



Age and sex differences in the differentiation of anger expression and interpersonal contexts among Japanese adolescents

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Differences in the frequency and differentiation of anger expression strategies, such as overt and constructive, and interpersonal contexts, such as parents and peers, were examined by sex and age in a community-based sample of 655 Japanese adolescents aged 9 to 16 years. The results revealed significant age-related differences in overt anger expression among females: 9-10 year-old females showed the least overt anger expression toward parents, while 15-16 year old females expressed their anger more overtly toward parents and more constructively toward peers than males. Moreover, females overtly expressed their anger toward parents and constructively expressed their anger toward peers more than males did, whereas males overtly expressed their anger toward peers more than females did. These results indicate the importance of considering strategies and interpersonal context in developmental research on anger expression.

Keywords: anger expression, emotion regulation, interpersonal context, age and sex difference, adolescence

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Introduction

The way that individuals express anger is important as it affects their social relationships with the social targets of their anger, their social outcomes and their well-being. Both overt anger expression and suppression, including verbal and physical aggression (e.g., Gross & John, 2003; Spielberger, 1988), and constructive anger expression, characterized by an assertive and problem-oriented form of anger expression without excessive and destructive expression, tend to affect interpersonal relationships and well-being (Graham et al., 2008; Hogan & Linden, 2004; Yoshida & Takai, 2008). However, the development of the use of constructive expression across targets of anger from late childhood to adolescence remains unclear. During adolescence, many behavioural and cognitive changes occur to assist the transition to the independent adult role, including emotional lability, perspective taking and social cognition (Eldreth et al., 2013). Such changes can also impact social relationships and confer psychopathological vulnerability (Kessler et al., 2005; Kilford et al., 2016). While sex differences have been observed in other types of emotional displays, sex differences in anger expression in adolescence remain relatively underexplored (Tobin & Graziano, 2006; Zimmerman & Iwanski, 2014). To address this gap, the present research examined age and sex differences related to two types of anger expression (overt and constructive) and two targets (parents and peers) in adolescence.

Multidimensionality of Anger Expression Strategies

For several decades, research has examined anger expression among adults using a dichotomous approach to study overt expression and suppression. However, while studies have examined *whether* adolescents express or suppress anger, fewer studies have considered anger from a multidimensional perspective to explore *how* adolescents express anger (Linden et al., 2003). In addition to the unidimensional overt anger expression/suppression dichotomy (Miers et al., 2007), recent research has pointed to another form of anger expression called “constructive expression.” Constructive expression is thought to be an assertive and problem-oriented form of anger expression that involves actively expressing one's thoughts, feelings, and desires while simultaneously listening to the feelings and desires of others and attempting to negotiate, compromise, and problem solve (Davidson et al., 2000; Linden et al., 2003). This expression is considered critical because of its beneficial influence on somatic and psychological well-being (Hogan & Linden, 2004; Graham et al., 2008; Rude et al., 2012) and friendship during youth (Salisch et al., 2014).

Investigations of constructive expression are mainly conducted among adults, with fewer studies addressing the development of constructive expression among children and adolescents. For example, children aged 8-9 years old are able to politely ask an individual to stop an aggressive or aversive behaviour (Oolup et al., 2016). On the other hand, adolescents utilize explanation and reconciliation to express their anger more than children and early adolescents (Salisch & Vogelgesang, 2005) since cognitive and relational changes in adolescence impact individuals' abilities and tendencies to take the perspectives of others and to experience feelings of concern (Kilford et al., 2016; Van der Graaff et al., 2014). However, no research addresses how constructive and overt expression strategies are differentiated according to sex and age.

The social information processing model (SIP; Crick, & Dodge, 1994) informs the differentiation of interpersonal context and strategy in anger expression being examined in the present study. The SIP model prescribes the way social information is processed to respond adequately to social situations. It proposes a model of social response that consists of five cognitive steps: encoding (i.e., searching for relative social information before responding), interpretation (i.e., giving meaning to cues), response search (i.e., generating possible behavioural response to situation), response decision (i.e., choosing response after evaluating potential consequences), and enactment (i.e., behavioural performance of the chosen response; Espelage et al., 2018). Aggressive youth may be deficient in one of these five steps in frustrating situations, and enactment and self-inhibition might play a role in the aggressive behaviour and overt anger expression (i.e., Espelage et al., 2018). In addition, several studies from neuropsychology have suggested that changes in the ventromedial prefrontal cortex (vmPFC) activation and the frontopolar cortex (FPC) during adolescence are related to imagine aggressive behaviour (i.e., Strenziok et al., 2011). Biological development can provide the background of SIP development in individuals and contribute to the adolescent development of social behaviour in aggressive contexts (Strenziok et al., 2011). With these theoretical and biological backgrounds, investigating the variation and differentiation of anger expression strategy in the present study, has the potential to expand the literature on anger expression.

Interpersonal Context of Anger Expression

Research suggests that the way anger is expressed depends on different interpersonal contexts, such as who the target of one's anger is. However, the findings are inconsistent, and there is a paucity of research investigating middle adolescence and subsequent developmental stages. For example, one study found that children aged 7-12 years were more likely to report expressing negative emotions in the presence of a parent than in the presence of a peer due to fear of peer rejection (Zeman & Garber, 1996), whereas another study found that children reported expressing their anger toward peers more openly than toward teachers (Underwood et al., 1992). Considering the previous research, the way that anger is expressed is expected to differ based on the targets of adolescents' anger and youth's age. However, to the best of our knowledge, to date, no research has focused on the effect of interpersonal contexts on overt and constructive anger expression strategies in adolescence or in other developmental periods.

Age and Sex Differences in Anger Expression

Conventionally, it has been suggested that sex differences in anger expression are consistent in youth but that age differences are somewhat inconsistent. Boys and younger children tend to express anger more outwardly than girls and adolescents (Kerr & Schneider, 2008; for peers Cox et al., 2000; Salisch & Vogelgesang, 2005; but see Wong et al., 2018). Regarding age differences, some studies have found that non-linear patterns of negative emotion expression and emotion regulation emerge during adolescence (e.g., Zimmermann & Iwanski, 2014). Recent meta-analytic data also suggest that there are no gender differences in externalizing

emotion expression during infancy, boys exhibit greater externalizing emotion expression during childhood, and girls exhibit such expression more than boys during adolescence (Chaplin & Aldao, 2013).

Age differences elicit different patterns of anger-related behaviour over the course of adolescence. Adolescence is known as a period of parent-child conflict; after this period, parents and children are able to reconstruct their relationship to be more horizontal, reciprocal and equal in exchanges, power, and decision-making (Branje, 2018). Some studies found that the frequency of conflict peaks in early adolescence and then declines, whereas the conflict intensity increases from early to middle adolescence (Hadiwijaya et al., 2017; Laursen et al., 1998). Naturally, due to conflicts with parents, children might be more anger-expressive toward their parents in adolescence than in other developmental periods.

Different interpersonal contexts may also have different effects among the sexes. The meta-analysis conducted by Chaplin and Aldao (2013) indicated that from infancy to adolescence, sex differences in externalizing emotion expression depended on interpersonal contexts. While boys tended to express externalizing emotions more than girls in the presence of peers or alone, no sex differences were observed when the children were with parents and adults (Chaplin & Aldao, 2013). However, this study did not examine either the age or sex differences in the effects of interpersonal contexts due to the small body of literature. Considering previous research, different interpersonal contexts are expected to differently influence how and the extent to which adolescents express their anger according to age and sex.

Importantly, it has been suggested that cultural differences influence emotion expression (i.e., Trommsdorff & Heikamp, 2013). For several decades, Japan has been considered as a typical collectivist society that prioritizes proper demeanour in hierarchical relationships, social harmony, and group interests (Trommsdorff & Heikamp, 2013; but Matsumoto, 2018) and avoids the direct expression of emotions and respects the emotions and thoughts of others (e.g., Kino, 2000; Yogo & Onoue, 1998). The power distance in Japan is moderate and close to that in the U.S. (54 for Japan; 40 for the US; 60 for South Korea; 80 for China; Hofstede et al., 2010).

Japanese parent-child and -adolescent relationships have been considered to have a specific organization. Being able to consider others' feelings, not necessarily fostering independence and assertiveness, is thought to be a virtue in the Japanese culture (Uji et al., 2006). Japanese individuals also expect others to be considerate of them, which is also a fundamental aspect of the Japanese psychological organization, "amae" (Doi, 1956). In Japanese culture, certain parenting behaviours, such as letting the child do what he/she wants, and respecting his/her decisions, are highly nuanced; the child's wishes are guessed by his/her parents and satisfied without a need for verbalization. This non-verbal interaction does not, however, mean that children are differentiated as independent individuals and are sent out alone into society by their parents (Uji et al., 2006). Although discussions about cultural differences in the development of parent-adolescent relationships and emotion expression are ongoing (i.e., Uji et al., 2006), this organization might lead to age and sex differences and the effect of interpersonal context and strategy in anger expression among Japanese youth.

Additionally, the assertive form of anger expression has also been investigated in few studies in Japan, and it is important to consider the role of cultural features on anger expression.

Current Research

While informative, the previously reviewed literature is limited in several respects. First, previous research has mainly focused on either overt or constructive anger expression strategies without attention to age and sex differences. Second, previous research focusing on adolescence has not distinguished between the targets of anger expression, thus leaving open the possibility that the age-related trends in anger expression differ as result of the function of the target. Third, previous studies have focused only on the frequency and mean differences in anger expression across age and sex, but did not examined the covariation between two anger expression strategies towards the same target (e.g., overt and constructive strategies toward parents) or between one strategy towards different targets (e.g., overt strategy toward parents and peers). Examining the age and sex differences in this covariation could elucidate when and how anger expression differentiates separately by sex. Identifying this differentiation could enhance our understanding of the period during which the ability to understand the concepts of anger expression is acquired and the implications of an effective intervention period for each sex. The aim of the current study is to examine the frequencies of constructive and overt anger expression toward parents and peers and the differences in the variation in anger expression strategies and targets across age and sex.

Methodology

Procedure and Participants

Participants were included as part of a five-year-wave longitudinal research study “Adolescent Emotion and Mental Health” that is currently in progress. The first wave of data was used in the present analysis. Mothers who had children in the target age ranges, 4th grade (9-10 years: late childhood), 7th grade (12-13 years: early adolescence), and 10th grade (15-16 years: middle adolescence), were recruited to participate in the study. Questionnaires and consent forms were mailed to these potential participants in December 2017, and reminder postcards were sent after two weeks. Of the 1,189 distributed questionnaires, 655 households were analyzed (valid response rate of 55.1%; boys = 320, 48.9%, $M_{\text{adolescent age}} = 12.83 \pm 2.52$, $M_{\text{mother age}} = 44.10 \pm 6.44$).

To protect the children’s privacy, an envelope that enabled the participants to conceal the questionnaires was enclosed with the consent forms and questionnaires. Participants were allocated an arbitrary ID. Only the research company held the participants’ individual information, and only the ID, not individual information, was disclosed to the researchers. All adolescents and parents provided consent to participate in the study, which was approved by the respective ethics committee.

The majority of respondents attended public schools (82.6%). The two most common ranges of annual family income were 4-6 million (25.0%) and 6-8 million (24.3%) JPY (approximately US\$37,000-74,000 as

of 2019). The majority of fathers (45.1%) and mothers (23.4%) had a university diploma or higher degree. In the majority of families, fathers had full-time jobs (87.9%), and mothers had part-time jobs (50.2%).

Measures

Overt (anger-out and direct expression: three items) and constructive (three items) expressions of anger toward parents and peers were assessed using an anger regulation scale that is widely used in Japan (Yoshida & Takai, 2008). The three items for constructive expression were as follows: (1) “I convey that I am angry while being careful not to make the person feel bad,” (2) “While considering the person’s feelings, I let him/her know my anger,” and (3) “I tell the person about my anger so as not to make him/her annoyed.” The three items for overt expression were as follows: (4) “I express my emotion without listening to the person’s opinion,” (5) “I blame the person for being at fault,” and (6) “I complain about the person’s words or behaviour.” The participants were asked how they expressed their anger toward parents and peers on a 5-point scale ranging from 0 (*never*) to 4 (*very often*). The validity of this scale was confirmed with a factor analysis, and a significant moderate correlation (.47 and .21 with emotion expression for overt and constructive expression, respectively; .26 with problem-solving and constructive expression) was observed with the emotion expression subscale of the coping strategy scale developed by Sasaki and Yamasaki (2002). In the present data, intraclass correlation coefficients (ICCs) between child-rated anger expression toward parent and parent-rated anger expression were as follows: .34, .18, .15, .26, .22, and .20, item No. 1-6, respectively). Cronbach’s alphas were all acceptable: .77 and .75 for overt expression toward parents and peers, respectively, and .74 and .77 for constructive expression toward parents and peers, respectively.

Participants were also asked how frequently they had experienced anger toward their parents and peers on the same Likert scale as anger expression. They answered the same seven items about both parents and peers.

Data Analysis Plan

A four-way repeated measures analysis of variance (ANOVA) was conducted using HAD (Shimizu, 2016) to investigate the mean differences in the two within-subject factors (constructive and overt expression strategies and interpersonal contexts toward parents and peers), and the two between-subject factors (two sexes and three grades), followed by Bonferroni’s post hoc test. The model included the centred scores of the two variables (the frequencies of feeling anger toward parents and peers) as covariates.

The differences in the correlations between constructive and overt anger expressions toward parents and peers across age and sex were investigated using cross-sectional data from three cohorts (late childhood, early and middle adolescence), applying six-group (cohort × sex) simultaneous confirmatory factor analysis (CFA), confirming the measurement invariance (Little et al., 2007) across groups, and comparing the latent factor correlations (Muthén & Muthén, 2017) using maximum likelihood estimation (Figure 1). To control the

effect of using the same items for parents and peers, the correlations of the residual variances among them were set between them.

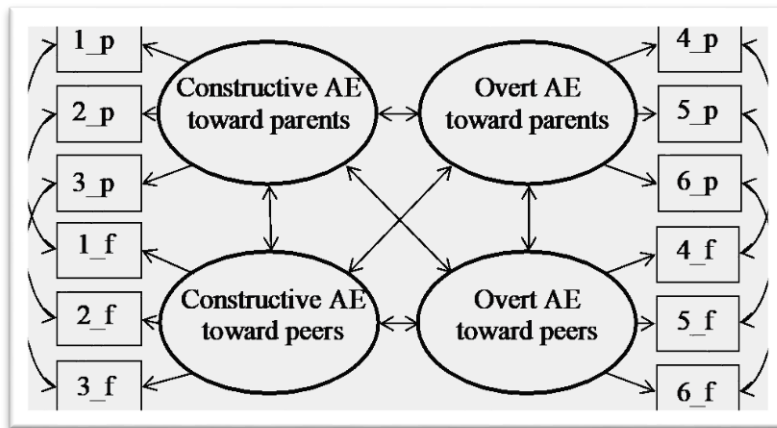


Figure 1. The model for a multiple-group simultaneous confirmatory factor analysis of the 6 groups (2 sexes \times 3 grades). The item numbers correspond to parents (p) and peers (f).

The factorial invariance was tested through the sequences: (a1) configural invariance, (a2) metric invariance, (a3) scalar invariance, and (a4) residual variance invariance (Little et al. 2007). Residual variance invariance was not used in the present research. The fit between the models and the data were evaluated with the following statistics: a comparative fit index (CFI) of .95 or greater, a root mean square error of approximation (RMSEA) of .05 or less, and a low Akaike's information criterion (AIC). It has been suggested that an acceptable fit is indicated by a CFI of .90 and an RMSEA of .08 (Brown, 2006). To assess the significance of each comparison, (A) the RMSEA value of the nested model had to be within the RMSEA confidence interval of the comparison model and (B) the change in value of the CFI was expected to be less than .01 (Little et al., 2007). After scalar invariance was confirmed, for the aims of the present research to compare groups by latent factor means and correlations, these relationships were assessed using the following sequence of steps: (b1,2) the test of factor variance/covariance equality, (b3) the test of factor mean equality, and (b4) the test of latent correlation equality. To test measurement invariance (a1-3), the CFI and RMSEA values were used since the $\Delta\chi^2$ test tends to be sensitive to the sample size (Little et al., 2007). To assess the significance of these steps (b1-3), the $\Delta\chi^2$ test was used with the constraint that all variables are equal, which is recommended for tests for specific hypotheses concerning latent variable parameters (means, variances, and correlations) since the estimates of the latent variable parameters are error-free and unbiased estimates of a given population at a given point in time (Little et al. 2007). To test which pairs showed differences in (b4), the Wald chi-square test was used with each grade or sex for one examination (i.e., fixing the correlation between constructive expression toward parents and peers with males from all grades as the same) following a post hoc test with a Wald test with a Bonferroni-adjusted alpha level of $p < .016$ ($\alpha = .05/3$).

Results

Age and Sex Differences in the Frequencies of Anger Expression

The results of a four-way repeated measures ANOVA investigating differences in anger expression are shown in Table I. The main effects of interpersonal contexts ($F(1, 590)=9.946, p<.01, \text{parent}>\text{peer}, d=.126$) and strategies ($F(1, 590)=7.517, p<.01, \text{constructive}>\text{overt}, d=.140$) were significant.

The four-way interaction was significant ($F(2, 590)=3.146, p<.05$). A significant age difference was found only for overt expression toward parents for females. Among females, overt expression toward parents was lower in 4th graders than in 7th and 10th graders (for 7th graders, $t(2358)=-2.618, p<.05, d=-.56$; for 10th graders, $t(2358)=-3.899, p<.001, d=-.82$). A significant sex difference was found for overt expression toward both targets and for constructive expression toward peers. Among 4th and 10th graders, males overtly expressed toward peers more than females (for 4th graders, $t(2358)=2.654, p<.01, d=.78$; for 10th graders, $t(2358)=2.041, p<.05, d=.56$). Among 10th graders, females overtly expressed toward parents more than males ($t(2358)=-3.691, p<.001, d=-1.01$). Fourth- and 10th-grade females used constructive expression toward peers more than males (for 4th graders, $t(2358)=-2.452, p<.05, d=-.72$; for 10th graders, $t(2358)=-2.070, p<.05, d=-.57$).

Interaction effects between interpersonal contexts and strategies were significant only for females in the four-way interaction. In expression toward peers, constructive expression was utilized more frequently than overt expression by females of all grades (for 4th graders, $t(588)=-5.739, p<.001, d=-.64$; for 7th graders, $t(588)=-4.394, p<.001, d=-.45$; for 10th graders, $t(588)=-5.835, p<.001, d=-.57$). In expression toward parents, among 7th- and 10th-grade females, overt expression was utilized more frequently than constructive expression (for 7th graders, $t(588)=2.793, p<.01, d=.29$; for 10th graders, $t(588)=2.982, p<.01, d=.29$). Among males, there were no significant differences between strategies and interpersonal context

The Confirmation of the Factorial Invariance

The fit indices of the measurement invariance models for all six groups (a1-3) are presented in Table II. The configural invariance model fit indices indicated an acceptable fit for the four-factor model. Metric invariance implied that full metric invariance was present for the four-factor model, which showed an acceptable fit. Scalar invariance was supported by ΔCFI values less than .01 and an RMSEA in the 90% CI of the metric invariance model, and it showed an acceptable fit. Homogeneity of variances (b1-3) was supported by the value of $\Delta\chi^2(20)=14.299, p=.82$, but homogeneity of latent mean invariances and equality of correlations were not supported ($\Delta\chi^2(20)=82.772, p<.001, \Delta\chi^2(30)=44.030, p<.05$, respectively). Therefore, there were differences in the correlations among the four factors across sexes and grades.

Table I. The results of repeated measures ANOVA for anger expression by sex, grade, strategy, and interpersonal context.

| | <i>N</i> | Overt expression | | Constructive expression | | Main Effect | Sex × Grade × Strategy × Interpersonal context Interaction | | | | |
|--------|----------|------------------|-----------|-------------------------|-----------|-------------|---|----------------|---------------------|------------------------|--------------------------------|
| | | parent | peer | parent | peer | | | | | | |
| | | <i>Mean</i> | <i>SD</i> | <i>Mean</i> | <i>SD</i> | <i>Mean</i> | <i>SD</i> | | | | |
| Male | 287 | | | | | | | Sex: <i>ns</i> | $F(2, 590)=3.146^*$ | | |
| 4th | 99 | 5.17 | 3.26 | 4.80 | 3.19 | 4.60 | 2.91 | 4.92 | 3.08 | Grade: <i>ns</i> | Female Oparent: |
| 7th | 88 | 6.09 | 2.86 | 5.14 | 2.90 | 5.39 | 2.91 | 5.53 | 3.31 | Strategy: | 4th<7th (-.56), 10th (-.82) |
| 10th | 100 | 4.90 | 3.12 | 4.74 | 3.04 | 5.00 | 2.93 | 5.13 | 2.98 | $F(1, 590)=7.517^{**}$ | 4th, 10th: |
| | | | | | | | | | | constructive | Opeer male>female (.78, .56) |
| | | | | | | | | | | >overt (.14) | Cpeer male<female (-.72, -.57) |
| Female | 309 | | | | | | | | | Interpersonal context: | 10th: |
| 4th | 89 | 4.49 | 3.13 | 3.48 | 2.86 | 5.11 | 3.07 | 5.69 | 3.73 | $F(1, 590)=9.946^{**}$ | Oparent male<female (-1.01) |
| 7th | 104 | 6.15 | 3.23 | 4.76 | 2.70 | 5.16 | 2.98 | 6.32 | 3.13 | parent>peer (.13) | all-grade female: |
| 10th | 116 | 6.54 | 3.02 | 4.20 | 2.70 | 5.54 | 2.59 | 6.16 | 3.12 | | Opeer<Cpeer (-.64, -.45, -.57) |
| | | | | | | | | | | | 7th, 10th female: |
| | | | | | | | | | | | Oparent>Cparent (.29, .29) |

Notes. Cparent: Constructive expression toward parents; Oparent: Overt expression toward parents;
Cpeer: Constructive expression toward peers; Opeer: Overt expression toward peers.
The parentheses after the inequalities indicate the effect size *d*.
* $p<.05$, ** $p<.01$, *** $p<.001$

Table II. Test of measurement invariance of anger expression across age and gender

| | χ^2 | <i>df</i> | ($\Delta\chi^2$) | (Δdf) | <i>p</i> | AIC | RMSEA | (Δ RMSEA) | 90% CI | CFI | (Δ CFI) | |
|---|----------|-----------|--------------------|-----------------|----------|---------|-------|-------------------|--------------|------|-----------------|-------------|
| Configural invariance | 402.16 | 252 | – | – | – | 22067.4 | .074 | – | [.060, .087] | .955 | – | – |
| Metric invariance ^a | 472.95 | 292 | (70.8) | (40) | – | 22058.2 | .075 | (.002) | [.063, .088] | .946 | (-.009) | :Configural |
| Scalar invariance ^a | 521.61 | 332 | (48.7) | (40) | – | 22017.0 | .070 | (-.002) | [.060, .084] | .947 | (.001) | :Metric |
| Homogeneity of variances ^b | 535.91 | 352 | (14.3) | (20) | >.05 | 22001.2 | .069 | (-.001) | [.057, .081] | .945 | (-.002) | :Scalar |
| Homogeneity of covariances ^b | 565.64 | 362 | (44.0) | (30) | <.05 | 22010.9 | .072 | (.002) | [.060, .083] | .940 | (-.007) | :Scalar |
| Latent mean invariance ^b | 604.38 | 352 | (82.8) | (20) | <.001 | 22069.7 | .081 | (.009) | [.070, .092] | .925 | (-.022) | :Scalar |

^aRMSEA test and ^b Chi-square difference test were used.

Table III. Factor covariance comparisons across age and gender

| | 1 | 2 | 3 |
|---|-----------------------------------|----------------------------------|--|
| Male | | | |
| 1 Cparent | | | |
| 2 Oparent | .534 / .089 _{ns} / .362 | | |
| 3 Cpeer | .803 / .728 / .678 | .411 / .222 _{ns} / .246 | |
| 4 Opeer | .328 / -.035 _{ns} / .428 | .507 / .591 / .397 | 4th**, 7th***<10th .376 / .254 / .766 |
| Female | | | |
| 1 Cparent | | | |
| 2 Oparent | .436 / .276 / .367 | | |
| 3 Cpeer | .835 / .515 / .464 | .407 / .357 / .423 | |
| 4 Opeer | .386 / .117 _{ns} / .335 | .621 / .673 / .507 | .431 / .397 / .462 |
| <i>Notes.</i> | | | |
| Cparent: Constructive expression toward parents; Oparent: overt expression toward parents; Cpeer: constructive expression toward peers; Opeer: overt expression toward peers. Correlation coefficients: Estimated. All are significant at $p < .05$ except for "ns." Left: 4th grade; middle: 7th grade; and right: 10th grade. | | | |
| Framed boxes indicate the correlation pairs that represent the differentiation of anger expression strategies. | | | |
| Double underlines indicate the correlation pairs that represent the differentiation of interpersonal contexts. | | | |
| Post hoc analysis revealed that five correlation pairs showed significant differences among grades. These are displayed on the upper side of each cell. In the Wald test, to prevent false β , the significant p -value was set as .016 and below. | | | |
| * $p < .016$, ** $p < .01$, *** $p < .001$ | | | |

Differentiating Interpersonal Contexts

To compare the estimated factor correlations (covariates) among the three groups in two sexes (double underlined in Table III), different Wald chi-square tests of correlation coefficients were conducted with the scalar invariance model. Significant age differences in the association between constructive expression toward parents and peers were found only among girls. Among girls, the correlation between constructive expression toward parents and toward peers was extremely high among 4th graders, while it was moderate among 7th and 10th graders ($r=.835$, $.515$, and $.464$ for 4th, 7th, and 10th graders, respectively, 7th graders<4th graders, $\chi^2(1)=9.061$, $p<.01$, 10th graders<4th graders, $\chi^2(1)=10.355$, $p<.01$). In contrast, among boys, the correlation between constructive expression toward parents and peers remained high throughout all grades ($r=.678$ -. 803). For both sexes, the correlation between overt expression toward parents and peers was moderate ($r=.397$ -. 673).

Differentiating Anger Expression Strategies

Significant age differences in the differentiation of anger expression strategies, were found only among boys (Table III, framed boxes). Among boys, the correlation between constructive and overt expression toward parents was significantly lower among 7th graders than 4th graders ($r=.534$, $.089$, and $.362$ for 4th, 7th, and 10th graders, respectively, 7th graders<4th graders, $\chi^2(1)=6.101$, $p<.016$). In addition, the correlations between constructive expression toward parents and overt expression toward peers amongst boys were not significant and were significantly lower in 7th graders than in 10th graders ($r=.328$, $-.035$ *n.s.*, and $.428$ for 4th, 7th, and 10th graders, respectively, 7th graders<10th graders, $\chi^2(1)=6.918$, $p<.01$). Girls did not show this difference among grades, although the correlation in 7th graders was low and not significant. Among boys, the correlations between constructive and overt expression toward peers among 10th graders were significantly higher than those among other grades ($r=.376$, $.254$, and $.766$ for 4th, 7th, and 10th graders, respectively; 4th graders<10th graders, $\chi^2(1)=7.297$, $p<.01$; 7th graders<10th graders, $\chi^2(1)=12.383$, $p<.001$). Girls showed moderate correlations throughout all grades ($r=.276$ -. 462) and did not show significant differences from boys.

Discussion

Whilst existing studies investigated the effects of interpersonal contexts and sex effects on anger expression (Chaplin & Aldao, 2013; Cox et al., 2000; Kerr & Schneider, 2008), the age and sex effects of the use and differentiation of multidimensional expression across targets of anger from late childhood to adolescence remain overlooked. The results of the current study advance our understanding of the differences in the frequencies in which adolescents express anger according to sex and age and the differentiation of anger expression strategies and interpersonal contexts among adolescents. Two novel findings were obtained in the present study. First, the interaction effect of age and sex differences, interpersonal contexts and strategy was observed. Second, sex differences were found in the manner of differentiating anger expression strategies and interpersonal contexts.

Age and Sex Differences in the Frequencies of Anger Expression

The novelty of the present study was its investigation of the interaction effects of age and sex differences, interpersonal context and anger expression strategies together (in contrast to individual main effects). The age effect on overt anger expression toward parents was found only amongst females, whereas the frequency of overt expression toward peers and constructive expression toward parents and peers did not differ across grades in either sex. These results supported the main effects of age and sex differences in the previous studies; the frequency of conflict peaks in early adolescence, with increasing conflict intensity from early to middle adolescence (Laursen et al., 1998), as well as age differences in overt anger expression in adolescence (Chaplin & Aldao, 2013). The sex effects were contingent on the combination of interpersonal contexts and strategies. Females overtly expressed their anger toward parents and constructively expressed their anger toward peers more than males did, whereas males overtly expressed their anger toward peers more than females did. These results also supported the main effects of age and sex differences found in previous research (e.g., Salisch & Vogelgesang, 2005; Underwood et al., 1992). The adolescent feature of anger expression may most clearly emerge in overt expression toward parents. These result might also imply that children already have the tendency not to overtly express their anger toward peers until middle childhood. As can be seen in the other results on sex differences and the correlations of constructive expression, constructive expression might be influenced by the interpersonal context. In addition to a previous meta-analysis (Chaplin & Aldao, 2013), the present results raise the possibility of the necessity to include both interpersonal contexts and strategies in investigating adolescents' anger expression.

Interestingly, the interaction of interpersonal context and strategy was significant only for females. Females in all grades highly utilized constructive expression toward peers more than overt expression, whereas they highly utilized overt expression toward parents more than constructive expression in early and middle adolescence. This might imply that females differentiate the interpersonal context in anger expression during this period. Although the present study cannot confirm a longitudinal change, the results might support previous results (Salisch & Vogelgesang, 2005) that adolescents, especially females, utilize explanation and reconciliation to express their anger more than children and early adolescents.

Differentiating Interpersonal Contexts

It is suggested that among girls, the interpersonal context for constructively expressing anger differs between late childhood and early adolescence. In contrast, among boys, constructive expression of anger toward parents and peers maintained high correlations throughout all grades. This result suggests that boys do not differentiate constructive anger expression between different targets. These results might be in line with previous findings (e.g., Kilford et al., 2016; Van der Graaff et al., 2014) that girls develop stronger abilities in perspective taking and empathic concern and are more sensitive to interpersonal contexts than boys from early to middle adolescence. In addition, significant age differences in the association between overt anger expression toward parents and peers were not observed for either sex. Regarding these associations, which were moderate, it is

speculated that adolescents' propensity to overtly express their anger does not differ by interpersonal context from late childhood through middle adolescence. Overall, the period between late childhood and early adolescence may be sensitive to differentiating interpersonal contexts in constructive anger expression, especially for girls.

Differentiating Anger Expression Strategies

Differentiating strategies in anger expression across age emerged only among boys, which possibly indicates a differentiation of these strategies toward parents among early-adolescent boys. Interestingly, however, the association between constructive and overt expression toward peers was higher in 10th grade than in other grades among boys. This might reflect the possibility that middle-adolescent boys express their anger with both strategies toward peers. On the other hand, it might indicate a brief state in their development before they develop differentiation of the multidimensionality of emotion expression. This result might be in line with the U-shaped development of emotion regulation (Zimmermann & Iwanski, 2014) and the beginning of perceiving one's emotions in "multidimensional" terms in early adolescence (Nook et al., 2018). The present result might indicate one feature of the variegation in emotion expression in adolescence, although the findings could not capture the change after middle adolescence. Additionally, among boys, the age difference in the association between constructive and overt expression toward parents differed from that toward peers. This difference might indicate the differentiation of interpersonal contexts among boys and reflect that for boys, the qualitative turning point of anger expression occurs in early and middle adolescence. These possibilities cannot be confirmed by the present research alone, and further research is needed.

Furthermore, the present results showed age differences between late childhood and early adolescence (between the age of 10 and 12) in both of differentiation of interpersonal context and strategy, but the directions of the effect differed among sexes. Although the role of development in the SIP model has not been well addressed (i.e., Crick & Dodge, 1994), several studies (i.e., Zimmermann & Iwanski, 2014; Nook et al., 2018) suggest a qualitative turning point of emotion expression and regulation in late childhood and early adolescence, especially around the age range of 10-15 years, and the present results support this. The present results might also indicate a qualitative turning point and age and sex differences in the development of several steps such as response search, response decision, and enactment.

From a cultural perspective, the results of differentiating interpersonal context and strategy might represent age and sex differences in Japanese parent-adolescent conflict and the development of their relationship. Although further research is needed, Japanese adolescents need to gain independent and assertive communication skills to increase their autonomy and adapt to a Westernizing Japanese society. Overall, the period between early and middle adolescence tends to be sensitive to differentiating anger expression strategies, especially for boys, who, in other words, could be assimilating anger expression strategies.

Limitations and Future Directions

One of the limitations of this study is that it relied on a subjective representation of anger expression based solely on youth self-report. This approach could not capture actual anger expression, such as what it looks like from a third-party perspective. In further multi-dimensional research, combining responses from multiple informants might enable us to examine this concept with a multidimensional approach and to obtain more reliable findings. Furthermore, this study used a cross-sectional design and did not capture the processes being investigated throughout adolescence and late adolescence or early adulthood. This limited sample and developmental period may limit the generalizability of these findings. The novel patterns of sex and age differences reported here also require replication.

Despite these limitations, we still found novel results concerning sex and age differences in differentiating anger expression strategies and interpersonal contexts. These results raise several questions about the development of anger expression strategies in adolescence and emerging adulthood. Future longitudinal research should investigate the antecedents of utilizing anger expression strategies, such as modelling parents' anger expression or emotion socialization, and enable us to understand adolescents' developmental trajectory of anger expression and regulation. Further research could help researchers and clinicians better understand adolescents' anger expression strategies, which could aid in the design and evaluation of interventions for both community samples and clinical clients with difficulties in emotion expression.

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References

- Branje, S. (2018). Development of parent–adolescent relationships: Conflict interactions as a mechanism of change. *Child Development Perspectives, 12*(3), 171-176. <https://doi.org/10.1111/cdep.12278>
- Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. The Guilford Press.
- Chaplin, T. M. & Aldao, A. (2013). Gender differences in emotion expression in children: A meta-analytic review. *Psychological Bulletin, 139*, 735–765. <https://doi.org/10.1037/a0030737>
- Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*, 74–101. <https://doi.org/10.1037/0033-2909.115.1.74>
- Cox, D. L., Stabb, S. D., & Hulgus, J. F. (2000). Anger and depression in girls and boys: A study of gender differences. *Psychology of Women Quarterly, 24*, 110–112. <https://doi.org/10.1111/j.1471-6402.2000.tb01027.x>

- Davidson, K., MacGregor, M. W., Stuhr, J., Dixon, K., & MacLean, D. (2000). Constructive anger verbal behavior predicts blood pressure in a population-based sample. *Health Psychology, 19*, 55–64. <http://dx.doi.org/10.1037/0278-6133.19.1.55>
- Doi, T. (1956). Japanese language as an expression of Japanese psychology. *West Speech 20*, 90–96.
- Eldreth, D., Hardin, M. G., Pavletic, N., & Ernst, M. (2013). Adolescent transformations of behavioral and neural processes as potential targets for prevention. *Prevention Science, 14*, 257–266. <https://doi.org/10.1007/s11121-012-0322-1>
- Espelage, D. L., Merrin, G. J., Hong, J. S., & Resko, S. M. (2018). Applying Social Cognitive Theory to Explore Relational Aggression across Early Adolescence: A Within- and Between-Person Analysis. *Journal of Youth and Adolescence, 47*(11), 2401–2413. <https://doi.org/10.1007/s10964-018-0910-x>
- Graham, J. E., Lobel, M., Glass, P., & Lokshina, I. (2008). Effects of written anger expression in chronic pain patients: Making meaning from pain. *Journal of Behavioral Medicine, 31*, 201–212. <http://doi.org/10.1007/s10865-008-9149-4>
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality & Social Psychology, 85*, 348–362. <http://doi.org/10.1037/0022-3514.85.2.348>
- Hadiwijaya, H., Klimstra, T., Vermunt, J., Branje, S., & Meeus, W. (2017). On the development of harmony, turbulence, and independence in parent–adolescent relationships: A five-wave longitudinal study. *Journal of Youth and Adolescence, 46*, 1772–1788. <https://doi.org/10.1007/s10964-016-0627-7>
- Hofstede, G., Hofstede G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind. Revised and Expanded* (3rd ed.). McGraw-Hill.
- Hogan, B. E., & Linden, W. (2004). Anger response styles and blood pressure: At least don't ruminate about it! *Annals of Behavioral Medicine, 27*, 38–49. https://doi.org/10.1207/s15324796abm2701_6
- Kerr, M. A. & Schneider, B. H. (2008). Anger expression in children and adolescents: A review of the empirical literature. *Clinical Psychology Review, 28*, 559–577. <https://doi.org/10.1016/j.cpr.2007.08.001>
- Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*, 593–602. <https://doi.org/10.1001/archpsyc.62.6.593>
- Kilford, E. J., Garrett, E., & Blakemore, S. (2016). The development of social cognition in adolescence: An integrated perspective. *Neuroscience and Biobehavioral Reviews, 70*, 106–120. <https://doi.org/10.1016/j.neubiorev.2016.08.016>
- Kino, K. (2000). Japanese anger expression styles and their interpersonal influence. *Japanese Journal of Psychology, 70*, 494–502. <https://doi.org/10.4992/jjpsy.70.494>

- Laursen, B., Coy, K., & Collins, W. A. (1998). Reconsidering changes in parent– child conflict across adolescence: A meta-analysis. *Child Development, 69*, 817– 832.
- Linden, W., Hogan, B. E., Rutledge, T., Chawla, A., Lenz, J. W., & Leung, D. (2003). There is more to anger coping than “in” or “out.” *Emotion, 3*, 12–29. <http://dx.doi.org/10.1037/1528-3542.3.1.12>
- Little, T. D., Card, N. A., Slegers, D. W., & Ledford, E. C. (2007). Representing contextual effects in multiple-group MACS models. In T. D. Little, J. A. Bovaird, & N. A. Card (Eds.), *Modeling contextual effects in longitudinal studies* (pp. 121–147). Lawrence Erlbaum Associates.
- Matsumoto, D. (2018), Time to rethink the common view. *Asian Journal of Social Psychology, 21*(4), 324–330. <https://doi.org/10.1111/ajsp.12334>
- Miers, A. C., Rieffe, C., Terwogt, M. M., Cowan, R., & Linden, W. (2007). The relation between anger coping strategies, anger mood and somatic complaints in children and adolescents. *Journal of Abnormal Child Psychology, 35*, 653–664. <https://doi.org/10.1007/s10802-007-9120-9>
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user’s guide (8th ed.)*. Muthén & Muthén.
- Nook, E. C., Sasse, S. F., Lambert, H. K., McLaughlin, K. A., & Somerville, L. H. (2018). The nonlinear development of emotion differentiation: Granular emotional experience is low in adolescence. *Psychological Science, 29*(8), 1346-1357. <https://doi.org/10.1177/0956797618773357>
- Oolup, C., Brown, J., Nowicki, E., & Aziz, D. (2016). The emotional experience and expression of anger: Children’s perspectives. *Child and Adolescent Social Work Journal, 33*, 279–292. <https://doi.org/10.1007/s10560-015-0423-3>
- Rude, S. S., Chrisman, J. G., Burton Denmark, A., & Maestas, K. L. (2012). Expression of direct anger and hostility predict depression symptoms in formerly depressed women. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement, 44*(3), 200–209. <https://doi.org/10.1037/a0027496>
- Salisch, M., & Vogelgesang, J. (2005). Anger regulation among friends: Assessment and development from childhood to adolescence. *Journal of Social and Personal Relationships, 22*, 837–855. <https://doi.org/10.1177/0265407505058702>
- Salisch, M., Zeman, J., Luepschen, N., & Kanevski, R. (2014). Prospective relations between adolescents’ social-emotional competencies and their friendships. *Social Development, 23*(4), 684–701. <https://doi.org/10.1111/sode.12064>
- Sasaki, M. & Yamasaki, K. (2002). Development of a dispositional version of the general coping questionnaire (GCQ) and examination of its reliability and validity. *Japanese Journal of Public Health, 49*(5), 399-408. [Japanese] https://doi.org/10.11236/jph.49.5_399
- Shimizu, H. (2016). An introduction to the statistical free software HAD: Suggestions to improve teaching, learning and practice data analysis. *Journal of Media, Information and Communication, 1*, 59-73.

- Spielberger, C. D. (1988). *Manual for the State-Trait Anger Expression Inventory (STAXI)*. Psychological Assessment Resources.
- Strenziok, M., Krueger, F., Heinecke, A., Lenroot, R. K., Knutson, K. M., van der Meer, E., & Grafman, J. (2011). Developmental effects of aggressive behavior in male adolescents assessed with structural and functional brain imaging. *Social Cognitive and Affective Neuroscience*, *6*(1), 2–11. <https://doi.org/10.1093/scan/nsp036>
- Tobin, R. M., & Graziano, W. G. (2006). Development of regulatory processes through adolescence: A review of recent empirical studies. In D. K. Mroczek & T. D. Little (Ed.), *Handbook of Personality Development* (pp.263-283). Psychology Press.
- Trommsdorff, G., & Heikamp, T. (2013). Socialization of emotions and emotion regulation in cultural context. In S. Barnow, & N. Balkir (Eds.), *Cultural variations in psychopathology: From research to practice* (pp. 67-92). Hogrefe.
- Uji, M., Tanaka, N., Shono, M., & Kitamura, T. (2006). Factorial structure of the Parental Bonding Instrument (PBI) in Japan: A study of cultural, developmental, and gender influences. *Child Psychiatry and Human Development*, *37*, 115–132. <https://doi.org/10.1007/s10578-006-0027-4>
- Underwood, M. K., Coie, J. D., & Herbman, C. R. (1992). Display rules for anger and aggression in school-age children. *Child Development*, *63*, 366–380. <https://doi.org/10.1111/j.1467-8624.1992.tb01633.x>
- Van der Graaff, J., Branje, S., De Wied, M. D., Hawk, S., Van Lier, P., & Meeus, W. (2014). Perspective taking and empathic concern in adolescence: gender differences in developmental changes. *Developmental Psychology*, *50*(3), 881-888. <http://doi.org/10.1037/a0034325>
- Wong, T. K. Y., Konishi, C., & Zhao, K. (2018). Anger and anger regulation among adolescents: A consideration of sex and age differences. *Canadian Journal of Behavioural Science*, *50*(1), 1–8. <http://dx.doi.org/10.1037/cbs0000089>
- Yogo, M. & Onoue, K. (1998). Social sharing of emotion in a Japanese sample. In A. Fischer (Ed.), *ISRE'98: Proceedings of the 10th Conference of the International Society for Research on Emotions*. 335-340.
- Yoshida, T. & Takai, J. (2008). Moderating factors of anger regulation: Focusing on interpersonal relationships with the agent of arousal. *The Japanese Journal of Research on Emotion*, *15*(2), 89-106. [Japanese] <https://doi.org/10.4092/jsre.15.89>
- Zeman, J. & Garber, J. (1996). Display rules for anger, sadness, and pain: It depends on who is watching. *Child Development*, *67*, 957–973. <https://doi.org/10.1111/j.1467-8624.1996.tb01776.x>
- Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development*, *38*, 182–194. <https://doi.org/10.1177/0165025413515405>