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Age Differences in Emotion Regulation Strategy Use, Variability, and Flexibility: An Experience Sampling Approach

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Abstract

Lifespan developmental theories suggest that as individuals age, they accumulate knowledge about how to deploy emotion regulation (ER) strategies effectively and learn how to match their ER strategy use with changes in situational demands. Using an event-contingent experience sampling design wherein 150 adults age 18 to 89 years reported on 64,213 social interactions (M =427.41, SD =145.66) during 9 weeks of daily life, this study examines (1) age-related differences in individuals' *usual ER strategy use* (reappraisal, suppression) during everyday social interactions, (2) age-related differences in how much individuals' use of these two strategies varies across social situations – *ER variability*, and (3) age-related differences in the extent to which ER strategy use covaries with relational (close vs. non-close others) and emotional (happy, sad) contextual features of those social situations – *ER flexibility*. In line with a small body of prior work, usual ER strategy use did not differ across adulthood and ER variability was lower at older ages. Results from multilevel models of intraindividual covariation suggested that individuals flexibly matched their ER strategy implementation to changes in emotional context – especially when interacting with close others. The results also provided evidence that the intraindividual covariation between relational context and use of suppression was weaker at older ages. Beyond these specific findings, this study demonstrated the utility of experience sampling designs, event-contingent reports, and the measurement/ modeling of intraindividual variation and covariation for study of emotional development across the life span.

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Keywords

event-contingent sampling; ecological momentary assessment; expressive suppression; cognitive reappraisal; lifespan development; intraindividual variability; social interactions

Emotion regulation (ER) is the process of maintaining, increasing or decreasing emotion experience and/or expression in response to situational demands (Cole, Martin, & Dennis, 2004; Gross, 1998; Thompson, 1994). In a given situation, an individual's ER is facilitated through deployment of any number of ER strategies that are meant to down-regulate, up-regulate and/or maintain their emotional experience or expression. Given that different situations are likely to pull for different strategies, and that different strategies are more or less effective in different situations, individuals who are "good" at regulating emotion would, in principle, need to dynamically vary their ER strategy use across situations – *ER variability*, and match their strategy use to situational demands – *ER flexibility* (Aldao, Sheppes, & Gross, 2015). Although several lifespan developmental theories of aging suggest individuals get better at regulating their emotions as they age (Baltes & Baltes, 1990; Carstensen et al., 2011; Charles, 2010), only one study to date (Eldesouky & English, 2018), has examined if and how ER (strategy) variability and ER flexibility change across the life span. This paper provides a more detailed look at age-related differences in ER variability and ER flexibility in the daily lives of adults age 18 to 89 years by using intensive experience sampling data and analysis of intraindividual (co-)variation.

ER Variability and ER Flexibility: Intraindividual Variation and Covariation

The study of *intraindividual variability* (*IIV*) focuses on the fluctuations, oscillations, and adaptations in behavior that manifest across micro-timescales such as minutes, hours or days (Nesselroade, 2001). In brief, many repeated measures are obtained from the same individuals over time. These intensive longitudinal data can then be used to quantify individuals' inherent capacities for change (or stability) – their *dynamic characteristics* (Ram & Gerstorf, 2009). Modern mobile technologies facilitate collection of such data and open new opportunities to examine the development of individuals' dynamic characteristics (Mehl & Conner, 2012; Ram & Diehl, 2015). For example, repeated measures of a single individual's use of an ER strategy (e.g., reappraisal) obtained on over 100 occasions can be used to quantify their prototypical or *usual ER strategy use* (typically operationalized as the intraindividual mean, *iMean*). Prototypical strategy deployment/implementation is one of many ER dynamic characteristics.

Pushing further into dynamics of change, there are several conceptualizations and quantifications of ER flexibility in the literature (see e.g., Bonanno & Burton, 2013; Hollenstein, Lichtwarck-Aschoff, & Potworowski, 2013; Kashdan & Rottenberg, 2010). Pertinent to this study, Aldao and colleagues (2015) defined *ER variability* as the variation in the use of (one or more) ER strategies across situations. In other words, ER variability is the extent to which an individual's ER strategy deployment varies in level across situations (within-strategy variability usually operationalized as the intraindividual standard deviation, *iSD*, spanning all measurement occasions), or the extent to which an individual deploys multiple strategies within a given situation (between-strategy variability, usually

operationalized as a *SD* of ER strategy intensities for each occasion) .Generally, individuals who behave in the same way (i.e., deploy an ER strategy to a similar extent) across situations would be considered inflexible (i.e., rigid), while individuals who behave differently across situations might be considered more flexible (ignoring the appropriateness of the behavior). In complement, Aldao and colleagues (2015) defined *ER flexibility* as the extent to which an individual's ER strategy use is synchronized with changes in the environment. This definition implies examination of how an individual's ER strategy use covaries with situational characteristics. With appropriate multivariate data, the extent of *intraindividual covariation* between repeated measures of ER strategy use and situational characteristics – such as whether the person is interacting with a close vs. non-close other – can serve as a measure of an individual's ER flexibility. Individuals whose ER strategy use is systematically related to (i.e., dependent on) situational characteristics would be considered more flexible, while individuals whose ER strategy deployment is unrelated to situational characteristics would be considered less flexible. In sum, study of intraindividual variation and intraindividual covariation provides for examination and quantification of the two dynamic characteristics of interest here – ER (strategy) variability and ER (strategy) flexibility.

Theoretical discussions and a small bit of empirical evidence suggest that greater ER variability and flexibility are related to more effective ER and better mental health (Aldao et al., 2015; Bonanno & Burton, 2013). In a pioneering study, Aldao and Nolen-Hoeksema (2012) obtained repeated measures of ER strategy use by asking participants (*Mage* = 36.10, *SD* = 13.29) to recall the ER strategies they used in the past 2 weeks during 24 situations that varied in circumstance, and the type and intensity of emotions elicited. Greater ER variability in 2 (of 7) strategies (acceptance, problem solving) was associated with lower levels of psychopathology symptoms. This result was interpreted as supporting flexibility models of ER where healthier and resilient individuals flexibly implement particular ER strategies across different situations, as opposed to implementing ER strategies to a similar extent across all situations (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004). In complement, Sheppes and colleagues' (e.g., Sheppes et al., 2014) many laboratory-based examinations of individuals' ability to flexibly – across time and context – choose between ER strategies (distraction, reappraisal) to regulate their emotional responses to negative picture stimuli highlight specific factors that contribute to variability in ER strategy selection, including the emotional intensity of the stimuli, the cognitive demands of the strategy, and the motivational incentives of the situation. Most recently, Blanke and colleagues (2019) quantified within- and between-strategy variability utilizing data from 4 experience sampling studies and found that on occasions where individuals showed more variation across different ER strategies, they also tended to experience lower negative affect compared to occasions where they showed less between-strategy variability. In sum, conceptual models and empirical work suggest that healthy adaptation requires using ER strategies in a manner that is responsive to variation in situational demands – both ER variability and ER flexibility.

Age differences in ER Variability and ER Flexibility

Several lifespan developmental theories of aging suggest individuals get better at regulating their emotions as they age (Baltes & Baltes, 1990; Carstensen et al., 2011; Charles, 2010). For example, Socioemotional Selectivity Theory (SST) suggests age-related shrinking of individuals' perceptions of their time left to live prompts a shift from greater prioritization of knowledge-related goals (e.g., experiencing novelty, expanding the breadth of one's knowledge) toward prioritization of social relationships, emotion experiences, and ER (Carstensen, Fung, & Charles, 2003; Carstensen et al., 2011). The general idea is that as individuals age, they accumulate knowledge about how to deploy ER strategies effectively, learn which strategies are most effective in which situations, and prioritize positive emotion experiences that build and maintain important social relationships (Blanchard-Fields, 2007; English & Carstensen, 2014; Gross et al., 1997; Shiota & Levenson, 2009). This all implies that older adults use ER strategies in a manner that is responsive to variation in situational demands – greater ER strategy variability and flexibility with age.

To our knowledge, very few studies have examined age differences in daily life ER strategy variability and flexibility. Using 9-occasion daily diary reports obtained from 272 adults age 23 to 85 years, Eldesousky and English (2018) found that – contrary to the SST prediction given above – older age was associated with less day-to-day ER variability for all examined ER strategies (situation selection, situation modification, distraction, positive reappraisal, detached reappraisal, suppression). These authors noted two interpretations of their results. Interpreted from the perspective that frequently adjusting one's regulation tactics is beneficial (e.g., Bonanno et al., 2004; De France & Hollenstein, 2017), lower ER variability is indicative of age-related decrements. Interpreted from the perspective that older adults' environments are more stable than younger adults' environments (e.g., Almeida & Horn, 2004), lower ER variability is indicative of appropriate matching of strategy use to (less variable) situational demands. This latter perspective especially highlights the need for studies that measure or manipulate the context in which ER strategies are deployed and that examine how ER strategy use covaries with salient aspects of those contexts.

Much of the developmental theory about age-related differences in adults' emotion regulation centers on changes in prioritization of social and emotional goals. SST, for example, specifically highlights greater prioritization of social relationships and emotionally meaningful experiences with age (Carstensen et al., 2003). Thus, if there are age-related differences in how ER strategy use covaries with changes in the environment, they might most easily be identified through examination of individuals' social lives, and the *relational* and *emotional* features therein (Butler, 2015; Campos, Walle, Dahl, & Main, 2011; Dixon-Gordon, Aldao, & De Los Reyes, 2015; Heiy & Cheavens, 2014; Tiedens & Leach, 2004).

ER flexibility and relational context.

Close interpersonal relationships (e.g., family members, romantic partners, friends) are often characterized by confiding about important issues, feelings of close emotional connection, giving/receiving diverse types of social support, and stability/persistence over time. In contrast, non-close relationships (more distant friends, acquaintances, co-workers, and strangers) are often characterized by specific role-prescribed types of giving/receiving

support, and instability/variability over time (Antonucci & Akiyama, 1987). The features differentiating these relationships have implications for the type and extent to which individuals engage ER strategies when interacting with others. For example, individuals may be more likely to use ER strategies when with close others than when with non-close others (English, John, & Gross, 2013; Gross & John, 2003). The extent to which an individual differentially attempts to regulate their emotions when interacting with different types of social partners – covariation between relational context and ER strategy use - is an indicator of their ER flexibility. High ER flexibility would be characterized by systematic covariation between ER strategy use and relational context, while low ER flexibility would be characterized by haphazard ER strategy use and lack of covariation.

Greater prioritization of meaningful social relationships with age (SST, Carstensen et al., 2003) suggests that older adults may be especially motivated to experience emotions in the presence of close others and, after years of experience, better able to engage appropriate ER strategies in the presence of non-close others. That is, older age might be associated with greater ER flexibility. Alternatively, age-related decrements in cognitive or biological function may lead to more haphazard use of ER strategies or greater tendency to use ER strategies similarly in all situations. Indeed, age-related shifts towards cognitively less demanding disengagement strategies in ER choice paradigms (Scheibe, Sheppes, & Staudinger, 2015) hint that older age might be associated with less ER flexibility. There is, however, very little evidence on which to form hypotheses about how ER flexibility differs/changes with age. To address this gap in the literature, the present study examines age-related differences in ER flexibility in a specific arena where they are likely to manifest – social contexts.

ER flexibility and emotional context.

In contrast to scant evidence regarding age-related differences in how variations in ER strategy use are associated with variations in relational context, there is already some (mixed) evidence of age differences in the extent to which individuals' ER strategy use is synchronized with changes in emotional context. Using the 2-week recall paradigm described above, Schirda and colleagues (2016) found that compared to younger adults (age 18–30 years), older adults (60–80 years) tended to use less "maladaptive" ER strategies (a composite factor including suppression) in situations marked as high or moderate intensity and by situations evoking anxiety and sadness, and the same amount of "adaptive" ER strategies (including reappraisal). Schiebe and colleagues (2015), used a laboratory-based paradigm where individuals chose between ER strategies (distraction, reappraisal) while regulating their emotional responses to negative picture stimuli. Results indicated that older adults (65–75 years) had greater preference for distraction over reappraisal than younger adults (19–28 years), but there were no differences in how older and younger adults' ER strategy choices were influenced by the emotional intensity of the stimuli.

The strength and direction of association between ER strategy use and emotional context may depend on the data collection paradigm. Two other studies – examining individuals in daily life – found age-related differences in the association between ER strategy use and negative emotion that contrast with each other and with the laboratory studies. In a sample

consisting primarily of undergraduates (M_{Age}=24 years) but that also included participants up to age 63 years, the association between reappraisal (but not mindfulness or suppression) and daily negative affect strengthened with age (Brockman, Ciarrochi, Parker, & Kashdan, 2017). In contrast, in a sample of adults age 19 to 70 years, the association between use of reappraisal (but not distraction or suppression) and daily negative affect during the most salient stressor of the day weakened with age (Troy, Saquib, Thal, & Ciuk, 2018). Interpreted from an ER flexibility perspective, these studies indicate that we still know very little about whether there are age-related decrements or improvements in how ER flexibility covaries with day-to-day or moment-to-moment changes in relational and emotional context.

Studying ER Strategy Use in Context: Experience Sampling Methods

Several data collection and analytic methods are used to measure, manipulate and quantify ER strategy use. Although common, single occasion self-report assessments of habitual ER strategy use and laboratory inductions of ER strategies (Gross & John, 2003; Webb, Miles, & Sheeran, 2012) do not obtain the data necessary for capturing and studying individuals' dynamic characteristics. Study of intraindividual variation of ER strategy use and covariation between ER strategy use and context requires multivariate intensive repeated measures. Although such data have been collected in a few laboratory-based studies of ER variability and flexibility, these paradigms prioritize internal validity over ecological validity and thus may not support inference to individuals' spontaneous use of ER strategies in everyday life (Aldao et al., 2015). Recent advances in mobile technology and individuals' ubiquitous use of smartphones provide new opportunities for researchers to sample and study behavior *in situ* – in the many naturally occurring contexts individuals encounter in their regular daily lives. Experience sampling methods (ESM), including ecological momentary assessment, on-line daily diary paradigms, and ambulatory monitoring, allow individuals to report on their current or recent emotions, behaviors, and experiences in their natural environments (Bolger, Davis, & Rafaeli, 2003; Csikszentmihalyi & Larson, 1987; Mehl & Conner, 2012; Shiffman, Stone, & Hufford, 2008). Data collections utilizing ESM are explicitly designed to reduce error and bias associated with retrospective reporting, enhance ecological validity, and obtain the intensive longitudinal data needed to examine individual differences in intraindividual variability and intraindividual covariation. In sum, ESM provide unique opportunities to intensively examine how and when individuals use ER strategies in context.

Thus far, ESM studies indicate there is as much or more within-person variation in ER strategy use across situations than there are between-person differences in usual ER strategy use (Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Brockman et al., 2017; Catterson, Eldesouky, & John, 2017; Eldesouky & English, 2018; Farmer & Kashdan, 2012; Haines et al., 2016; Nezlek & Kuppens, 2008; Troy et al., 2018). Good news for study of individual differences in ER variability! All that is additionally needed for study of individual differences in ER flexibility is that repeated assessments of relevant contextual features are obtained alongside the assessments ER strategy use (Aldao, 2013; Greenaway, Kalokerinos, & Williams, 2018).

Several methods exist for capturing contextual features relevant to ER strategy use. In particular, this paper forwards the utility of event-contingent sampling wherein individuals provide reports immediately after a specifically defined type of event, for example, a face-to-face social interaction lasting more than five minutes (Moskowitz & Sadikaj, 2012; Roche, Pincus, Rebar, Conroy, & Ram, 2014; Wheeler & Reis, 1991). Conceptually, this sampling approach holds value for study of age differences in ER flexibility beyond more typical interval-contingent (e.g., every 24 hours) or signal-contingent (e.g., randomly timed alerts) sampling approaches because it prioritizes assessment in a salient context where emotions are likely experienced and regulated differently at different ages (Carstensen et al., 2003), and it decreases time between ER strategy use and the reports of ER strategy use and surrounding context - thereby reducing retrospective bias and selectivity (Schwarz, 2012). When invoked with an age-heterogenous study sample, event-contingent experience sampling of individuals' social interactions in daily life provides an ideal venue for studying age differences in ER variability and flexibility.

The Present Study

Several lifespan developmental theories of aging suggest individuals get better at emotion regulation as they age (Baltes & Baltes, 1990; Carstensen et al., 2011; Charles, 2010). The general idea is that as individual age they become more attuned/sensitive to the regulation context, are able to dynamically vary their ER strategy use across situations – *ER variability*, and are better able to flexibly match their ER strategy use to situational demands – *ER flexibility* (Aldao et al., 2015). Few studies have examined age-related differences in how individuals use ER strategies in their daily lives. The existing findings are mixed. Only one study we know of has examined age-related differences in ER variability and ER flexibility in daily life. Using 9-occasion daily diary reports obtained from adults age 23 to 85 years, Eldousky and English (2018) found older age was associated with less day-to-day ER variability. Addressing this gap in the literature, and extending the prior work, this study examines age-related differences in ER strategy use in the daily lives of adults age 18 to 89 years using an intensive, event-contingent, *in-situ* experience sampling design. In particular, we examine (1) age-related differences in individuals' *usual ER strategy use* of reappraisal and suppression, (2) age-related differences in how much individuals' use of these two strategies varies across a wide range of different social situations – *ER variability*, and (3) age-related differences in the extent to which ER strategy use covaries with relational (close vs. non-close others) and emotional (happy, sad) features of those social situations – *ER flexibility*.

Given discrepancies between theoretical predictions and the limited and mixed nature of prior empirical findings, we generally take an exploratory approach in our analysis of a new and rich data stream. We do, though carry some expectations. In particular, we expect that individuals' *usual use of reappraisal and suppression strategies will be lower at older ages*, given that both these strategies may require substantial cognitive or biological resources (Charles, 2010; Urry & Gross, 2010). The only other age-heterogenous experience sampling study in this area, however, found no evidence of age-related differences in individuals' daily use of reappraisal or suppression (Eldesouky & English, 2018). Following this prior study's findings regarding ER variability and the interpretation that older adults'

environments are more stable than younger adults' environments (e.g., Almeida & Horn, 2004) and thus require less variability in ER strategy use, we expect that *ER variability would be lower at older ages*. Building from SST (and related lifespan developmental theories) and the idea that when individuals' ER strategy use is coupled with situational features they are doing something strategic, we expect that older individuals will more flexibly match their ER strategy use in social situations to the relational and emotional features of those social situations. That is, we expect that *ER flexibility would be greater at older ages*.

In summary, this study extends a growing body of theoretical and empirical work on usual ER strategy use, ER variability and ER flexibility. We utilize data from an intensive, event-contingent, *in-situ* experience sampling study design where reports of individuals' use of reappraisal and suppression were obtained immediately after social interactions – the exact area of daily life where developmental theories such as SST suggest that age-related differences in ER strategy use will manifest. Following the conceptual work on ER variability and flexibility (Aldao et al., 2015), we operationalize these constructs using IIV metrics and methods for studying development of individuals' dynamic characteristics. Along the way we describe a few additional details we learned about individuals' perceived and actual use of ER strategies in social situations.

Method

Data were drawn from the Intraindividual Study of Affect Health and Interpersonal Behavior (iSAHIB), a multiple time-scale ESM study designed for articulating process-oriented theory and methods (Ram et al., 2014). Details relevant to this analysis are given in the following sections.

Participants

With approval from the Institutional Review Board at the Pennsylvania State University*; protocol #33706*], data were collected from a group of adults recruited from the Pennsylvania State University and surrounding community. The iSAHIB sample consists of 150 adults (50% women), stratified by gender and age to cover the full adult life span. Participants were between the ages of 18 and 89 years (M_{Age} =47.10, SD_{Age} =18.76), had obtained between 2 and 24 years of formal education (M_{Educ} =16.36, SD_{Educ} =3.90), 91% self-identified as Caucasian (4% African American, 1% Asian American, and 4% Mixed or Other ethnicity), and 93% as heterosexual (6% bisexual/gay/lesbian, 1% preferred not to answer). After participants were recruited, informed of the intensive nature of the assessments, and self-selected into the study, they provided extensive reports about their lives during the next year through a combination of web-based (completed during 6 visits to the laboratory) and smartphone-based questionnaires (completed multiple times per day during regular daily life).

Procedure

Participants completed three 21-day "measurement bursts" spaced approximately evenly over 1 year. During each burst, individuals used a study-provided smartphone (Verizon

XV6900) with a customized 'iSAHIB Surveys' application. Specifically, as an adaptation of the Rochester Interaction Record (RCI) (Wheeler & Nezlek, 1977), participants provided event-contingent reports of face-to-face social interactions that lasted 5 minutes or longer. To facilitate compliance, the smartphones were programmed to chime a prompt if the participant had not provided a report for any two-hour span between 8am and 8pm. Data flow was monitored in real-time, a process that enabled the research staff to make periodic "check-in" calls that supported, motivated, and helped participants (e.g., solving technical problems) provide high quality data. At the beginning and end of each burst, individuals visited the laboratory, received training or debriefing, picked-up or dropped-off smartphones, and completed web-based demographic, health, personality, and other questionnaires. Participants were compensated $500 for completing the entire three-burst protocol.

Measures

Our analysis makes use of the intensive repeated measures of ER strategy use (cognitive reappraisal and expressive suppression), relational context (close vs. non-close social interaction partner) and emotional context (happy, sad) surrounding daily life social interactions. Over the course of the study participants reported on between 88 and 869 social interactions ($M = 427.41$, $SD = 145.66$). Age was not associated with the number of reports provided ($r = -0.04$).

Emotion regulation during social interactions.—The extent of individuals' engagement of ER strategies was measured after each social interaction using two items adapted from the Emotion Regulation Questionnaire (ERQ) (Gross & John, 2003; Nezlek & Kuppens, 2008). Specifically, *expressive suppression* was assessed by prompting participants to rate the extent to which they agreed with the statement, "*During this interaction, I kept my emotions to myself,*" using a 'touch-point-continuum' (slider-type interface) with end-point anchors labeled "*Not at all … Very much.*" Responses were digitally coded on a 0.0 to 10.0 scale (numbers were not visible to participants). Similarly, *cognitive reappraisal* was assessed by prompting participants to rate the extent to which they agreed with the statement, "*I controlled my emotions by changing how I thought about the interaction*" (also coded on the 0.0 to 10.0 scale).

Relational context of social interaction.—Relational context was operationalized with respect to the type of social interaction partner – close vs. non-close. After each social interaction, participants indicated whether they had interacted with a stranger, friend, co-worker, romantic partner, family member, service professional, or other (with a follow-up question that obtained additional detail; e.g., whether family member was a spouse, child, parent or extended family member). Responses were collapsed into a binary variable indicating whether the relational context was characterized by interaction with a non-close other (=0) or close other (=1). Non-close others included casual acquaintance friendships, new romantic relationships, co-workers (professional colleague, employer/supervisor, employee/supervisee), service professionals (retail worker, restaurant worker, health care provider, other), and others (student, client, someone else). Close others included enduring and lifelong friendships, casual and serious romantic relationships, family members (spouse, child, parent, extended family member), and roommates. Validity of grouping was confirmed

through comparison of corresponding ratings participants provided about familiarity of the relational context (i.e., "How well do you know this person?;" see Vogel, Ram, Conroy, Pincus, & Gerstorf, 2017). Social partners categorized as non-close others were rated as significantly less familiar (M =45.58, SD =12.67) than social partners categorized as close others (M =85.78, SD =8.49), $F(1, 296)$ =35.31, $p < .001$. Person- level differences in individuals' typical relational context were quantified as the proportion of social interactions that were with close others (*CloseOtherPropi*).

Emotional context of social interaction.—Emotional context was operationalized with respect to the discrete emotions of happy and sad – two straightforwardly face valid characterizations. Features of the emotional context were measured after each social interaction by asking "*How do you feel right now?*", followed by prompts for particular discrete emotions (including happy, sad). Responses provided on a 'touch-point-continuum' (slider-type interface) with end-point anchors labeled "*Not at all … Extremely*" were digitally coded on a 0.0 to 10.0 scale. The repeated measures of emotional context exhibited substantial variation, of which 51% and 36% could be considered between-person variance (happy, sad, respectively), with the remaining 49% to 64%, considered within-person variance (and measurement error). Following usual practice in ESM data (Bolger & Laurenceau, 2013) the repeated measures of emotional context were separated into between-person and within-person components. For example, the repeated measures of happy were split into a person-level, time-invariant variable, *iMeanEmotioni*, that was calculated as the intraindivdual mean across the repeated measures, and a situation-specific, time-varying variable, *Emotionit*, that was calculated for each observation as the deviation from the person-specific mean.

Age.—Chronological *age* was calculated as the difference between an individual's birthdate (from demographic questionnaire) and the day on which the study commenced.

Data Analysis

Individuals' usual ER strategy use of reappraisal and suppression across social interactions was quantified as the arithmetic intraindividual mean (*iMean*) of their repeated measures of each ER strategy. Specifically,

$$\mu_{xi} = \frac{1}{T}\sum_{t=1}^{T} x_{it} \tag{1}$$

where μ_{xi} is the average of all reports about a particular ER strategy (x = reappraisal or suppression) for individual i across all t = 1 to T social interactions. In parallel, individuals' ER variability was quantified as the intraindividual standard deviation (*iSD*) of the same ensemble of individual i's repeated measures,

$$SD_{xi} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(x_{it} - \mu_{xi})^2} \tag{2}$$

Evidence of age differences in usual ER strategy use (*iMean*) and ER variability (*iSD*) were examined using simple correlations (implemented using the *psych* package in R, Revelle, 2018).

Age differences in the extent to which ER strategy use covaried with relational (close vs. non-close others) and emotional (happy, sad) features of social situations – *ER flexibility* - were examined within a multilevel modeling framework that accommodated the nested nature of the repeated measures (social interactions nested within persons) (Fitzmaurice, Laird, & Ware, 2011). Age-related differences in intraindividual covariation of ER strategy use, and relational and emotional features of each social situation were examined using models of the form,

$$ERstrategy_{it} = \beta_{oi} + \beta_{1i}(closeOther_{it}) + \beta_{2i}(Emotion_{it}) + \beta_{3i}(CloseOther_{it} * Emotion_{it}) + e_{it} \quad (3)$$

where the repeated measures of ER strategies (reappraisal, suppression in separate models) for individual i after social interaction t, $ERstrategy_{it}$, are modeled as a function of person-specific intercepts, β_{0i}; changes driven by relational context (close vs non-close), β_{1i}; changes driven by emotional context (happy, sad), β_{2i}; the interplay between relational and emotional contextual features, β_{3i}; and residual differences, e_{it} Person-specific coefficients were simultaneously modeled as a function of person-level predictors,

$$\beta_{0i} = \gamma_{00} + \gamma_{01}(Age_i) + \gamma_{02}(\text{CloseOtherProp}_i) + \gamma_{03}(\text{iMeanEmotion}_i) + u_{0i} \quad (4)$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}(Age_i) + u_{1i} \quad (5)$$

$$\beta_{2i} = \gamma_{20} + \gamma_{21}(Age_i) + u_{2i} \quad (6)$$

$$\beta_{3i} = \gamma_{30} + \gamma_{31}(Age_i) + u_{3i} \quad (7)$$

where γ_{00}, γ_{10}, γ_{20}, and γ_{30} are sample-level parameters describing the prototypical person, and the other γ parameters describe how individual differences in age, proportion of social interactions that were with close others, and usual level of emotion are related to individuals' ER strategy use and/or moderate the within-person associations between time-varying relational and emotional contextual features and ER strategy use. Random effects (u_{0i}, u_{1i}, u_{2i}, u_{3i}) were allowed to covary, but were orthogonal to the residual error, e_{it}. Altogether, extent of intraindividual covariation between two measures of ER strategy use (reappraisal, suppression), the relational context (close other), and two aspects of the emotional context (happy, sad) were examined using four models; Model 1: Reappraisal ~ CloseOther + Happy, Model 2: Suppression ~ CloseOther + Happy, Model 3: Reappraisal ~ CloseOther + Sad, and Model 4: Suppression ~ CloseOther + Sad. Prior to model fitting, we examined the distributions of the data and checked for outliers. Person-level variables were sample-mean centered to facilitate interpretation with respect to the prototypical (average age = 47.1 years) person in the sample. All models were fit in R using the *lme4* package (Bates,

Mächler, Bolker, & Walker, 2015; R Core Team, 2017), with restricted maximum likelihood estimation and the small amount of missing data (<1%) treated as missing at random. Plots were created in R using the *ggplot2* package (Wickham, 2016). Significance of parameter estimates was evaluated by whether 95% confidence intervals spanned zero. Comprehensive code and output can be found at www.quantdev.ssri.psu.edu.

Results

Prior to the main analyses, we calculated intraclass correlation coefficients to examine the extent to which individuals' use of reappraisal and suppression in social interactions differed across situations and between individuals (Bolger & Laurenceau, 2013). For reappraisal, 63% of the variance could be considered within-person variation, and 37% between-person variation. Similarly, for suppression, 64% of the variance was within-person and 36% between-person variation. These variance decompositions indicate, in line with prior studies, that there was both between- and within-person variance in each ER strategy in daily life, with the additional nuance that ER strategy use tended to vary more across situations than between persons. This result supports further examination of ER variability and how time-varying relational and emotional features of social interactions covary with individuals' ER strategy use – ER flexibility.

Age Differences in Usual ER Strategy Use and ER Variability

Descriptive statistics for analysis variables are given in Table 1. As in the prior study of daily ER strategy use (Eldesouky & English, 2018), there was no evidence of age differences in individuals' usual ER strategy use of reappraisal ($r = -0.08$, $p = .33$) or suppression ($r = -0.05$, $p = .55$), but there were age differences in ER variability. Older age was associated with lower ER variability in both reappraisal ($r = -0.28$, $p < .001$) and suppression ($r = -0.16$, $p = .05$). As outlined earlier, this finding may reflect age differences in the variability of individuals' social lives and/or individuals' ER flexibility. Thus, we proceeded to examine intraindividual covariation of ER strategy use and contextual features.

Although not a main focus of this analysis, we also found, in contrast to research showing habitual reappraisal and suppression are uncorrelated (Gross & John, 2003), both the average within-person correlation between reappraisal and suppression ($r = 0.54$, $p < .001$), and the correlation between individuals' usual level (*iMeans*) of reappraisal and suppression ($r = 0.82$, $p < .001$) were relatively high.

Age Differences in ER Flexibility

Age differences in reappraisal and suppression and variations due to relational and emotional contextual features are shown in Table 2. For clarity, parameter estimates and confidence intervals are not included in the text, however parameter names are provided so the corresponding numerical values can be easily located in the table. For the prototypical person (i.e., as described by the average demographics above) after the prototypical interaction with a non-close other, the expected levels of reappraisal (γ_{00}) were 2.86 (Model 1) and 2.70 (Model 3) and the expected levels of suppression (γ_{00}) were 3.60 (Model 2), and

3.42 (Model 4). As with the iMeans above, none of the models suggested that individuals' usual level of ER strategy use differed systematically with age (γ_{01}).

Role of Relational Context in ER Strategy Use.—On average, just over half of individuals' social interactions were with close others. Those who had a higher proportion of social interactions with close others did not differ in use of reappraisal or suppression compared to those who had a lower proportion of social interactions with close others (γ_{02}). In line with prior work, the prototypical individual tended to engage reappraisal and suppression to a lesser extent when interacting with close others than when interacting with non-close others (γ_{10}), evidence of ER flexibility. There was also evidence of age differences in the extent of intraindividual covariation between relational context and suppression (γ_{10}; Models 2, 4). However, as shown in Figure 1, covariation between relational context and suppression was stronger at younger ages than at older ages (red dashed line is steeper than the solid green line). There was no evidence of age differences in extent of intraindividual covariation between relational context and reappraisal (γ_{10}; Models 1, 3).

Role of Emotional Context in ER Strategy Use.—Individuals with higher overall levels of happiness across social interactions tended to use less reappraisal and suppression (γ_{03}). Similarly, in situations when individuals were happier than usual, they tended to engage less reappraisal and suppression (γ_{20}), evidence of ER flexibility. In complementary fashion, individuals with higher overall levels of sadness across social interactions tended to use more reappraisal and suppression, and in situations when individuals were sadder than usual, they tended to use more reappraisal and more suppression (γ_{20}). Contrary to expectations, however, there was no evidence of age differences in the extent to which individuals' ER strategy use (reappraisal, suppression) covaried with emotional context (happy, sad).

Role of Interplay between Relational and Emotional Context in ER Strategy Use.—There was further evidence of ER flexibility in how the interplay between relational and emotional contexts was associated with ER strategy use (γ_{30}; Models 1, 3, 4; trend in expected direction for Model 2). Panel A of Figure 2 shows that when individuals were happier than usual in a given social interaction, they tended to engage less reappraisal, especially when the interaction was with a close other. Similarly, in social situations when individuals were sadder than usual, they tended to engage more reappraisal (Panel C) and more suppression (Panel D), especially when the interaction was with a close other. Contrary to expectation, the context-dependent nature of ER flexibility did not differ with age in any model (γ_{31}). Overall, across ER strategy types and emotional contexts, these findings suggest the covariation between ER strategy use and emotional context is stronger in relational contexts involving close others than in context involving non-close others.

Discussion

Theories of emotional development emphasize how the age-related changes in network composition and emotion-focused priorities contribute to changes in ER (Campos et al., 2011; Carstensen et al., 2011). Thus far, empirical research on age-related differences in ER

strategy use has primarily relied on single occasion self-report methods to infer individual differences and laboratory studies to infer intraindividual variation. In recent years, studies using ESM have also begun to tackle questions pertaining to how often and in what contexts ER strategies are used (Cameron & Overall, 2018; Catterson et al., 2017; English, Lee, John, & Gross, 2017; Heiy & Cheavens, 2014), within- and between-strategy variability (Blanke et al., 2019), covariation between ER strategies and emotion experiences (Blalock, Kashdan, & Farmer, 2016; Brans et al., 2013; Kashdan & Steger, 2006; Nezlek & Kuppens, 2008; Troy et al., 2018), and age-related differences in ER strategy use (Brockman et al., 2017; Eldesouky & English, 2018). Thus far, however, most studies have relied on young undergraduate samples and end-of-day reports – design features that preclude examination of age-related differences in ER processes and that disconnect these processes from on-going changes in context. Using a rich sampling of adults' naturally occurring daily life social interactions over the course of 1 year, the present study is the first to examine how adults of diverse ages vary their ER strategy use across many social situations – *ER variability*, and systematically covary their ER strategy use with the changes in the relational (close vs non-close others) and emotional (happy, sad) features of those situations *ER flexibility* (Aldao et al., 2015).

Preliminary analyses indicated that there is substantial variability, both within-person and between-persons, in how individuals deploy reappraisal and suppression strategies in the social situations they encounter in daily life. Variance decompositions, based on approximately 7 repeated measures per day, align with variance decompositions reported in prior ESM studies of ER strategy use (Brans et al., 2013; Brockman et al., 2017; Catterson et al., 2017; Eldesouky & English, 2018; English et al., 2017; Farmer & Kashdan, 2012; Nezlek & Kuppens, 2008; Troy et al., 2018). However, in contrast to most prior studies that examined ER strategy use at the daily level, the present study examined ER strategy use at a faster time scale. Thus, these new results provide further evidence that individuals' deployment of ER strategies shifts quite quickly – at least every few hours. These situation-to-situation differences highlight the state-like nature of ER strategy use, and suggest some re-orientation away from examination of between-person, trait-like differences in habitual use and toward modeling of ER processes (Cole et al., 2004).

Summarizing the intensive repeated measurements of each individual's ER strategy use obtained immediately after 400+ social situations, we examined age-related differences in reappraisal and suppression – *usual ER strategy use* (*iMean*), and how much individuals' use of these strategies varied across different social situations – *ER variability* (*iSD*). In line with prior research on day-to-day ER strategy use and ER variability (Eldesouky & English, 2018), there were not systematic age-related differences in individuals' usual ER strategy use of reappraisal or suppression during social interactions. In contrast, older age was associated with less *ER variability* for both reappraisal and suppression. As noted in prior work, this result can be interpreted in two ways. Interpreted from the perspective that frequently adjusting one's regulation tactics is beneficial (e.g., Bonanno et al., 2004), lower ER variability is indicative of age-related decrement in ER. Alternatively, if older adults' environments are relatively more stable, the negative age gradient in ER variability may indicate they are appropriately matching their strategy use to situational demands (i.e., more stable environments require less variability in ER strategy use over time). Prior research

(utilizing other variables from the larger study that the present data come from) provides peripheral evidence that this may be the case, as we found similarly negative age gradients for stressor diversity – another marker of contextual variability (Koffer, Ram, Conroy, Pincus, & Almeida, 2016).

Using multilevel models of intraindividual covariation, we then examined age-related differences in *ER flexibility*, specifically differences in the extent to which use of reappraisal and suppression was coupled with situation-to-situation differences in the relational (close vs. non-close others) and emotional (happy, sad) features of the social situations our participants encountered in their daily lives. In line with conceptual work on ER variability (Aldao et al., 2015; Bonanno & Burton, 2013), the prototypical person in our sample (age 47.1 years) showed ER flexibility – with significant intraindividual covariation of all relational and emotional features examined with both reappraisal and suppression: less deployment of reappraisal and suppression when with close others and when happier, and more deployment of reappraisal and suppression when sadder (Table 2). These associations align with expectations about how individuals typically deploy ER strategies. From an IIV perspective, there were substantial interindividual differences in extent of each type of ER flexibility examined (i.e., extent of ER strategy use covariation with relational and emotional contextual features). This means that, as Aldao and colleagues (2015) and others suggest, ER flexibility is a measurable and potentially informative marker of differences in how individuals adaptively deploy ER strategies to regulate their emotions in ways that are synchronized with changes in the environment.

Contrary to expectations based on lifespan developmental theories of socioemotional aging, ER flexibility was related to age in only one circumstance. Specifically, we found that the covariation between relational context and suppression was slightly weaker at older ages (Models 2 and 4, Figure 1). This might suggest older adults are less attuned to whether they are interacting with a close or non-close other. This interpretation though runs counter to the SST-based idea that older adults prioritize relationships with close others, and thus might be more likely to deploy specific types of ER strategies with people they care about (Carstensen et al., 2003). However, SST also suggests that older adults prioritize emotional experiences. It may be older adults have less need to engage ER strategies with non-close others because they are more comfortable allowing their emotions to unfold naturally. It could also be that through greater accumulation of ER experiences and/or greater knowledge of how to implement ER strategies successfully, older adults have established stronger ER habits – behavioral patterns that result in less variation and flexibility in ER strategy use. Notably, there were not age differences in extent of intraindividual covariation between use of reappraisal and relational context. Thus, we remain cautious in reaching distinct conclusions about why intraindividual covariation between use of suppression and relational context is weaker at older ages, but highlight this initial identification of age differences in ER flexibility as a direction for further study.

Our analytic framework also provided evidence that ER flexibility itself is context dependent. Specifically, the extent to which reappraisal and suppression covaried with emotional features of social situations (happy, sad) was moderated by the relational context. On average, there was greater ER flexibility (i.e., covariation between emotional context and

ER strategy use) when individuals interacted with close others compared to non-close others (differential steepness of lines in Figure 2). That individuals engage different amounts of ER flexibility in different types of context makes sense, of course. Almost by definition, individuals should be more sensitive to emotional cues when interacting with close others – individuals such as family members, romantic partners, and close friends with whom there is an emotional connection (Antonucci & Akiyama, 1987). Conceptual and empirical work note that ER strategy use and ER flexibility should be considered with respect to individuals' goals (Aldao et al., 2015; English et al., 2017). Our findings support the notion that individuals' regulation goals differ when socializing with close or non-close others and that they are more or less motivated to flexibly adapt their strategy use to situational demands when using different goal sets.

The identification of interactions among relational and emotional features of the social context also has implications for future research on ER variability and ER flexibility. In this study we identified social situations as a key context where age-differences were likely to manifest, and used an intensive event-contingent experience sampling paradigm to obtain many measurements of individuals' ER strategy use in those situations. Future studies should additionally consider the many other ways that situations differ and the particular features of each situation that are assumed to be fixed or random, and/or that individuals are actually attempting to flexibly match their ER strategy use to. More robust measurement of a wider variety of contextual and personal features at multiple time scales – including longer-term longitudinal assessment of ER strategy use - will be needed to parse how ER flexibility changes within person and develops across the life span (Aldao et al., 2015; Ram & Gerstorf, 2009).

Strengths, Limitations, and Future Directions

This study is the first to use such a broad ranging age-heterogeneous community sample to examine age-related differences in individuals' ER strategy use in naturally encountered daily life social situations. The intensive, event-contingent experience sampling design provided for examination of several dynamic characteristics: usual ER strategy use, ER variability and ER flexibility. Although these data provided a rich sampling of experiences, some cautions regarding generalizability are warranted. For example, the sample was relatively high functioning, and only a third of participants were older than 65. As such, there may not be enough representation of the physical, cognitive, and social decrements/changes that manifest in old age and are likely to influence ER strategy use, variability and flexibility (Baltes & Baltes, 1990). Further, with each individual only providing data during 1 year, we could only examine age-related differences and not age-related changes. Future research should consider how to make use of more widely spaced measurement bursts (e.g., across years or decades) in order to examine within-person changes in intraindividual variation and covariation (Ram & Diehl, 2015).

During 9 weeks of study, participants in this study provided, on average, 400+ reports per person – the most intensive monitoring of individuals' socioemotional lives to date. Strengths of this approach involve obtaining a representative sampling of individuals' everyday social ecosystems, and sufficient statistical power to estimate models with complex

random effects structures and cross-level interactions. The protocol, however, also missed potentially important types of social interactions. For example, social interactions that are negative valence dominant (i.e., when the intensity of the negative valence emotions is greater than the intensity of the positive valence emotions), may not last more than 5 minutes and thus may be under-represented in these data. Social interactions conducted through electronic media were not sampled at all. Thus, care should be taken to interpret the findings as specifically focused on the type of social situations that were sampled – face-to-face social interactions. Future research that makes use of social media and passive data collection paradigms will be especially important, given that so much of individuals' social lives are now conducted on-line (Chiatti et al., 2017; Mehl, Pennebaker, Crow, Dabbs, & Price, 2001). Indeed, digital media, and the ability to monitor individuals' digitally-mediated behavior, provides a plethora of additional opportunities to investigate both how media content provokes ER strategy use, and how media are used to implement ER strategies (Reeves et al., 2018). We strongly encourage moves in this direction.

The data, IIV metrics, and multilevel models used in our analysis focused on situation-to-situation ER strategy use. ER strategy use and, more generally, ER also manifest at other time scales and with temporal dependency. We treated each social situation as independent of all others, without considering whether ER strategy use in one situation influences ER strategy use in the next situation, how the sequencing and duration of ER strategy deployment influences relational and emotional features of a changing context, the temporal dynamics through which ER strategy use and emotional experience influence each other, or the interplay between ER strategies and emotions that occurred *within* a social interaction (Kalokerinos, Résibois, Verduyn, & Kuppens, 2017; Koval, Butler, Hollenstein, Lanteigne, & Kuppens, 2015). Whereas most ESM research on ER strategy use has obtained one measurement per day, and our event-contingent design obtained approximately 7 measurements per day, future research and theory about ER variability and flexibility should consider more carefully and precisely whether day-to-day variations (data obtained at relatively consistent time intervals), situation-to-situation variations (data obtained at relatively inconsistent time intervals), or hour-to-hour/ second-to-second variations provide the most accurate representation of the dynamic characteristics and processes of interest (Ram & Gerstorf, 2009). Movement toward explicit modeling of temporal dynamics of the underlying regulation and adaptation *processes* is encouraged.

Finally, our analysis made use of data that was not specifically designed as an exhaustive investigation of age-related differences in ER strategy use, ER variability, and ER flexibility, and all relevant social context features. Individuals only reported on two ER strategies (reappraisal and suppression), and a limited set of relational and emotional features of the social context that were operationalized using a rather general binary distinction between interactions with close vs. non-close others, and situation-specific ratings of two emotions, happy and sad. Future work should more closely follow other work on ER strategy use that considered and measured more types of ER strategies and discrete emotions. Eldesouky and English (2018), for example, measured a wide variety of antecedent-focused strategies that have their primary impact early in the emotion-generative process (e.g., situation selection and modification, distraction, cognitive reappraisal) and response-focused strategies that have their primary impact later on (e.g., expressive suppression), which permitted

examination of within-day ER diversity. Pertaining to discrete emotions, sadness is a relatively low arousal emotion, so future work might examine other emotions that are high on the arousal component (e.g., anger) and also show age-related changes/differences (Blanchard-Fields & Coats, 2008; Charles, 2010). Other research demonstrates the need for examining associations between suppression and positive emotion experiences such as pride in specific interpersonal settings (Kalokerinos, Greenaway, Pedder, & Margetts, 2014). Finally, as noted above, future research should engage with and measure a wider variety of contextual and personal features that may be coupled with individuals' moment-to-moment ER strategy use (Aldao et al., 2015; Sheppes et al., 2014).

Conclusion

This study builds on prior work on developmental change in IIV across adulthood to examine age-related differences in how individuals use of ER strategies in daily life. In particular, we used data from an intensive, event-contingent experience sampling design to examine (1) age-related differences in individuals' *usual ER strategy use* of reappraisal and suppression during everyday social interactions, (2) age-related differences in how much individuals' use of these two strategies varied across a range of different social situations – *ER variability*, and (3) age-related differences in the extent to which ER strategy use covaried with relational (close vs. non-close others) and emotional (happy, sad) features of those social situations – *ER flexibility*. In line with a small body of prior empirical work in this area, we found that usual ER strategy use did not differ across adulthood, and that ER variability was lower at older ages. Using multilevel models of intraindividual covariation, we found evidence that individuals flexibly matched their ER strategy use to emotional context, and particularly so when interacting with close others. There was also limited evidence of age-related differences in intraindividual covariation between ER strategy use and relational context. In particular, use of suppression (but not reappraisal) was weaker at older ages. Beyond these specific empirical findings, this study demonstrates the utility of experience sampling designs and the measurement/modeling of intraindividual variation and covariation for study of emotional development across the life span.

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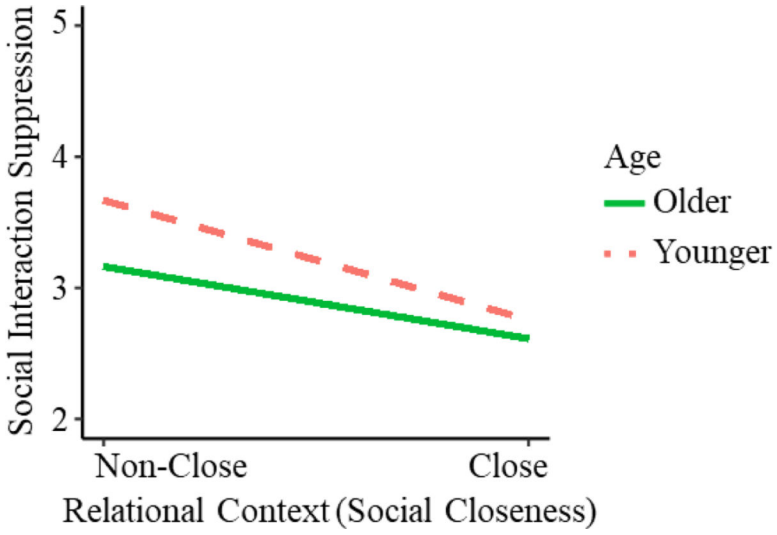

Figure 1.

Within person association between relational context and suppression moderated by age (−1*SD* = age 28 years, +1*SD* = age 66 years).

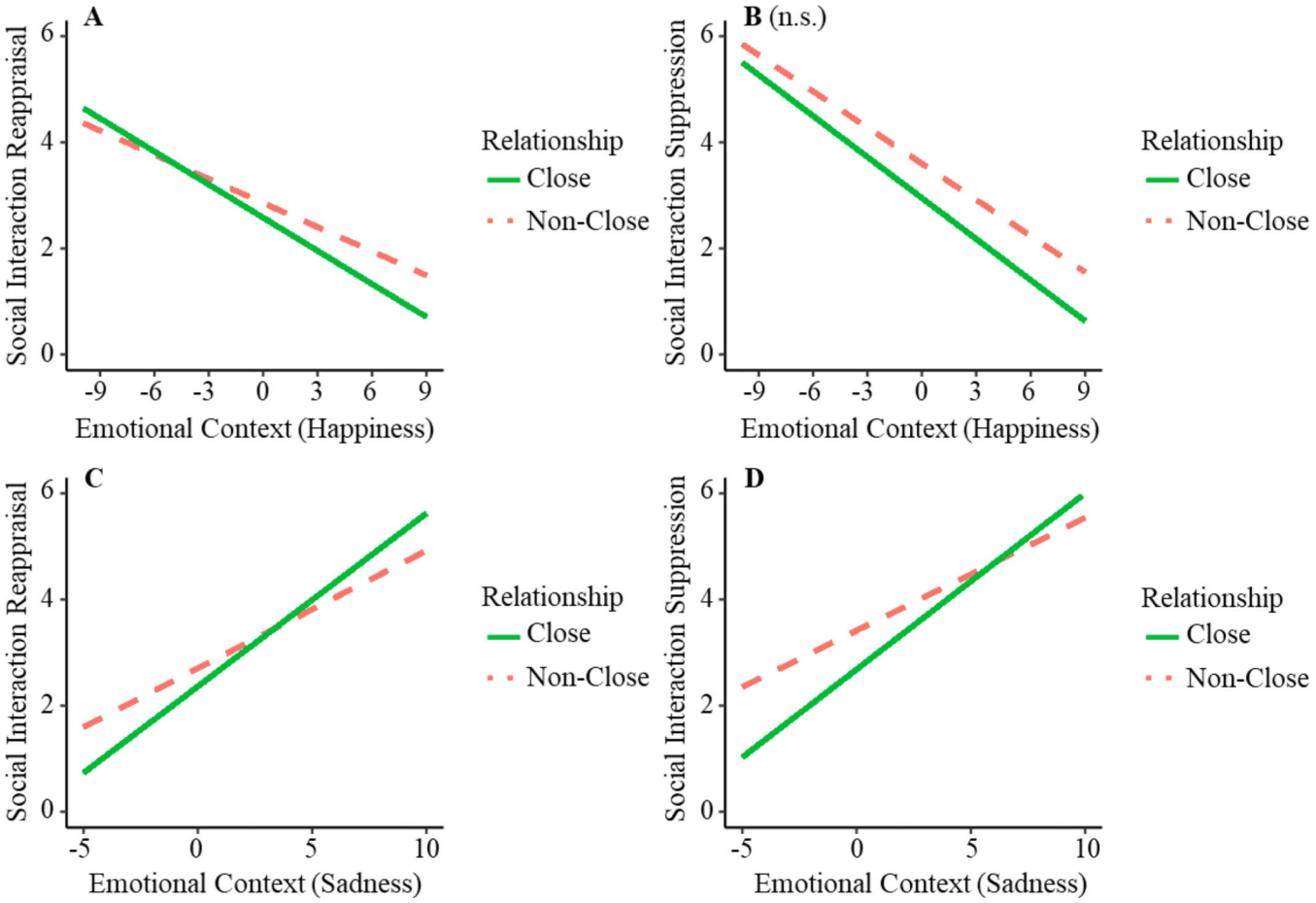

Figure 2.

Within person association between emotional context (happy, sad) and ER strategy use (reappraisal, suppression) moderated by relational context (close vs. non-close other).

Table 1

Descriptives and interrelations (between-person and within-person) among study variables.

	Emotion Regulation Strategy		**Relational Context**	**Emotional Context**		**Age**	**ER Variability**	
	Reappraisal	**Suppression**	**Close Other**	**Happy**	**Sad**		***iSD* Reappraisal**	***iSD* Suppression**
Reappraisal	1.00	0.54	−0.07	−0.14	0.16	-	-	-
Suppression	**0.82**	1.00	−0.14	−0.17	0.14	-	-	-
Close Other	**−0.10**	**−0.11**	1.00	0.07	0.03	-	-	-
Happy	**−0.15**	**−0.19**	**0.19**	1.00	−0.32	-	-	-
Sad	**0.38**	**0.33**	**−0.13**	**−0.44**	1.00	-	-	-
Age	**−0.08**	**−0.05**	**−0.14**	**0.00**	**0.05**	1.00	-	-
iSD Reappraisal	**0.60**	**0.55**	**−0.09**	**−0.04**	**0.15**	−0.28	1.00	-
iSD Suppression	**0.44**	**0.54**	**−0.06**	**−0.07**	**0.16**	−0.16	0.84	1.00
Sample Mean	2.47	2.94	0.55	6.27	1.12	47.10	1.92	2.16
Sample SD	1.58	1.74	0.17	1.59	0.96	18.76	0.82	0.79

Note: Correlations in **bold** type indicate extent of between-person association among person-level characteristics (*iMeans* = intraindividual means). Correlations in regular type indicate the average within-person correlation, *iCorrs*, between time-varying measures. *iSD*= intraindividual standard deviation. Relational context is a binary variable indicating non-close others (=0) and close others (=1).

Table 2

Results from Multilevel Models Examining Age-Related Differences in ER Strategy Use and Variations based on Relational and Emotional Features of the Social Context

		Model 1: Reappraisal ~ Happy + CloseOther		Model 2: Suppression ~ Happy + CloseOther		Model 3: Reappraisal ~ Sad + CloseOther		Model 4: Suppression ~ Sad + CloseOther	
		Estimate	***95%CI***	**Estimate**	***95%CI***	**Estimate**	***95%CI***	**Estimate**	***95%CI***
Fixed Effects									
Intercept	γ_{00}	**2.86**	[2.01, 3.70]	**3.60**	[2.68, 4.52]	**2.70**	[1.91, 3.50]	**3.42**	[2.55, 4.28]
Age	γ_{01}	−0.01	[−0.02, 0.01]	−0.01	[−0.03, 0.005]	−0.011	[−0.024, 0.003]	−0.013	[−0.029, 0.002]
CloseOtherProp	γ_{02}	−0.41	[−1.87, 1.03]	−0.52	[−2.09, 1.05]	−0.09	[−1.44, 1.27]	−0.12	[−1.59, 1.35]
iMeanEmotion	γ_{03}	**−0.18**	[−0.34, −0.02]	**−0.22**	[−0.39, −0.05]	**0.69**	[0.44, 0.93]	**0.63**	[0.36, 0.89]
CloseOther	γ_{10}	**−0.28**	[−0.40, −0.16]	**−0.65**	[−0.80, −0.49]	**−0.34**	[−0.46, −0.22]	**−0.73**	[−0.89, −0.58]
CloseOther*Age	γ_{11}	0.002	[−0.004, 0.009]	**0.009**	[0.001, 0.017]	0.002	[−0.004, 0.009]	**0.01**	[0.001, 0.018]
Emotion	γ_{20}	**−0.15**	[−0.20, −0.11]	**−0.23**	[−0.27, −0.18]	**0.22**	[0.17, 0.27]	**0.21**	[0.16, 0.26]
Emotion*Age	γ_{21}	0.001	[−0.001, 0.003]	0.001	[−0.001, 0.004]	−0.001	[−0.004, 0.002]	−0.0006	[−0.003, 0.002]
CloseOther*Emotion	γ_{30}	**−0.06**	[−0.10, −0.02]	−0.03	[−0.07, 0.01]	**0.10**	[0.05, 0.16]	**0.12**	[0.06, 0.18]
CloseOther*Emotion*Age	γ_{31}	−0.001	[−0.004, 0.001]	−0.001	[−0.004, 0.001]	0.002	[−0.001, 0.005]	0.002	[−0.001, 0.006]
Random Effects									
Variance Intercept	σ^2_{u0i}	**2.88**	[2.25, 3.57]	**3.60**	[2.82, 4.47]	**2.58**	[2.02, 3.20]	**3.39**	[2.66, 4.20]
Variance CloseOther	σ^2_{u1i}	**0.51**	[0.40, 0.65]	**0.84**	[0.66, 1.07]	**0.51**	[0.40, 0.65]	**0.87**	[0.68, 1.10]
Variance Emotion	σ^2_{u2i}	**0.06**	[0.04, 0.08]	**0.07**	[0.05, 0.09]	**0.05**	[0.03, 0.07]	**0.05**	[0.03, 0.07]
Variance CloseOther*Emotion	σ^2_{u3i}	**0.03**	[0.02, 0.05]	**0.04**	[0.03, 0.06]	**0.06**	[0.04, 0.09]	**0.06**	[0.04, 0.09]
Correlation Intercept, CloseOther	$\rho[u_{0i}, u_{1i}]$	**−0.45**	[−0.58, −0.31]	**−0.50**	[−0.62, −0.36]	**−0.50**	[−0.62, −0.36]	**4.72**	[−0.65, −0.41]
Correlation Intercept, Emotion	$\rho[u_{0i}, u_{2i}]$	0.16	[−0.02, 0.33]	**0.19**	[0.01, 0.36]	−0.17	[−0.36, 0.03]	**−0.53**	[−0.55, −0.16]
Correlation Intercept, CloseOther*Emotion	$\rho[u_{0i}, u_{3i}]$	−0.16	[−0.36, 0.05]	−0.19	[−0.39, 0.02]	0.15	[−0.06, 0.35]	−0.37	[−0.01, 0.44]
Correlation CloseOther, Emotion	$\rho[u_{1i}, u_{2i}]$	−0.01	[−0.19, 0.17]	−0.01	[−0.19, 0.18]	0.17	[−0.03, 0.37]	0.22	[−0.02, 0.39]
Correlation CloseOther, CloseOther*Emotion	$\rho[u_{1i}, u_{3i}]$	−0.12	[−0.32, 0.09]	−0.02	[−0.22, 0.19]	**−0.23**	[−0.42, −0.01]	0.19	[−0.39, 0.04]
Correlation Emotion, CloseOther*Emotion	$\rho[u_{2i}, u_{3i}]$	**−0.28**	[−0.48, −0.05]	**−0.35**	[−0.54, −0.12]	**−0.48**	[−0.65, −0.23]	**−0.18**	[−0.61, −0.15]

		Model 1: Reappraisal ~ Happy + CloseOther		Model 2: Suppression ~ Happy + CloseOther		Model 3: Reappraisal ~ Sad + CloseOther		Model 4: Suppression ~ Sad + CloseOther	
		Estimate	***95%CI***	**Estimate**	***95%CI***	**Estimate**	***95%CI***	**Estimate**	***95%CI***
Residual variance	σ^2_{eit}	**4.04**	[3.99, 4.08]	**4.61**	[4.56, 4.66]	**4.09**	[4.05, 4.14]	**−0.41**	[4.67, 4.77]

Note. CI = 95% confidence interval; Bolded estimates indicate *CI*s that do not span zero. Data are reports on ($63{,}732_{model1}$, $63{,}733_{model2}$, $63{,}588_{model3}$, $63{,}590_{model4}$) social interactions nested within 150 persons.

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