Evolutionary Human Sciences (2022), **4**, e33, page 1 of 14
doi:10.1017/ehs.2022.34

RESEARCH ARTICLE

Age- and sex-based differences in the moral intuitions of American early adolescents

Brandon L. Bretl[1]* and Marlon Goering[2]

[1]University of Texas at Tyler, Tyler, Texas, USA and [2]University of Alabama at Birmingham, Birmingham, Alabama, USA
*Corresponding author. E-mail: BBRETL@uttyler.edu

Abstract

This study sought to explore the validity of a latent-factor model of moral intuition development during early adolescence. The 3-Factor Character Foundations Survey (CFS-3) was used to assess the moral intuitions of early adolescents ($n = 850$, mean = 12.4 years old, SD = 0.96) under a moral foundations theory framework. Confirmatory factor analysis supported the psychometric validity of the three latent factor constructs (autonomy, loyalty and empathy), and partial metric invariance was established to allow for the comparison of latent factor means between four age- and sex-based groups coinciding with averages for pubertal onset. Results support prior findings of greater latent factor means for females in all three factors when compared with males in the 11–12-year-old age group. Additionally, 13–14-year-old females exhibited lower latent factor means in autonomy and loyalty factors when compared with 11–12-year-old females. This resulted in 13–14-year-old females remaining higher in empathy and autonomy but showing no difference in loyalty when compared with 13–14-year-old males. The results are interpreted through the lens of attachment theory, socio-cultural influence and certain limitations of the survey instrument itself. Suggestions for future studies are proposed.

Keywords: Moral development; adolescence; autonomy; loyalty; empathy

Social media summary: The moral intuitions of American early-adolescent boys and girls show different developmental patterns.

Introduction

Moral foundations theory (MFT) posits that consistency in the types of social challenges faced during our evolutionary past has given rise to innate cognitive biases that provide a foundation for morality. Innate here refers to evolutionarily derived, genetically guided ontogeny that could influence cognitive processing or bias learning outcomes in meaningful ways, e.g. more readily learning a fear of snakes as opposed to learning a fear of flowers (Cook & Mineka, 1989; Deloach & LoBue, 2009; Rakison, 2009). As an intuitionist theory, MFT claims that moral judgements are primarily guided by feelings rather than the slower, rational processes of moral reasoning (Graham et al., 2012; Haidt, 2012). While MFT has found valid applications in social and political psychology studies involving adults, the field of moral *development* remains dominated by rationalist perspectives focused on the development of reasoning abilities (Killen & Dahl, 2021). To what degree evolutionarily derived innate biases influence moral intuition development and to what degree learning and reasoning influence moral intuition development are perennial questions of psychologists in the field. While this study cannot answer those questions per se, it does offer an important starting point for understanding the development of moral intuitions by considering a biologically driven latent factor structure to moral judgements

in early adolescents and assessing the latent factor mean differences between males and females in two distinct age groups roughly based on pubertal onset.

Placing morality in the context of evolutionary theory

From an evolutionary theory perspective, theories of human morality draw primarily from research on group-level selection (Smith, 2020). Under this paradigm, MFT views morality as a complex function of evolved psychological mechanisms and their genetic, cognitive, and cultural correlates that increase cooperation and group fitness, i.e. the ability for extended members of a family, clan, tribe, or society to function better (reproductively fitter) than another family, clan, tribe, or society (Curry, 2016; Curry, Mullins, & Whitehouse, 2019; Henrich & Henrich, 2006). Common components of these mechanisms include empathy, the basic emotions (e.g. fear), the moral emotions (e.g. guilt and shame), cultural norms and taboos, and reward and punishment (e.g. punitive deterrents). Importantly, the functional fitness gained from such mechanisms refers to incremental gains throughout evolutionary history and does not necessarily have anything to say about how beneficial these evolved psychological and cultural mechanisms are in the contexts of modern-day societies (Gross, 1998; Richerson & Boyd, 2006; Tooby & Cosmides, 1990).

Evolutionary theory also suggests certain sex differences in moral intuitions, and these differences might be primarily derived from differences in reproductive strategies. For example, sexual strategies theory suggests that males are biased towards short-term promiscuous sexual strategies whereas females are biased towards long-term and more committed sexual strategies (Buss, 2016), and different moral intuitions will be more or less aligned with these strategies. For example, empathy and loyalty are consistent with long-term strategies whereas autonomy is more consistent with a short-term strategy.

Moral foundations theory therefore attempts at an evolution-based explanation for many of the moral phenomena demonstrated in experimental studies and everyday life, e.g. the tendency to rapidly judge others' behaviours as right or wrong (good or bad), the increased emotional salience of moral violations when compared with social norm violations, and the persistence with which people will maintain their moral beliefs even in the face of evidence against their rational concerns, a.k.a., moral dumbfounding (McHugh et al., 2017). Moral foundations theory researchers have systematised the testing of these theoretical foundations of moral concern using five specific criteria: (1) evidence of stimulating a common concern in third-party normative judgements; (2) evidence of automatic affective stimulation; (3) evidence of widespread cultural distribution; (4) evidence of some form of innate preparedness; and (5) evidence that an evolutionary model demonstrates an adaptive advantage. For more elaboration on the development of these criteria and examples for how they are met, see Graham et al. (2011, 2012).

The six most widely accepted and studied foundations of MFT are care, justice, loyalty, authority, sanctity and autonomy. However, more recent studies of adults have shown that models that split the care foundation into animal physical harm, human physical harm and human emotional harm exhibit better model fit statistics (Clifford et al., 2015). Prior studies of adolescents have assumed a latent factor structure of moral intuitions based on the original six factors mentioned above (Bespalov et al., 2017; Cingel & Krcmar, 2020; Joeckel et al., 2012, 2013; Tamborini, 2011; Valkenburg & Peter, 2013). However, in more recent studies designed specifically to assess the latent factor structure of adolescents, only three of these foundations found psychometric support consistent with MFT: autonomy, loyalty and animal physical harm (Bretl, 2020). Therefore, the present study explored the theoretical potential of considering these three foundations as primary components of adolescent moral development by testing for psychometric validity and comparing their latent factor mean differences based on age and sex.

Autonomy, loyalty and empathy in developmental context

For this study, we explored the possibility of considering the three factors exhibiting prior psychometric validity with adolescent populations (autonomy, loyalty and animal physical harm) as a triad of

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

primary latent factor constructs relevant to adolescent moral development. Ratings of animal physical harm were considered a proxy for empathy because links between empathy development and judgements of animal cruelty have empirical support (Eisenberg-Berg & Mussen, 1978; McPhedran, 2009; Taylor & Signal, 2005). Indeed, the animal physical harm vignettes used in the present study were especially well suited to assess an empathy construct because they theoretically allowed for the bypassing of intentionality and culpability processing. The important role of intentionality and culpability processing in moral judgements and the ability to bypass such processing has been demonstrated experimentally as well (Alicke, 2000; Clark et al., 2015; Cushman, 2008; Davies & Rogers, 2009).

Autonomy is often considered *the* goal of adolescent development, and thousands of research papers attest to the importance of this construct across cultural settings (Smetana, 2017; Soenens et al., 2017; Zimmer-Gembeck et al., 2003). Previous research using autonomy violation vignettes to assess moral judgements has demonstrated that judgements of autonomy violations seem to be especially sensitive to the degree of kinship between actors. For example, moral violation ratings seem to be particularly sensitive to autonomy violations between immediate family members – and even more precisely sensitive to mother/daughter relationships, thus suggesting possible evolutionary correlates (Curtin et al., 2020; Lieberman et al., 2007).

Loyalty can be seen as the antithesis to autonomy development, as loyalty involves the balancing of commitments to others with commitments to self. Often described as 'the vexing virtue', there is good reason for adolescents to be especially sensitive to loyalty violations (e.g. betrayal) as they navigate increasingly meaningful peer relationships and at the same time seek to increase their independence (autonomy).

Unfortunately, little research to date has studied these developmental constructs under an MFT-based paradigm. Nonetheless, what can be gleaned from the scant literature suggests that the latent factor constructs of autonomy, loyalty and empathy as a triad of primary constructs related to adolescent moral development provide a promising starting point for future research investigating innate correlates of moral development during the transition from childhood to adulthood.

Age differences and hormonal influence

Hormonal influence on cognition and brain development has been generally understudied despite overwhelming evidence that there is a lot of meaningful sex-hormone-dependent brain development that takes place (Cahill, 2018). Indeed, pubertal onset is when many sex-based brain structure and function differences emerge (Goddings et al., 2019). Of relevance to general social processing and affectively mediated moral intuitions, a common theme of U-shaped and inverted U-shaped patterns of affective reactivity during adolescent development have been shown to be influenced by sex hormones. For example, inverted U-shaped peaks in amygdala and hippocampus responses to fearful facial expressions and sex differences in social- and self-evaluative processing brain regions have been found. However, testosterone levels in females exhibited an inverse pattern (U-shaped) in these neural responses correlated with pubertal stage (Vijayakumar et al., 2019). All of this is to suggest the possibility of meaningful correlations between pubertal sex hormones and affectively mediated moral intuitions.

More specifically, previous research suggests that early adolescence is a critical period for the maturation of brain areas that are involved in both socio-cognitive and affective processing, and these developmental changes may lead to fluctuating empathy levels during early adolescence (Blakemore & Choudhury, 2006). Interestingly, previous empirical findings suggest a temporal decline in general empathy during early adolescence (Goering & Mrug, 2021; Van der Graaff et al., 2014). Concurrently, early adolescence is a critical period for the nascent development of autonomy from parents as youth begin to detach from caregivers and spend more time with their peers (Meeus, 2016). In turn, adolescents' feelings of loyalty, specifically to other adults, may also decrease – which often manifests as parent–child conflict and increased feelings of adults as out-group 'others' during early adolescence (Marceau et al., 2015). Thus, we might expect to see higher sensitivity to violations of autonomy

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

and lower sensitivity to violations of loyalty corresponding with pubertal onset; however, it should be noted that this would only hold true for moral violations committed by adults.

On average, the onset of gonadarche is about age 11 for females and about age 13 for males, and the activation of the growth hormone axis (a primary consequence of puberty) is about age 12.5 for females and about age 13.8 for males (Figure 1) (Hansen et al., 2019). Therefore, we hypothesised that sensitivity to violations of autonomy would be particularly pronounced in 11–12-year-old females and in 13–14-year-old males owing to the onset of pubertal processes. We also hypothesised a decrease in loyalty sensitivity in these same groups owing to the fact that the moral violation vignettes in the current study involve adult perpetrators.

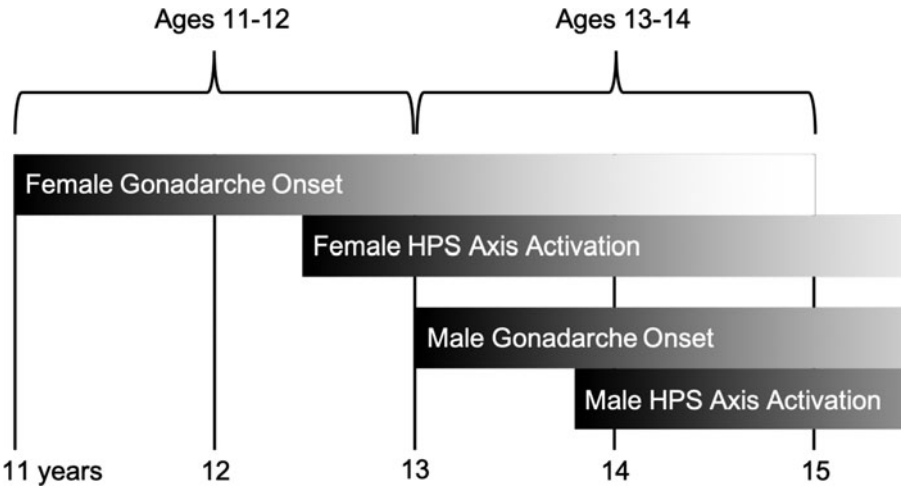

Figure 1. CFS-3 latent factor mean comparisons between age and sex groups.

Sex differences

Sex differences in empathy, autonomy and loyalty during early adolescence have been reported in prior research. In general, early adolescent females have higher levels of empathy compared with their male counterparts, and males experience a stronger temporal decline in empathy during early adolescence (Van der Graaff et al., 2014). Autonomy development has been specifically linked to the onset of puberty, and therefore females may develop concerns for autonomy earlier than their male counterparts as a result of having earlier pubertal timing (Branje, 2018; Negriff & Susman, 2011), and indeed, research in this area has demonstrated that females have higher levels of autonomy and self-reliance compared with males during early adolescence (Steinberg & Silverberg, 1986).

A meta-analysis on sex differences in friendship expectations found that females, in general, put greater emphasis on peer relationships, operationalised as feelings of loyalty, compared with males (Hall, 2011). There is also evidence that males and females exhibit different degrees of betrayal sensitivity, with females showing greater sensitivity (Atlas & Ingram, 1998; Burton et al., 2011; Feldman & Cauffman, 1999; Gobin & Freyd, 2009; Keng et al., 2019; Leets & Sunwolf, 2005; Singer & Doornenbal, 2006). However, relatively few studies have examined sex differences in loyalty expectations in early adolescence outside the realm of traumatic betrayal (Blakemore & Choudhury, 2006).

Current study

This study sought to confirm the psychometric validity of these three latent factors as assessed by the 3-Factor Character Foundations Survey (CFS-3). The study then sought to determine if there exist any significant differences between males and females during the developmental period of early

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

adolescence and between two distinct age groups (11–12-year-old and 13–14-year-old). Based on prior research, it was hypothesised that compared with males, females would have a higher latent factor mean rating in the animal physical harm factor (which serves as a proxy for empathy), a higher latent factor mean in the autonomy factor, and a higher latent factor mean in the loyalty factor. It was also hypothesised that 11–12-year-old females and 13–14-year-old males (when compared with same sex, different age groups) would have higher ratings in the autonomy factor but lower ratings in the loyalty factor owing to pubertal timing. In short, we hypothesised that there would be significant differences based on age and sex, yet owing to the lack of prior developmental research under an MFT-based paradigm and no direct measure of pubertal stage, our primary goals were exploratory in nature.

Methods

Measures

The study presented here used the CFS-3, which draws from a standardised database of moral violation vignettes created by Clifford et al. (2015). A complete list of vignettes for each factor is presented in Table 1.

For this study, the CFS-3 was administered as part of a larger, eight-factor, 48-item instrument, with the additional items acting as validation evidence in other studies (Bretl, 2020). The survey was taken via Qualtrics online software, and vignettes were presented in six blocks with each block containing eight randomly ordered vignettes (the order of which randomly changed for each participant) plus norm violation ratings and attention checks for further validation purposes. Instructions for each block read 'Rate the following situations': and each vignette started with 'You see a/an/someone …' and was followed by the moral violation. Under each vignette was a five-point Likert scale consisting of the choices 1 = 'Not Bad', 2 = 'A Little Bad', 3 = 'Bad', 4 = 'Very Bad' and 5 = 'Extremely Bad'. After completing all blocks of vignettes, participants were asked a series of demographic questions including grade, age and sex. Two attention checks asked participants to simply choose a specific

Table 1. Factors and **items** of the CFS-3

Item ID	Factors and items
	Animal physical harm
Q1_8	You see a man beating his pony with a whip for getting loose from its pen.
Q2_2	You see a woman throwing her cat across the room for scratching the furniture.
Q3_2	You see someone leaving his dog outside in the rain after it dug in the trash.
Q4_2	You see a male throwing rocks at cows in a field.
Q5_2	You see a zoo trainer jabbing a dolphin to get it to entertain his customers.
	Autonomy
Q2_4	You see a mother telling her son that she is going to choose all of his friends.
Q3_4	You see a man forbidding his wife to wear clothing that he has not first approved.
Q4_4	You see a woman pressuring her daughter to become a famous evening news reporter.
Q6_4	You see a mother forcing her daughter to enroll as a medical student in college.
	Loyalty
Q1_6	You see a coach celebrating with the other team's players who just won the game.
Q2_6	You see a former US General saying publicly he would never buy any American product.
Q3_6	You see a mayor saying that the neighbouring town is a much better town.
Q4_6	You see a teacher publicly saying she hopes another school wins the math contest.

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

rating for that item (e.g. 'For this item, select 'A Little Bad'). The protocol for this study was approved by the University of Kansas's Institutional Review Board as STUDY00142366: 'Character Foundations Survey (CFS) Reliability and Validation Study'.

Participant demographics

Adolescent participants came from three medium-sized, suburban middle schools in Kansas, USA. These schools had relatively large military populations as a result of nearby military bases. About 50% of students at these schools qualified for free or reduced lunch, and the racial demographics of the schools closely equated to national averages from the 2010 census (i.e. about 65% white, 15% black, 15% Hispanic and 5% other).

A total of 1,373 students from these three schools logged on to the survey website (62% of total school enrollment). Of students who logged on to the survey, 62% rated all violations, provided age and sex demographic information and answered the two attention checks correctly ($n = 850$). Respondents had an average reported age of 12.4 years (SD = 0.96). Frequencies of students divided into four age- and sex-based groups are provided in Table 2.

Table 2. Age and sex group frequencies

Age and sex	Frequency
11–12 male	203
13–14 male	172
11–12 female	259
13–14 female	216
Total	850

Statistical analysis: factor analysis

Factor analysis is one the most widely used multivariate statistical procedures in psychology (Brown, 2015; Spearman, 1904). The method is primarily concerned with determining the number and nature of latent variables (factors) that account for variation and covariation among a set of observed measures (indicators) (Brown, 2015). In other words, a latent factor is an unobserved variable that influences a set of observed measures and accounts for correlations among observed measures. Often, the interpretation is that the observed measures are intercorrelated because they share a common cause (i.e. influenced by the same underlying construct). To accomplish this, factor analysis partitions the variance of each indicator (derived from the sample correlation/covariance matrix which is used as input for the analysis) into two parts: (1) common variance, which is the variance accounted for by the factor, estimated on the basis of variance shared with other indicators in the analysis; and (2) unique variance, which is a combination of (a) reliable variance specific to the indicator (i.e. systematic influence on only one indicator) and (b) random error variance (i.e. measurement error or unreliability in the indicator) (Brown, 2015).

Results

CFA of the CFS-3, adolescent data

A baseline null model was run to determine the relevance of comparative fit indices. For this model, the RMSEA was above 0.158 (RMSEA = 0.195), thus providing evidence that comparative fit indices could be used to compare the model fit (Kenny et al., 2015). The CFA showed good model fit (Table 3).

Modification indices indicated one substantial point of strain in the model between items Q4_4 and Q6_4. These were the only two items that involved an autonomy violation between a mother/daughter

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

pair. That covariance was included in the model and fit significantly improved, so that covariance was kept in the model for subsequent analyses. The final model showed excellent fit (Table 4), and a final model path diagram is provided in Figure 2.

CFS-3 Multi-Group CFA by Age and Sex

A multi-group CFA was then run by dividing adolescent participants into four groups: 11–12-year-old males, 13–14-year-old males, 11–12-year-old females and 13–14-year-old females (Table 2). A multi-group CFA was then conducted to see if the multi-group model fit sufficiently well. The model showed good fit (Table 5). No further meaningfully interpretable error covariances could be found from the modification indices.

Table 3. Fit statistics of CFS-3, adolescent data

Factors	Model description	x^2	d.f.	x^2/d.f.	RMSEA	90% CI	AIC	CFI
3	Animal physical harm, autonomy and loyalty factors	153.137	62	2.470	0.044	0.035, 0.053	31,423.73	0.957

x^2, chi squared; d.f., degrees of freedom; RMSEA, root mean square error of approximation; CI, confidence interval; AIC, Akaike information criterion; and CFI, comparative fit index.

Table 4. CFS-3 fit statistics with relevant error covariance, adolescent data

Factors	Model description	x^2	d.f.	x^2/d.f.	RMSEA	90% CI	AIC	CFI
3	Animal physical harm, autonomy, and loyalty factors plus justifiable error covariance between items Q4_4 and Q6_4	102.190	61	1.675	0.028	0.019, 0.040	31,369.059	0.980

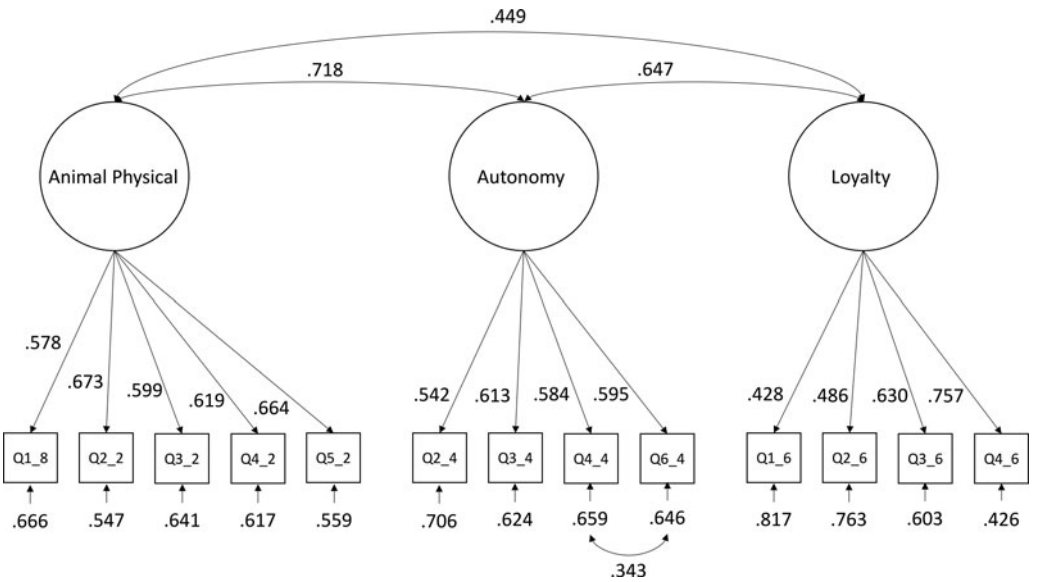

Figure 2. Adolescent CFS-3 path diagram (standardised).

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

Table 5. CFS-3 multi-group CFA fit statistics, adolescent data

Factors	Model description	x^2	d.f.	x^2/d.f.	RMSEA	90% C.I.	AIC	CFI
3	Final three-factor, multi-group model	403.898	304	1.329	0.040	0.029, 0.051	31,326.179	0.955

In order to compare latent factor means, a standard procedure of establishing partial metric invariance was followed (Putnick & Bornstein, 2016). The initial multi-group model demonstrated metric invariance but scalar non-invariance, so items were released one-by-one based on chi-square difference testing. In the end, partial metric invariance was established by releasing three items (Q2_4, Q3_4 and Q3_2; Table 6). Items, non-invariant groups and relevant item characteristics are provided in Table 7. Elaboration on the characteristics of these three items is provided in the Discussion section.

Table 6. CFS-3 configural, metric and scalar model comparisons

Model	Statistics						
	d.f.	AIC	BIC	x^2	x^2 Diff.	d.f. Diff.	*p*-Value
Configural	244	31,344	32,160	325.70			
Metric	274	31,324	31,997	365.07	39.365	30	0.118
Scalar	295	31,313	31,887	396.21	31.141	21	0.071

Table 7. Scalar non-invariant items, groups and relevant item characteristic

Item ID	Non-invariant groups	Relevant item characteristic
Q2_4	11–12-year-old males, 13–14-year-old males	Only item involving a mother violating son's autonomy
Q3_4	11–12-year-old males, 11–12-year-old females	Only item involving a man violating his wife's autonomy
Q3_2	11–12-year-old males, 13–14-year-old males	Only item involving a pet dog, possibly a highly salient and recognisable experience for teen males

To compare latent factor means between groups, multi-group CFAs were conducted with a reference group's latent factor intercepts constrained to zero. Standardised latent factor intercepts of the other groups could then be interpreted as latent factor mean differences. A table of the latent factor mean comparisons is presented in Appendix A, and a graph of significant mean differences is presented in Figure 3.

In the 11–12-year-old range, females had higher latent factor means in all three factors (animal physical harm, autonomy and loyalty). When comparing 11–12-year-old females with 13–14-year-old females, we see lower latent factor means for autonomy and loyalty, but no significant difference in animal physical harm. The comparison of 13–14-year-old females and males showed no significant differences in the loyalty latent factor mean but higher autonomy and animal physical harm latent factor means in females compared with males. The lack of significant differences between latent factor means of 11–12-year-old males and 13–14-year-old males suggests no significant differences in males during early adolescence on these latent factor constructs.

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

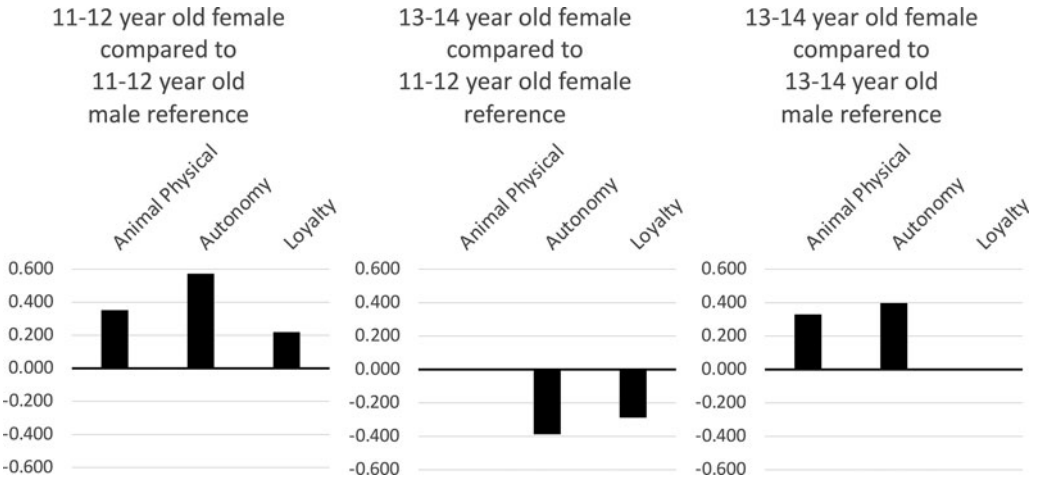

Figure 3. CFS-3 latent factor mean comparisons between age and sex groups. Reference group means constrained to zero. Graphs showing results at $p < 0.05$ significance level. No statistically significant results found between latent factor means of 11–12 year old males and 13–14 year old males.

Discussion

Validity and partial metric invariance

Analyses support the psychometric validity of the CFS-3 to assess the three latent factor constructs of autonomy, loyalty and animal physical harm in early adolescence under an MFT-based paradigm; additionally, partial metric invariance across age- and sex-based groups was achieved by releasing three items to allow inter-group comparisons. The three items released included two from the autonomy factor and one from the animal physical harm factor. The non-invariant items align with item characteristics that further support the idea of autonomy violation ratings as being highly sensitive to the nuanced details of kin relationships (Table 7). Given the lack of prior research on this area, no firm conclusions about the possible role of culture in these outcomes can be made, but a reasonable explanation for the male groups demonstrating non-invariance in this animal physical harm item might be the result of it being the only item involving a pet dog, and the experience of a having a pet dog might be uniquely salient to early adolescent males in this cultural context and during this developmental window. Again, this is merely an example of how culture might have an influence in these circumstances.

Latent factor mean differences

Animal physical harm

The present findings suggest that females have higher ratings on the animal physical harm factor in both age groups. When ratings of animal physical harm are used as a proxy for empathy, the present findings are consistent with previous findings suggesting that sex-based differences in empathy peak during early adolescence with females being more empathic and showing greater concern for physical harm violations (Rochat, 2022). The present findings showed no significant age differences in animal physical harm ratings. Therefore, the present findings do not support previous evidence of a temporary decline in empathy during early adolescence in males, but it should be noted that those prior studies did not include adolescents younger than 13 years old (Van der Graaff et al., 2014), and others involved a predominantly African American youth population who experience earlier pubertal timing and puberty-related social-emotional changes (Chumlea et al., 2003; Goering & Mrug, 2021). Therefore, the male participants in the current study might simply be too young to demonstrate a developmental change in the empathy construct.

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

Autonomy

Consistent with our hypothesis, some age-based differences in sensitivity to violations of autonomy between 11–12- and 13–14-year-old females were demonstrated. Specifically, 13–14-year-old females showed lower sensitivity to violations of autonomy compared with 11–12-year-old females. As mentioned previously, adolescents' concern for autonomy has been linked specifically to the onset of puberty (Branje, 2018). These findings are consistent with an inverted U-shaped pattern often seen in adolescent development where autonomy sensitivity is low prior to early adolescence, peaks at the onset of puberty, and then declines again in mid to late adolescence.

However, these differences were not demonstrated between 11–12- and 13–14-year-old males. One possible explanation is that all the items of the autonomy factor in the CFS-3 involve violations committed by an adult, so for females we might be witnessing effects as a result of declining attachments to parents and adult figures in general during pubertal onset. It has been demonstrated that females form stronger attachments with adults, so the lack of such attachments in males might explain the lack of decrease in male ratings of autonomy violations committed by adults at the onset of puberty.

The present findings also suggest that compared with males, females have higher sensitivity to violations of autonomy in both age groups – even after the significant decrease in autonomy sensitivity suggested by lower latent factor means in 13–14-year-old females described above. Again, greater autonomy during early adolescence is associated with de-idealising childhood attachment figures, and therefore may also be confounded by the CFS-3 employing only adults as committers of autonomy violations. Thus, the higher sensitivity to violations of autonomy in females may be explained by females having an earlier pubertal timing than males and the socio-cultural attachments that females tend to form with adult caregivers (Negriff & Susman, 2011), and it should also be noted that early adolescent males are usually granted more autonomy by caregivers compared with females, which may also explain higher sensitivity to violations of autonomy in females (Bumpus et al., 2001).

Loyalty

Consistent with our hypothesis, the present findings suggest that females have greater sensitivity to violations of loyalty compared with males at age 11–12 years old. Again, a possible explanation of this is the shift adolescents experience as they separate from primary attachment figures and form greater attachments with peers (Meeus, 2016). Similar to the items in the autonomy factor, the items in the loyalty factor all involve situations in which an adult in a position of power shows disloyalty to their in-group. A greater sensitivity to violations of loyalty from authority figures may be an expression of closer attachment to such authorities. Previous research suggests that females have closer attachments to non-parental authority figures such as teachers during both childhood and adolescence (Commodari, 2013; Liljeberg et al., 2011) and may thus be more sensitive to violations of loyalty from these figures compared with males.

Interestingly, the present results suggest that males and females do not differ in their sensitivity to loyalty violations at age 13–14 years old even though females aged 13–14 showed lower sensitivity to violations of loyalty than females aged 11–12 years old. With the development of more objective evaluations of attachment figures taking place during early adolescence combined with decreasing reliance on these attachment figures (Allen, 2008), slightly older adolescent females may be less sensitive to loyalty violations committed by adults. Lower sensitivity to violations of loyalty in 13–14-year-old females would also be consistent with an inverted U-shaped pattern where high loyalty sensitivity (at least when considering adult violators) correlates with the onset of puberty and decreases in mid- to late-adolescence. However, the lack of this pattern in males is inconsistent with our hypotheses, suggesting that there may be important interaction effects from socio-cultural factors that are not accounted for in the present study.

Limitations

The present study has some important limitations worthy of consideration by anyone interested in future research on this topic. Several of these limitations relate to the instrument itself and the

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

characteristics of the items. For example, the autonomy and loyalty items are distinct in that the autonomy items describe violations that occur in a close relationship of two individuals, whereas the loyalty items describe violations of one individual to a group of people. Future studies should test if there are effects based on individual- vs. group-based violations that confound the autonomy and loyalty constructs. Additionally, both the autonomy and loyalty items only include violations committed by adults, and therefore the instrument does not capture autonomy and loyalty violations committed by adolescent peers. As peers become increasingly important attachment figures during early adolescence, future research should seek to replicate the present findings with items involving violations committed by fellow adolescents. Another limitation is that the age differences found may not reflect *actual* developmental change as the present study used a cross-sectional design and did not collect longitudinal data. Future research should aim to replicate the age differences found with a longitudinal design that examines within-subject change during the critical period of early adolescence. Another important limitation is that participants in this study all came from a distinctly Mid-western USA socio-cultural context. This includes social demographics of the participant schools that include relatively high military populations and conservative political ideologies. Future studies of other social and cultural contexts in the USA and abroad will need to be done to further parse the biological and socio-cultural factors directing moral intuition development.

Conclusion

Results from the 3-Factor Character Foundations Survey demonstrated psychometric validity when used to assess early adolescents' moral intuitions in the domains of autonomy, loyalty and animal physical harm under an MFT paradigm. These three domains represent a triad of factors theoretically recognised as having significant influence on social and developmental outcomes during adolescence. Partial metric invariance was established for the instrument and age- and sex-based differences in latent factor means were found. Consistent with our hypothesis, 11–12-year-old females exhibited higher latent factor means than 11–12-year-old males in all three latent factor constructs, but inconsistent with our hypothesis, males exhibited no latent factor mean differences between the 11–12- and 13–14-year-old age groups. Consistent with our hypothesis, 13–14-year-old females exhibited a lower latent factor mean in the autonomy construct, but inconsistent with our hypothesis, they also exhibited a lower latent factor mean in the loyalty construct. This resulted in 13–14-year-old females remaining higher than 13–14-year-old males in the latent factor means of empathy and autonomy but showing no significant difference in the latent factor mean of loyalty. These results are consistent with inverted U-shaped developmental patterns common during adolescence, but further research will be need to confirm such a pattern. These findings nonetheless provide an important starting point for those interested in studying moral intuition development from a biological perspective and under an MFT-based paradigm. Additionally, the CFS-3 shows promise as a tool to test more rigorous theories of human evolution and innate neural ontogeny relevant to moral development, e.g. using the vignettes in neuroimaging studies to test the functional networking and influence of sex hormones on regions of interest theoretically involved in moral processing.

Author contributions. BB conceived and executed the study, data analysis, and first drafts. MG contributed significantly to the theoretical interpretation of findings and subsequent drafts.

Conflicts of Interest. None declared.

Data availability. All data will be made freely available by the corresponding author upon request

References

Alicke, M. D. (2000). Culpable control and the psychology of blame. *Psychological Bulletin*, *126*(4), 556.

Allen, J. P. (2008). The attachment system in adolescence. In *Handbook of attachment: Theory, research, and clinical applications* (2nd ed., pp. 419–435). The Guilford Press.

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

Atlas, J. A., & Ingram, D. M. (1998). Betrayal trauma in adolescent inpatients. *Psychological Reports*, *83*(3), 914.
Bespalov, A., Prudnikova, M., Nyamdorj, B., & Vlasov, M. (2017). Life aspirations, values and moral foundations in Mongolian youth. *Journal of Moral Education*, *46*(3), 258–271.
Blakemore, S., & Choudhury, S. (2006). Development of the adolescent brain: Implications for executive function and social cognition. *Journal of Child Psychology and Psychiatry*, *47*(3–4), 296–312.
Branje, S. (2018). Development of parent–adolescent relationships: Conflict interactions as a mechanism of change. *Child Development Perspectives*, *12*(3), 171–176.
Bretl, B. L. (2020). *Assessing the structure of moral intuitions*. Dissertation. University of Kansas. http://hdl.handle.net/1808/31814.
Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford Publications.
Bumpus, M. F., Crouter, A. C., & McHale, S. M. (2001). Parental autonomy granting during adolescence: Exploring gender differences in context. *Developmental Psychology*, *37*(2), 163–173. https://doi.org/10.1037/0012-1649.37.2.163
Burton, C. W., Halpern-Felsher, B., Rankin, S. H., Rehm, R. S., & Humphreys, J. C. (2011). Relationships and betrayal among young women: Theoretical perspectives on adolescent dating abuse. *Journal of Advanced Nursing*, *67*(6), 1393–1405.
Buss, D. M. (2016). *The evolution of desire: Strategies of human mating*. Basic Books.
Cahill, L. (2018). How does hormonal contraception affect the developing human adolescent brain? *Sex and Gender*, *23*, 131–135. https://doi.org/10.1016/j.cobeha.2018.06.015
Chumlea, W. C., Schubert, C. M., Roche, A. F., Kulin, H. E., Lee, P. A., Himes, J. H., & Sun, S. S. (2003). Age at menarche and racial comparisons in US girls. *Pediatrics*, *111*(1), 110–113. https://doi.org/10.1542/peds.111.1.110
Cingel, D. P., & Krcmar, M. (2020). Considering moral foundations theory and the model of intuitive morality and exemplars in the context of child and adolescent development. *Annals of the International Communication Association*, *44*(2), 120–138.
Clark, C. J., Chen, E. E., & Ditto, P. H. (2015). Moral coherence processes: Constructing culpability and consequences. *Current Opinion in Psychology*, *6*, 123–128.
Clifford, S., Iyengar, V., Cabeza, R., & Sinnott-Armstrong, W. (2015). Moral foundations vignettes: A standardized stimulus database of scenarios based on moral foundations theory. *Behavior Research Methods*, *47*(4), 1178–1198. https://doi.org/10.3758/s13428-014-0551-2
Commodari, E. (2013). Preschool teacher attachment, school readiness and risk of learning difficulties. *Early Childhood Research Quarterly*, *28*(1), 123–133. https://doi.org/10.1016/j.ecresq.2012.03.004
Cook, M., & Mineka, S. (1989). Observational conditioning of fear to fear-relevant versus fear-irrelevant stimuli in rhesus monkeys. *Journal of Abnormal Psychology*, *98*(4), 448–459. https://doi.org/10.1037/0021-843X.98.4.448
Curry, O. S. (2016). Morality as cooperation: A problem-centred approach. In *The evolution of morality* (pp. 27–51). Springer.
Curry, O. S., Mullins, D. A., & Whitehouse, H. (2019). Is it good to cooperate?: Testing the theory of morality-as-cooperation in 60 societies. *Current Anthropology*, *60*(1), 47–69. https://doi.org/10.1086/701478.
Curtin, C. M., Barrett, H. C., Bolyanatz, A., Crittenden, A. N., Fessler, D. M. T., Fitzpatrick, S., … Henrich, J. (2020). Kinship intensity and the use of mental states in moral judgment across societies. *Beyond Weird*, *41*(5), 415–429. https://doi.org/10.1016/j.evolhumbehav.2020.07.002
Cushman, F. (2008). Crime and punishment: Distinguishing the roles of causal and intentional analyses in moral judgment. *Cognition*, *108*(2), 353–380.
Davies, M., & Rogers, P. (2009). Perceptions of blame and credibility toward victims of childhood sexual abuse: Differences across victim age, victim-perpetrator relationship, and respondent gender in a depicted case. *Journal of Child Sexual Abuse*, *18*(1), 78–92.
DeLoache, J. S., & LoBue, V. (2009). The narrow fellow in the grass: Human infants associate snakes and fear. *Developmental Science*, *12*(1), 201–207. https://doi.org/10.1111/j.1467-7687.2008.00753.x
Eisenberg-Berg, N., & Mussen, P. (1978). Empathy and moral development in adolescence. *Developmental Psychology*, *14*(2), 185–186. https://doi.org/10.1037/0012-1649.14.2.185
Feldman, S. S., & Cauffman, E. (1999). Your cheatin' heart: Attitudes, behaviors, and correlates of sexual betrayal in late adolescents. *Journal of Research on Adolescence*, *9*(3), 227–252.
Gobin, R. L., & Freyd, J. J. (2009). Betrayal and revictimization: Preliminary findings. *Psychological Trauma: Theory, Research, Practice, and Policy*, *1*(3), 242.
Goddings, A.-L., Beltz, A., Peper, J. S., Crone, E. A., & Braams, B. R. (2019). Understanding the role of puberty in structural and functional development of the adolescent brain. *Journal of Research on Adolescence*, *29*(1), 32–53. https://doi.org/10.1111/jora.12408
Goering, M., & Mrug, S. (2021). Empathy as a mediator of the relationship between authoritative parenting and delinquent behavior in adolescence. *Journal of Youth and Adolescence*, *50*(7), 1308–1318.
Graham, J., Haidt, J., Koleva, S., Motyl, M., Iyer, R., Wojcik, S., … Ditto, P. (2012). *Moral foundations theory: The pragmatic validity of moral pluralism* (Vol. *47*). Social Science Research Network.

https://doi.org/10.1017/ehs.2022.34 Published online by Cambridge University Press

Graham, J., Iyer, R., Nosek, B. A., Haidt, J., Koleva, S., & Ditto, P. H. (2011). Mapping the Moral Domain. *Journal of Personality & Social Psychology*, *101*(2), 366–384.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, *2*(3), 271–299. https://doi.org/10.1037/1089-2680.2.3.271

Haidt, J. (2012). *The righteous mind: Why good people are divided by politics and religion*. Pantheon.

Hall, J. A. (2011). Sex differences in friendship expectations: A meta-analysis. *Journal of Social and Personal Relationships*, *28*(6), 723–747.

Hansen, D. M., Bretl, B. L., & Amini, B. (2019). *Adolescent development in context: Social, psychological, and neurological foundations*. University of Kansas Library.

Henrich, J., & Henrich, N. (2006). Culture, evolution and the puzzle of human cooperation. *Cognitive Systems Research*, *7*(2), 220–245. https://doi.org/10.1016/j.cogsys.2005.11.010.

Joeckel, S., Bowman, N. D., & Dogruel, L. (2012). Gut or game? The influence of moral intuitions on decisions in video games. *Media Psychology*, *15*(4), 460–485. https://doi.org/10.1080/15213269.2012.727218

Joeckel, S., Bowman, N. D., & Dogruel, L. (2013). The influence of adolescents' moral salience on actions and entertainment experience in interactive media. *Journal of Children & Media*, *7*(4), 480–506. https://doi.org/10.1080/17482798.2013.781513

Keng, S.-L., Noorahman, N. B., Drabu, S., & Chu, C. M. (2019). Association between betrayal trauma and non-suicidal self-injury among adolescent offenders: Shame and emotion dysregulation as mediating factors. *International Journal of Forensic Mental Health*, *18*(4), 293–304.

Kenny, D. A., Kaniskan, B., & McCoach, D. B. (2015). The performance of RMSEA in models with small degrees of freedom. *Sociological Methods & Research*, *44*(3), 486–507.

Killen, M., & Dahl, A. (2021). Moral reasoning enables developmental and societal change. *Perspectives on Psychological Science*, *16*(6), 1209–1225. https://doi.org/10.1177/1745691620964076

Leets, L. & Sunwolf (2005). Adolescent rules for social exclusion: When is it fair to exclude someone else? *Journal of Moral Education*, *34*(3), 343–362.

Lieberman, D., Tooby, J., & Cosmides, L. (2007). The architecture of human kin detection. *Nature*, *445*(7129), 727–731. https://doi.org/10.1038/nature05510

Liljeberg, J. F., Eklund, J. M., Fritz, M. V., & af Klinteberg, B. (2011). Poor school bonding and delinquency over time: Bidirectional effects and sex differences. *Journal of adolescence*, *34*(1), 1-9.

Marceau, K., Ram, N., & Susman, E. J. (2015). Development and lability in the parent–child relationship during adolescence: Associations with pubertal timing and tempo. *Journal of Research on Adolescence*, *25*(3), 474–489.

McHugh, C., McGann, M., Igou, E. R., & Kinsella, E. L. (2017). Searching for moral dumbfounding: Identifying measurable indicators of moral dumbfounding. *Collabra: Psychology*, *3*(1), 23. https://doi.org/10.1525/collabra.79

McPhedran, S. (2009). A review of the evidence for associations between empathy, violence, and animal cruelty. *Aggression and Violent Behavior*, *14*(1), 1–4. https://doi.org/10.1016/j.avb.2008.07.005

Meeus, W. (2016). Adolescent psychosocial development: A review of longitudinal models and research. *Developmental Psychology*, *52*(12), 1969.

Negriff, S., & Susman, E. J. (2011). Pubertal timing, depression, and externalizing problems: A framework, review, and examination of gender differences. *Journal of Research on Adolescence*, *21*(3), 717–746.

Putnick, D. L., & Bornstein, M. H. (2016). Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental Review*, *41*, 71–90. PubMed. https://doi.org/10.1016/j.dr.2016.06.004

Rakison, D. H. (2009). Does women's greater fear of snakes and spiders originate in infancy? *Evolution and Human Behavior*, *30*(6), 438–444. https://doi.org/10.1016/j.evolhumbehav.2009.06.002

Rochat, M. J. (2022). Sex and gender differences in the development of empathy. *Journal of Neuroscience Research*,. https://doi.org/10.1002/jnr.25009

Singer, E., & Doornenbal, J. (2006). Learning morality in peer conflict: A study of schoolchildren's narratives about being betrayed by a friend. *Childhood*, *13*(2), 225–245. https://doi.org/10.1177/0907568206062930

Smetana, J. G. (2017). The development of autonomy during adolescence: A social–cognitive domain theory view. In *Autonomy in Adolescent Development* (pp. 69–89). Psychology Press.

Smith, D. (2020). Cultural group selection and human cooperation: A conceptual and empirical review. *Evolutionary Human Sciences*, *2*, e2. Cambridge Core. https://doi.org/10.1017/ehs.2020.2

Soenens, B., Vansteenkiste, M., & Van Petegem, S. (2017). *Autonomy in adolescent development: Towards conceptual clarity*. Psychology Press.

Spearman, C. (1904). General intelligence, objectively determined and measured. *The American Journal of Psychology*, *15*(2), 201–292. https://doi.org/10.2307/1412107

Steinberg, L., & Silverberg, S. B. (1986). The vicissitudes of autonomy in early adolescence. *Child Development*, 841–851.

Tamborini, R. (2011). Moral intuition and media entertainment. *Journal of Media Psychology: Theories, Methods, and Applications*, *23*(1), 39.

Taylor, N., & Signal, T. D. (2005). Empathy and attitudes to animals. *Anthrozoös*, *18*(1), 18–27. https://doi.org/10.2752/089279305785594342

Tooby, J., & Cosmides, L. (1990). The past explains the present: Emotional adaptations and the structure of ancestral environments. *Ethology and Sociobiology*, *11*(4), 375–424. https://doi.org/10.1016/0162-3095(90)90017-Z

Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model. *Journal of Communication*, *63*(2), 221–243.

Van der Graaff, J., Branje, S., De Wied, M., Hawk, S., Van Lier, P., & Meeus, W. (2014). Perspective taking and empathic concern in adolescence: Gender differences in developmental changes. *Developmental Psychology*, *50*(3), 881.

Vijayakumar, N., Pfeifer, J. H., Flournoy, J. C., Hernandez, L. M., & Dapretto, M. (2019). Affective reactivity during adolescence: Associations with age, puberty and testosterone. *Cortex*, *117*, 336–350. https://doi.org/10.1016/j.cortex.2019.04.024

Zimmer-Gembeck, M., Collins, W., & Adams, G. (2003). Blackwell handbook of adolescence. Blackwell.

Appendix A: Latent factor mean comparisons between age and sex groups

Reference		Comparison groups					
11–12 male		13–14 male		11–12 female		13–14 female	
	Factor	Standard	*p*	Standard	*p*	Standard	*p*
	Animal Physical	−0.053	0.666	**0.352**	0.002	**0.270**	0.026
	Autonomy	−0.233	0.180	**0.572**	0.000	0.180	0.213
	Loyalty	−0.161	0.260	**0.219**	0.047	−0.050	0.677
11–12 female		13–14 female		13–14 male			
	Factor	Standard	*p*	Standard	*p*		
	Animal Physical	−0.096	0.376	**−0.395**	0.001		
	Autonomy	**−0.388**	0.005	**−0.848**	0.000		
	Loyalty	**−0.288**	0.010	**−0.435**	0.001		
13–14 male		13–14 female					
	Factor	Standard	*p*				
	Animal Physical	**0.330**	0.012				
	Autonomy	**0.397**	0.015				
	Loyalty	0.093	0.426				

Significant ($p < 0.05$) latent factor mean differences in bold.

Cite this article: Bretl BL, Goering M (2022). Age- and sex-based differences in the moral intuitions of American early adolescents. *Evolutionary Human Sciences* **4**, e33, 1–14. https://doi.org/10.1017/ehs.2022.34