem items

Self-esteem item	Intra-class correlations		ADE estimates		
	ICC _{MZ}	ICC _{DZ}	A	D	E
I like most parts of my personality.	.34	.08	.53 [.45, .60]	–	.85 [.80, .90]
In many ways, I feel disappointed in my achievements in life. (reverse scored)	.36	.12	.58 [.54, .65]	–	.82 [.76, .87]
When I look at the story of my life, I am pleased with how things have turned out so far.	.36	.07	.00	.57 [.48, .64]	.82 [.77, .88]
Self-confident.	.40	.13	.61 [.54, .68]	–	.79 [.74, .85]
Overall, how satisfied are you with yourself?	.37	.04	.00	.59 [.56, .66]	.81 [.76, .87]

Note: ICC, intraclass correlation; A, additive genetic effects; D, nonadditive genetic (or dominance) effects; E, nonshared environmental effects.

of socioemotional functioning from which self-esteem items were identified.

Results

Descriptive statistics and intercorrelations among the variables used for analyses are presented in Table 6.

ACE Model

Intraclass correlations and univariate ACE estimates for each of the self-esteem items were assessed using *umx* in R version 4.3.1 and are presented in Table 7. Model comparisons are depicted in Table S2. Variability in each self-esteem item was explained by genetic and nonshared environmental factors. Similar to the self-perception results found in Study 1, heritability estimates ranged from 28% to 37%, and nonshared environmental estimates ranged from 62% to 72%. There were no significant influences of the shared environment on any of the self-esteem items.

A genetic common pathways model within *umx* was used to examine the extent to which genetic and environmental factors explained variance in a common self-esteem factor. Residuals for each item were based on the univariate modeling; thus, each item included A, D, and E residuals where appropriate. Comparison of nested models (see Table 8) showed that the AE model best fit the data. The common pathways model for self-esteem is depicted in

Table 8. Model comparisons for genetic factor models of self-esteem

	-2LL	Δdf	AIC	Model compared to
1. Full model	19527.49	–	19577.49	–
2. Full model + drop common D	19527.49	1	19575.49	1
3. Full model + drop common A and common D	19625.08	1	19671.08	2

Note: AIC, Akaike Information Criterion. A, additive genetic effects; D, nonadditive genetic (or dominance) effects. Best model appears in bold.

Figure 2. Genetic and nonshared environmental influences explained 58% and 42% of the variance in self-esteem, respectively.

Familial Factors Contributing to Self-Esteem

An initial, intercept-only model was used to quantify the amount of variance in the adult self-esteem factor that was shared between twins prior to evaluating the primary hypotheses. Table 9 displays the estimated variance components for this baseline model (Model 0). The intraclass correlation indicated that 32% of variance in self-esteem was shared between twins; estimated residual variance was significant ($p < .001$) across both twin pairs (Level-2) and participants (Level-1). Due to the wide age range of adult participants (i.e., 25–75 years), Model 1 introduced participant

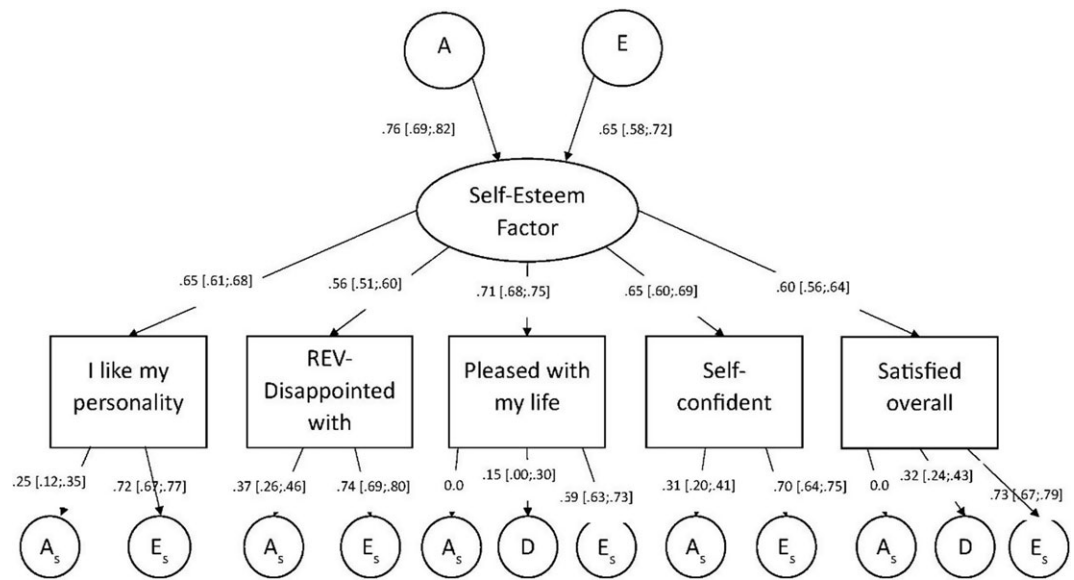


Figure 2. Final ACE model estimates for common pathways model of adult self-esteem. Residuals for 5 items were taken from best univariate ACE models prior to running common pathway model. Estimates are standardized. Note: A, additive genetic effects; D, nonadditive genetic (or dominance) effects; E, nonshared environmental effects.

age as a covariate, which was significantly related to self-esteem, $b = 0.01$, $t(753) = 3.52$, $p < .001$, and accounted for 3.4% of variance between twin-pairs (i.e., Level-2 variance).

Hypothesized sex differences. Model 2 introduced participant sex and co-twin sex as potential predictors of adulthood self-esteem (see Table 9). Inclusion of these main effects was associated with a slight improvement in model fit via the AIC. Inspection of the individual coefficients showed that male participants, on average, reported significantly higher self-esteem than females, $b = 0.09$, $t(1441) = 2.19$, $p = .03$. Co-twin sex was not significantly related to adulthood self-esteem, $b = 0.02$, $t(1441) = 0.55$, $p = .58$. Despite the coefficient for participant sex being significant, the effect size was trivial (0.1% of Level-1 variance in self-esteem and 0.4% of total variance).

A third model was used to determine whether the magnitude of the observed sex difference (see Model 3) differed depending on whether the twin and their co-twin were male or female. Adding the participant sex \times co-twin sex interaction did not result in improved overall model fit and accounted for negligible additional variance explained (<0.1% of both Level-1 and total variance). Notably, once the interaction was included, the coefficient that was previously associated with participant sex was no longer significant.

Relationship between maternal and paternal parenting on self-esteem. Three additional models were used to quantify the relationship between parenting and self-esteem (see Table 10). Model 5 included mother’s affection and discipline, whereas Model 6 added the same predictors, but for ratings of the father’s parenting. Model 7 included both parents simultaneously. As age and sex differences in self-esteem were identified previously, these variables were retained as covariates in these models, as well as used as a baseline model for subsequent comparisons (see Table 10, Model 4). These models were estimated using data from participants who provided complete data for both maternal and paternal parenting (usable $n = 1425$; 95% of the original sample).

Relative to the baseline model, the addition of maternal parenting was associated with improvements in overall model fit. Both maternal affection, $b = 0.28$, $t(1292) = 10.02$, $p < .001$, and

discipline, $b = 0.08$, $t(1381) = 2.63$, $p = .009$, were positively associated with self-esteem. The maternal parenting variables explained 4% of Level-1 variance and 9% of total variance in self-esteem, which correspond to medium and large effect sizes for individual differences research (Gignac & Szodori, 2016) respectively. It is important to note that, after including maternal parenting in the model, participant sex was no longer significantly associated with self-esteem. The model with paternal affection and discipline was also associated with significantly improved overall fit relative to the baseline model. The overall effect sizes were comparable to those for maternal parenting (5% of Level-1 and 8% of total variance); however, only paternal affection was significantly predictive of self-esteem, $b = 0.26$, $t(1247) = 10.35$, $p < .001$ (see Table 10).

When both maternal and paternal parenting were combined in the same model (Model 7 in Table 10) an additional 2% of Level-1 variance and 3% of total variance in self-esteem was provided over and above that provided by maternal parenting alone. The incremental improvement in fit was supported with the lowest overall AIC value, making this the best-fitting model. Maternal affection, $b = 0.19$, $t(1298) = 6.32$, $p < .001$, and paternal affection, $b = 0.17$, $t(1259) = 6.23$, $p < .001$, were significantly related to adult self-esteem. Maternal discipline reduced to a marginal level of significance, $b = 0.07$, $t(1382) = 1.90$, $p = .057$, once paternal parenting was controlled.

Sex differences in the relationship between remembered parenting and self-esteem. An additional model was estimated, based on the best-fitting model (Model 7), to explore potential sex differences in the role of maternal and paternal parenting on self-esteem (Model 8; see Table 10). This model included interactions between parenting and participant sex and was compared to Model 7, which contained only main effects. The improvement associated with including these interactions (AIC = 2841.02) was small relative to Model 7 (AIC = 2842.85). A significant sex \times maternal affection coefficient (see Table 10) indicated that the relationship between maternal affection and self-esteem was significantly weaker among males, simple slope $b = 0.11$, $t(601) = 2.29$, $p = .02$, than among females, simple slope $b = 0.23$,

Table 9. Relationship between participant sex and co-twin sex on adult self-esteem ($N = 1506$)

Predictors	Model/Estimates (SE)			
	0. Intercept-only	1. Age (in years)	2. Participant and co-twin sex main effects	3. Participant × co-twin sex interaction
Intercept	0.00 (0.02)	0.00 (0.02)	−0.05 (0.03)	−0.03 (0.03)
Age (covariate)		0.01* (0.00)	0.01* (0.00)	0.01* (0.00)
Participant sex	–		0.09* (0.04)	0.03 (0.06)
Co-twin sex	–		0.02 (0.04)	−0.04 (0.06)
Participant sex × co-twin sex	–		–	0.12 (0.10)
Variance components				
Twin pairs (Level-2), τ	.1656	.1600	.1582	.1575
Individual participants (Level-1), σ^2	.3520	.3520	.3515	.3515
Total	.5176	.5120	.5097	.5090
ICC	.3199	.3125	.3104	.3094
AIC	3206.82	3196.52	3194.65	3195.17
Estimated parameters	3	4	6	7

Note: ICC, intraclass correlations; AIC, Akaike Information Criterion. Best model is Model 1. Age (in years) was centered and participant and co-twin sex were dummy coded prior to entry. As such, the estimated coefficients represent the magnitude of the mean differences between males (1) and females (0) for participants and their co-twins.

* $p < .05$.

Table 10. Relationship between remembered maternal/paternal parenting and adult self-esteem ($N = 1425$)

Predictors	Model/Estimates (SE)				
	4. Sex differences	5. Maternal parenting	6. Paternal parenting	7. Maternal and paternal parenting	8. Sex × parenting interactions
Intercept	−0.02 (0.03)	−0.01 (0.03)	−0.01 (0.03)	−0.01 (0.03)	−0.00 (0.03)
Participant age (covariate)	0.01* (0.00)	0.01* (0.00)	0.01* (0.00)	0.01* (0.00)	0.01* (0.00)
Participant sex (covariate)	0.08* (0.04)	0.04 (0.04)	0.05 (0.04)	0.04 (0.04)	0.04 (0.04)
Maternal affection	–	0.28* (0.03)	–	0.19* (0.03)	0.24* (0.04)
Maternal discipline	–	0.08* (0.03)	–	0.07 (0.04)	0.03 (0.05)
Sex × maternal affection	–	–	–	–	−0.12* (0.06)
Sex × maternal discipline	–	–	–	–	0.10 (0.07)
Paternal affection	–	–	0.26* (0.02)	0.17* (0.03)	0.17* (0.04)
Paternal discipline	–	–	−0.02 (0.03)	−0.04 (0.03)	−0.07 (0.04)
Sex × Paternal affection	–	–	–	–	−0.01 (0.05)
Sex × Paternal discipline	–	–	–	–	0.07 (0.06)
Variance components					
Twin pairs (Level-2), τ	.1611	.1329	.1369	.1267	.1244
Individual participants (Level-1), σ^2	.3375	.3232	.3220	.3165	.3154
Total	.4986	.4561	.4589	.4432	.4398
ICC	.3231	.2914	.2983	.2859	.2829
AIC	2985.17	2877.31	2882.73	2842.85	2841.02
Estimated parameters	5	7	7	9	13

Note: ICC, Intraclass correlations; AIC, Akaike's Information Criterion. Model 8 provides the best fit to the data. For sex, 0 = female, 1 = male. Age and parenting variables were centered prior to entry; as such, the intercept represents the expected self-esteem for a 42-year-old female participant who provided mean levels of remembered parenting.

* $p < .05$.

$t(719) = 5.67$, $p < .001$. None of the other participant sex × parenting interactions were significant. Moreover, the effect sizes associated with the interactions were small (1.82% of

Level-2 variance) or trivial (0.78% of total variance). Main effects for both maternal and paternal affection remained significant ($p < .001$) after including the interaction terms.

Discussion

The goal of Study 2 was to examine genetic and familial influences on self-esteem in adulthood, with a particular emphasis on familial factors. The five self-esteem items identified in Marshall et al. (2021) loaded onto one self-esteem factor, and variance in the factor was explained by significant additive genetic and nonshared environmental factors. This extends findings from previous twin studies of self-esteem (e.g., Kendler et al., 1998; Marshall et al., 2021; Roy et al., 1995) that have demonstrated additive genetic and nonshared environmental effects on adult self-esteem by demonstrating similar heritability on a factor score instead of a variable created by averaging items (as in Marshall et al., 2021), and also by augmenting the twin sample used in Marshall et al. (2021) by including a large number of opposite-sex twin pairs. Remembered maternal and paternal affection were also significantly related to self-esteem when controlling for sex and age. Effects of maternal parenting on self-esteem were stronger among males, but they were significant for both sexes. Thus, memories of parenting appear to be a critical influence on self-esteem even into adulthood. Co-twin sex was not significantly related to self-esteem, suggesting that if co-twins influence one another's self-esteem, it is through more nuanced processes, such as the co-twin relationship.

General Discussion

Self-esteem is dynamic and develops throughout the lifespan. The goals of the present study were to investigate genetic influences on its childhood precursor, self-perception, as well as on self-esteem in adulthood, and to examine the contribution of parenting styles and co-twin sex. Results showed that both self-perception and self-esteem were heritable, and the nonshared environment also explained variability in both constructs. The interaction between participant sex and co-twin sex was not related to self-perception or self-esteem. However, as expected, parenting was related to self-perception in childhood and self-esteem in adulthood.

Genetic Effects

We extended previous research by utilizing a genetic factor model, showing that shared genes contribute to the covariance between components of self-perception in both childhood and adulthood. With respect to self-perception, the presence of a common factor suggests that children's assessments of themselves on the three facets of competence and acceptance are related to one another. Although not directly examined in the present study, it is possible that genes that contribute to temperament in childhood and personality in adulthood are also related to self-perception and self-esteem. For example, children and adults high on positive affect may be more likely to have generally positive opinions of themselves; thus, genes that influence temperament and personality traits that are associated with higher levels of positive affect (e.g., surgency and extraversion) may also be related to self-esteem. Given the relationship between self-esteem and internalizing disorders in both children and adults (Creemers et al., 2013; Keane & Loades, 2017; Klaver et al., 2014), another possibility is that genes that contribute to depression and anxiety also may explain variability in self-perception and self-esteem. The nongenetic variance in self-perception and self-esteem was explained by nonshared environmental factors, suggesting that experiences that twins do not share are critical for explaining how people think about themselves in both childhood and adulthood.

It should also be noted that the pattern of genetic and environmental influences on the residual variance in self-perception scales parallels findings on adolescents (Neiderhiser & McGuire, 1994). Peer social acceptance was explained only by environmental influences, whereas the other measures of self-perception showed genetic influence. However, it is also important to note that peer acceptance loaded on the general self-perception factor, which showed significant genetic influence. Thus, social acceptance may be partially influenced by genetic factors that are shared with self-competence measures.

Co-Twin Effects on Self-Perception and Self-Esteem

Co-twins are important parts of each other's social environments and are attachment figures, particularly for MZ twins (de Oliveira Landenberger et al., 2021). Nevertheless, co-twin sex was not related to self-perception and self-esteem. Although the interaction between sex and co-twin sex was not significant in early childhood or adulthood, the inclusion of the interaction in the models predicting adult self-esteem reduced the small effect of participant sex to zero. Thus, the effect of participant sex was not robust for adults. This is consistent with the findings for self-perception in childhood, in which participant sex and co-twin sex were not significantly predictive. To our knowledge, only one study has previously shown effects of co-twin sex on self-esteem (Kendler et al., 1998); thus, it is possible that, if co-twins influence each other's self-esteem, the processes through which this occurs are more complex. It is possible that a positive relationship with the co-twin is related to positive feelings about the self, regardless of the sex of the co-twin. Future research should examine co-twin relationship quality as a possible predictor of self-esteem.

Parental Influences on Self-Perception and Self-Esteem

It was hypothesized that more positive parenting would be related to both self-perception and self-esteem. However, contrary to expectations, most parenting measures were unrelated to early childhood self-perception, with the exception of parent positive affect being negatively related to self-perception in all children and authoritative parenting style being negatively related to self-perception for boys. The direction of these effects is contrary to expectations; however, it is possible that parents are responding to children who exhibit negative self-perceptions with increased positivity and more guidance and direction. Thus, the effect may be at least partly child-driven (Sameroff, 2009), and this possibility should be examined further.

Findings with respect to adult self-esteem, on the other hand, were in line with expectations, with more remembered parental affection being related to higher self-esteem, particularly in females. These findings suggest that parents play different roles in their children's feelings about themselves throughout the lifespan. In childhood, self-perception represents the cognitive component of self-esteem (Richardson et al., 2009), and children use assessments of their performance in different areas to inform their self-perception (Harter, 1990b). In addition, some young children (approximately 33%) tend to over-estimate their self-perception, and some children underestimate their performance (Mathias et al., 2011). Although they may use their own experiences in a given area to estimate their self-perception in that area, their assessments are not entirely objective and may be more related to an innate assessment of self. Thus, parenting may be less influential at these ages. Self-esteem, by contrast, consists of both cognitions (i.e., thoughts about the self) and affective states

(i.e., feelings about the self; Rosenberg, 1965). Affectionate interactions with parents may be important as individuals attempt to increase their competencies, particularly when failures occur. Especially during late childhood and adolescence, affectionate parents may help their children develop resilience to failures (Masten & Palmer, 2019). It is notable that the effect of maternal affection was stronger for females than males. However, it was significant for both males and females, suggesting that affection from mothers contributes to the self-esteem of both genders.

Authoritative parenting style was negatively related to self-perception for preschool boys only. It was expected that authoritative parenting would be related to self-perception due to its relationship to a host of positive outcomes, including academic skills (Hayek *et al.*, 2022), prosocial behavior (Kang & Guo, 2022), and fewer problem behaviors (Wells *et al.*, 2020). However, it is possible that even authoritative parenting style, which includes warm and constructive corrections of the child's behaviors, emphasizes children's failures and contributes to negative feelings about themselves. By contrast, remembered maternal discipline was positively related to self-esteem in adults. Paternal discipline, on the other hand, was not related to self-esteem in adulthood. It is possible that adults contextualize their mothers' discipline and understand that it was meant to help them. Fathers tend to engage in less discipline than mothers in general (Chen *et al.*, 2001), partly due to decreased time spent together (Craig, 2006) so perhaps children receive more helpful corrections from their mothers that are related to increased success. Future research should focus on attitudes toward parenting practices throughout the lifespan and how those attitudes contribute to the relationship between parenting and self-esteem.

Strengths and Limitations

An important strength of this study was the use of a twin design to examine the heritability of self-perception and self-esteem. The use of twins in a multilevel modeling framework allowed for a more robust test of parenting effects on self-perception and self-esteem compared to studies of one individual per family. The present study also examined self-perception in early childhood and self-esteem in adulthood. Thus, we were able to answer developmental questions about how genes, co-twins, and parents relate to assessments of the self at different ages. Although longitudinal studies that include the entire lifespan are needed to fully answer these questions, cross-sectional investigations do allow consideration of how children differ from adults. Understanding how early self-perception differs from later self-esteem is an important step to understanding this development across time.

There are also some limitations that should be addressed. First, the parenting measures in childhood and adulthood were different, making it difficult to compare results across ages. Thus, differences in relationships between parenting and self-perception and self-esteem across ages could be due to measurement effects. Additionally, each measure had limitations that should be addressed. The parenting measure in Study 1 consisted of a 10-minute parent-child interaction in the lab. This scenario may not reflect what routinely occurs in the home, particularly as only one parent and the twins are present. Thus, influences of the other parent in the home, as well as any additional siblings, were not examined, and only one parent was involved in the observed parent-child interactions. Additionally, remembered parenting in adulthood may not reflect the parenting that actually occurred in childhood. Although memories of parenting may have an

important influence on adult behaviors, it would be valuable to also assess parenting that was actually experienced in childhood as it impacts adult self-esteem. Overall, longitudinal studies with similar measures of parenting across the lifespan are needed.

In addition, the study was cross-sectional and only included early childhood and a wide age range of adulthood. Thus, longitudinal studies are still needed to understand how self-perception develops into self-esteem across the lifespan and how parents and siblings contribute to that process. It will be particularly important to examine middle childhood, when self-esteem can begin to be measured accurately, and adolescence, which is a critical period of identity development during which individuals begin to separate from parents. Also, this sample was comprised of twins, and they may differ from singletons in development of self-esteem. One study showed that twins appear to differ from singletons in certain aspects of identity development (Amani & Shariatipour, 2021), although no difference was found in an earlier study on self-esteem (Pearlman, 1990).

Future Directions

The findings of this study suggest that genes are important for early childhood self-perception and adult self-esteem. However, genes related to self-perception and self-esteem have not been identified. Genes that contribute variability to temperament and personality, as well as those that contribute to variability in internalizing disorders, are possible candidate genes that may be related to self-perception and self-esteem. Identification of these genes could be used to create polygenic risk scores that can examine whether the influence of parenting and other environmental factors on self-esteem is dependent upon genes (i.e., gene-environment interaction). The small to moderate effects of parenting found in this study suggest that it is possible that parenting influences different individuals in different ways, and this may be dependent on genes.

Conclusion

The present study adds to the literature on self-perception and self-esteem by exploring genetic and familial factors related to self-perception in childhood and self-esteem in adulthood. Variability in self-perception and self-esteem was explained by genetic and nonshared environmental factors, suggesting possible developmental cascades involving both genes and environmental factors. Although the relationship between affectionate parenting and early self-perception is still unclear, affectionate parenting does appear to be an important environmental factor related to self-esteem.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/thg.2023.44>.

Data availability. The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Competing interests. None.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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