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Adolescents Provide More Complex Reasons for Lowering the Voting Age Than Do Adults: Evidence From National Convenience Samples

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Abstract

Debates about lowering the voting age often center on whether 16- and 17-year-old adolescents possess sufficient cognitive capacity and political knowledge to participate in politics. Little empirical research has examined age differences in adolescents' and adults' complexity of reasoning about political issues. We surveyed adults (n = 778; M_{age} = 38.5, SD = 12.5; 50% female; 72% non-Hispanic White) and 16- and 17-year-old adolescents (n = 397; 65% female; 69% non-Hispanic White) concerning judgments and justifications about whether the United States should change the minimum voting age. Justifications for changing the voting age were coded for integrative (i.e., integrating multiple perspectives to form a judgment about changing the voting age), elaborative (i.e., providing multiple reasons to support the same judgment about changing the voting age), and dialectical (i.e., recognizing multiple differing perspectives on changing the voting age) complexity of reasoning. Bayesian regressions indicated that adolescents provided greater integrative and elaborative complexity in their reasoning to change the voting age than adults. Adolescents and adults did not meaningfully differ in their dialectical complexity. Findings are consistent with past research indicating that adolescents possess the cognitive capacity and political knowledge to vote in U.S. elections.

Keywords

voting; adolescence; rights and responsibilities; politics; political reasoning

In recent years, scholars and policymakers have considered whether the U.S. minimum voting age should be changed to 16 years of age (e.g., Oosterhoff et al., 2021; Wray-Lake et al., 2020). The minimum voting age for national elections is currently 16 years in 10 countries including Argentina, Austria, Brazil, Cuba, Ecuador, Malta, Nicaragua, the Isle of Man, Jersey, and Guernsey. Additionally, a few small U.S. municipalities have expanded the voting age for local elections to include 16- and 17-year-old adolescents, including

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Takoma Park and Greenbelt, Maryland. Reconsidering the minimum voting age in the United States has historical precedence, with the minimum U.S. voting age shifting from 21 to 18 years after passing the Voting Rights Act of 1970. Proponents of expanding the voting age highlight the social benefits of increasing political representation and encouraging civic engagement (Hart & Atkins, 2011), given known stability in voting habits (Holbein & Hillygus, 2020; Hooghe & Wilkenfeld, 2008).

However, only about 40% of U.S. adults support allowing 16- and 17-year-old adolescents to vote (Wray-Lake et al., 2020). Public opinion research indicates that those who oppose changing the voting age believe 16- and 17-year-old adolescents lack the political knowledge, cognitive capacity, independence, political interest, and life experience to vote. Similar concerns were raised when the minimum voting age was changed from 21 to 18 years (Carleton, 2010). Whereas developmental science generally does not support these concerns (see Oosterhoff et al., 2021, for review), past research evaluating age differences in political knowledge has been mixed. Some evidence using U.S. nationally-representative and Austrian convenience sampled data suggests that 16- and 17-year-old adolescents have similar levels of political knowledge as adults (Hart & Atkins, 2011; Hart & Youniss, 2018; Wagner et al., 2012), while one study using nationally-representative U.K. data found that adolescents have lower political knowledge compared with adults (Chan & Clayton, 2006). This research has generally examined “propositional” political knowledge, which pertains to factual aspects of the political system such as the number of senators representing a state. But political engagement involves much more than procedural knowledge about government and history. Although people who have more propositional political knowledge do tend to engage in more political participation (Campbell & Niemi, 2016), propositional knowledge does not predict other indicators of political reasoning, such as making accurate judgments about the credibility of news information (Kahne & Bowyer, 2017). Making decisions about complex political and social issues requires sophisticated reasoning about political viewpoints and not just factual knowledge about the political system.

Measuring Complex Reasoning

Accurately measuring political reasoning ability poses a methodological challenge because few social issues have clear, consistent, and objectively correct responses. Rather than focusing on the content of political arguments, which are deeply rooted in values and ideologies, one useful strategy is to analyze the structure of the argument. Research in cognitive science has a long history of examining the integrative complexity of political arguments by quantifying participants’ reasoning about social issues regardless of their position on the issues (e.g., Conway et al., 2008). Integrative complexity is the extent to which people integrate multiple perspectives to form a judgment about an issue. Integrative complexity is operationalized by a combination of differentiation (i.e., perception of different dimensions and/or taking different perspectives when taking an issue) and integration (i.e., development of conceptual connections among differentiated dimensions or perspectives of a statement). High integrative complexity entails identifying distinct dimensions on a particular issue and acknowledging the connections among these dimensions. For instance, consider the following statement:

> There are strengths and weaknesses to lowering the voting age. Lowering the voting age may increase representation, but it may also damage democracy if young people do not have the necessary knowledge to vote. I recommend lowering the voting age if young people have sufficient knowledge to vote responsibly.

This statement would be high on integrative complexity because it recognizes multiple competing perspectives to lowering the voting age, and connects these two perspectives to form a specific, qualified judgment.

A statement can be complex in multiple ways, making integrative complexity a broad construct. Separating complexity into conceptually distinct domains can provide important specificity to enrich our understanding of age differences in reasoning. The multiple-complexity model (Conway et al., 2008) proposes that integrative complexity can be separated into two components: dialectical and elaborative complexity. Whereas *dialectical complexity* entails the recognition of multiple differing perspectives on an issue (e.g., reasons to support lowering the voting and reasons to oppose lowering the voting age), elaborative complexity entails providing multiple reasons to support the same judgment (e.g., multiple reasons to oppose lowering the voting age). In the above example, the statement “Lowing the voting age may increase representation, but it may also damage democracy if young people do not have the necessary knowledge to vote” would be an example of higher dialectical complexity given that the provided reasons support different conclusions. In contrast, stating “Lowering the voting age may increase representation and increase future voting” would be an example of higher elaborative complexity given that each reason supports the same conclusion. Examining total integrative complexity, as well as its two components of dialectical and elaborative complexity, in justifications concerning political issues—including whether the United States should change the voting age—represents one way to measure adolescents’ and adults’ ability to reason about political issues. If 16- and 17-year-old adolescents lack the capacity and knowledge to participate in politics, their justifications for changing the voting age should have lower integrative, dialectical, and elaborative complexity on average relative to adults.

Age Differences in Complex Reasoning

Past research, theory, and public opinion data produce three plausible hypotheses regarding age differences in the complexity of reasoning regarding lower the voting age. First, the domain-specificity theory of integrative complexity proposes that people provide more complex reasoning for issues that are more personally relevant compared with those that are less relevant (Conway et al., 2001). From this perspective, both adolescents and adults would be expected to have more complex reasoning for some issues and less for others. Multiple political issues disproportionately affect adolescents, such as education, environmentalism, and gun control, and would be expected to have more complex reasoning about such issues from a domain-specificity theory. Likewise, expanding the voting age to include 16- and 17-year-old adolescents would reasonably have a larger impact on youth relative to adults and thus may be more relevant for teens. Thus, consistent with domain-specificity theory, adolescents may have higher integrative, elaborative, and dialectical complexity in their reasoning about changing the voting age relative to adults.

Second, empirical studies of cognitive development and cognitive aging have found that late adolescents (ages 16 to 17 years) perform as well as adults–or better–on many different tests of cognitive ability (Lee et al., 2008; Steinberg et al., 2009). In fact, across nearly all tests of cognitive ability, the average performance of 16- to 17-year-olds is higher than the average performance of people over the age of 65, who currently make up more than a quarter of U.S. voters (Fabina, 2021). Consistent with this past research, adolescents may have similar or higher levels of integrative, elaborative, and dialectical complexity in their reasoning about changing the voting age relative to adults.

Third, the theory of crystallized intelligence argues that cultural and factual information increases linearly across adulthood, until very old age (Baltes, 1987). Adults' lay theories conform to this idea, as public opinion data indicate that adults believe youth have insufficient cognitive ability and knowledge to participate in politics (Wray-Lake et al., 2020). Research has found positive associations between crystallized intelligence and political knowledge (Hambrick et al., 2010). Thus, this perspective suggests that political knowledge may grow across the life span with adolescents starting lower than adults, and thus would predict that adolescents would have lower levels of integrative, elaborative, and dialectical complexity in their reasoning about changing the voting age relative to adults.

The Current Study

The current study has two aims. The first aim is to replicate past public opinion research indicating that the majority of adults do not support lowering the voting age because they think adolescents' lack sufficient political knowledge and cognitive ability to vote (Wray-Lake et al., 2020). The second aim is to test competing hypotheses regarding adolescents' political reasoning by examining age differences between 16- and 17-year-old adolescents and adults in their integrative, elaborative, and dialectical complexity for their reasons about whether the United States should change the minimum voting age to 16 years. In conducting this analysis, it was important to examine alternative explanations for any age-group differences and test the generalizability of the proposed effect. We thus controlled for response word count and judgments about changing the voting age, as longer responses are likely to be more complex and those who are unsure about changing the voting age likely provide greater dialectical complexity (i.e., recognizing multiple perspectives) in their reasoning. Expanding voting rights—including lowering the voting age—is also a highly partisan issue (Hannity, 2019). Thus, to test the generalizability of the proposed findings, analyses explored whether age differences in complexity differed across political ideology.

Method

Participants and Procedures

Data were collected in the spring of 2019 from 1,175 adolescents and adults. An a priori power analysis indicated that a minimum sample size of 394 per group ($N = 788$) was required to detect a small effect size ($d = .20$) at 80% power using a Frequentist statistical approach and assuming an alpha of .05. To maximize precision, recruitment continued past the minimum sample size until project funds were expended. Of these, 397 adolescents aged 16 to 17 years (65% female) were recruited from across the United States using

targeted advertising on social media. Participants were represented from all 50 U.S. states. The sample consisted of a relatively equal number of 16- (n = 201) and 17- (n = 196) year-old adolescent were in 10th (n = 122), 11th (n = 176), or 12th (n = 99) grade. Youth identified as non-Hispanic White (69.0%), Hispanic or Latinx (11.1%), Black or African American (6.5%), Asian (8.8%), American Indian or Alaska Native (4.2%), 1.0% identified as a different race or ethnicity, and 14.1% indicated being biracial. Youth also reported on parent/guardian education: college or a higher level of education (mothers: 53.9%; fathers: 48.7%), completed some college (mothers: 23.7%; fathers: 20.2%), or completed high school or below (mothers: 19.6%; fathers: 24.9%). As a proxy for family financial strain (Galinsky, 1999), youth were asked whether their families had: enough money to buy almost anything they wanted (6.6%), no problem buying the things they need and can also sometimes buy special things (49.2%), just enough money for the things they need (31.7%), or a hard time buying the things they need (12.4%). Youth ranged in their political beliefs, with 10.7% identifying as very conservative, 18.3% identifying as conservative, 19.1% identifying as moderate, 22.4% identifying as liberal, 17.4% identifying as very liberal, and 15.1% indicating that they did not know their ideology.

We also sampled 778 adults (M_{age} = 38.5, SD = 12.5, range: = 19 to 78 years; 50% female) through Amazon's Mechanical Turk. Participants were represented from all 50 U.S. states and were primarily non-Hispanic White (72.1%), Hispanic or Latinx (11.7%), Black or African American (11.6%), Asian (7.1%), American Indian or Alaska Native (1.4%), 1.3% identified as a different race or ethnicity, and 2.2% indicated being biracial. Adults reported on their highest level of completed education: college or a higher level of education (55.0%), completed some college (20.1%), or completed high school or below (13.9%). The level of college degree attainment is higher than the national average of 42% for U.S. adults 25 and older from 2015–2019 (McElrath & Martin, 2021). Participants' median house-hold income ranged from $40,000 to $59,999. Adults varied in their political ideology, with 8.5% identifying as very conservative, 20.2% identifying as conservative, 25.1% identifying as moderate, 27.7% identifying as liberal, 16.7% identifying as very liberal, and 1.3% indicating that they did not know their ideology.

All participants indicated that they were U.S. citizens. Adolescent participants who provided informed assent and adult participants who provided informed consent completed a five-minute survey. This study involved no more than minimal risk and thus, passive parental permission was used for adolescents. Upon survey completion, adolescents were given a link to a letter explaining their participation in the study and asked to provide this letter to their parents. Adolescents who completed the survey were eligible to win a randomly drawn Amazon gift card worth $50 and adults received $1 for their participation. This study was approved by the Institutional Review Board at Montana State University (Beliefs About Teens Study BO022019-EX).

Measures

Judgments and Justifications for Changing the Voting Age—Participants reported on their judgments about whether the voting age should be changed by responding to a single question that stated, "Should 16- and 17-year-old adolescents be able to vote?"

Responses were given on a 3-point nominal scale, where 1 = *yes*, 2 = *maybe*, 3 = *no*. A follow-up question ("Why or why not?") prompted participants to justify their judgments. A coding system was designed to assess the meaning of participants' justifications for changing the voting age and assign specific content codes. Two coders, the first author and a reliability coder, analyzed participants' justifications and assigned a single code for integrative, dialectical, and elaborative complexity for that justification. Coders were blinded to participants' age. Kappa coefficients of .70 or higher and were considered adequate (de Vries et al., 2008). Table 1 displays the content coding categories and reliability metrics for participants' justifications about changing the voting age.

Integrative Complexity Coding—The first author and three trained research assistants coded adolescents' and adults' integrative, elaborative, and dialectical complexity of their justifications for changing the voting age. Given that elaborative and dialectical complexity can simultaneously contribute to integrative complexity and following recommendations of Conway, et al. (2008), all three forms of complexity were used to test study hypotheses. Table 2 displays example statements representing low, medium, and high complexity. Coders were trained using the standardized coding manual for integrative complexity (Baker-Brown et al., 1992) and the elaborative and dialectical coding manual (Conway et al., 2008). A single integrative, elaborative, and dialect complexity score was assigned to each participant, with the complete free-response justification representing a codable statement. A practice dataset consisting of 30 responses was used for training prior to coding the full data. Interrater reliability was good across ages and categories (intraclass correlation coefficients = .85–.92).

Integrative, elaborative, and dialectical complexity were scored using the same 7-point scale, where 1 = *no differentiation/integration*, 3 = *differentiation but no integration*, 5 = *differentiation and integration*, and 7 = *differentiation, integration, and a larger systemic analysis of multiple integrated factors*. For elaborative complexity, "differentiation" referred to the extent to which multiple distinct justifications were provided for the same conclusion. For dialectical complexity, "differentiation" referred to the extent to which multiple distinct justifications were provided for competing conclusions. Both forms of differentiation were scored for integrative complexity. Each free response was first scored by trained coders for overall integrative complexity. The same free-response was then subsequently assigned both dialectical and elaborative complexity scores using an identical 7-point scale, which were based on how much of the overall integrative complexity score was due to each component. Specifically, coders are trained to determine whether a score greater than 1 for integrative complexity emerged for dialectical or elaborative reasons. Within the multiple complexity model, it is possible (but not necessary) that a statement demonstrates both dialectical and elaborative complexity.

Analytic Technique

Bayesian *t*-tests and regression models were used test study hypotheses. Bayesian analyses were especially suited to test study hypotheses given the ability to quantify evidence of absence (i.e., adolescents and adults are practically similar in their reasoning complexity). Primary analyses occurred in two steps. First, Bayes factors (BFs) were estimated

for between-person *t*-tests to examine mean differences in integrative, elaborative, and dialectical complexity among 16- and 17-year-old adolescents and adults. Second, three Bayesian regression models were estimated to examine associations between age and integrative, elaborative, and dialectical complexity, after accounting for task-related and individual difference covariates. Each indicator of complexity was specified as the outcome, dichotomous age (16 to 17 years vs. 18+ years) was specified as the primary independent variable and response word count, support for changing the voting age, and political ideology were specified as covariates. A region of practical equivalence (ROPE) was specified for the posterior distribution as one tenth of a standard deviation of the dependent variable above and below zero (Cohen, 1988). Evidence in support of the alternative or null hypothesis was reflected in BFs >3.0 (with very strong evidence indicated by BF >10) or 95% of the posterior distribution being located above or below the ROPE. Models were estimated using *ggstatsplot* and the *rstanarm* packages in R (Muth et al., 2018; Patil, 2021). The rstanarm package estimates general linear models using four chains and 2,000 iterations as a default specification.

Priors Specification—A default weakly informative Cauchy prior of .707 was used for the estimated BFs. Default weakly informative priors were also used for the Bayesian regressions, which entails applying scaling adjustments to normal priors centered at 0 and with a 2.5 standard deviation. Weakly informative priors are supported by past research suggesting that adolescents and adults are similar in cognitive ability (Steinberg et al., 2009) and were preferred over flat or uninformative priors, which assign an equal probability to values extremely high, low, and near zero.

Planned Robustness Checks—Three robustness checks were planned for this study. First, although weakly informed priors were preferred over uninformative priors due to the unequal likelihood of extreme values, sensitivity analyses were performed by setting priors to be uniform to determine if prior specification altered study inferences. Second, although the purpose of this study is to compare 16- and 17-year-old adolescents reasoning complexity to adults, it is possible that potential age differences in reasoning complexity varies among adults (Salthouse, 2004). Thus, complexity ratings were plotted as a function of continuous age to explore possible differences that arise at specific age groups. Third, to test the generalizability of our effects, sensitivity analyses were conducted to explore if age differences in reasoning complexity varied by political ideology.

Missing Data—Low levels of missing data on demographic covariates (<5%) were estimated using multiple imputation and the MICE package. Sensitivity analyses demonstrated that findings were similar in terms of effect size and pattern of significance when using multiple imputation and listwise deletion.

Results

Judgments and Justifications About Changing the Voting Age

Figure 1A and 1B displays adolescents' and adults' judgments for whether 16- and 17-year-old adolescents should be able to vote in the United States. Overall, 34% of youth indicated

that the voting age should be changed, 33% indicated that they were unsure, and 33% indicated that the voting age should not be changed. Adults were less supportive of changing the voting age relative to youth ($\chi^2 = 117.21$, $p > .001$); all adjusted chi-square residuals >6.2. For adults, 16% indicated that the voting age should be changed, 18% were unsure, and 67% indicated that the voting age should not be changed.

Table 1 and Figure 1 (Panels C and D) present the frequencies of justifications against changing the voting age among those who were unsure or opposed the change for both 16- and 17-year-old adolescents and adults. Consistent with past research (Wray-Lake et al., 2020), justifications against changing the voting age primarily concerned whether 16- and 17-year-old adolescents possessed sufficient political maturity to vote, including beliefs that (a) youth lack sufficient political knowledge to vote (38% of adolescents; 36% adults), (b) youth lack the cognitive capacity to vote (23% of adolescents; 23% of adults), (c) youth lack the necessary independence to vote (20% adolescents; 14% of adults), (d) youth lack the life experience to vote (6% of adolescents; 15% of adults), and (e) youth have insufficient political interest and awareness to vote (14% of adolescents; 6% of adults). Reliabilities were acceptable for each of these five categories (κs= .79–.92). Justifications supporting changing the voting age included beliefs that (a) adolescents possess a high amount of political knowledge to vote (33% of adolescents; 13% adults), (b) that changing the voting is necessary to uphold the social contract (30% of adolescents; 12% of adults), (c) that adolescents possess a high degree of developmental maturity (11.7% adolescents; 6.2% adults), (d) and that allowing youth to vote will benefit democracy (8.3% adolescents; 3.1% adults). Reliabilities were acceptable for each of these four categories (κs= .74–.91).

Age Differences in Complexity of Reasoning

Table 3 displays the means, standard deviations, and bivariate correlations among study demographics and reasoning complexity. Youth provided longer responses to their justification about changing the voting age, with 16- and 17-year-old adolescents writing approximately 9 more words on average than adults (34 average words compared with 25 average words). Those who indicated that they were unsure whether the voting age should be changed had higher integrative, elaborative, and dialectical complexity in their reasoning relative to those who indicated “yes” or “no.” Consistent with previous research (Suedfeld, 2010), identifying more strongly as liberal was correlated with higher integrative, elaborative, and dialectical complexity in their reasoning.

Figure 2 (Panels A through C) displays mean comparisons of integrative, elaborative, and dialectical complexity for 16- and 17-year-old adolescents versus adults. BFs indicate very strong evidence that adolescents had higher integrative ($BF_{10} > 10$), elaborative ($BF_{10} > 10$), and dialectical complexity ($BF_{10} > 10$) relative to adults, with the largest age difference being in elaborative complexity. Bayesian regressions were estimated with integrative, elaborative, and dialectical complexity specified as outcomes, age specified as the primary independent variable, and judgment, response word count, and ideology specified as covariates. Table 4 displays model estimates and Figure 2 (Panels D through F) displays posterior distributions for the effects of age on reasoning complexity. After adjusting for word count, issue stance, and political ideology, there was a 97.17% probability that

adolescents had a higher integrative complexity and 2.83% probability that adolescents had a similar level of integrative complexity compared with adults, with a −.16 median effect of age. There was a 0% probability that adults had a higher integrative complexity relative to adolescents. Additionally, there was a 100% probability that adolescents had a higher elaborative complexity than adults, with a −.19 median effect of age. There was a 0% probability that adults had a similar or higher dialectical complexity relative to adolescents. Further, there was a 17.08% probability that adolescents had a higher dialectical complexity, and 82.78% probability adolescents had a similar level of dialectical complexity than adults, with a −.02 median effect of age. There was a 1.30% probability that adults had a higher dialectical complexity relative to adolescents.

Planned Robustness Checks

Alternative Priors—Alternative uniform prior distributions were specified to test the robustness of our models and the possible impact of the weakly informative prior specifications on our inferences. Estimates are presented in the online supplemental material. In all analyses, models specifying uniform priors provided similar support for age differences in all three types of reasoning complexity, with adolescents demonstrating more complex reasoning relative to adults.

Continuous Age Trends—A second series of robustness checks examined whether integrative, elaborative, and dialectical complexity varied across the adult years. Figure 3 displays reasoning complexity by continuous age and indicates that the average level of integrative, elaborative, and dialectical complexity is always higher for 16- and 17-year-old adolescents relative to the average level of complexity at all other ages.

Generalizability Across Political Ideology—A third series of robustness checks examined whether age differences in integrative, elaborative, and dialectical complexity varied across political ideology. Our primary regression models were reestimated with an interaction term specified between age and ideology. Full models are presented in the online supplemental material. All credibility intervals for the interaction between age and political ideology contained zero, and there was an 86% to 100% probability that the interaction coefficient was located within the ROPE across models. Subgroup analyses indicated that adolescents demonstrated higher integrative, elaborative, and dialectical complexity compared with adults across ideology.

Discussion

Reasoning about political issues is an important marker of the cognitive abilities and is necessary for high-quality political participation. Consistent with past research (Wray-Lake et al., 2020), findings from this study indicate that a primary reason why the general public opposes lowering the voting age concerns beliefs that 16- and 17-year-old adolescents possess insufficient political knowledge and cognitive ability to make informed decisions. A goal of this study was to test age differences and similarities in adolescents' and adults' justifications for whether 16- and 17-year-old adolescents should be able to vote. Contrary to public opinion, but consistent with theory and past research (Conway et al.,

2008; Oosterhoff et al., 2021), results indicate that adolescents provide more complex reasoning in their justifications for or against changing the voting age relative to adults. These findings were consistent after accounting for voting age policy opinions, response length, and political ideology.

Two different cognitive development perspectives could explain our findings. The first perspective concerns past research and theory regarding the age at which adolescents possess adult-like cognitive abilities. Some evidence suggests that beginning at 16 years, adolescents become similar to adults in basic cognitive skills, including working memory and verbal fluency (Steinberg et al., 2009). In line with this evidence, some scholars have argued adolescents are, on average, equally equipped as adults with the basic cognitive skills that are necessary for reasoning about political decisions (Hart & Youniss, 2018). Findings from our study empirically demonstrate that adolescents and adults did not meaningfully differ in their dialectical complexity about whether 16- and 17-year-old adolescents should be able to vote, which means they showed equal capacity for considering multiple points on both sides of this issue.

The second potential explanation for our findings comes from the domain-specificity theory of cognitive complexity, which proposes that people provide more complex reasons for beliefs on issues of high personal relevance (Conway et al., 2001). This theory may explain why adolescents provided even greater integrative and elaborative complexity in their reasoning for or against changing the voting age compared with adults. Deciding whether adolescents have the right to vote has greater implications for youth relative to adults, which may have prompted greater critical thinking for adolescents. The domain relevance may stimulate forms of reasoning that are key to articulating views that are already formed, such as abilities to integrate multiple perspectives about an issue (i.e., integrative complexity) and to provide multiple reasons to support the same argument (i.e., elaborative complexity). Although we only examined one issue in this study, many other political issues disproportionately affect young people relative to adults, including education policy, environmentalism, gun control and campus carry, the age of being prosecuted as an adult, and abortion laws. Future research should examine age differences in the complexity of reasoning applied to a wider variety of issues that are more and less relevant for young people to test the robustness of domain-specificity theory.

Although not central to our primary research questions, participants who were unsure about whether the voting age should be changed provided greater integrative and dialectical complexity in their justifications. Those who recognize multiple competing arguments for and against changing the voting age may have greater uncertainty concerning this issue, and as such, these findings provide evidence that supports the validity of the complexity coding system. We also found that greater word count was significantly associated with higher integrative, elaborative, and dialectical complexity, although the effect size was small and within the region of practical equivalence. Providing multiple justifications—whether through elaborating on or contrasting ideas—likely requires more words than providing fewer justifications. The small effect size could reflect the scaling of word count frequency (e.g., providing one additional word likely has a nonzero but small correspondence to the complexity of an argument) and this result should be interpreted in the context this scaling.

Political ideology was associated with reasoning complexity at a bivariate level, which may reflect contextual differences in political messaging or knowledge seeking behavior. However, we did not find evidence of ideological differences in reasoning complexity after adjusting for other covariates and we did not find evidence that ideology moderated age differences in complexity. Thus, ideology was not a plausible alternative to age differences in reasoning complexity.

Results from this study offer important contributions to public and policy debates over expanding voting rights for 16- and 17-year-old adolescents. Adolescents were equally equipped to recognize multiple opposing perspectives on an issue that concerns their own rights and showed higher capacity for integrative and elaborative complexity in reasoning than adults. Even if adolescents are better at reasoning about certain issues that affect them, there are numerous such issues, and sophisticated reasoning is certainly advantageous for voting. Furthermore, adults are not required to meet any criteria for complex reasoning capacity in order to be allowed to vote; thus, it might be considered unduly burdensome to require that adolescents' reasoning be as good or better than adults on every single issue before they are allowed the right to vote. Evidence on adolescents' reasoning for any single issue counters public and policymakers' blanket concerns that 16- and 17-year-old adolescents are not developmentally capable of high-quality political participation (Wray-Lake et al., 2020). Overall, findings from this study contribute to a broader mission of using developmental science to inform public policy concerning the rights and responsibilities of adolescents (Oosterhoff et al., 2021; Steinberg & Icenogle, 2019).

Findings should be interpreted in context of certain limitations and constraints on generalizability. Although adolescents and adults were similar in terms of demographic characteristics, both samples were primarily White. Future research is needed to replicate these findings with more racially and ethnically diverse samples. Adolescents and adults were recruited using different online methods (social media and Mechanical Turk). Although we controlled for issue stance and word count in our model, it is possible that other differences between recruitment methods and task motivation of participants may have contributed to differences in our results. It is important to consider that even if youth in this sample were more motivated and engaged in their responses, these differences would still demonstrate that 16- and 17-year-old adolescents can provide more complex reasoning about political issues than adults. Future research should replicate our research design with nationally representative samples. Future research should also investigate how those who support changing the voting age engage with the political system to enact such change. An alternative hypothesis for developmental differences in reasoning complexity is cohort effects: Today's adolescents may have richer opportunities to learn and practice complex reasoning compared with adolescents of previous generations. Historical data on reasoning complexity would be needed to examine possible cohort effects, yet patterns favoring higher complex reasoning among adolescents would still suggest their sufficient cognitive capabilities to vote. While we view this study as an initial important step in understanding age differences in political reasoning, future research should continue to examine other contextual factors (e.g., issue salience, civics education) that may be linked with judgments and reasoning complexity for beliefs about lowering the voting age.

Conclusion

Developmental scholars have called for the use of developmental science to provide an empirically-informed voting age (Oosterhoff et al., 2021). This study informs this effort by providing evidence the refutes popular opinion regarding the capability of adolescents to meaningfully engage with political issues. Results build on a growing body of evidence that indicates that 16- and 17-year-old adolescents are developmentally prepared to vote (Hart & Atkins, 2011; Stiers et al., 2020). Democracy can be strengthened by expanding voting rights to younger citizens and allowing youth to participate in decisions that affect their lives and futures. Voting can benefit adolescents' civic development over time, which also benefits democracy, including establishing long-term voting habits and increasing political interest, knowledge, and other civic commitments (Hart & Youniss, 2018; Hooghe & Wilkenfeld, 2008). Unfortunately, voting policy decisions are not often made in consultation with scientific evidence, and even less often consider a developmental science perspective. In fact, many long-standing and recent voting policies across the United States suppress the votes of youth and youth of color (e.g., Anderson, 2018). Our study contributes more evidence of young people's capacities to vote and highlights the urgent need to take adolescents and their views seriously.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data, study material, and analysis script from this article are available on request from Benjamin Oosterhoff. This study was not preregistered.

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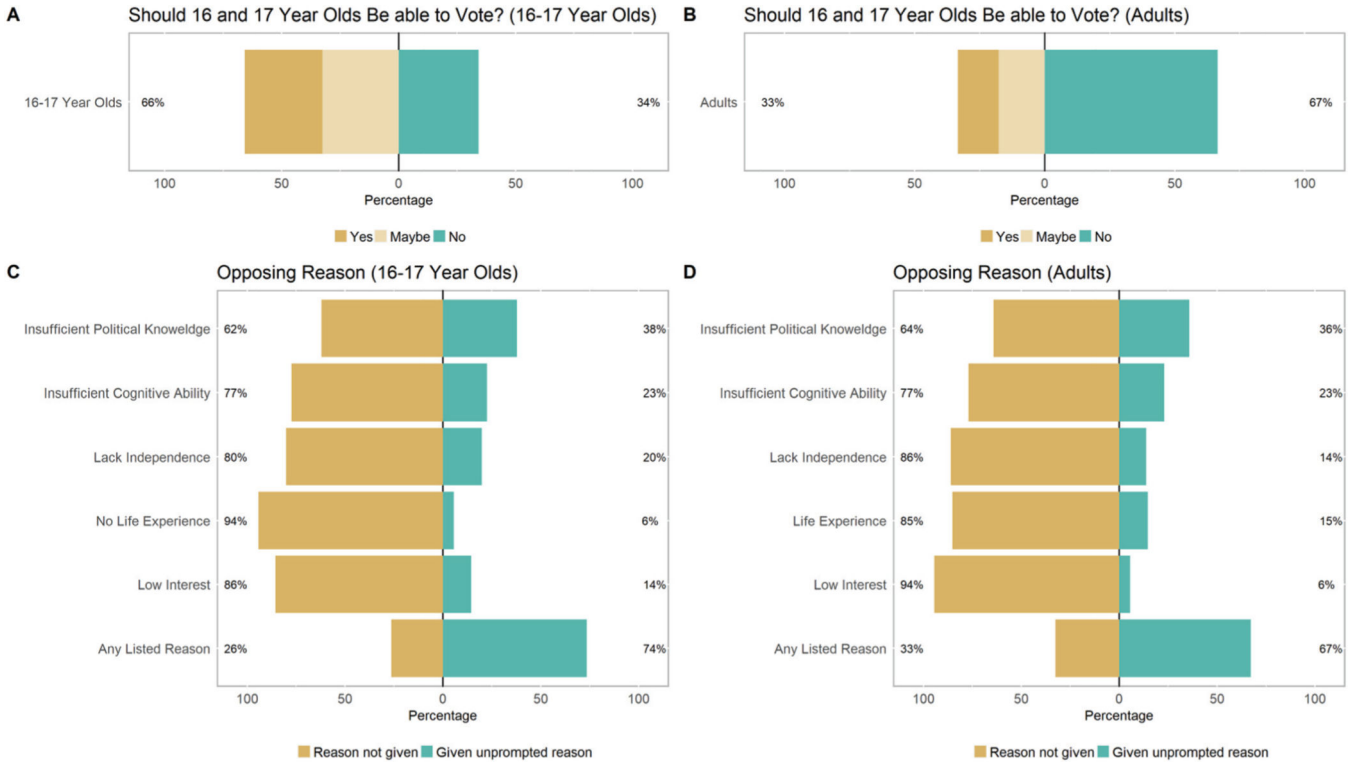

Figure 1. Frequencies of Voting Age Judgments and Justifications

Note. Judgments about changing the voting age of 16- to 17-year-old adolescent participants (A) and of adult participants (B). (C) Adolescent participant justifications for changing the voting age among those who opposed (indicated *maybe* or *no*). (D) Adult participant justifications for changing the voting age among those who opposed (indicated *maybe* or *no*). See the online article for the color version of this figure.

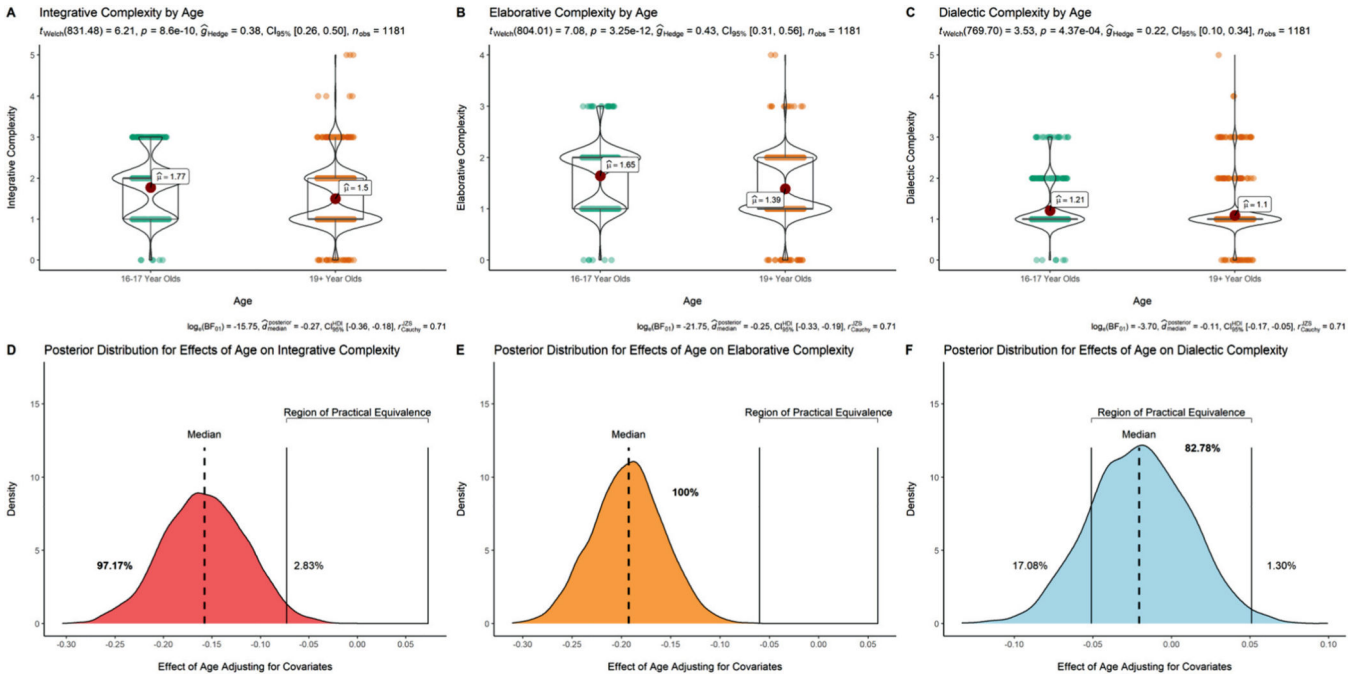

Figure 2. Effects of Age on Complexity of Reasoning for Changing the Voting Age

Note. (A) Unadjusted mean differences in integrative complexity. (B) Unadjusted mean differences in elaborative complexity. (C) Unadjusted mean differences in dialectical complexity. (D) Effects of age on integrative complexity adjusting for judgments, wordcount, and ideology. (E) Effects of age on elaborative complexity adjusting for judgments, wordcount, and ideology. (F) Effects of age on dialectical complexity adjusting for judgments, word count, and ideology. For Panels A through C, each dot represents a participants' complexity score (*y*-axis), with the large red dot representing the mean and the hour-glass shape representing the distribution. The dots are separated by age category. Frequentist inferential statistics are reported below each title and Bayesian inferential statistics are reported on the bottom right corner for each graph. See the online article for the color version of this figure.

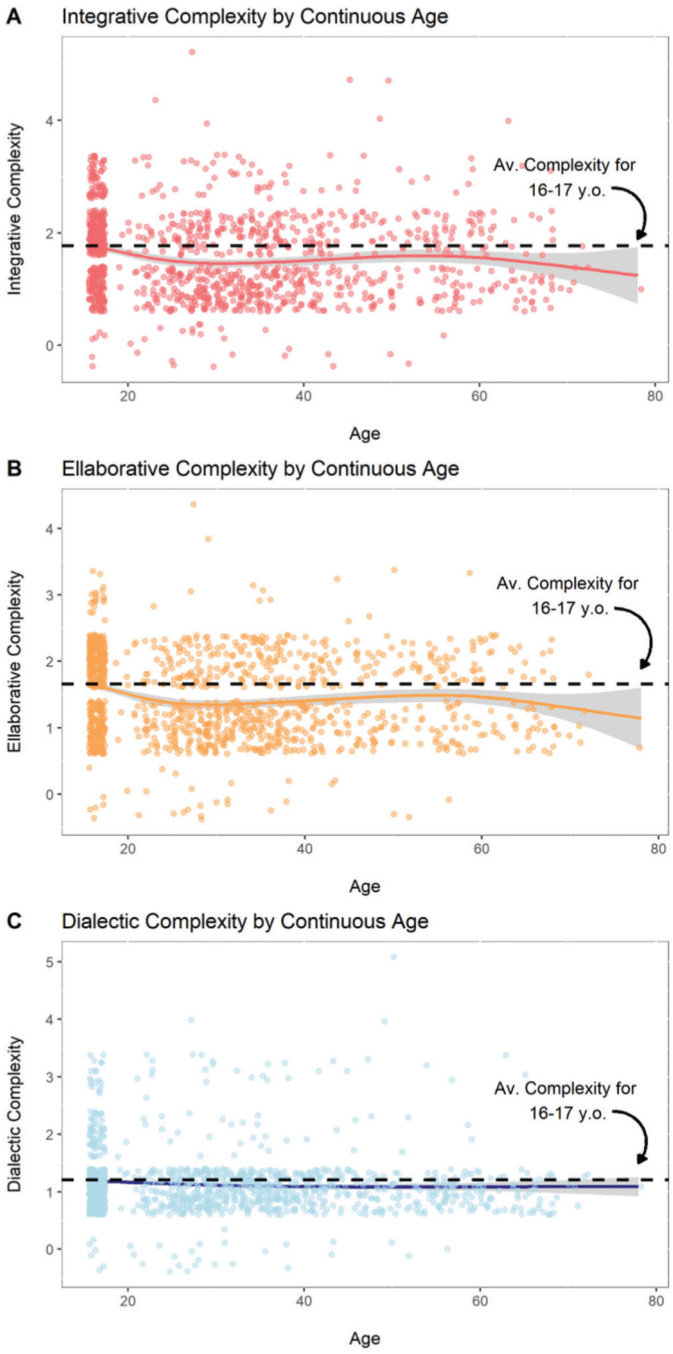

Figure 3. Reasoning Complexity by Continuous Age

Note. (A) Integrative complexity by continuous age. (B) Elaborative complexity by continuous age. (C) Dialectical complexity by continuous age. See the online article for the color version of this figure.

Table 1

Coding Categories and Examples of Justifications For and Against Changing the Voting Age by Participants

Justification	Example statement	(Teen/adult) κ	Total *N* (%)	16 to 17 year olds *n* (%)	Adults *n* (%)
	Categories opposing changing the voting age				
Lack political knowledge	Teen: I don't think we are educated enough to understand what our vote means and how we are impacting the country.	.92/.85	303 (25.8)	89 (21.7)	214 (27.2)
	Adult: Most 16- and 17-year-old adolescents aren't aware of enough of the important political decisions that need to be made.				
Lack cognitive capacity	Teen: The human brain isn't developed enough to vote, even at 18.	.91/.90	232 (19.7)	68 (16.6)	164 (21.0)
	Adult: Their brains are not mature yet.				
Lack political independence	Teen: We are easily affected by peer pressure.	.79/.83	161 (13.7)	60 (14.7)	101 (12.9)
	Adult: They will do what their parents do.				
Lack political interest	Teen: Most teens in these days don't bother with politics.	.80/.82	78 (6.6)	40 (9.8)	38 (4.8)
	Adult: Too young to care.				
Lack life experience	Teen: Not enough life experience to really understand the choice they are making.	.84/.86	112 (9.5)	15 (3.7)	97 (12.4)
	Adult: I think that 16- and 17-year-old adolescents need a little more real-world experience before they should be allowed to vote.				
	Categories supporting changing the voting age				
High political knowledge	Teen: Many 16- and 17-year-old adolescents are more politically informed than actual eligible voters.	.83/.91	239 (20.3)	134 (32.7)	105 (13.3)
	Adult: Probably more informed than a lot of the electorate.				
High developmental maturity	Teen: I believe we are at an age where we can make solid choices.	.75/.78	96 (8.2)	48 (11.7)	48 (6.2)
	Adult: I think 16-year-old adolescents can make important decisions.				
Uphold social contract	Teen: We deserve to have our voices heard because the problems affect us too.	.85/.80	223 (19.0)	127 (30.1)	96 (12.2)
	Adult: They're affected by the policies being implemented.				
Benefit democracy	Teen: Since voter turnout is low, having 16- and 17-year-old adolescents vote will bring it up. It'll help people become more involved in politics and their community.	.74/.82	58 (4.9)	34 (8.3)	24 (3.1)
	Adult: If teenagers could vote, U.S. citizens would take more of an interest in politics at an early age.				

Note. Percentages are relative to the total sample (adults: $n = 778$; 16- and 17-year-old adolescents: $n = 397$).

Table 2

Example Statements From Adolescents Who Support Changing the Vote Age by High, Medium, and Low Complexity

Type of complexity	Operationalization	High (scored 3)	Medium (scored 2)	Low (scored 1)
Integrative complexity	The extent to which people integrate multiple perspectives to form a judgment about an issue. Consists of a combination of differentiation (perception of different dimensions and/or taking different perspectives when taking an issue) and integration (development of conceptual connections among differentiated dimensions or perspectives of a statement).	"Once you are 16, you are able to work. Many companies hire at 16, you can drive at 16, you could drop out of school at 16. This means that many laws that did not affect you before will now affect you. However, if we give 16-year-olds the right to vote, we need to also give them information about politics and the government."	"We are certainly impacted by these laws, and many 16- and 17-year-old adolescents are more politically informed than actual eligible voters."	"We should because we are made to figure a viewpoint of the politics but not allowed to speak out word or vote on anything."
Elaborative complexity	Differentiation represented by multiple arguments that lead to the same conclusion (i.e., providing multiple justifications that support the same argument).	"We know just as much about the candidates and how they will affect our future as any adult. most of us don't live on our own, pay taxes, et cetera, et cetera (whatever excuse an adult will say for no), but we do understand that whosever in office will affect us for the rest of our lives, and that we need a say."	"Were the ones who have to live with the laws being created and our voice needs to be heard just as much as the others."	"Because we should have a voice, too."
Dialectical complexity	Differentiation represented by multiple arguments that lead to different conclusions (i.e., recognizing multiple sides of an argument).	"I think there are a lot of 16- and 17-year-old adolescents with defined political views and ideas that deserve to be recognized and taken seriously. We're treated as dumb little kids when we have opinions that matter too. Of course, there are some teenagers who wouldn't take voting seriously or who don't have ideals that a lot of people would agree with. But what exactly makes you any moreready to vote the moment you turn eighteen? Where do you draw that line? There are some people who mature well before their time and some people who stay immature and childish well into adulthood."	"I'm not sure because although I'm confident I should be able to vote and my friends should too, I don't know enough about other people to voucher for them, as well."	"I think 16- and 17-year-old adolescents are mostly capable of making decisions upon presidency. We are the future generation."

Note. Complexity scores range from 1 to 7. All quotes are from the adolescent sample. Operationalizations taken from the *Conceptual/Integrative Complexity Scoring Manual* (Baker-Brown et al., 1992) and elaborative and dialectical complexity coding manual (Conway et al., 2008).

Table 3

Means, Standard Deviations, and Bivariate Correlations Among Study Variables

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Vote	2.34	0.81	—						
2. Word count	27.62	25.94	−.08**	—					
3. Ideology	3.30	1.19	−.33**	.09**	—				
4. Age	1.66	0.48	.29**	−.14**	−.05	—			
5. Integrative complexity	1.59	0.73	−.07*	.48**	.06*	−.18**	—		
6. Elaborative complexity	1.48	0.60	−.05	.47**	.03	−.20**	.85**	—	
7. Dialectical complexity	1.13	0.51	−.04	.36**	.07*	−.10**	.72**	.39**	—

Note. Vote is coded as follows: 1 = no (oppose change), 2 = maybe (undecided), 3 = yes (support change). Age is coded as follows:1 = 16- to 17-year-old adolescents, 2 = 19+ year old.

* $p < .05$.

** $p < .01$.

Table 4

Bayesian Regression Estimates Predicting Reasoning Complexity

	Integrative complexity				Elaborative complexity				Dialectical complexity			
Variable	***Mdn***	**95% CI**	**% direction**	**ROPE %**	***Mdn***	**95% CI**	**% direction**	**% ROPE**	***Mdn***	**95% CI**	**% direction**	**ROPE %**
(Intercept)	1.41	[1.21, 1.63]	1.00	0.00	1.53	[1.35, 1.69]	1.00	0.00	0.83	[0.69, 0.97]	1.00	0.00
Vote: Maybe	0.25	[0.13, 0.36]	1.00	0.00	−0.08	[−0.18, 0.01]	0.95	0.33	0.39	[0.31, 0.47]	1.00	0.00
Vote: No	0.05	[−0.06, 0.16]	0.81	0.66	0.02	[−0.07, 0.10]	0.64	0.79	0.08	[0.00, 0.15]	0.97	0.27
Word count	0.01	[0.01, 0.01]	1.00	1.00	0.01	[0.01, 0.01]	1.00	1.00	0.01	[0.01, 0.01]	1.00	1.00
Ideology	0.01	[−0.03, 0.04]	0.63	1.00	0.00	[−0.03, 0.03]	0.50	1.00	0.01	[−0.02, 0.03]	0.76	1.00
Age	−0.16	[−0.24, −0.07]	1.00	0.03	−0.19	[−0.27, −0.12]	1.00	0.00	−0.02	[−0.08, 0.04]	0.74	0.83

Note. Region of practical equivalence (ROPE) % calculated based on distribution. CI = credibility interval.