# Adolescents' state authenticity and inauthenticity when socialising online with a friend: Motivations in friendship

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## ARTICLE INFO

## ABSTRACT

Authenticity is important for psychological thriving and adolescents experiment with who they are becoming (identities) with friends, so friendships are an important relationship where state authenticity and inauthenticity (the sense of and being the real me right now, versus not the real me) occur. Recent qualitative research noted friendship motivations may be connected to adolescents' state authenticity and inauthenticity experiences, so the current study quantitatively investigated whether motivations/regulations (intrinsic, identified, introjected, external, and amotivation) predict adolescents' state authenticity and inauthenticity when socialising online with a friend they also know in-person. Adolescents (13–17 years old, $N = 130$) completed an online survey about their experience of socialising online with a friend in the past 24 hours. Two exploratory factor analyses (EFA) using polychoric matrices were conducted ($n^1 = 115$), followed by a multiple linear regression ($n^2 = 108$). Two EFAs were conducted, with state authenticity and inauthenticity items forming one factor, while motivation in a friendship items formed two distinct factors (autonomous motivation and controlled motivation). The regression showed autonomous motivation in a friendship predicted and explained 18% of variability in state authenticity and inauthenticity (large effect). A very large sample is required to validate and identify whether controlled motivation in a friendship (e.g., involving guilt) may have a small effect. Autonomous motivation in a friendship includes positive social values, such that friendships where autonomous motivation is present enables state authenticity, and by extension, opportunities for teens to psychologically thrive.

## Introduction

Authenticity is considered important for psychological wellbeing and predicts positive psychological outcomes in teens; however, inauthenticity and lower authenticity predict psychological ill-being (Alchin et al., 2024). It is around 13 years of age that teens begin to become more aware of their own sense of authenticity and inauthenticity, and teens increasingly explore and gauge self-relevant information in friendships (Harter et al., 1997) while exploring their identity (Erikson, 1968). That is, adolescent friendships are a

developmentally important context where experiences of authenticity and inauthenticity occur (Harter et al., 1996). Around 60% of adolescents socialise online several times daily with friends (Lyyra et al., 2022), with 42% of 13-year-old teens spending a minimum of four hours per day on social media, which increases per year of age to 62% for 17-year-old teens (Rothwell, 2023). In self-determination theory (SDT; Ryan & Deci, 2017), the moment where authenticity comes into existence is in a current situation—-like while socialising online with a friend—as authenticity involves autonomous behaviours aligned with one's own values and beliefs, and which represent one's own inner experience (e.g., self-regulating one's emotions; Ryan & Ryan, 2019). Teens have indicated that underlying motivations can be an important reason for inauthenticity with other teens (Harter et al., 1996). For example, a desire to please others (Harter et al., 1996). *State authenticity* "refers to the subjective sense of, and being, the real me… right now (Sedikides et al., 2019)" (Alchin et al., 2024, p. 281). *State inauthenticity* refers to the sense of, or being, a false self or not being the real me in the present moment (Sedikides et al., 2019). State authenticity can be caused by satisfying the psychological need for autonomy, and state authenticity predicts wellbeing when assessed by positive and negative affect (e.g., "happy, excited, relaxed, satisfied" and "angry, anxious, depressed, sad", Thomaes et al., 2017, p. 1049). However, the role of motivations in connection with adolescents' experiences of state authenticity and inauthenticity when socialising online remain unexplored (Alchin et al., 2024).

*Motivations in self-determination theory (SDT)*

SDT (Ryan & Deci, 2017) provides a strong theoretical framework for understanding motivations that range along an autonomy continuum. The continuum ranges from more autonomous to more controlled forms of motivation which correspond to regulations that are internal or external to the self, or are not regulated at all (Ryan & Deci, 2017). There are three main types of motivation in SDT: intrinsic, extrinsic, and amotivation (Ryan & Deci, 2017). *Intrinsic motivation* is the most autonomous and exists when a person is inclined towards and engages in behaviour which is perceived as extremely interesting, enjoyable, and inherently satisfying (e.g., a hobby; Ryan & Deci, 2017). Extrinsic motivation includes three regulatory styles/motivations: identified, introjected, and external (Ryan & Deci, 2017; Sheldon et al., 2017) that lead to a separate outcome, such as an activity undertaken at school. *Identified motivation* involves social values and beliefs that have been progressively learned during development and become largely internalised as part of a person's own value system, and are considered personally important (Ryan & Deci, 2017). *Introjected motivation* is more externally driven and less autonomous than identified motivation, because it involves values that are not congruent with other values held by the self (Ryan & Deci, 2000) or are being tried out during adolescence to see if they will become one's own. Self-control may be present, however, activities undertaken are regulated through psychological defences such as avoiding guilt or maintaining self-esteem (introjects) and therefore are often coupled with negative experiences (Ryan & Deci, 2000). *External motivation* is the least autonomous and most extrinsic (Ryan & Deci, 2000). It exists when people participate in an activity because it appears to offer useful transient benefits or rewards that must be maintained. Alternatively, extrinsic motivation may be regulated by efforts to avoid punishment (Ryan & Deci, 2000). In both cases, the motivation is perceived as being controlled by external factors (Ryan & Deci, 2017). *Amotivation* is a lack of motivation (Ryan & Deci, 2000). There are two types of amotivation in SDT. The first is nonintentional, with insufficient competence to engage in an activity or behaviour (i.e., ineffective), or feeling helpless because they feel they have no control at all (Ryan & Deci, 2000). The second involves impersonal amotivation stemming from indifference or resistance, where a person is competent enough to engage in the behaviour or activity but chooses not to (Ryan & Deci, 2000). In the context of adolescent friendships, it is more likely indifference may occur.

*Motivations in friendship and state authenticity and inauthenticity*

It remains unknown whether the five SDT motivations in friendship predict state authenticity and inauthenticity in the context of a single episode of interaction. The 20-item SDT Friendship Self-regulation Questionnaire (SRQ-F; Ryan & Connell, 1989) was originally designed to assess intrinsic, identified, introjected, and external motivations in adults, in the context of a single friendship (Center for Self-Determination Theory, 2024). From a developmental perspective, it is uncertain whether the original SRQ-F items (Center for Self-Determination Theory, 2024) may be interpreted differently by adolescents compared to adults, due to differences in psychosocial maturity. As the SRQ-F does not appear to have been assessed using an exploratory factor analysis (EFA) process in an adolescent population aged 13–17 years to see whether the items represent the same constructs for teens, this is one aim of the current study. Items for a new amotivation scale targeting the indifference aspect of amotivation in a friendship were also developed for the current study.

*State authenticity and inauthenticity when socialising online with a friend*

Adolescents' qualitative descriptors of state authenticity and inauthenticity when socialising online with a friend indicated that some adolescents only experience state authenticity, while others experience moments of reduced state authenticity or state inauthenticity (Alchin et al., 2024b). Additionally, aspects of self-determined intrinsic and extrinsic motivations (including identified, introjected, and external motivations/regulations) appear to be connected to varying degrees of state authenticity being experienced (Alchin et al., 2024b). Extrinsic motivations may underpin why adolescents might feel they have the ability to be inauthentic when socialising online (Alchin et al., 2024b). Therefore, the context of socialising online with a friend is a developmentally important space to continue exploring adolescents' experiences of state authenticity and inauthenticity, including the importance of motivations in friendship that may influence or be part of those experiences.

*State authenticity and inauthenticity as potentially separate constructs*

It is unknown whether state authenticity and inauthenticity may be separate constructs for adolescents (Alchin et al., 2024). Lack of

social presence when interacting online—for example, only using text to communicate—can enable opportunities to be inauthentic if a teen feels there will be few or no external negative personal ramifications for acting in socially inappropriate ways, like being mean (Alchin et al., 2024b). Thomaes et al.'s (2017) state authenticity and inauthenticity measure has been used with adolescents previously and has three positively-valenced items. Therefore, those three items were adapted in the current study to explicitly ask about inauthenticity. This is because inauthenticity has been experienced by adolescents in subtle ways as "a little bit of inauthenticity," "unintentional hiding," and transient inauthenticity when socialising online with a friend they also knew in-person (Alchin et al., 2024b). Therefore, having separate items to assess inauthenticity may clarify whether state inauthenticity is experienced separately to state authenticity, and if so, whether it appears to be part of the same construct as state authenticity or not in the context of socialising online with a friend.

### Study rationale

Discovering which motivations are the most important predictors of state authenticity and inauthenticity may be integral to understanding some reasons why adolescents experience more or less state authenticity or inauthenticity in the context of socialising with a friend online. This evidence may lead to an initial theoretical understanding of how best to support adolescents to be their authentic selves.

## Current study

This study aimed to investigate what adolescents' experiences of state authenticity and inauthenticity are like when socialising online with a friend they also know in-person. More specifically, we were interested in understanding the motivations in friendship that predict state authenticity and inauthenticity. Therefore, analyses involved an EFA on state authenticity and inauthenticity items, a separate EFA on SRQ-F and new amotivation items, and a multiple linear regression to determine which motivations in friendship predict adolescents' state authenticity and inauthenticity.

## Method

### Participants

Adolescents aged between 13–17 years old living in Australia were eligible to participate if they had recently socialised online with a friend they also knew in-person. The age range of 13–17 years was chosen as some 12-year-old adolescents may not yet understand the idea of not being their real selves (Harter et al., 1997). The sample had 130 participants (girls, $n = 88$; boys, $n = 36$; non-binary/ gender diverse, $n = 3$; prefer not to say, $n = 4$). Almost half of the total participants were 14.5 years old or younger ($n = 88$, 48.5%). Participants who completed the questionnaire could enter a prize draw with a chance of winning an AUD\$20 digital e-gift voucher (81% of participants opted into the prize draw). On average, it took participants 27 min to complete the questionnaire (range 4–50 min, 80% of participants took less than 17 min).

### Interaction recency, apps, and technology mechanisms

Over 73% of 130 participants had socialised online with their friend within the past six hours (the rest within 24 hours). The most common apps used were Messages (42% of participants), SnapChat (39%), and WhatsApp (32%). Some participants used multiple apps simultaneously. The most common way participants interacted with their friend was to use text (86% of participants; microphone = 35%; video = 18%). See Appendix A for additional data about recency, apps and mechanisms.

### Recruitment

Adolescents were recruited by sharing digital invitations via 11 Australian schools (7 metropolitan areas, 4 regional areas), texted to adult personal contacts of the researchers, and shared via social media. The adolescents were encouraged to share the invitation with friends. Schools shared the invitations using each school's preferred distribution methods. One school voluntarily set aside time during class when interested adolescents could choose to participate. The invitations contained a link to an online platform where participant information was presented in two formats as recommended by Alchin et al. (Unpublished, in preparation): an easy-to-understand video and a written document. Both could be accessed anonymously and optionally downloaded. The platform included a consent process entry point, followed by the questionnaire. The online platform used LimeSurvey and was hosted on secure servers of the host university.

### Ethical considerations

The participant information was co-designed with three teenagers (19, 16, and 14 years old) to ensure it used developmentally appropriate wording with plain-language explanations. Participant information mentioned the importance of the research, voluntary anonymous participation, eligibility details, example survey questions, how personal information would be collected, stored, and used, research team details and support services, prize draw details, and an outline of the process to give consent.

### Online consent

Adolescents who are 13 years old and above can give online consent without parental involvement to join several social media

platforms and apps (e.g., Messenger and Snapchat; Meta, 2024; Snap Inc., 2024). The approach used for the current study maintained adolescents' autonomy while meeting Australian ethical standards regarding checking capacity to give consent (National Health and Medical Research Council, 2023). An online consent process adapted from recommendations of Mackenzie et al. (2021) was used to gauge participants' capacity to give their own consent. Comprehension checks were built into the online consent process, which occurred immediately before the online questionnaire. The consent process included question-and-answer sets which screened out adolescents who were not mature enough to understand the relevant information and to give their own consent. Adolescents who successfully gave consent completed the questionnaire.

## Procedure and measures

### Procedure

After giving consent, adolescents were presented with the anonymous online questionnaire which began with: "Please think about the most recent time in the past 24 hours when you actively socialised online with a friend, who you also know in-person. Socialising online includes things like using live video to see each other and chat, using your microphone to chat while doing an online activity with your friend (like gaming or in virtual reality), and chatting using text. It includes sending each other videos, pictures, memes, sounds, and using emojis as part of socialising. (It doesn't include things like videos posted to a feed where people only press 'like'.)" Adolescents were asked questions about their technology use (contained in Appendix A). The measures shown below were presented. Following those, questions about gender and what year they were born were presented. All questions were mandatory except one, which asked what type of online technologies they had used while interacting with their friend. The survey finished by asking whether participants wished to enter the prize draw and/or receive a summary of the study's outcomes.

### Measures

**State Authenticity scale** (Thomaes et al., 2017). This scale comprises three items with response options ranging from $1 = not\ at\ all\ true$ to $5 = very\ true$, where higher scores represent greater authenticity. In the current study, all response options were labelled. An example item is "Today I acted as I really am" (Thomaes et al., 2017, p. 1049) and reliability and validity have been established in adolescents ($\alpha = .92$, Thomaes et al., 2017), with reliability confirmed in the current sample ($\alpha = .90$, $N = 130$). The scale was modified to replace the word "today" with, "While I was socialising with my friend...", and participants were reminded to think about the most recent time in the past 24 hours when they had actively socialised online with their friend. Participant scores were calculated by averaging their responses across the three items.

**State Inauthenticity scale.** The 3-item State Authenticity scale by Thomaes et al. (2017) was adapted to also represent inauthenticity. The modified items were: "I was a false self", "I didn't act as I really am", and "I was inauthentic and not 'real'". Response options and score calculation methods were the same as for state authenticity. Higher scores represented greater inauthenticity. Reliability in the current sample was $\alpha = .79$ ($N = 130$). The three state authenticity items were presented first in the questionnaire, followed by the three state inauthenticity items.

**Motivations in Friendship.** The Friendship Self-Regulation Questionnaire (SRQ-F, Ryan & Connell, 1989) was used to assess motivations in friendship (licensed scale with item details available from Center for Self-Determination Theory, 2024). It contains four question prompts which assess the degree of intrinsic motivation, identified regulation, introjected regulation, and external regulation a person experiences in their friendship with one friend. The question prompts contain mixed response items for a total of 20 response items assessing four subscales. The first question prompt has twice the number of response items compared to the other prompts. Therefore, each subscale (i.e., intrinsic, identified, introjected, and external) has five items. Response options range from $1 = not\ at\ all\ true$ to $7 = very\ true$, where higher scores represent more of each of motivation. The original response options have descriptive labels for options 1, 4, and 7. To minimise ambiguity and cognitive fatigue for adolescents, descriptive labels were added to response options 2, 3, 5, and 6; for example, $6 = mostly\ true$. The order of SRQ-F questions and items were unchanged, with the addition of two new amotivation items for the first question, and one new amotivation item for the other three questions. These new items were developed to create an amotivation subscale based on the premise that amotivation can occur when a person may be indifferent in a friendship, despite having competence. Three new items contained the phrase "I'm not interested," one contained "I don't care," and the last new item referred to being a friend "because it is convenient." Response options and labels were the same as for the other SRQ-F subscales. Higher scores on any of the SRQ-F and amotivation items represented greater motivation, regulation, or amotivation in the friendship. In the current study an EFA was conducted on SRQ-F items, so for the emergent factor subscale structures, participant responses were averaged across items which remained within each factor (please see the Results for more information).

The intrinsic motivation subscale has been found reliable in a small sample of 26 children and adolescents ages 9–15 years meeting clinical autism spectrum criteria (4-point response scale; $\alpha = .87$; Shea et al., 2013). In a sample of adolescents and young adults aged 15–21 years (mean age 17 years), Soenens and Vansteenkiste (2005) calculated a relative autonomy index (RAI) across five SRQ-F subscales, which included amotivation items different to the ones developed for the current study. The RAI had a reliability of $\alpha = .73$; reliabilities for individual SRQ-F subscales were not reported. Tanhaye Reshvanloo et al. (2021) verified the SRQ-F's original four-factor structure in young adults aged 18–25 years through exploratory and confirmatory factor analysis, and reported reliabilities for the individual subscales ranging $\alpha = .82$–.89.

**Satisfaction with Friendship scale** (Kuroda & Sakurai, 2003). This scale was used to assess convergent validity of the post-EFA SRQ-F subscales, state inauthenticity 3-item scale, and composite 6-item state authenticity and inauthenticity scale. The satisfaction with friendship scale has been validated and established as reliable ($\alpha = .73$–.88) in adolescents (Kuroda & Sakurai, 2003; Okada, 2007). The original scale refers to "friends" (plural), so was modified in the current study to refer to a "friend" (singular). Original items

were in Japanese (Kuroda & Sakurai, 2003), and were translated using Google Translate for this study. The translations were refined through discussion between two of the authors. The English items used were: "I have a very fulfilling friendship with my friend," "I feel very satisfied with my friendship with my friend," "I enjoy being with my friend," and "Our friendship has a good influence on both of us." Response options were based on Okada (2007) and maintained the same range where 1 = *not true at all* to 5 = *very true*, with additional labels added for responses of 2, 3, and 4 to improve clarity.

**Dispositional Optimism scale** (Ey et al., 2005). This scale was used to assess discriminant validity for the post-EFA SRQ-F, state inauthenticity or composite state authenticity/inauthenticity scales. Ey et al. (2005) noted the six-item scale was reliable (α = .79) and validated in children; which means adolescents should easily understand what the items mean. An example item is: "When things are bad, I expect them to get better" (p. 552). In the original scale there are four labelled response options, ranging from 0 = *not true for me* to 3 = *true for me*. The range was altered in the current study to start at one instead of zero to maintain consistency for participants across the questionnaire, minimising cognitive fatigue. Participant scores were calculated by averaging their responses across the six items.

## Data analysis

IBM SPSS Statistics (version 29.0.2.0, 20; IBM, 2023) was used to analyse most data. FACTOR (version 12.04.05 October 2023; Lorenzo-Seva & Ferrando, 2006-2023) was used for EFAs involving polychoric correlations. Polychoric correlations are more robust than Pearson correlations during factor analyses involving items exhibiting skewness (Flora, LaBrish, & Chalmers, 2012; Gaskin & Happell, 2014) or excess kurtosis (Muthén & Kaplan, 1985; Muthén & Kaplan, 1992). Polychoric correlations also estimate the strength of relationships between Likert-type ordinal response variables more accurately than Pearson correlations (Garrido et al., 2013; Holgado-Tello et al., 2013; Olsson, 1979). Cases were included in analyses where participants had completed all mandatory items. During data screening, there was no evidence in participants' responses of 'straightline' responding or other repeated patterns that may be used to speed through a questionnaire (e.g., 3, 2, 1, 3, 2, 1). After reviewing descriptive statistics, analytical processes focused on EFA of state authenticity and inauthenticity items. Then, a separate EFA for SRQ-F items and new amotivation items was performed. Internal consistency of the emergent factors and convergent and discriminant validity were then assessed. A linear multiple regression was conducted using the emergent SRQ-F factors as predictors, and state authenticity and inauthenticity as the outcome variable.

## Preliminary procedures

When reviewing the descriptive statistics, some items had skewness outside the –2 to + 2 range (George & Mallery, 2010) or kurtosis outside the –7 to + 7 range (Hair et al., 2010). At item level, skewness and kurtosis seemed to represent a range of genuine responses and there was no reason why the data should potentially be considered systematically biased or unrepresentative. Appendix B describes the reasoning, checks, and procedures taken to reduce skewness and kurtosis in the dataset prior to conducting EFAs. Appendix C contains descriptive statistics for the whole sample prior to that process ($N$ = 130) and the outcomes of that optimisation process for the reduced sample ($n^1$ = 115). All remaining items had at least one bivariate correlation with another conceptually related item stronger than Pearson's $r$ = .30 or –.30.

## State authenticity and inauthenticity EFA procedure

The method for factor analysis of state authenticity and state inauthenticity items was robust unweighted least squares (which is robust for small samples; Rogers, 2022) based on a polychoric correlation dispersion matrix (polychoric algorithm used Bayes modal estimation; Choi et al., 2011). The number of factors was determined using the optimal implementation of parallel analysis (Timmerman & Lorenzo-Seva, 2011) based on 500 random correlation matrices involving permutation of raw data (Buja & Eyuboglu, 1992). Robust analyses were bias-corrected and accelerated (Lambert et al., 1991) and the asymptotic covariance/variance matrix estimated using bootstrap sampling, with factor score estimates based on a linear model. Responses for inauthenticity items were reverse-coded (so higher scores represented less inauthenticity) to prevent artificial loading on separate factors being driven by opposing skewness.

## Motivation EFA procedure

The EFA procedure for motivation items was the same as for state authenticity/inauthenticity, with the following differences. A normalised varimax rotation (orthogonal) was chosen, as patterns in earlier unsuccessful explorations involving 25 motivation items had shown a tendency for several intrinsic motivation and identified regulation items to consistently load on and dominate one factor. Remaining items had been scattered across uninterpretable factor(s), cross-loaded too highly with the first factor, or negatively loaded on the first while positively loading on other factors. Therefore, an orthogonal rotation was appropriate to clearly separate factors. When the matrix was not positive definite, the sweet smoothing procedure (Lorenzo-Seva & Ferrando, 2021) was not applied as it destroys covariance in the model. Instead, items identified by FACTOR as potentially causing this issue were considered as they arose and, if necessary, omitted (as discussed in Appendix C). Items were individually sequentially omitted based on lowest communalities, then a final item where cross-loading between factors was less than .300 absolute value was removed.

## Linear multiple regression

Multiple regression used the emergent SRQ-F factors as predictor variables and state authenticity/inauthenticity as the outcome variable. Linear multiple regression was conducted using Pearson correlations, as a polychoric correlation matrix requires response scales for all variables to have the same range (Lorenzo-Seva & Ferrando, 2023), which was not the case in the current study.

Assumptions for multiple regression were checked based on the new scales which emerged from the EFAs, and outlier cases were omitted where Mahalanobis' distance $p \leq .05$.

## Results

### State authenticity and state inauthenticity

#### Descriptive statistics

Adolescents' mean state authenticity was high ($N = 130$, $M = 4.42$ on 5-point scale, $SEM = 0.06$, $SD = 0.73$) and very similar to what adolescents have previously reported (Thomaes et al., 2017). Adolescents' mean state inauthenticity was very low ($N = 130$, $M = 1.37$ on 5-point scale, $SEM = 0.05$, $SD = 0.59$). More than half of the participants (58%) indicated they did not experience state inauthenticity.

Items on the state authenticity scale and adapted items for the state inauthenticity scale were assessed for optimisation prior to EFA (see Appendix B). Internal consistency for both scales could not be improved by removing items, so all six items were retained for a combined EFA. Appendix C Table C1 contains item-level descriptive statistics for those items for the whole sample ($N = 130$), and for the reduced sample used for EFA ($n^1 = 115$) after outlier cases ($n = 14$) were omitted. Polychoric correlations between all state authenticity and state inauthenticity (reversed) items were moderate to strong, and the polychoric correlation matrix was adequate to proceed with EFA (see Appendix C Table C2).

#### Exploratory factor analysis ($n^1 = 115$)

Optimal implementation of parallel analysis suggested one factor, with real-data percent of variance at 84.39%. Results of the EFA are shown in Table 1. One factor emerged containing all six items. Internal reliability of the state authenticity/inauthenticity scale was excellent. All item communalities were greater than .400 (recommended by Costello & Osborne, 2005) and all loadings were well above .320 (recommended by Tabachnick & Fidell, 2001). This means the items have practical relevance (Hair et al., 2014).

#### Convergent and discriminant validity

Convergent validity was established through the weak, positive, and significant relationship between state authenticity/inauthenticity and friendship satisfaction ($r = .382$ [CI .167, .607], $p < .001$). However, the weak and statistically significant positive correlation with optimism ($r = .372$ [CI .186, .533], $p < .001$) did not establish discriminant validity, as the strength of the correlation was too similar to friendship satisfaction. Optimism may be a better marker for convergent validity than discriminant validity for state authenticity/inauthenticity, even though the optimism scale used was not friendship specific.

In the EFA sample ($n^1 = 115$), mean friendship satisfaction was very high ($M = 4.56$ on 5-point scale, $SEM = .051$, $SD = 0.549$) and optimism was moderately high ($M = 2.84$ on 4-point scale, $SEM = .063$, $SD = 0.679$). Internal consistencies were good for the friendship satisfaction ($\alpha = .80$) and optimism ($\alpha = .83$) scales.

### Motivations in friendship (SRQ-F and amotivation)

#### Descriptive statistics prior to EFA

Item-level descriptive statistics prior to EFA for the SRQ-F original subscales and for the new proposed amotivation scale are shown in Appendix C Table C3, for the whole sample ($N = 130$) and the reduced sample after outlier cases were removed ($n^1 = 115$). Preliminary optimisation of scale items at subscale level based on data from the whole sample (see Method) resulted in seven items being omitted prior to EFA (see Appendix C Table C3, superscript 'c').

#### Exploratory factor analysis

Technical and statistical details of the polychoric EFA process for motivation items are reported in Appendix C. The motivation EFA met required participant-per-item ratios recommended by Hair et al. (2014), so it was appropriate to proceed with the EFA. Optimal implementation of parallel analysis suggested two factors and simple structure was achieved through the EFA process, with the final

**Table 1**
State Authenticity and Inauthenticity Exploratory Factor Analysis Communalities, Factor Loadings, and Scale Reliability.

| Item | Communalities | Factor loadings [95% CI] | Reliability Cronbach's $\alpha = .89$<br>Item-total correlation |
|---|---|---|---|
| I was my true self | .757 | .870 [.724, .944] | .729 |
| I acted as I really am | .835 | .914 [.801, .976] | .763 |
| I was "real" and authentic | .848 | .921 [.762, .969] | .801 |
| I was a false self (reversed) | .703 | .839 [.660, .931] | .671 |
| I didn't act as I really am (reversed) | .821 | .906 [.788, .975] | .750 |
| I was inauthentic and not "real" (reversed) | .634 | .796 [.584, .914] | .585 |

*Note.* $n^1 = 115$. Root mean square of residuals = 0.048 [CI 0.028, 0.060].

solution containing two factors with six items per factor. The polychoric matrix for the final EFA solution was adequate and indices of factor simplicity were excellent. Polychoric correlations for the 12 items retained in the final EFA solution are reported in Appendix C Table C4.

The two factors were named *Autonomous Motivation in Friendship* and *Controlled Motivation in Friendship*. The Autonomous Motivation in Friendship factor contained three items from the intrinsic motivation subscale, and three items from the identified regulation subscale. Similarly, the Controlled Motivation in Friendship factor contained three items from the introjected regulation subscale and three items from the external regulation subscale.

Factor loadings, communalities, indicators of internal consistency, and variance explained are shown in Table 2. All item factor loadings were greater than .500, which is above the minimum of .320 suggested by Tabachnick and Fidell (2001) and indicates the items have practical significance (Hair et al., 2014), not just statistical. Communalities for nine of 12 items were above the .400 threshold recommended by Costello and Osborne (2005). While the remaining three items on the Controlled Motivation factor were below the recommended communality threshold, factor loadings were greater than .550 which suggests items have practical significance (Hair et al., 2014) and overlapping variance with other items on the Controlled Motivation factor greater than 10% (see Costello & Osborne, 2005; Tabachnick & Fidell, 2001), so were worth retaining. The relationship between participants' mean scores for the two factors was nearly non-existent ($r = .020$ [CI –.162, .203], $p = .828$, $n^1 = 115$). This indicates the factors are cleanly distinguishing between two constructs.

Table 3 shows descriptive statistics for the two forms of motivation in friendship, friendship satisfaction, and optimism. On average, autonomous motivation in friendship was very high for adolescents. The mean for controlled motivation in friendship hovered just under the scale's mid-point but had greater variability around the mean than autonomous motivation, which suggests some adolescents experience more controlled motivation than others. On average, friendship satisfaction with the friend they had interacted with was very high for adolescents. Adolescents were also reasonably optimistic, with the sample mean a little above the mid-point on the scale.

### Convergent and discriminant validity

The strong positive relationship between autonomous motivation in friendship and friendship satisfaction ($r = .697$ [CI .496, .829], $p < .001$) established convergent validity, and the very weak correlation with optimism ($r = .187$ [CI .018, .362], $p = .046$) established discriminant validity. While the very weak negative relationship between controlled motivation in friendship and friendship satisfaction did not reach statistical significance ($r = –.123$ [CI –.296, .047], $p = .189$), it was in the appropriate direction for convergent validity. It was also stronger than the near non-existent relationship between optimism and controlled motivation in friendship ($r = –.007$ [CI –.209, .197], $p = .943$) that established discriminant validity.

### Multiple linear regression

A multiple linear regression was conducted with state authenticity/inauthenticity as the outcome variable, and autonomous motivation in friendship and controlled motivation in friendship as predictor variables. Assumption checks for linear regression were conducted on the same sample used for EFA ($n^1 = 115$), and outliers removed (see Method), as scattered outliers suggested the equal variances assumption was violated. In the final sample ($n^2 = 108$) assumptions of linearity and equal variances (homoscedasticity) were met, and there were no multicollinearity issues. The histogram and normal P-P plot of regression standardised residuals showed skewness, however, the normality assumption applies to the population rather than the sample, and the sample size is considered large enough to be robust to violations of normality (Field, 2013). Descriptive statistics are shown in Table 4.

**Table 2**
Motivation Exploratory Factor Analysis Communalities, Factor Loadings, and Scale Reliabilities, for 12-item SRQ-F.

|  |  | Rotated factor loadings [95% bootstrapped CI] |  |  |
| --- | --- | --- | --- | --- |
| Item | Communalities | Autonomous Motivation in Friendship | Controlled Motivation in Friendship | Reliability, item-total correlations |
| 10–T2 (INT) | .822 | .906 [.565, .988] |  | .764 |
| 12–T4 (IDE) | .795 | .890 [.508, .969] |  | .763 |
| 16–L4 (IDE) | .761 | .871 [.457, .977] |  | .730 |
| 06–C6 (INT) | .735 | .857 [.506, .946] |  | .711 |
| 04–C4 (IDE) | .636 | .794 [.472, .902] |  | .684 |
| 02–C2 (INT) | .554 | .728 [.491, .895] |  | .595 |
| 03–C3 (EXT) | .762 |  | .873 [.598, .973] | .689 |
| 05–C5 (INJ) | .578 |  | .759 [.379, .859] | .612 |
| 14–L2 (INJ) | .531 |  | .721 [.343, .850] | .585 |
| 15–L3 (EXT) | .365 |  | .582 [.304, .770] | .481 |
| 09–T1 (EXT) | .352 |  | .577 [.288, .769] | .384 |
| 18–P2 (INJ) | .334 |  | .553 [.288, .760] | .489 |
| Variance explained for rotated solution, value and percent |  | 4.355 (36.29%) | 2.869 (23.91%) |  |
| Cronbach's |  | $\alpha = .88$ (good) | $\alpha = .79$ (acceptable) |  |

*Note.* $n^1 = 115$. SRQ-F = Self-Regulation Questionnaire–Friendship (Ryan & Connell, 1989). CI = confidence interval, INT = Intrinsic, IDE = Identified, INJ = Introjected, EXT = External. Reliabilities were calculated in SPSS.

**Table 3**

Descriptive Statistics for Motivation, Friendship Satisfaction, and Optimism.

| Variables | *M* | *SEM* | *SD* | *Skew* | *Kurtosis* | Cronbach's α |
|---|---|---|---|---|---|---|
| Autonomous Motivation in Friendship | 6.46 | .068 | .726 | −1.930 | 4.154 | .88 |
| Controlled Motivation in Friendship | 3.31 | .127 | 1.365 | .213 | −.681 | .79 |
| Friendship Satisfaction | 4.58 | .051 | .549 | −1.633 | 2.713 | .80 |
| Optimism | 2.84 | .063 | .679 | −.614 | −.136 | .83 |

*Note.* $n^1 = 115$. Possible mean scores for both Motivation scales range from 1 to 7, Friendship Satisfaction from 1 to 5, Optimism from 1 to 4, with higher scores representing more of each construct.

The regression model reached significance with the predictor variables together explaining 18.5% of the variability in state authenticity and inauthenticity, $F(2,105) = 11.92$, $R^2 = .185$, $p < .001$. Cohen's $f^2$ for the model was 0.48, which is a large effect (large effects $\geq 0.35$, Cohen, 1988). Autonomous motivation in friendship was a significant predictor of state authenticity and inauthenticity ($\beta = .285$ [CI .152, .424], $t = 4.825$, $p < .001$), and when controlled motivation in friendship was statistically controlled for in the model, autonomous motivation had a positive moderate relationship with state authenticity and inauthenticity ($r_{partial} = .426$) and also uniquely explained 18.0% of the variability in state authenticity and inauthenticity. Therefore, for adolescents, increases in autonomous motivation predict increases in state authenticity and inauthenticity towards greater authenticity (and for adolescents who experience inauthenticity, decreases in inauthenticity). As autonomous motivation decreases, authenticity also decreases (and inauthenticity increases). Controlled motivation in friendship was not a significant predictor of state authenticity/inauthenticity ($\beta = -.024$ [CI −.077, .031], $t = -0.936$, $p = .351$, $r_{partial} = -.091$). Post-hoc power analysis showed achieved power to detect medium size effects was .95 ($n^1 = 108$, medium $= 0.15$, α error probability $= 0.05$), however, there was insufficient statistical power to detect small effects (small $= 0.02$, achieved power $= .24$). This means that for controlled motivation in friendship, a minimum sample size of 485–776 people (based on power of .80–.90) would be required in future research to detect whether it may have a small effect on state authenticity/inauthenticity in the context of a friendship when autonomous motivation is in the regression model, if that effect exists.

As a final note, a common index calculated using the SRQ-F is the RAI, which is a weighted calculation based on the four forms of motivation/self-regulation in the SRQ-F, and its formula is described in the instrument that was used for the current study (Center for Self-Determination Theory, 2024). When the RAI was calculated for the sample used in the regression ($n^2 = 108$) based on the 12 items retained as a result of the EFA and used as the predictor in linear regression, it explained 4.6% of variability in state authenticity/inauthenticity, $F(1,106) = 5.162$, $R^2 = .046$, $p = .025$. When the RAI was calculated for the same sample using all 20 original items from the SRQ-F, the regression model did not reach significance, $F(1,106) = 3.545$, $R^2 = .032$, $p = .062$. Therefore, using the RAI does not provide a clear picture of the comparative contribution of autonomous motivation in friendship when compared to controlled motivation in friendship on state authenticity and inauthenticity.

## Discussion

This study aimed to identify which SDT motivations in friendship may predict state authenticity and inauthenticity when socialising with a friend online. The results of this study showed that when adolescents are socialising online with a friend they also know in-person, state authenticity and inauthenticity represent a unidimensional construct. For motivations assessed by the SRQ-F (Ryan & Connell, 1989), the study showed a selection of items from the intrinsic motivation and identified regulation subscales resolved on to an Autonomous Motivation in Friendship factor, and a selection of items from the introjected regulation and external regulation subscales resolved on to a Controlled Motivation in Friendship factor. Autonomous motivation in friendship uniquely predicted state authenticity and inauthenticity, but controlled motivation in friendship did not.

### State authenticity/inauthenticity as part of the same construct

Adolescents generally experienced quite high levels of state authenticity when socialising online with their friend, and just over one third of participants experienced state inauthenticity too in comparably low levels. EFA results indicated that state authenticity and inauthenticity combine to define a unidimensional construct. The adapted state inauthenticity items helped differentiate between adolescents who did and did not experience inauthenticity and there was no improvement to internal consistency in the combined state authenticity and inauthenticity scale if some of the inauthenticity items were to be deleted to create a shorter scale. Convergent and

**Table 4**

Descriptive Statistics for Multiple Regression.

| Variables | *M* | *SEM* | *SD* | Skew | Kurtosis | Cronbach's α |
|---|---|---|---|---|---|---|
| State Authenticity/Inauthenticity | 4.69 | .038 | .395 | −1.121 | .197 | .86 |
| Autonomous Motivation in Friendship | 6.52 | .057 | .589 | −1.312 | .788 | .83 |
| Controlled Motivation in Friendship | 3.28 | .131 | 1.357 | .245 | −.593 | .78 |

*Note.* $n^2 = 108$. Possible State Authenticity/Inauthenticity mean scores range from 1 to 5, with higher scores representing greater authenticity/less inauthenticity. Possible mean scores for both Motivation scales range from 1 to 7, with higher scores reflecting greater motivation.

discriminant validity for the combined scale was established.

*SDT motivations in friendship: autonomous motivation and controlled motivation*

For motivation, the EFA revealed two factors: Autonomous Motivation in Friendship and Controlled Motivation in Friendship. Overall, adolescents' autonomous motivation in friendship was very high and controlled motivation was slightly low, on average. The Autonomous Motivation in Friendship factor contained six items from the SRQ-F intrinsic motivation and identified regulation sub-scales. The items contained positively-valenced emotion words and comprised the idea of holding the friend in high regard and continuing to deepen the friendship by being receptive to moments of disclosure from their friend. All six items which loaded together to define the Controlled Motivation factor had an emotional valence (the four eliminated items did not). Three items represented an adolescent's negative feelings, one item represented a friend's potential negative feeling, one item was about a friend's potential negative action, and the last item was about a friend's potential positive action. It is possible that adolescents found the emotional descriptors easy to understand, compared to the content in the eliminated items. Together, this suggests that the theoretical premise of the four forms of motivation/regulations in friendship can emerge in adolescent data, however, these same motivations were identifiable using a two-dimensional factor structure based on a smaller set of items. (Appendix D discusses all items which were progressively eliminated during the EFA process, from a developmental perspective.)

The correlation between adolescents' mean factor scores for Autonomous Motivation in Friendship and Controlled Motivation in Friendship was nearly non-existent. This suggests the two constructs—as identified by 12 items—are conceptually distinct. Convergent and discriminant validity were established for the Autonomous Motivation in Friendship scale, and discriminant but not convergent validity for the Controlled Motivation in Friendship scale. The very weak negative relationship between controlled motivation in friendship and friendship satisfaction did not reach significance, and this may have occurred as the three introjected regulation items in the controlled motivation factor reflect emotions associated with potentially not meeting social norms for friendship (e.g., motivated by the potential punishment of feeling guilty, for not listening to their friend), so may not closely affect friendship satisfaction. The type of structure found in the current study where intrinsic and identified items resolved on to one factor representing more autonomous forms of motivation, and introjected and external items resolved on to the other factor representing more controlled forms of motivation, has been found in young adults using a general measure of self-regulation which was not friendship-specific (Sheldon et al., 2017). In the study by Sheldon et al. (2017), cluster analysis methods identified fairly conceptually clear lower order factors of individual types of motivation/regulation (intrinsic, identified, positive introjection, negative introjection, external, and amotivation) which clustered on two higher-order factors (autonomous and controlled). A cluster analysis based on the current study's whole sample ($N = 130$; not reported in Results) was investigated using the same Ward linkage principle as Sheldon et al. (2017), and while there were two upper-order clusters, only two of the four lower-order clusters had partial conceptual coherence and they did not resemble the degree of clarity found by Sheldon et al. (2017). This helped visually confirm that an exploratory approach, rather than confirmatory, was most appropriate to identify which items may be most relevant to adolescents. Additionally, in the current study the two-factor EFA approach provided greater clarity about motivation in relation to state authenticity/inauthenticity than the weighted RAI. The weighted RAI has been critiqued on the basis that it can sometimes confound interpretation when used on its own (Sheldon et al., 2017), and Ünlü (2016) outlined an adjusted weighting technique initially identified in a study involving children by Ünlü and Dettweiler (2015), which relies on the idea that identified and introjected regulations "can be modelled as a convex combination" (p. 680) of intrinsic motivation and external regulation. In the current study, the EFA process permitted identification of intrinsic motivation and identified regulation items on the SRQ-F which distinctly represent autonomous motivation in friendship, and introjected and external regulation items which distinctly represent controlled motivation in friendship.

*SRQ-F construct in adolescents 13–17 years of age*

Patterns of polychoric correlations for the SRQ-F shown in Appendix C Table C4 show that some items correlate more strongly with items on a different subscale construct, than with items on the same subscale construct they were intended to measure. For example, two intrinsic regulation subscale items (06–C6 and 10–T2) had stronger correlations with two identified regulation subscale items (12–T4 and 16–L4), than they did with the remaining intrinsic item. Similarly, one external regulation subscale item (09–C3) had much stronger correlations with two introjected regulation subscale items than with either of the other two external regulation items. Together, these findings suggest that the constructs may not be as clearly defined during adolescence as they are during emerging adulthood (see Tanhaye Reshvanloo et al., 2021, as an example).

In the current sample, items on the five-item external regulation subscale prior to EFA had substantively different directions of skewness to each other (see Appendix C Table C3), which suggests that in the context of friendship in adolescence, some of those items may not be measuring external regulation well. There was a similar pattern across the five items for the introjected regulation subscale which was less prominent, but present. Affected items may benefit from contemporary adolescent focus group discussions to check what adolescents understand those items to mean.

*Amotivation*

Means for four of the five new amotivation items were in the expected direction relevant to the context of a close friendship (see Appendix C Table C3). However, the range of responses for those items was so narrow that they became nearly dichotomous in form, which is likely the reason the polychoric correlation processes were unable to resolve into a positive definite matrix, leading to amotivation items being excluded during the EFA. It is also likely, given the means for those four items in the current sample, that amotivation—as conceptualised in the form of indifference despite having competence—is only very minimally evident in some

adolescents' interactions while socialising online with a friend they also know in-person. Item 10.5–T2.5, however, did not robustly define that form of amotivation; the sample mean was around the centre of the response scale and the histogram for the item showed an approximately normal distribution, which would not be expected in the context of friendship. During preliminary analyses, that item also had correlations at a statistically significant level with several items across the four SRQ-F subscales, which confirmed it was not reliably assessing the concept of amotivation. The remaining four amotivation items may be more appropriate for clinical contexts where reduced empathy toward others is present.

*Summary*

In summary, the SRQ-F EFA process in the current study produced a simplified matrix of items to define an Autonomous Motivation in Friendship factor in adolescents, which in young adults resolves into the more nuanced forms of motivation of intrinsic motivation and identified regulation (Tanhaye Reshvanloo et al., 2021). Similarly, a Controlled Motivation in Friendship factor emerged in the current study for adolescents, which in young adults tends to resolve on the more nuanced sub-concepts of introjected regulation and external regulation (Tanhaye Reshvanloo et al., 2021).

*Autonomous motivation in a friendship predicts state authenticity/inauthenticity when socialising online with a friend*

Multiple linear regression showed that motivation had a large effect on state authenticity and inauthenticity when socialising with a friend online, with autonomous motivation in friendship uniquely predicting 18% of variability in state authenticity and inauthenticity, where greater autonomous motivation predicted greater state authenticity (and lower inauthenticity for those who experienced it), and lower autonomous motivation predicted lower state authenticity (and greater inauthenticity). In contrast, controlled motivation in friendship was not a significant predictor, even though over 95% of adolescents in the sample experienced it. It is potentially possible that controlled motivation in friendship may have a small effect on state authenticity/inauthenticity, but a much larger sample would be required to identify it, if it exists.

Although the current study does not establish causality, the positive explanatory relationship between autonomous motivation in friendship and state authenticity/inauthenticity echoes the causal influence of autonomy as a basic psychological need on state authenticity reported by Thomaes et al. (2017). In the current study, the aim was to identify predictors of state authenticity/inauthenticity based on the motivation/self-regulation model in SDT, rather than autonomy, competence, and relatedness as basic psychological needs (Ryan & Deci, 2017). What has emerged from the current study is support for the idea that autonomy is a crucial aspect closely associated with state authenticity, irrespective of context or recency of experience; with greater autonomy associated with higher authenticity and lower inauthenticity, and less autonomy predicting lower authenticity and higher inauthenticity.

*Autonomous motivation in friendship and state authenticity/inauthenticity*

The Autonomous Motivation in Friendship scale contained items regarding enjoyment and freedom as part of a motivation in friendship, and these ideas align well with aspects of adolescents' experiences of state authenticity described during interviews, where adolescents indicated their interaction had been comfortable and easy when the interactions were flowing well, and there was an absence of any need to try to hide or hold back (Alchin et al., 2024b). The experience of having fun and being happy also means that adolescents feel they do not need to pretend (Gaudiello & Waldo, 2024).

*Controlled motivation in friendship and state authenticity/inauthenticity*

Five of six items on the Controlled Motivation in Friendship scale contained negative and uncomfortable emotion words. When considered in relation to adolescents' qualitative descriptions of state authenticity and state inauthenticity experiences, a gut feel where an interaction was starting to feel "a bit off" was present when adolescents appeared to be experiencing a little bit of inauthenticity (Alchin et al., 2024b). As indicated in the Results section for the multiple regression, a much larger sample size would be required in future to determine whether controlled motivation may have a small effect on state authenticity and inauthenticity (if any).

*State authenticity/inauthenticity, motivation, and trait authenticity*

Our state-based findings offer preliminary insight into developmental aspects of authenticity/inauthenticity when theorising about and measuring authenticity traits in adolescents. Wood et al.'s (2008) authentic personality construct is an individual-differences approach based in person-centred psychology. In their view, people vary on a spectrum in comparison to each other regarding the degree to which they have components of that personality. The three components are: accepting external influence, authentic living, and self-alienation. To score high on Wood et al.'s authentic personality measure, a person needs to have a clear idea of their values and beliefs, know their personal attributes well, and be able to accurately reflect on the degree to which they are true to themselves in most situations. A person needs to understand and be able to recognise they can feel disconnected from their true self, and do not usually do what other people ask when it conflicts with their own views. Therefore, Wood et al.'s construct contains elements which require greater experience, awareness, and self-knowledge than younger and some older adolescents could be expected to have achieved overall. For example, to "live in accordance with my values and beliefs" (p. 388) requires a clear understanding of one's own values and beliefs first. During adolescence, values and beliefs are being experimented with and some are gradually internalised (or rejected; Ryan & Deci, 2017), so an authentic personality may not be able to be fully developed until early adulthood. Our study demonstrates that at a state level, autonomous motivations in a friendship (involving internalised and identified friendship values) explain considerable variability in state authenticity/inauthenticity. This suggests personally important values have considerable involvement

in authenticity experiences. However, controlled motivation (involving values which are merely introjected or remain external) had a near non-existent relationship with state authenticity/inauthenticity in our study. This provides preliminary state-based support for Wood et al.'s view that an authentic personality requires identification of and living in accordance with one's own values, not other peoples' values. However, interviews with adolescents suggested their state inauthenticity experiences were centred on their own positive relationship maintenance values, such as respect, reciprocal care, and morality (Alchin et al., 2024b). That is, inauthenticity in adolescents in the context of friendship may sometimes be less connected to being influenced by others' values (i.e., external), and more about consciously initiating self-regulation based on their own values. Further research is needed to explore this potential.

Kernis and Goldman's (2006) multicomponent conceptualisation of authenticity theory is adult oriented. It revolves around the idea of a fully functioning person, so requires a developmental level of maturity and self-congruence which starts to gain importance in late adolescence and early adulthood. They defined authenticity as the "unobstructed operation of one's true- or core-self in one's daily enterprise" (p. 294). In principle, that aligns with part of the definition for state authenticity. Kernis and Goldman's theory has four components. *Awareness* requires conscious knowledge of one's "motives, feelings, desires, and self-relevant cognitions … strengths and weaknesses, personality, and roles in behavior" (p. 302). *Unbiased processing* means not having a distorted view of oneself and not denying internal experiences. The *behaviour* component involves actions aligned with one's values, needs, and desires, while avoiding acting in ways only to please others (i.e., to receive external rewards or avoid external punishments). The final component is *relational orientation*, which means "being genuine and not fake in one's relationships with others" (p. 302). When this theory is considered in relation to adolescence, teens may have some conscious awareness in a friendship context, however, they are developmentally engaged in identity-related exploration and experimenting to determine which societal values to internalise as their own. They are sensitive to self-esteem challenges while seeking to satisfy their need to belong through friendships (Allen et al., 2022), so may have biased views of their weaknesses. Also, young adolescents are typically not aware of the possibility of a false self (Harter et al., 1997). Therefore, our study demonstrates preliminary state-based support for some parts of Kernis and Goldman's (2006) theory, as most adolescents were being completely or mostly who they really are when socialising with their friend (i.e., genuine in their relational orientation), and minimal state inauthenticity was reported overall. Our study also demonstrates that intrinsic and identified self-regulatory motivation processes—required to become a fully functioning person—explained variability in teens' state authenticity/inauthenticity.

**Strengths and limitations**

A strength of the study was that adolescents were randomly recruited from around Australia using multiple methods and there was a good age spread of teenagers in the sample, ensuring it was representative of the target adolescent population. Another strength was that the online consent process supported adolescents' autonomy, which gave adolescents the freedom to participate at any time and place they wished, affording privacy, convenience, and minimising potential biases from adults. The study identified which items on the SRQ-F are most relevant for adolescents, although further research is required to validate the Controlled Motivation in Friendship factor, and new co-design efforts involving adolescents may help refine the wording of some items which did not load well on to the two factors.

A limitation of this study due to its exploratory nature is that as the multiple regression was based on predictor and outcome variables identified via EFAs with the same overall participant sample, it means that generalisation to the wider adolescent population is not practical until item relevancies and factor structures are confirmed in other studies involving teen samples. An unrestricted factor analysis (semi-confirmatory) based on polychoric correlations, or a similar approach to that suggested by Ünlü (2016) may be beneficial for that purpose. A larger sample size will be required in future studies to identify whether controlled motivation in friendship has a small effect on state authenticity/inauthenticity when autonomous motivation is in the regression model, or no effect.

Finally, only some adolescents experienced state inauthenticity using the three adapted items. Qualitative interviews with adolescents suggest there may be additional ideas which represent subtleties of state inauthenticity while socialising with a friend, such as hiding or holding back feelings (Alchin et al., 2024b) which has been previously found as a general indicator of dispositional authenticity in adolescents (Weir & Jose, 2010).

**Future directions**

Future research is suggested to check some of the SRQ-F items using a co-design or qualitative consultation process with adolescents, so the phrasing reflects ways contemporary adolescents think and talk, and so researchers can confirm through discussion that the items appear to be reflecting underlying constructs which are developmentally relevant for the adolescent population. Regarding controlled motivation in friendship, which did not predict state authenticity and inauthenticity when autonomous motivation was in the model, adolescents tend to socialise with friends frequently, and the current study asked adolescents about an interaction in the past 24 hours. It is therefore likely that most participants had been socialising with a close friend, rather than someone who is part of their wider group of friends, or friends they do not get along with so well. Further research into controlled motivation in friendship may find greater effects on state authenticity and inauthenticity in these types of situations. Research into the effect of autonomous motivation in friendship in these types of friendships is necessary to separate out the effect of controlled motivation in friendship. A causal study similar to that conducted by Thomaes et al. (2017) based on a very recent memory of an interaction may be an effective methodology for analysing intrinsic motivation and identified regulation in the form of autonomous motivation in those other friendship categories.

Regarding state authenticity and inauthenticity, the degree of authenticity experienced may not only depend on the type of friendship, but also depend on the type of activity being undertaken by the adolescent and their friend at the time, such as catching up,

gaming, doing schoolwork, or engaging in deep and meaningful conversations. The number of questions across the questionnaire was already large in the current study, so we were unable to ask about their activities.

An important area of research which remains unexplored is the impact of technological affordances on state authenticity/inauthenticity in the context of socialising online with a friend. In the current study, there were no significant differences in mean state authenticity and inauthenticity depending on the mechanism used (i.e., texting, video, microphone; these additional analyses are available on request). Therefore, it is more likely that affordances such as cue absence or cue presence may mediate between autonomous and controlled motivations in friendship, activity, and experienced state authenticity and inauthenticity. For example, the degree of perceived social presence—which adolescents have indicated in interviews would be similar when using video to what it is like to be in-person with their friend, and is difficult to gauge if only using text mechanisms (Alchin et al., 2024b)—might affect one's own state authenticity and inauthenticity if that affordance occurs in a context where autonomous motivation is involved, compared to when controlled motivation is involved. Angelini et al. (2022) have conducted research on the relationship between affordances and perceived online support, expression of e-motions, and their connections to validation, companionship, and conflict resolution in friendship. Adding state authenticity and inauthenticity into Angelini et al.'s framework of experiences means that state authenticity and inauthenticity can be utilised as a rapid indicator of whether the interaction may potentially benefit one's wellbeing.

## Conclusion

Autonomous motivation predicted nearly one fifth of the variability in adolescents' state authenticity and inauthenticity when socialising online with a friend in this study. This large effect indicates teens who are more motivated in a friendship because they intrinsically expect it will be enjoyable, value being with their friend, and anticipate they will experience freedom, also experience higher state authenticity and lower inauthenticity when they socialise with their friend. Even though adolescents were also motivated in their friendship by the fear of not living up to social norms, controlled motivation had no significant effect on state authenticity and inauthenticity in this study. Further research with a larger teen sample is required to identify whether controlled motivation might have a very small influence on state authenticity and inauthenticity in teenagers. In summary, adolescents feel free to be, and are, their real selves when a social situation is conducive to psychological flourishing, and a satisfying friendship is a motivating context.

## Ethical approval

Ethics approval was received from University of Southern Queensland, Australia.

## Availability of data and materials

Anonymised data is available in a repository on Open Science Framework (Alchin et al., 2024c).

## CRediT authorship contribution statement

**Carolyn Elizabeth Alchin:** Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tanya M. Machin:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Neil Martin:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Lorelle J. Burton:** Writing – review & editing, Supervision.

## Funding

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Carolyn Elizabeth Alchin reports financial support was provided by the Australian Government Research Training Scholarship. Tanya M. Machin and Neil Martin declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Lorelle J. Burton reports a relationship with University of Southern Queensland Australia that includes employment, and there are no other activities or potential conflicts of interest to declare relevant to this research.

## Acknowledgements

## Appendix A. Questions and full results for recency of interaction, apps, and mechanisms

*Method: questions used about recency of interaction, apps, and mechanisms*

**Recency of Interaction.** "How long ago did you last socialise with your friend online? (A guess is fine)." Response options: "Less than 10 minutes", "More than 10 but less than 30 minutes", "About an hour ago", "About 2–3 hours ago", "About 4–6 hours ago", "About 7–12 hours ago", "About 13–24 hours ago", "More than 24 hours ago".

**App, Platform, or Website.** To focus the adolescent's attention on the specifics of the single episode of interaction, the following question was included. "What app, platform, or website did you mainly use when socialising online with your friend on that occasion? Examples: Snapchat, Insta, Fortnite, Discord, Xbox Party Chat, PlayStation Party Chat, VR Chat, WhatsApp, Messenger, Messages."

**Mechanisms.** A custom list was created to identify which technologies were used. "Please select all that apply from the list below. When I was socialising online with my friend…

I had my video camera on so my friend could see my face.

I used a microphone to chat with my friend.

I used text to chat with my friend.

I sent my friend at least one video, picture, emoji, meme, or sound effect while socialising with them.

My friend had their video camera on so I could see their face.

My friend used a microphone to chat with me.

My friend used text to chat with me.

My friend sent me at least one video, picture, emoji, meme, or sound effect while socialising with them.

We socialised using VR (virtual reality).

Other: [Free response text field]."

*Results: interaction recency, apps, and technology mechanisms*

The main article contains key data for interaction recency, apps, and mechanisms. This Appendix A contains the full information. As mentioned in the article, over 73% of 130 participants had socialised online with their friend within the past six hours (less than 10 mins ago = 12%; more than 10 mins to less than 30 mins = 17%; about 1 hr = 10%; 2–3 hrs = 17%; 4–6 hrs = 18%; 7–12 hrs = 11%; 13–24 hrs = 16%). Apps used included Messages (42% of participants), SnapChat (39%), WhatsApp (32%), Instagram (20%) and Discord (18%). While 60% of participants only used one app, the rest used two or more simultaneously (two apps = 19% of participants; three apps = 8%; four apps = 10%; five apps = 3%).

For technology mechanisms, the most common way participants had interacted with their friend was to use text (86% of participants; microphone = 35%; video = 18%), but only 58% used text exclusively, as 16% also used a microphone, and another 12% used video with microphone and text. One person socialised with their friend using virtual reality. Most participants (67%) reported their friend used the same mechanisms as themselves (e.g., both used a microphone and text). Seven percent of participants said they were in the same physical room as their friend while socialising online with them. At least one video, picture, emoji, meme, or sound effect was sent by participants (68%) or received from their friend (65%) during the interaction.

## Appendix B. Method: preliminary procedures conducted prior to exploratory factor analyses

This Appendix B outlines preliminary procedures taken to reduce skewness and kurtosis in the dataset prior to conducting exploratory factor analyses (EFAs). As mentioned in the main article, when reviewing descriptive statistics for the whole sample, it became apparent there were several items where skewness or kurtosis were extreme. These tendencies were evident in item-level histograms, so the data was checked for outliers. Item-level boxplots showed potential univariate outliers tended to represent tail ends of distributions, rather than being clear exceptions. Where the same potential outlier case was identified in several boxplots, participant-level data was reviewed to identify whether their pattern of responding generally displayed conceptual consistency for items within and across subscales, which was the case. Bivariate scatterplot matrices for each of the motivation subscales, and a matrix for items in the authenticity and inauthenticity scales, showed conceptually related items had linear relationships with scattered outliers and no secondary clusters.

As item-level skewness and kurtosis seemed to represent a range of genuine responses and there were no clear explanatory reasons associated with participation or recruitment regarding why the data should potentially be considered systematically biased or un-representative, Friendship Self-Regulation Questionnaire (SRQ-F; Ryan & Connell, 1989; Center for Self-Determination Theory, 2024) item-level data for the adolescent sample was compared to published data from Tanhaye Reshvanloo et al. (2021) in a young adult sample to see if item-level response patterns were somewhat similar. It became apparent adolescents had responded quite differently to the young adults for some items, with more extreme responding and narrower variability. For one item the mean for adolescents was at the opposite end of the response scale compared to the adult sample (SRQ-F External Regulation item 09–T1). As the SRQ-F was originally developed for adults (Center for Self-Determination Theory, 2024), and for adolescents some SRQ-F items within the introjected regulation and external regulation subscales had opposing patterns of skewness in the histograms to a degree which suggested some items may not represent those concepts well for adolescents, three authors of the current study had conceptual discussions about how adolescents may have interpreted the phrasing of some items. It was decided the tendencies in adolescents' responses had logical developmental semantic explanations, which are discussed in the Discussion section.

The data therefore appeared to represent adolescents' perspectives, but the level of skewness and kurtosis for some items was too great to reliably proceed with EFAs, and the presence of scattered bivariate outliers appearing likely to reduce the strength of some relationships and increasing the strength in others was also potentially problematic. As expected, attempts to proceed with EFA of the 25 motivation items on that basis (not detailed here) were unsuccessful, whether or not the 5 new amotivation items were included, and whether based on Pearson correlations (where bivariate outliers are particularly problematic) or polychoric correlations. Methods utilising oblique rotation approaches which presume factors are correlated (like maximum likelihood with promax rotation and Kaiser normalisation) were halted by Heywood cases, and orthogonal rotation approaches which presume factors are uncorrelated (like principal axis factoring or unweighted least squares with varimax rotation and Kaiser normalisation) did not resolve into solutions with conceptually comprehensible simple structures. A recurring feature was that scree plots identified two dominant factors, and two-factor structures tended to be more conceptually comprehensible overall than four or five factors, irrespective of method and rotation.

Therefore, a two-step preliminary subscale optimisation and multivariate outlier identification-exclusion procedure was conducted before proceeding further. The first purpose of this procedure was to identify which items within each conceptual subscale contributed the best to its internal consistency and so were more likely to be representative of that concept for adolescents. The preliminary optimisation step was conducted at subscale level for each of the five motivation subscales, for authenticity, and for inauthenticity. Preliminary optimisation occurred by investigating Cronbach's alpha for each subscale and progressively eliminating items where alpha would be improved if that item were deleted. The outcomes of that process are shown in Appendix C. The second purpose was to identify multivariate outlier cases across the reduced pool of items, and exclude those cases from further analyses (i.e., excluded from EFAs and multiple regression). Mahalanobis' distance was calculated across the reduced pool of items (i.e., across authenticity, inauthenticity, and the reduced pool of motivation items) and outlier cases ($n = 14$ participants) where the $p$-value for the distance was less than or equal to 0.05 were excluded before proceeding with the EFAs. These preliminary processes eliminated four original SRQ-F items, three new amotivation items, followed by 14 outlier participant cases.

## Appendix C.  Technical statistical results

*State authenticity and state inauthenticity*

*Descriptive statistics for state authenticity and state inauthenticity at item level*

Table C1 shows item-level descriptive statistics for state authenticity and state inauthenticity for the whole sample ($N = 130$), and for the reduced sample used for exploratory factor analysis (EFA; $n^1 = 115$) after outlier cases ($n = 14$) were omitted based on Mahalanobis' distance across authenticity, inauthenticity, and 18 motivation items. This improved skewness and excessive kurtosis in state inauthenticity items without altering the scale's internal consistency, which is beneficial for EFA, but also reduced the percentage of participants who experienced state inauthenticity by 5%.

**Table C1**
Descriptive Statistics for State Authenticity and Inauthenticity for the Whole Sample and for the Reduced Sample used for EFA.

| | Whole sample | | | | | | Reduced sample used for EFA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M* | *SEM* | *SD* | Skew | Kurtosis | Cronbach's α | *M* | *SEM* | *SD* | Skew | Kurtosis | Cronbach's α |
| State authenticity | | | | | | .90 | | | | | | .87 |
| I was my true self | 4.40 | .075 | .850 | −1.566 | 2.353 | | 4.52 | .063 | .680 | −1.443 | 2.089 | |
| I acted as I really am | 4.45 | .061 | .695 | −1.172 | 1.157 | | 4.53 | .056 | .597 | −.874 | −.207 | |
| I was "real" and authentic | 4.41 | .073 | .832 | −1.380 | 1.245 | | 4.51 | .068 | .730 | −1.561 | 2.219 | |
| State inauthenticity | | | | | | .79 | | | | | | .79 |
| I was a false self | 1.43 | .074 | .844 | 2.579 | 7.207 | | 1.26 | .046 | .497 | 1.737 | 2.220 | |
| I didn't act as I really am | 1.42 | .063 | .713 | 1.933 | 3.732 | | 1.31 | .050 | .536 | 1.493 | 1.342 | |
| I was inauthentic and not "real" | 1.26 | .056 | .642 | 3.100 | 11.437 | | 1.17 | .041 | .444 | 2.607 | 6.388 | |
| | *N =* | | | | | | *n¹ =* | | | | | |
| | 130 | | | | | | 115 | | | | | |

*Note.* Potential responses for all state authenticity and inauthenticity items range from 1 = *not at all true* to 5 = *very true.*

Based on Mardia (1970) multivariate skewness was not significant ($n^1 = 115$, skewness coefficient = 24.03, statistic = 460.58, $df = 56$, $p = 1.00$) but kurtosis was (coefficient = 82.81, statistic = 19.05, $p < .001$), which confirmed the necessity of using polychoric correlations for the EFA.

*Polychoric correlation data for state authenticity and state inauthenticity items*

Polychoric correlations between all state authenticity and state inauthenticity (reversed) items were moderate to strong and are displayed in Table C2 on the lower diagonal half.

**Table C2**
Correlations between State Authenticity and Inauthenticity (reversed) Items.

| Item | I was my true self | I acted as I really am | I was "real" and authentic | I was a false self (reversed) | I didn't act as I really am (reversed) | I was inauthentic and not "real" (reversed) |
|---|---|---|---|---|---|---|
| I was my true self | — | .652* | .676* | .588* | .621* | .390* |
| I acted as I really am | .819 | — | .759* | .500* | .633* | .483* |
| I was "real" and authentic | .817 | .907 | — | .541* | .639* | .575* |
| I was a false self (reversed) | .766 | .690 | .701 | — | .646* | .507* |
| I didn't act as I really am (reversed) | .785 | .815 | .788 | .829 | — | .506* |
| I was inauthentic and not "real" (reversed) | .612 | .721 | .768 | .720 | .721 | — |

*Note.* $n^1 = 115$; polychoric correlations are on the lower half of the diagonal, and Pearson correlations on the upper half. *All Pearson correlations were significant at $p < .001$, two-tailed. Significance is not reported in FACTOR for polychoric correlations (standardised matrix).

The polychoric correlation matrix was adequate to proceed with EFA (determinant = 0.0013; Bartlett's statistic = 738.6, $df = 15$, $p < .001$; Kaiser-Meyer-Olkin test = 0.861 [CI 0.355, 0.861], good). Optimal implementation of parallel analysis suggested one factor based on the six items, with real-data percent of variance at 84.39%. (Eigenvalue for the factor was 4.825, which explained 80.42% of variance.)

*Motivations in friendship (SRQ-F and amotivation)*

*Descriptive statistics prior to EFA*

Item-level descriptive statistics prior to EFA for the Friendship Self-Regulation Questionnaire (SRQ-F; Ryan & Connell, 1989; Center for Self-Determination Theory, 2024) original subscales and for the new proposed amotivation scale are shown in Table C3, for the whole sample ($N = 130$) and for the reduced sample after outlier cases were removed ($n^1 = 115$). Preliminary optimisation of scale items at subscale level based on data from the whole sample (see Method), resulted in seven items being omitted prior to EFA. Those items are marked with superscript 'c' in Table C3.

**Table C3**
Descriptive Statistics and Internal Consistencies Prior to EFA, for SRQ-F, and New Amotivation Items.

| Items | Whole sample | | | | | | | Reduced sample used for EFA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M* | *SEM* | *SD* | Skew | Kurtosis | Cronbach's α [a] | Cronbach's α [b] after prelim. optimisation | *M* | *SEM* | *SD* | Skew | Kurtosis | Cronbach's α prior to EFA |
| SRQ-F INT | | | | | | 5 items .749 | 3 items .846 | | | | | | 3 items .741 |
| 02–C2 | 6.40 | .097 | 1.104 | −2.393 | 6.412 | | | 6.52 | .080 | .862 | −1.992 | 3.609 | |
| 06–C6 | 6.15 | .117 | 1.338 | −1.963 | 3.813 | | | 6.33 | .099 | 1.066 | −1.848 | 3.652 | |
| 10–T2 | 6.48 | .098 | 1.115 | −3.298 | 12.569 | | | 6.67 | .059 | .631 | −1.944 | 3.345 | |
| 13–L1 [c] | 5.68 | .132 | 1.506 | −1.163 | .813 | | | — | — | — | — | — | |
| 19–P3 [c] | 5.75 | .105 | 1.201 | −.902 | .168 | | | — | — | — | — | — | |
| SRQ-F IDE | | | | | | 5 items .803 | 3 items .830 | | | | | | 3 items .804 |
| 04–C4 | 5.98 | .115 | 1.315 | −1.433 | 2.096 | | | 6.11 | .102 | 1.090 | −1.013 | .145 | |
| 08–C8 [c] | 5.62 | .132 | 1.506 | −1.296 | 1.412 | | | — | — | — | — | — | |
| 12–T4 | 6.39 | .110 | 1.254 | −2.719 | 7.825 | | | 6.61 | .075 | .802 | −2.280 | 5.092 | |
| 16–L4 | 6.22 | .124 | 1.416 | −2.119 | 3.854 | | | 6.50 | .090 | .968 | −2.407 | 6.182 | |
| 17–P1 [c] | 6.42 | .092 | 1.048 | −2.398 | 7.116 | | | — | — | — | — | — | |
| SRQ-F INJ | | | | | | 5 items .668 | 5 items (no change) | | | | | | 5 items .695 |
| 01–C1 [d] | 4.37 | .176 | 2.004 | −.345 | −1.124 | | | 4.43 | .189 | 2.027 | −.406 | −1.088 | |
| 05–C5 | 3.48 | .195 | 2.225 | .316 | −1.383 | | | 3.37 | .201 | 2.154 | .382 | −1.282 | |
| 11–T3 [d] | 4.88 | .158 | 1.800 | −.671 | −.497 | | | 4.90 | .166 | 1.784 | −.699 | −.430 | |
| 14–L2 | 3.44 | .181 | 2.061 | .397 | −1.191 | | | 3.32 | .186 | 1.994 | .484 | −1.015 | |
| 18–P2 | 4.83 | .182 | 2.073 | −.544 | −1.087 | | | 4.91 | .187 | 2.007 | −.575 | −1.011 | |
| SRQ-F EXT | | | | | | 5 items .648 | 5 items (no change) | | | | | | 5 items .654 |
| 03–C3 | 3.48 | .198 | 2.252 | .368 | −1.366 | | | 3.37 | .205 | 2.194 | .434 | −1.259 | |
| 07–C7 [d] | 4.98 | .175 | 1.994 | −.849 | −.396 | | | 4.98 | .186 | 1.991 | −.871 | −.362 | |

*(continued on next page)*

**Table C3** (*continued*)

| Items | Whole sample | | | | | | | Reduced sample used for EFA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | SEM | SD | Skew | Kurtosis | Cronbach's α [a] | Cronbach's α [b] after prelim. optimisation | M | SEM | SD | Skew | Kurtosis | Cronbach's α prior to EFA |
| 09–T1 | 1.68 | .113 | 1.289 | 2.433 | 5.923 | | | 1.56 | .097 | 1.036 | 2.326 | 5.827 | |
| 15–L3 | 3.32 | .191 | 2.182 | .441 | −1.261 | | | 3.30 | .202 | 2.168 | .446 | −1.249 | |
| 20–P4 [d] | 4.88 | .175 | 2.000 | −.637 | −.820 | | | 4.81 | .190 | 2.039 | −.596 | −.902 | |
| Amotivation New Items | | | | | | 5 items .402 | 2 items .619 | | | | | | 2 items .487 |
| 04.5–C4.5 [c] | 1.58 | .109 | 1.244 | 2.690 | 7.263 | | | — | — | — | — | — | |
| 08.5–C9 [d] | 1.19 | .073 | .827 | 5.894 | 37.790 | | | 1.07 | .027 | .288 | 4.490 | 21.694 | |
| 10.5–T2.5 [c] | 3.32 | .159 | 1.810 | .303 | −.894 | | | — | — | — | — | — | |
| 15.5–L3.5 [c] | 1.24 | .049 | .554 | 2.541 | 6.637 | | | — | — | — | — | — | |
| 18.5–P2.5 [d] | 1.28 | .072 | .817 | 4.305 | 22.598 | | | 1.17 | .044 | .476 | 3.442 | 13.655 | |
| | $N = 130$ | | | | | | | $n^1 = 115$ | | | | | |

*Note.* SRQ-F = Self-Regulation Questionnaire–Friendship (Ryan & Connell, 1989). INT = Intrinsic, IDE = Identified, INJ = Introjected, EXT = External. Potential responses for all items range from 1 = *not at all true* to 7 = *very true*, and higher scores represent greater motivation (or amotivation for the new items). [a] Cronbach's alphas shown for original scales (5 items per scale) and for new amotivation scale. [b] Cronbach's alphas after preliminary scale optimisations (see Method) with reduced number of items for intrinsic motivation, identified regulation, and amotivation scales. [c] Items omitted after preliminary scale optimisations (before EFA). [d] Items eliminated as an outcome of EFA.

### Motivation EFA Technical details and statistical data

Optimal implementation of parallel analysis suggested two factors based on the 18 motivation items which remained after optimisation (this Appendix C Table C3 lists all motivation items, with items eliminated via optimisation marked with superscript 'c'). In the first EFA iteration, FACTOR software identified two items (Amotivation 08.5–C9 and Intrinsic 02–C2) which appeared to be causing the polychoric correlation matrix to be not positive definite. Removing the amotivation item did not resolve the issue and left only one amotivation item to represent that concept, so it was also removed. This resolved the matrix issue and permitted retention of the intrinsic regulation item. The polychoric matrix for the 16 remaining items showed all items had correlations greater than .300 with at least four other items and was adequate to continue with the EFA (determinant = 0.00002; Bartlett's statistic = 1156.8, $df = 120$, $p < .001$; Kaiser-Meyer-Olkin test = 0.73886 [CI 0.278, 0.785], fair).

Items were sequentially removed based on the lowest communality. The final step removed External item 07–C7 because its cross-loading distance on the two factors was less than .300 absolute difference. Items removed are shown in the descriptive statistics Table C3 in this Appendix C, marked with superscript 'd'.

Simple structure was achieved with two factors having six items each. The polychoric matrix for this solution was adequate (determinant = 0.00018; Bartlett's statistic = 938.5, $df = 66$, $p < .001$; Kaiser-Meyer-Olkin test = 0.74953 [CI 0.454, 0.810], fair). Indices of factor simplicity were excellent (Bentler's simplicity index = 0.999 [CI 0.999, 1.000], percentile 99, Bentler, 1977; Loading simplicity index = 0.712 [CI 0.632, 0.855] percentile 100, Lorenzo-Seva, 2003). The root mean square of residuals was acceptable (0.055 [CI 0.030, 0.072]; Harman, 1962). Multivariate skewness was not significant (skewness coefficient = 46.88, statistic = 898.58, $df = 364$, $p = 1.000$) but kurtosis was (coefficient = 195.21, statistic = 7.96, $p < .001$), confirming the necessity of using polychoric correlations for this EFA. Prior to rotation, optimal implementation of parallel analysis indicated real percent of variance explained by a first dimension (potential factor) as 40.11%, and a second as 28.85%; with Eigenvalue data being similar (first variable = 4.634, 38.62% variance explained; second variable = 3.337, 27.81% explained; cumulative = 66.43%).

Rogers (2022) noted that large participant samples are not essential to appropriately ascertain factor structures via EFAs, with situations where cross-loadings between factors are lower than .30 and item-factor loadings are high (greater than .50) requiring smaller samples. As shown in the Results section (see Table 1 in the main article), the current study's results fit these characteristics.

### Polychoric correlation data for two-factor motivation scale

The correlation matrix for the 12 items retained in the final EFA solution is shown in Table C4 in this Appendix C, with polychoric correlations shown on the lower diagonal.

**Table C4**
Correlations between 12 SRQ-F Motivation Items in the EFA Two-Factor Solution (Polychoric on Lower Diagonal).

| Item | 02–C2 (INT) | 06–C6 (INT) | 10–T2 (INT) | 04–C4 (IDE) | 12–T4 (IDE) | 16–L4 (IDE) | 05–C5 (INJ) | 14–L2 (INJ) | 18–P2 (INJ) | 03–C3 (EXT) | 09–T1 (EXT) | 15–L3 (EXT) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02–C2 (INT) | — | .403* | .610* | .534* | .539* | .439* | .092 | .034 | .026 | .063 | −.004 | .161 |
| 06–C6 (INT) | .556 | — | .607* | .579* | .666* | .637* | −.058 | −.125 | .137 | −.023 | −.081 | .094 |
| 10–T2 (INT) | .736 | .761 | — | .564* | .643* | .663* | −.024 | −.068 | .033 | −.005 | −.092 | .091 |
| 04–C4 (IDE) | .649 | .694 | .696 | — | .552* | .561* | −.022 | −.114 | .069 | −.014 | −.048 | −.029 |
| 12–T4 (IDE) | .673 | .787 | .784 | .664 | — | .674* | −.006 | −.113 | .104 | −.071 | −.158 | .062 |
| 16–L4 (IDE) | .558 | .768 | .798 | .706 | .770 | — | .022 | −.080 | .163 | .047 | −.099 | .171 |
| 05–C5 (INJ) | .102 | −.094 | −.069 | −.053 | −.049 | −.010 | — | .446* | .314* | .703* | .323* | .324* |
| 14–L2 (INJ) | .088 | −.168 | −.065 | −.142 | −.135 | −.091 | .523 | — | .439* | .516* | .303* | .335* |
| 18–P2 (INJ) | .043 | .153 | .104 | .108 | .190 | .213 | .342 | .500 | — | .372* | .112 | .437* |
| 03–C3 (EXT) | .120 | −.042 | .029 | −.058 | −.079 | .040 | .769 | .600 | .434 | — | .394* | .367* |
| 09–T1 (EXT) | .051 | −.091 | −.127 | −.141 | −.216 | −.131 | .458 | .406 | .189 | .531 | — | .270* |
| 15–L3 (EXT) | .240 | .146 | .149 | −.027 | .098 | .206 | .364 | .379 | .520 | .424 | .370 | — |

*Note.* $n^1 = 115$. SRQ-F = Self-Regulation Questionnaire–Friendship (Ryan & Connell, 1989). INT = Intrinsic, IDE = Identified, INJ = Introjected, EXT = External. Polychoric correlations are shown on the lower half of the diagonal, and Pearson correlations on the upper half. * Pearson correlation significant at $p < .001$, two-tailed. Significance is not reported in FACTOR for polychoric correlations (standardised matrix).

## Appendix D. Discussion of SRQ-F and amotivation items eliminated during exploratory factor analysis, from a developmental perspective

Four of eight Friendship Self-Regulation Questionnaire (SRQ-F; Ryan & Connell, 1989; Center for Self-Determination Theory, 2024) items from the intrinsic motivation and identified regulation subscales which were eliminated during the exploratory factor analysis (EFA), appear to require a degree of psychosocial maturity in the context of general friendships which is likely to be more prominent in early adulthood than in adolescence. When viewed as a set, SRQ-F items 08–C8, 13–L1, 17–P1, and 19–P3 infer underlying other-oriented values which are more likely to have relevance in the context of a longer-term, more mature adolescent romantic relationship, than in a general friendship. The underlying ideas involve appreciating being committed to another person, living up to commitments one makes to the other person and finding it very pleasurable to do so, and a deeply internalised genuine interest in that person's experiences. It is also possible these items may have relevance for older adolescents nearing young adulthood in the context of a long-standing general friendship; but these kinds of values and the level of internalisation required to truly be committed toward another person take time to develop, so these items are less likely to be understood or have salience during early and middle adolescence. Item 17–P1 contains a phrase younger adolescents may not understand and can be simplified. The question asked in the SRQ-F measure about commitments in conjunction with item 19–P3 may be interpreted as being quite major by younger adolescents compared to how adults might interpret it. This is because the type of commitments younger adolescents are likely to think about might include ideas like agreeing not to get their friend into trouble.

Three SRQ-F items from the original introjected regulation and external regulation subscales that were eliminated during the EFA process (items 01–C1, 07–C7, and 11–T3) may have greater relevance in the context of a friendship which carries with it a group identity, and either social position or social responsibility within that group; so may be present to a greater degree in broader contexts like a school-based friendship where peer pressure and peer group identities may be more prevalent. The items appeared to have underlying meanings which could be understood in terms of social status/self-esteem and conforming to social norms that may have relevance in groups where a person is popular so feels they have social obligations to others who are less popular in the group to keep their popular status, or, where a person has less social status in the group so is friends with someone in the group that makes them feel as though they have a higher social status. In the current study, adolescents were free to choose which individual friend and which online interaction with that single friend in the past 24 hours they wanted to focus on, so many adolescents are likely to have chosen a closer friend, rather than someone who was part of their broader friend group. Finally, item 20–P4 would benefit from being re-written in everyday plain language contemporary adolescents understand, as the underlying principle of trust between friends is relevant during most of adolescence.

## Data availability

Anonymised data is available in a repository on Open Science Framework: https://doi.org/10.17605/OSF.IO/9PE56.

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