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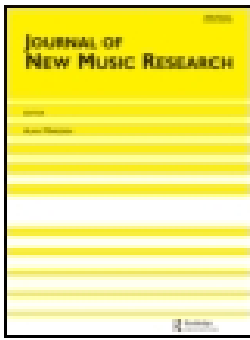
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Success in reaching affect self-regulation goals through everyday music listening

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ABSTRACT

While music listening on mobile phones can serve many affect-regulatory goals, success in reaching these goals is yet to be empirically assessed. This study aimed to determine how frequently listeners successfully reach their affect-regulatory goals, and the predictors of this success. Data were collected using the experience sampling app MuPsych, from 293 Finnish participants. Goals were successfully reached in less than half of cases, with adults more successful than adolescents. Success was determined largely within contexts, and strongly predicted by an initial low-valenced emotional state of the listener, suggesting that music listening is particularly useful for those in negative states.

1. Introduction

Young people are avid music listeners. Especially during this age, music listening goes beyond being a pleasant, aesthetic experience – it is an activity deeply connected to the development and negotiation of emotional, social, and cognitive aspects (Baltazar, 2019; Saarikallio, 2017, 2019; Saarikallio & Baltazar, 2018). During adolescence, there is a peak in music engagement (North et al., 2000) and music listening occurs in a significantly wider variety of contexts than during adulthood (Bonneville-Roussy et al., 2013). Previous scholars have argued that the unique connection that young people have with music reflects its contribution to key developmental tasks (e.g. identity and agency, emotional regulation, social connectedness; Laiho, 2004; Miranda, 2013; Schwartz & Fouts, 2003).

Music has been identified as a useful tool for regulating affective states in contexts ranging from stress management (Pelletier, 2004) to sport and exercise (Terry et al., 2020). For adolescents, one of the most relevant functions of music is the regulation of affective states (Baltazar, 2019; Saarikallio & Erkkilä, 2007). Affect regulation through music is a process defined by the engagement with music in order to alter experienced states or create new ones. Since these states can be of different durations and intensities (e.g. moods, emotions, energy levels, stress responses), affect is used as an umbrella term (Baltazar & Saarikallio, 2016; Juslin & Sloboda, 2010). Adolescence, especially in its early years, is a period marked by frequent negative states and increases in affective instability (Larson et al., 2002), which represents a particular need for affect self-regulation. The ability to self-regulate is strengthened during adolescence by the cognitive development characteristic of this stage (Campos et al., 1989) and the repertoire of regulation strategies (i.e. the tools used to achieve affective goals; Koole, 2009) is widened. However, the development of this repertoire is not necessarily linear, and during some years of adolescence the usage of regulation strategies might actually be impaired, leaving adolescents in a more fragile situation (Kovacs et al., 2019). Lennarz et al. (2019) found in their experience-sampling study that, when experiencing negative affect, adolescents used the strategy *acceptance* the most, followed by *problem-solving*, *rumination*, *distraction*, *avoidance*, *reappraisal*, *social support*, and *suppression*. Of these, *problem-solving*, *acceptance*, and *reappraisal* were more successful in down-regulating negative affect (when compared to *rumination*). Individual and contextual differences are major influences in the acquisition of regulation skills, such that some adolescents are faced with dysregulation and emotional distress (Cole et al., 1994; Diamond & Aspinwall, 2003; Fox & Calkins, 2003; Rubin et al., 2001). It has been argued that the heightened brain plasticity observed during adolescence can mean both increased opportunities and increased vulnerabilities (Fuhrmann et al., 2015). Importantly, consequences of poor self-regulation reach varied areas of functioning, such as social integration, mental health, and learning (e.g. Chervonsky & Hunt, 2019; Eisenberg et al., 2000; Hatzenbuehler et al., 2008; Silk et al., 2003). Despite the impact of emotion regulation on adolescents' well-being, at the time of publishing,

no previous research reporting success rates on adolescents' emotion regulation in daily life could be found. Published studies report, mainly, the predictive power of regulation strategies, context, and affective variables such as intensity (DeFrance & Hollenstein, 2022; Hiekkaranta et al., 2021; Lennarz et al., 2019), whereas the percentages of observed change or self-perceived success are omitted.

During this developmental stage marked by a constant negotiation between increments in skills and in challenges/responsibilities, music listening seems to offer adolescents a rich platform to explore, extend, and foster self-regulation skills (Baltazar, 2019; Saarikallio, 2019; Saarikallio & Baltazar, 2018). Previous work has shown that adolescents engage in music to achieve their affective goals, be it to feel better, cope with feelings, intensify experienced states, or feel something new (Baltazar & Saarikallio, 2019; McFerran et al., 2018; Miranda, 2019; Saarikallio & Erkkilä, 2007; ter Bogt et al., 2017). As the psychology literature postulates, affect regulation can serve different goals: including to change, create, enhance, or maintain current states (Gross, 1999; Koole & Aldao, 2016; Tamir, 2009), both positive and negative.

Although there is no standard categorisation of affective goals in the literature of musical regulation, one way of characterising them is in terms of desired changes in valence and arousal. Valence and arousal are two components of affect that efficiently map out experiences in a two-dimensional space (affect circumplex; Russell, 1980). Valence represents the hedonic component of affect and is commonly polarised as positive–negative or pleasurable–displeasurable, whereas arousal represents the activation component of affect and is commonly polarised as low arousal–high arousal or calm–energetic (Barrett et al., 2007; Russell, 2003). In regards to valence, young people most commonly use music to improve affective states (towards positive valence) or to maintain their (usually positive) states by listening to affect-congruent music (Bishop et al., 2007; McFerran et al., 2015; Papinczak et al., 2015; Saarikallio & Erkkilä, 2007). In regards to arousal, one of the most common affect-regulatory uses of music is relaxation (Van Goethem & Sloboda, 2011). Goals relating to changes in arousal level also appear to be something that people are consciously relatively aware of, such as calming down for sleep or raising energy before a sports training session (Saarikallio, 2011; Saarikallio et al., 2017; Van Goethem & Sloboda, 2011).

Overall, adolescents regulate their affect through music in a diverse way, by employing a variety of regulation strategies (e.g. coping, problem-solving, diversion, entertainment, solace, venting; Miranda, 2019; Papinczak

et al., 2015; Saarikallio & Erkkilä, 2007). It can be argued that music acts as a beneficial resource for affective self-regulation, assisting and supporting it in a multitude of ways. Due to its unique properties, music listening may even facilitate, 'scaffold', or extend regulatory skills that otherwise would not be so easily reachable (DeNora, 2000; Elvers et al., 2018; Krueger, 2018; Saarikallio, 2019). However, depending on certain factors, music listening is sometimes linked to deleterious outcomes (e.g. Miranda et al., 2012; Miranda & Claes, 2004; Reybrouck et al., 2020). Indeed, music listening for affect regulation has been identified in the literature as both a protective and a risk factor.

Previous research has investigated whether the beneficial outcomes of music listening are influenced by individual differences. As a specific tactic of self-regulation (Baltazar & Saarikallio, 2016; Van Goethem & Sloboda, 2011), music listening has been considered to reflect the individual's competences, needs, and vulnerabilities (McFerran & Saarikallio, 2014; Miranda et al., 2012). Even though some researchers have presented concerns in regards to some genres such as heavy metal music, further studies have argued that the observed associations between music genres and behavioural and affective problems are rather explained by underlying vulnerabilities or individual traits (Baker & Bor, 2008; Lacourse et al., 2001; Martin et al., 1993; Mulder et al., 2010; Schwartz & Fouts, 2003). For sad music, for instance, the relationship between music listening and experienced emotions seems to relate to individual differences (Eerola et al., 2018; Garrido & Schubert, 2013). The effect of sad music on adolescents ranges from consolation and solace (Hanser et al., 2016; Saarikallio & Erkkilä, 2007; ter Bogt et al., 2017; Tol & van den, 2016) to increased sadness (ter Bogt et al., 2021). The differentiating factor seems to be underlying affective difficulties, as found by ter Bogt et al. (2021) and supported by studies with the adult population (Garrido & Schubert, 2015; Schubert et al., 2018). Similarly, McFerran et al. (2015) found that, amongst the collected sample, distressed participants were more likely to report feeling worse after listening to music. Thus, listening to sad or aggressive music may be detrimental in terms of intensifying negative states and strengthening maladaptive patterns particularly for the ones who already suffer from depression or other affective disorders (Baker & Bor, 2008; McFerran & Saarikallio, 2014; Stewart et al., 2019).

However, individual differences are not the only predictor of music listening outcomes. A growing approach to music and wellbeing has been an integrative one, aiming to take into account the complexity of individual, musical, and also contextual factors that shape this relationship. Recent work using experience sampling

methodology (ESM; Csikszentmihalyi & LeFevre, 1989) shows that the emotional outcomes of daily music listening are largely explained by contextual factors such as the situational mood of the listener and activities related to the listening context (Randall & Rickard, 2017a). Marik and Stegemann (2016) further point out that isolated uses of maladaptive or ineffective strategies most likely are harmless, whereas their repeated use in day-to-day listening situations leads to the accumulation of negative outcomes. This is something Miranda et al. (2012) call the gradual development effect, referring to small yet cumulative effects – everyday experiences with music that throughout time shape the adolescents' development and mental health.

Taken together, it seems plausible that both individual and contextual factors shape the efficacy and health-impact of musical choices and listening strategies. However, the current literature is particularly sparse concerning the impact of contextual and situational factors. Furthermore, it has been relatively common to address musical affect self-regulation patterns using surveys, questionnaires, and interviews that can identify general tendencies and retrospective personal interpretations, but do not manage to actively track moment-to-moment changes in affective states across the multitude of music listening situations. Two recent studies have addressed this concern, both of which utilised experience sampling of everyday music listening, and multilevel modelling to determine the effects of listening within contexts. The first of these, undertaken by Randall and Rickard (2017a), did not directly assess regulatory success, while the second, performed by Greb et al. (2019), focused on random sampling of music selection behaviours, rather than real-time affective outcomes. As such, no previous study has investigated the ecological and real-time success of regulation strategies within everyday music listening contexts.

1.1. Aim and research questions

The current study aimed to investigate the frequencies and predictors of success in affect regulation through personal music listening. In particular, it focused on the situational determinants of affect-regulatory success during moment-to-moment listening episodes of everyday life. Success was defined as alignment/coherence of the self-reported affective goal and the self-reported affective outcome in a given listening episode. Our research questions were:

> RQ1. How frequently are adolescents and adults successful in reaching their stated affect regulation goals during everyday music listening?

> RQ2. What are the significant predictors of affect-regulatory success for both adolescents and adults, including regulation strategies utilized, initial mood, contextual variables, and individual trait variables?

Due to the lack of any prior research on this, we did not have predictions for exact percentages for success concerning different affect-regulatory goals. However, as prior research generally identifies young people as being competent in using music as a tool for their affect regulation, we generally hypothesised that listeners would more often succeed than fail in their regulatory attempts (there would be congruence between goal and outcome). Furthermore, based on prior research (Saarikallio, 2011) we hypothesised that they would have higher success concerning the arousal-related than valence/intensity related aspects of regulation. For the second research question, based on prior research (Randall et al., 2014) we expected that the success in reaching different regulation goals would depend particularly on the contextual variables, such as the initial mood of the listener, their listening context, and their reason for listening.

2. Materials and methods

2.1. Participants

The main sample consisted of 293 participants – all of Finnish nationality – who were divided into two separate groups: adolescents and adults. The adolescent group ($n = 205$) were aged from 13 to 19 years ($M = 14.8$, $SD = 1.7$), were 64.4% female (33.7% male, 2.0% non-binary), and predominantly secondary school students (93.5%; 5.5% tertiary students, 1.0% employed part-time). The adult group ($n = 88$) were aged from 20 to 52 years ($M = 26.8$, $SD = 6.5$), were 78.4% female (19.3% male, 2.3% non-binary), and consisted of 63.2% tertiary students (21.8% employed full time, 9.2% employed part-time). The majority of adolescent participants were recruited through secondary schools within the Jyväskylä sub-region of Finland, while all other participants were recruited through social media platforms and email lists. Any Finnish speaking person was eligible to participate if they used a mobile phone with the Android operating system to listen to music. A third group ($n = 268$) consisted of adolescents ($M_{age} = 15.3$, $SD = 1.7$) who did not use an Android phone to listen to music, and instead completed an online survey, for comparative purposes. Participation was incentivised through a draw to win subscriptions to music streaming services. Informed consent was acquired from each participant when they downloaded the data collection app or opened the online survey.

2.1. Materials

For the first two groups, all research materials were presented to participants using *MuPsych*, an app which utilises the experience sampling method (ESM; Csikszentmihalyi & LeFevre, 1989) to measure real-time responses to music listening on mobile phones (Randall & Rickard, 2013). The app collected data in two ways: through the event-based presentation of questions during music listening – referred to as experience sampling reports (ESRs) – and through a set of psychological surveys.

2.1.1. Music ESRs: questions at start of listening

Music ESRs consisted of a series of screens presented to participants immediately when they listened to any music on their phone. The first of these screens assessed their subjective affective state, with responses given on two 7-point slider scales: the first titled 'Mood' (labelled at points 1, 4, 7: Negative–Neutral–Positive) and the second titled 'Energy' (labelled at points 1, 7: Very low–Very high). These variables were labelled 'Initial valence' and 'Initial arousal', respectively. The dimensions of valence and arousal have been demonstrated to be efficient and reliable measures of music-induced emotion, explaining a high proportion of variance (Thoma et al., 2012; Vuoskoski & Eerola, 2011). Following this screen, a second screen (titled 'How do you feel?') presented a list of discrete emotional states, from which participants selected a single state that best matched their current mood. This list – taken from a total of 27 emotional states – was shortened to approximately 10 options (presented in alphabetical order), based on the valence and arousal ratings given on the previous screen. On a third screen, participants rated how strongly they felt this selected emotional state, with another 7-point slider, titled 'How < EmoState > do you feel?' (in which < EmoState > was replaced by the discrete emotional state selected by the listener; labelled Not at all–Very). This variable – labelled 'Initial Intensity' – was therefore a measure of how strongly the listener felt the emotional state they selected (e.g. intensity of anger or excitement). The following three screens used an option-list format to assess the music listening context, with lists for who was listening to the music ('Listeners'), where they were ('Location'), and what they were doing while listening ('Activity'; shortened from a total of 30 options based on selected responses of 'Listeners' and 'Location'). Time of day was also recorded, and categorised into: Morning (4am–12pm), Afternoon (12pm–5pm), Evening (5pm–8pm), and Night (8pm–4am). Following these three initial affective state screens and three context

screens, participants were left to listen to their music for a period of five minutes.

2.1.2. Music ESRs: questions after five minutes of listening

If music was still playing on the phone after this five-minute period, a second set of ESR screens was presented to participants. The first of these screens assessed Valence, Arousal, and Intensity of the selected discrete state, with the same 7-point slider format and labels as the initial measures. The differences between each of these initial and secondary measures were used to determine how affect changed over the listening experience, and were recorded as the variables 'Valence change', 'Arousal change', and 'Intensity change'. Following this was a screen of questions related to the music, also measured on 7-point slider scales: the subjectively perceived valence of the music (titled 'Mood of the music'; labelled Negative–Neutral–Positive), and arousal of the music ('Energy of the music'; Very low–Very high); along with level of Attention ('How much attention are you paying to the music?'; None–Complete); Enjoyment ('How much are you enjoying this music?'; Not at all–Very much); and Familiarity ('How familiar are you with this music?'; Not at all–Very familiar).

Finally, music ESRs ascertained the main reason participants had for listening. This was assessed using a branching option-list format, with an initial list of 9 reason categories, which branched off to 55 specific primary reasons for listening. Of these primary reasons for listening, six were considered emotion regulation goals: 'To maintain a(n) < EmoState > mood' (labelled Maintain), 'To feel less < EmoState >' (Diminish), 'To feel more < EmoState >' (Enhance), 'To feel better' (Improve), 'To raise/boost energy' (Raise), and 'To relax/calm down' (Relax). If one of these primary regulation goals was selected, the next screen asked participants to select the emotion regulation strategy they used in order to reach their emotional goal. If any other primary reason was selected, the next screen instead asked 'Was there also an emotional reason?', with the six emotion regulation goals presented as list options, along with 'There was no emotional reason' (recorded as secondary regulation goal).

2.1.3. Surveys

A set of psychological surveys was presented to participants within the app, which were available to complete at any time. A 'Basic details' survey collected demographic details such as age, gender, and nationality. Personality traits were assessed using a short version of the Big Five Inventory, which retains significant levels of reliability and validity when compared to the longer

versions (BFI-10; Rammstedt & John, 2007). Previous research has revealed various links between these personality traits and both how music is used (Chamorro-Premuzic & Furnham, 2007), and emotional reactions to everyday listening (Juslin et al., 2008). Psychological well-being and flourishing were assessed using the Flourishing Scale (FS; Diener et al., 2010), which measures self-perceived success in important life areas. Prior research has shown that psychological well-being, though measured with other scales, relates positively with musical affect regulation through reappraisal (Chin & Rickard, 2014), but negatively with musical rumination and avoidance (Saarikallio et al., 2015). Trait empathy was measured using the Interpersonal Reactivity Index (IRI; Davis, 1980); specifically, the subscales of 'Fantasy' and 'Empathic Concern', which have been shown to be related to the intensity of music-induced emotions (Vuoskoski & Eerola, 2012). Previous research has demonstrated that scales presented within MuPsych produce similar Cronbach alpha scores to those published from the standard questionnaires (Randall & Rickard, 2013). All music ESR items and surveys were presented in Finnish, then back-translated to English.

2.2. Procedure

Participants were instructed – either in-person or through recruitment material – to install the MuPsych app on their mobile phone, and launch the 'OmaMusa' study. All components of the study were presented to participants through the app, including the information statement and consent form, all music ESRs, and the set of psychological surveys. Following installation and consent, music ESRs were presented automatically when the participant next started playing music on their phone, in any music player app. Once a music ESR had been completed (including the questions at the start of listening and those after five minutes of listening), no new music ESRs were presented for a period of three hours, to avoid respondent fatigue. Surveys were available within the app, and could be completed at any time of convenience. Data collection continued for a period of one week, after which no more music ESRs were presented. The online survey group received information statements and consent at the beginning of the survey and responded only to the demographic and psychological surveys for comparative purposes.

2.3. Data analyses

In comparing the adolescent ESM group (Android users only) and the online survey group, no difference was found on any of the five BFI measures of personality (all

Table 1. Regulation goal frequencies for adolescents and adults.

Goal	Group	Primary	Secondary	Pri + Sec	Pre-Covid	Covid
Improve*	Adol.	5.8%	14.0%	19.8%	16.4%	23.7%
	Adults	3.1%	14.3%	17.5%	–	–
Relax	Adol.	7.6%	7.1%	14.7%	15.1%	13.0%
	Adults	7.4%	8.8%	16.2%	–	–
Raise	Adol.	0.7%	6.4%	7.1%	6.7%	7.8%
	Adults	2.3%	11.2%	13.5%	–	–
Diminish*	Adol.	1.2%	3.6%	4.8%	4.3%	4.3%
	Adults	0.5%	5.7%	6.2%	–	–
Enhance	Adol.	4.2%	6.1%	10.3%	9.1%	11.5%
	Adults	2.5%	8.9%	11.4%	–	–
Maintain*	Adol.	6.4%	7.0%	13.4%	11.1%	15.5%
	Adults	4.7%	9.4%	14.1%	–	–
Total*	Adol.	25.8%	44.3%	70.2%	62.7%	75.6%
	Adults	20.6%	58.3%	78.9%	–	–

Note: *Significant associations found between age group and goal type (primary/secondary).

$p > .400$), or the two IRI subscales. However, the survey group was significantly older ($M_{age} = 15.3$) than the ESM group ($M_{age} = 14.8$; $p = .003$), and scored higher on the Flourishing Scale (Survey $M_{FS} = 42.92$, ESM $M_{FS} = 40.27$; $p = .002$; an overall correlation between age and Flourishing was also observed, $p = .026$). A Chi-squared test of independence suggested that the survey group also had a greater proportion of females, as compared to the ESM group ($p = .001$). Two separate and complementary approaches were utilised to analyse the ESM data: aggregate frequencies and scores on the individual listener level, and multilevel models of listening experiences nested within listeners.

2.3.1. Aggregate analyses

On the listener level, aggregate scores were created for each individual participant, producing overall success scores for each of the regulation goals, along with means for additional measures such as changes in valence, arousal, and mood intensity. For these analyses, only participants with five or more music ESRs with a regulation goal were included ($N = 136$). This aggregate approach is recommended for ESM (Hektner et al., 2007), and has been utilised in previous ESM studies of music use (Juslin et al., 2008; Randall & Rickard, 2017b). Due to the differences in numbers and distributions, the two age groups remained separated for all listener-level analyses, with non-parametric tests performed to indicate inter-group differences.

Firstly, the frequency at which each of the regulation goals was selected for primary and secondary reasons was determined for each of the age groups (Table 1). Chi-squared tests of independence were performed to determine any association between age group and goal type (primary/secondary) for each of the regulation goals. In addition, as data collection for the adolescent group took place both before and during the national lockdown due

to the COVID-19 virus starting in March 2020, total frequencies were compared between these two periods. Secondly, aggregate scores were ascertained for initial states (valence, arousal, and intensity), music measures (valence and arousal), and experience measures (attention, familiarity, enjoyment), for both age groups and each of the regulation goals (primary and secondary combined; Table 2). All initial states, music and experience measures were standardised to provide a score between −1 and +1. Mann–Whitney U tests were performed to determine any difference between the two age groups on these measures. Thirdly, the success of each regulation goal was determined by performing Wilcoxon signed-rank tests on the initial and changed states for each success measure (Table 3). For the regulation goal of Improve, success was defined as an increase in valence over the listening experience. For Diminish and Enhance, success was defined by a decrease or increase in emotional state intensity, respectively. For Relax and Raise, success was defined by a decrease or increase in arousal, respectively. Failure for each of these five goals was defined as the success measure changing in the opposite direction. For Maintain, success was defined as no change in intensity, and failure as any decrease in intensity. Success frequencies were calculated, and Chi-squared tests of independence were used to determine associations between age group and success for each of the regulation goals. Fourthly, Kruskal Wallis H Tests were performed to determine if there was any difference in success across (the 10 most frequent) regulation strategies, listener emotional states (Table 4a), or concurrent activities (Table 4b). Finally, a supplementary analysis was performed on the listener level to determine if valence, arousal, and intensity significantly changed from their respective initial states (regardless of regulation goal). Mann–Whitney U tests were performed using absolute change scores, for both age groups (adolescent/adult),

and each of the goal types (primary/secondary/no goal; Appendix).

2.3.2. Multilevel analyses

The multilevel structural equation models (SEM) nested music listening experiences within individual listeners, and were implemented using Mplus statistical software (version 7.4: Muthén & Muthén, 2015). Separate models were created predicting success for each of the goals Improve, Relax, Raise, and Enhance (Diminish was removed due to insufficient data, and Maintain was removed due to a non-continuous success measure). An overall model was also created, combining the continuous success measures for Improve, Relax, Raise, Diminish, and Enhance. For each model, the continuous measure of success was the only outcome, with the experience level predictors: initial affective states, context (listeners, location, time, activity), music variables, regulation strategies and goals; and listener level predictors: age group (adolescent/adult), gender, flourishing, and subscales from the Interpersonal Reactivity Index and Big Five Index. All musical experiences with either primary or secondary regulation goals were included in the models, with the overall model consisting of 2,032 music listening experiences nested within 293 listeners. The models utilised maximum likelihood estimation with robust standard errors (MLR), with an accelerated expectation–maximisation (EMA) optimisation algorithm.

3. Results

3.1. Aggregate analyses

The frequencies of primary and secondary regulation goals are presented in Table 1. Results show that adolescents more frequently had a primary regulation goal when listening, while adults more frequently had

Table 2. Initial states, music and experience measures for each regulation goal.

Goal	Group	Initial state			Frequent states	Music measures		Experience measures		
		Valence	Arousal	Intensity		Valence	Arousal	Attention	Familiarity	Enjoyment
Improve	Adol.	.181*	.266	.419	Happy, Tired	.381	.560	.462	.614*	.711
	Adults	.010*	.141	.391	Tired, Calm	.233	.667	.379	.424*	.590
Relax	Adol.	.165	.158	.481	Tired, Happy	.275	.298*	.458	.662*	.746
	Adults	.016	.224	.419	Tired, Anxious	.219	.531*	.484	.302*	.635
Raise	Adol.	.167	.216	.392	Bored, Happy	.270	.564	.441	.652	.721
	Adults	.128	.344	.413	Tired, Hopeful	.142	.538	.420	.483	.490
Diminish	Adol.	−.206	−.006	.418	Bored, Tired	.309	.485	.382	.479	.600
	Adults	−.102	−.085	.322	Tired, Annoyed	.322	.565	.520	.316	.508
Enhance	Adol.	.356	.362	.625	Happy, Motivated	.490*	.517*	.580	.660*	.753
	Adults	.352	.552	.567	Happy, Motivated	.222*	.709*	.602	.510*	.670
Maintain	Adol.	.548*	.460	.641*	Happy, Motivated	.483*	.587	.487	.667*	.767
	Adults	.326*	.601	.528*	Happy, Excited	.191*	.656	.483	.483*	.625
No Goal	Adol.	.258	.185*	.503	Happy, Tired	.287	.379	.390	.559*	.629*
	Adults	.159	.360*	.466	Motivated, Happy	.151	.511	.340	.298*	.458*

Note: * Significant difference between groups at an adjusted *p*-value of .00625.

Table 3. Success measures and frequencies for adolescents and adults.

Goal	Group	Success measure Initial	Success measure Change	Wilcoxon W	Wilcoxon p	Primary goal Success	Primary goal Failure	Secondary goal Success	Secondary goal Failure
Improve	Adol.	.181	+.225	1513	< .001**	45.3%	6.4%	58.1%	12.2%
	Adults	.010	+.254	437	< .001**	75.5%	9.2%	55.2%	12.2%
Relax	Adol.	.158	-.137	1855	.005*	41.4%	29.2%	28.4%	17.2%
	Adults	.224	-.210	3002	< .001**	37.3%	31.8%	55.6%	11.3%
Raise	Adol.	.216	-.027	460	.487	^	^	17.9%	39.5%
	Adults	.344	-.087	890	.011*	22.5%	41.7%	20.6%	40.7%
Diminish	Adol.	.418	-.167	279	.008*	41.7%	16.7%	28.6%	15.9%
	Adults	.322	-.307	645	< .001**	^	^	62.9%	0.8%
Enhance	Adol.	.625	-.020	352	.764	15.9%	21.8%	18.5%	14.5%
	Adults	.567	+.007	245	.709	12.5%	17.6%	26.3%	14.9%
Maintain	Adol.	.641	+.037	375	.051	62.5%	18.5%	65.8%	7.7%
	Adults	.528	.000	159	.931	65.7%	22.5%	71.0%	9.8%
Overall	Adol.					47.1%	18.3%	37.8%	17.5%
	Adults					45.4%	27.9%	48.5%	14.6%

Note: *Significant at $p = .05$, ** Significant at adjusted $p = .0042$; ^ = Insufficient counts.

Table 4a. Mean success for the 10 most frequent discrete emotional states.

State	Mean Success (rank) Adol.	Mean Success (rank) Adults	Significant difference Adol.	Significant difference Adults	Most frequent Goals (Pri + Sec) Adol.	Most frequent Goals (Pri + Sec) Adults
Tired	1.206 (1)	0.987 (1)	5, 6*, 7*, 8, 9*, 10*	4*, 6*, 8, 9, 10	Improve, Relax	Improve, Relax
Annoyed	0.810 (2)	0.619 (3)	9, 10		Improve, Diminish	Diminish, Relax
Bored	0.625 (3)	0.250 (7)	9, 10		Diminish, Improve	Diminish, Raise
Calm	0.556 (4)	0.826 (2)	8, 9, 10*	4, 6, 8, 9, 10	Relax, Improve	Relax, Improve
Hopeful	0.350 (5)	0.172 (9)	1	1, 2	Improve, Relax	Improve, Raise
Happy	0.268 (6)	0.295 (4)	1*, 9, 10	1*, 2	Maintain, Enhance	Enhance, Maintain
Motivated	0.135 (7)	0.271 (6)	1*, 10	1*, 2	Enhance, Maintain	Enhance, Maintain
Anxious	0.000 (8)	−0.200 (10)	1, 4	1, 2	Relax, Diminish	Relax, Improve
Excited	−0.139 (9)	0.273 (5)	1*, 2, 3, 4, 6		Improve, Enhance	Maintain, Improve
Confident	−0.296 (10)	0.235 (8)	1*, 2, 3, 4*, 6, 7	1, 2	Maintain, Improve	Maintain, Improve

Note: *Significant at $p < .001$ (all others at $p < .05$).

Table 4b. Mean success for the 10 most frequent activities for adolescents.

Activity	Mean Success	Significant difference*	Most frequent Goals (Pri + Sec)
Focused music listening	1.026	6, 7, 8, 9, 10	Maintain, Relax
Housework	0.609	10	Improve, Maintain
Walking	0.607	10	Improve, Enhance
Creative arts/hobbies	0.476		Improve, Enhance
Working/studying	0.407	10	Improve, Maintain
Nothing/waiting	0.279	1	Improve, Relax
Thinking/problem-solving	0.152	1	Improve, Relax
In a car (road trip)	0.083	1	Improve, Relax
Web browsing	0.051	1	Improve, Relax
Gaming	−0.600	1, 2, 3, 5	Relax, Improve

*Note: all significant at $p < .05$.

a secondary regulation goal. This association was supported by Chi-squared testing performed on the related counts ($\chi^2 = 13.20$, $p < .001$). Additional Chi-squared tests revealed that adolescents more frequently used Improve ($\chi^2 = 3.96$, $p = .047$), Diminish ($\chi^2 = 3.99$, $p = .046$), and Maintain ($\chi^2 = 7.21$, $p = .007$) as a primary goal, when compared to adults. Table 1 also shows that adolescents had a regulation goal for 70.2% of all listening experiences, with no emotion-related goal for 29.8% of experiences (78.9%; 21.1% for adults). Also

shown in Table 1 are the pre-Covid and Covid total (primary + secondary) frequencies for adolescents. A significant association between goals and Covid timing was observed ($p < .001$), with increased use of Improve and regulation goals overall apparent for those listening during the pandemic.

The initial affect states, music variables, and experience variables related to each regulation goal are shown in Table 2. Mann–Whitney U tests revealed that adolescents were in a more positive initial state than adults when their regulation goal was Improved ($U = 10,163$, $p = .002$), and had both higher initial valence ($U = 4000$, $p < .001$) and mood intensity ($U = 4358$, $p = .002$) when their goal was Maintain. Adolescents also selected more positively valenced music than adults when their goal was Enhance ($U = 3160$, $p < .001$) or Maintain ($U = 4070$, $p < .001$), and lower arousal music than adults when their goal was Relax ($U = 10,277$, $p = .001$) or Enhance ($U = 5547$, $p = .003$). Furthermore, they listened to more familiar music than adults when their goal was Improve ($U = 8815$, $p < .001$), Relax ($U = 4685$, $p < .001$), Enhance ($U = 3300$, $p = .001$), or Maintain ($U = 4197$, $p < .001$). Table 2 also shows the two

most frequent initial emotional states for each (primary) regulation goal for both adolescents and adults. These initial emotional states are relatively similar between adolescents and adults, but only adults report initial anxiety when aiming to relax and initial tiredness when aiming to raise energy. For the goal Diminish, adolescents were more frequently bored or tired, while adults were tired or annoyed.

The changes in success measures and frequencies of success for each regulation goal are shown in Table 3. Wilcoxon signed-rank tests revealed a significant increase in valence for the goal Improve for both adolescents and adults, and significant changes for the goals Relax (decrease in arousal) and Diminish (decrease in emotional state intensity) for adults. Both age groups were successful for the goal Maintain, as there was no significant change in intensity for either group. Overall success frequency across all regulation goals was higher for adults (47.7% success; 18.5% failure) than for adolescents (42.2% success; 16.0% failure). Supporting these findings, chi-squared testing revealed that adults were more frequently successful in reaching their regulation goals (primary and secondary combined) for Relax ($\chi^2 = 6.76$, $p = .034$), Diminish ($\chi^2 = 9.09$, $p = .011$), and for regulation overall ($\chi^2 = 6.81$, $p = .033$). For adolescents, overall success was 40.4% pre-Covid (16.9% failure), and 44.5% during the Covid lockdown (14.4% failure).

Kruskal Wallis H Tests were performed to determine if there was any difference in success across the 10 most frequent regulation strategies, listener emotional states, or concurrent activities. No emotion regulation strategy was found to result in higher success, for either adolescents or adults. For both age groups, the emotional state 'Tired' was most successfully regulated, followed by 'Annoyed' and 'Bored' for adolescents, and 'Calm' and 'Annoyed' for adults (Table 4a). These four states, along with 'Anxious', each had a negative mean initial valence level for both groups (ordered from most negative for adolescents: 'Annoyed': $M = -.368$; 'Anxious': $M = -.333$; 'Tired': $M = -.207$; 'Bored': $M = -.126$; 'Calm': $M = -.028$). No concurrent activity resulted in higher success for adults, while for adolescents, 'Focussed music listening' resulted in significantly higher success, followed by 'Housework' and 'Walking' (Table 4b).

To determine if five minutes of music listening was able to cause changes in emotional states, Mann–Whitney U tests were performed on the absolute change scores for valence, arousal, and intensity. Across all emotional goal conditions (primary, secondary, and no emotional goal), the mean absolute change of each of these affective measures was significantly greater than zero ($p < .001$ for all; see Appendix A).

3.2. Multilevel analyses

Results of the multilevel structural equation models of success are presented in Table 5. Predictors with no significant effect on success for any regulation goal were removed from the table, including gender, and many of the individual activities, strategies, and trait subscales. Success for the goal Improve was predicted by high initial arousal and intensity, along with music familiarity and attention. For Relax, success was strongly predicted by a negative initial valence, with success lower in the evening (5–8pm), and higher while going to sleep. Success for Raise was positively predicted by adolescence, agreeability, initial valence, music arousal, and the activity 'Nothing/waiting'. In the overall model (combining Improve, Relax, Raise, Diminish, and Enhance), success was negatively predicted by initial valence and the goal Enhance, and positively predicted by initial arousal, initial intensity, and music arousal. Intraclass correlations (ICCs) were notably low for all models except for Raise, suggesting that success was predicted almost entirely on the experience level.

4. Discussion

The current study investigated the frequency and predictors of short-term success in reaching affective goals while listening to music on mobile phones. Generally, both adolescent and adult listeners had difficulty in reaching their stated regulation goals within the observed five minutes. While levels of valence, arousal and affective state intensity were changing – regardless of goal type – these changes were often not in the intended directions. In terms of predictors of success, the affective state of the listener at the moment they started listening to music emerged as a key variable. Specifically, more negative initial valence and specific low-valence states led to higher levels of success in reaching goals.

4.1. RQ1: regulation goals were successfully reached in less than half of cases

The first research question was: how successful are young people in reaching different affect regulation goals? Results revealed overall success rates to be low for both age groups, with listeners reaching their regulation goals in less than half of listening episodes in which they had one (42.2% for adolescents, 47.8% for adults). This was also the case for most individual goals when regulation was the primary reason for listening, with the only exceptions being Maintain ('To maintain a < EmoState > mood'), and for adult listeners –

Table 5. Multilevel models of success.

	Predictor	Improve β (S.E.)	Relax β (S.E.)	Raise β (S.E.)	Enhance β (S.E.)	Combined β (S.E.)
Initial state	Valence	–	−.641 (.055)**	.338 (.090)**	−.018 (.129)	−.515 (.052)**
	Arousal	.453 (.071)**	–	–	−.044 (.121)	.230 (.058)**
	Intensity	.154 (.037)**	.055 (.033)	.106 (.067)	–	.113 (.041)**
Listeners	Listening alone	−.082 (.038)*	−.033 (.050)	.002 (.038)	.020 (.075)	.006 (.037)
Location	Work/School	.023 (.049)	.007 (.024)	–	.206 (.080)*	−.015 (.037)
Time	Afternoon	.063 (.065)	−.109 (.054)*	−.064 (.083)	.153 (.214)	−.086 (.047)
	Evening	.054 (.061)	−.172 (.038)**	.037 (.078)	.178 (.131)	−.045 (.040)
Activity	Working/Studying	−.083 (.041)*	−.021 (.035)	.131 (.080)	−.033 (.084)	−.003 (.042)
	Nothing/waiting	.015 (.035)	.057 (.053)	.196 (.051)**	.017 (.049)	.019 (.044)
	Gaming	−.004 (.024)	.077 (.034)*	–	–	−.007 (.023)
	Going to sleep	–	.100 (.030)**	–	–	.076 (.033)*
Music	Valence	.032 (.039)	.032 (.039)	−.115 (.052)*	−.088 (.130)	−.015 (.033)
	Arousal	.023 (.050)	.005 (.048)	.277 (.085)**	.011 (.092)	.113 (.043)**
	Attention	.093 (.034)**	−.078 (.042)	.068 (.058)	.164 (.078)*	.053 (.036)
	Familiarity	.113 (.039)**	−.089 (.037)*	−.011 (.074)	−.007 (.133)	−.001 (.037)
Strategy	Focus on: Feelings	–	.054 (.034)	–	–	.080 (.031)*
Goal	Raise	–	–	–	–	−.100 (.042)*
	Enhance	–	–	–	–	−.145 (.031)**
Age	Adolescent	−.020 (.158)	.220 (.199)	.495 (.181)**	−.398 (.292)	.301 (.187)
FS	Flourishing	.460 (.206)*	−.009 (.218)	.035 (.197)	.241 (.326)	.126 (.267)
IRI	Empathic concern	−.579 (.243)*	.204 (.225)	.079 (.153)	.177 (.277)	−.075 (.230)
BFI	Agreeableness	.020 (.183)	−.017 (.194)	.405 (.144)**	−.496 (.383)	−.034 (.191)
Variance	Within variance	.220**	.151**	.170**	.676**	.688**
	Between variance	.516*	.849**	.561**	.010	.805**
	Intercept	−3.012	4.863	−6.414*	−.497	−2.298
	ICC	.084	.065	.169	.068	.056

β = standardised parameter estimate; S.E. = standard error; * significant at $p < .05$; ** significant at $p < .01$; ICC = Intraclass Correlation.

Improve ('To feel better'). The only goal for which adolescents significantly changed their state in the intended direction was Improve, while for the adult group this change was significant for Improve, Relax ('To relax/calm down'), and Diminish ('To feel less < EmoState >'; while both groups had success for Maintain). Taken together, these results indicate that when listening to music, people more frequently fail to meet their regulation goals in the short-term, rather than succeed. These low regulatory success rates may have implications in terms of mental health outcomes. Maladaptive emotion regulation is a central component in the development of many forms of psychopathology, including mood and personality disorders (E.g. Berking et al., 2012; Gross, 2002). Inability to reach explicitly declared regulation goals may be an indicator of regulatory deficits, particularly in cases in which affect measures move in the opposite direction to what the listener intended. These cases could have adverse consequences for mental health, particularly when a listener is unable to use music to make themselves feel better, or to reduce stress. As these regulation goals were specified by the listeners during the listening episode, failure to reach them – or having the opposite outcome to that intended – is of some concern.

There are alternate explanations for the observation of low regulation success rates. It is possible that five minutes is not sufficient time for these regulation goals to be fulfilled. This concern of insufficient time is countered by the finding that affective measures significantly changed from their initial states – across all goal types – suggesting that states did have enough time to change, but that this change was not always in the intended direction. Furthermore, as the mechanisms that induce emotions from music listening do so over a timeframe of a few seconds (Juslin & Västfjäll, 2008), and most experiments that induce emotions with music use excerpts of less than two minutes (median time of 90 s; Eerola & Vuoskoski, 2013), it is expected that five minutes is sufficient time to induce new emotional states. However, specific regulation processes such as the reduction of stress has been shown to occur over a longer timeframe (Linnemann et al., 2018), so the current results must be interpreted in terms of short-term success only.

A related possibility is that over time, listeners may reverse the direction of affective change, so what may be considered a failure in the short term could become a success over an extended listening session. Related to this, it is important to clarify that short-term hedonic success may not predict long-term benefits of music listening. For example, regulation strategies such as distraction may provide short-term relief from negative experiences, but may be maladaptive in the long-term, as they prevent deep processing of emotional stimuli (Sheppes & Gross, 2011). Conversely, strategies such as reappraisal may involve the painful confrontation of negative feelings, but may be beneficial over time, as they provide semantic meaning to emotional information (Sheppes & Gross, 2011).

For some regulation goals, the lack of successful outcomes could be partially due to a ceiling effect. This is particularly relevant for Raise ('To raise/boost energy') and Enhance ('To feel more < EmoState > '), for which respective levels of arousal and intensity were already high at the start of listening. This potential ceiling may also explain how 'Confident' and 'Excited' were the only emotional states that had mean negative success scores – indicating general failure – for adolescent listeners. For the goal Relax, low success rates may be related to an ambiguity in how adolescents define relaxation. While success in relaxation in this study was defined as a reduction of arousal, adolescents may actually conceptualise it as a sense of decreasing feelings of stress and tension while becoming energised: it has been reported that when adolescents are asked to listen to their own relaxation music they report 'energize' almost as commonly as 'calm down' as an outcome of their music listening (Saarikallio et al., 2017). Several current findings support this notion that success in relaxation is not as simple as decreasing arousal: 30% of experiences in which Relax was the primary goal resulted in an increase in arousal, 'Tired' was the most frequent state, and adults were more successful in relaxing when listening to music with significantly higher energy.

4.2. RQ2: success was predicted by negative initial affective states

The second research question was: what are the significant determinants of affect-regulatory success? Results from the combined multilevel model revealed the strongest predictor of success to be low initial valence, indicating that those who had a regulation goal when in a negative affective state had greater success in reaching that goal. This finding supports previous ESM research on reasons for listening (Randall & Rickard, 2017b), which concluded that personal music listening is utilised to fulfil specific emotional needs that are largely determined by initial mood. Initial affective states also played a central role in the multilevel models of individual goals, with initial arousal and initial intensity the strongest predictors of success for Improve. Furthermore, initial valence positively predicted success for Relax, and negatively predicted success for Raise. This finding suggests that arousal regulation is linked to initial valence – with those in a positive state more able to relax and less able to raise energy – and should be investigated further in future research. Low valence states also featured in the comparison of success across the most frequent emotional states, which revealed that 'Tired' was the most successfully regulated state for both age groups. This was followed by 'Annoyed' and 'Bored' for adolescents, and by 'Calm' and

'Annoyed' for adults. Each of these states were associated with a negative initial valence level. This result was also reflected in the goal frequencies during the Covid pandemic – a time of increased negative affect – which saw an increase in the use of Improve, and regulation goals overall. This is aligned with previous findings that people experiencing increased negative emotions during the pandemic used music more for solitary emotional regulation (Fink et al., 2021).

The main finding that listeners in negative initial states had more success in reaching their regulation goals carries several implications. It supports the notion that listeners use music specifically and deliberately for regulating their negative affective states, as has been found in previous ESM studies on mobile phones (Randall & Rickard, 2017b). It seems logical that musical affect regulation is at its most successful when the initial state is negative. An initially negative state is likely to present a concrete need to act upon that state, diminish it or change it for the better. In contrast, an initially positive state may not need a particular action; regulation (conscious or unconscious) is not necessary as the current state is already acceptable. Although success was only assessed for listening episodes in which a regulation goal was stated by the listener, reaching these goals may be of less importance when in an already positive state. This brings us back to the question of how music listening may relate to mental health and wellbeing, and presents an important perspective to our first research question and our observation of relatively low success rates. These findings may not be as alarming after all, when we consider the context of the experiences. These experiences represent mundane everyday situations that, for the majority of time, are not likely to consist of intense negative emotions. Thus, regulation attempts in these situations may generally be mild and non-critical for mental health. However, in cases when music episodes start with negative affect, music does seem to work as a regulatory aid in a desirable manner.

The one apparent exception to the finding that negative initial states were successfully regulated was the emotional state 'Anxious'. While all other negative states were successfully regulated by both groups, 'Anxious' was the only state with a mean negative success score for adults, and the least successfully regulated negative state for adolescents. This finding suggests that anxiety may be more difficult to self-regulate through music listening, when compared to other negative states. This appears to go against a meta-analysis of anxiety reduction through music listening, which found decreases in self-reported anxiety levels (Panteleeva et al., 2018), although research from the Covid pandemic found that high anxiety was related to having negative responses

to music (Carlson et al., 2021). While both the current and latter findings were based on a small number of cases, this is an interesting finding that warrants further investigation.

The multilevel models revealed that individual-level variables such as personality traits were not significant predictors of success, which was reflected in notably low intraclass correlations (ICCs). The only exception to this was observed for the regulation goal Raise, for which success was predicted by the adolescent age group, and higher levels of agreeableness. Previous experience sampling studies on everyday music listening have shown that ICCs are generally very low for emotional outcomes (∼ .05; Randall & Rickard, 2017a), and also low for the characteristics of selected music (∼ .15; Randall & Rickard, 2017a; Greb et al., 2019). This finding is in line with these previous studies, and suggests that success in emotion regulation through music listening is determined largely within the listening context, and has little to do with the traits of the listener. This calls into question previous research that has attempted to explain regulation outcomes through their association with trait measures (E.g. Garrido & Schubert, 2015), and suggests that surveys – with their retrospective recall and lack of contextual considerations – are limited in their assessment of everyday self-regulation with music.

4.3. Regulation may require more effort for adolescents

A finding of particular interest that emerged from the results is the association between age group and goal type. Adolescent listeners more frequently had a regulation goal as their primary reason for listening, and when this was the case, they had overall higher success rates – and lower failure rates – than adults. Conversely, adults more frequently had a secondary regulation goal, and were more successful in reaching these goals. The effect of this was apparent for the goals Relax and Diminish, for which only adults were able to successfully regulate their states, largely due to their higher secondary success frequencies. A possible interpretation is that as regulation abilities develop with age, regulation requires less active effort, and is able to occur passively, without being the specific focus of the listening experience. Support for this notion is found in the results for concurrent activities: regulation success for adults was unrelated to their activity, while adolescents had greater success during focused music listening. Following this, success was highest for housework and walking – activities that may not require active cognitive effort – while the only negative mean success score was recorded for gaming, which usually requires attention and effort. Increased efforts for

regulation may also be related to the finding that adolescents enjoyed music significantly more than adults when they were listening with no regulation goal. However, it would appear that this effect is not directly related to attention, with no significant differences between age groups in attention for any goal, and no major influence of attention seen in the multilevel models (only a weak effect in the Improve model). Therefore, regulation success for adolescents might not require attention to the music, but rather a lack of distraction from concurrent activities. This may involve a greater focus given to regulatory thoughts and cognitions, although this was not directly assessed in the current study, so requires further investigation.

4.4. Limitations and future research

There are several design and sampling issues that leave room for improvement in future studies. As previously discussed, some results or lack thereof could have been due to measurement of success over only five minutes. Future ESM studies can extend this time-frame, and include a third-time point, to investigate how affective states change beyond this short-term hedonic change. Another potential design concern is that all regulation goals were assessed at the end of this five-minute period, rather than at the start of listening. This design choice was made to minimise intrusiveness on the initial listening experience; however it may have introduced some potential retrospective recall biases. It is possible that listeners reported how they think their states changed, rather than how they intended them to change, which may have been particularly influential on secondary regulation goals. However, despite this potential for retroactive goal changing, the main finding that overall success rates were low suggests that the impacts were not substantial. A recent addition to MuPsych studies is a button interface presented at the start of listening, to quickly assess intention to change valence (with buttons for: 'Worse'/'Same'/'Better'), arousal ('Less energetic'/'Same'/'More energetic'), and intensity ('Less < EmoState > '/'Same'/'More < EmoState > '). In addition to the recall issue, this interface helps to address the previous finding that music listening is used to fulfil different functions simultaneously (an average of 3 per episode; Greasley & Lamont, 2011). Furthermore, the use of specific wording for arousal goals ('Less energetic'/'More energetic'), and coinciding intensity goals (E.g. 'Less Anxious') will allow for more direct measures of success, and avoid problematic definitions such as that for Relax as only a decrease in arousal. Future experience sampling research on regulatory success could also incorporate musical feature analysis, to determine the effects

of these more objective music variables on determining success.

Some potential sampling issues were also evident in this study, with the sample consisting entirely of Finnish Android users. While the differences between Android (ESM) and non-Android (survey) groups may have only been age- and gender-based, future studies should recruit a larger sample from a wider range of countries and demographic groups. A specific issue for this study is that while data collection occurred both prior to and during the COVID-19 pandemic for the adolescent group, all data from adults were collected during the pandemic period. Finally, while the analysis grouped listening experiences within listeners, it did not consider the longitudinal effects of these episodes. Gradual development – the cumulative effects of several subsequent listening episodes – should be taken into account, as these may indicate particularly unhealthy listening patterns (Miranda et al., 2012).

4.5. Conclusions

This study investigated the frequency and predictors of success in reaching regulatory goals during music listening. It found that while adults were more successful in reducing unwanted states, listeners were able to reach their affect regulation goals in less than half of listening episodes in which they declared one. An association between age group and goal type was observed, suggesting that regulation with music may become more passive as skills develop. The finding that listeners may not be selecting music to reach their affective goals provides support for the use of hyper-personalised curation algorithms, that take into account initial affective state, and specific goals. Success was strongly predicted by negatively-valenced emotional states at the start of listening, and was higher for those experiencing negative initial emotional states, with the notable exception of those in an anxious state. Listener level variables had very little effect on success, meaning that success is largely determined within contexts, and not pre-determined by listener traits. These findings indicate that when listeners are in a negative mood, music listening can become a powerful self-regulation resource to reach their affective goals.

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References

Baker, F., & Bor, W. (2008). Can music preference indicate mental health status in young people? Australasian Psychiatry, *16*(4), 284–288. https://doi.org/10.1080/103985607018 79589

Baltazar, M. (2019). Musical affect regulation in adolescents: A conceptual model. In K. S. McFerran, P. Derrington, & S. Saarikallio (Eds.), *Handbook of music, adolescents, and wellbeing* (pp. 65–74). Oxford University Press. https://doi.org/10.1093/oso/ 9780198808992.003.0006

Baltazar, M., & Saarikallio, S. (2016). Toward a better understanding and conceptualization of affect self-regulation through music: A critical, integrative literature review. *Psychology of Music*, *44*(6), 1500–1521. https://doi.org/10.1177/ 0305735616663313

Baltazar, M., & Saarikallio, S. (2019). Strategies and mechanisms in musical affect self-regulation: A new model. *Musicae Scientiae*, *23*(2), 177–195. https://doi.org/10.1177/10298 64917715061

Barrett, L. F., Mesquita, B., Ochsner, K. N., & Gross, J. J. (2007). The experience of emotion. *Annual Review of Psychology*, *58*(1), 373–403. https://doi.org/10.1146/annurev.psych.58. 110405.085709

Berking, M., Poppe, C., Luhmann, M., Wupperman, P., Jaggi, V., & Seifritz, E. (2012). Is the association between various emotion-regulation skills and mental health mediated by the ability to modify emotions? Results from two cross-sectional studies. *Journal of Behavior Therapy and Experimental Psychiatry*, *43*(3), 931–937. https://doi.org/10.1016/j.jbtep.2011. 09.009

Bishop, D. T., Karageorghis, C. I., & Loizou, G. (2007). A grounded theory of young tennis players' use of music to manipulate emotional state. *Journal of Sport and Exercise Psychology*, *29*(5), 584–607. https://doi.org/10.1123/jsep.29. 5.584

Bogt, T. F. M. t., Canale, N., Lenzi, M., Vieno, A., & van den Eijnden, R. (2021). Sad music depresses sad adolescents: A listener's profile. *Psychology of Music*, *49*, 257–272. https://doi.org/10.1177/0305735619849622

Bogt, T. F. M. t., Vieno, A., Doornwaard, S. M., Pastore, M., & van den Eijnden, R. J. J. M. (2017). "You're not alone": music as a source of consolation among adolescents and young adults. *Psychology of Music*, *45*(2), 155–171. https://doi.org/10.1177/0305735616650029

Bonneville-Roussy, A., Rentfrow, P. J., Xu, M. K., & Potter, J. (2013). Music through the ages: Trends in musical engagement and preferences from adolescence through middle adulthood. *Journal of Personality and Social Psychology*, *105*(4), 703–717. https://doi.org/10.1037/a0033770

Campos, J. J., Campos, R. G., & Barrett, K. C. (1989). Emergent themes in the study of emotional development and emotion regulation. *Developmental Psychology*, *25*(3), 394–402. https://doi.org/10.1037/0012-1649.25.3.394

Carlson, E., Wilson, J., Baltazar, M., Duman, D., Peltola, H. R., Toiviainen, P., & Saarikallio, S. (2021). The role of music in

everyday life during the first wave of the coronavirus pandemic: A mixed-methods exploratory study. *Frontiers in Psychology*, *12*, 1469. Article number: 647756. https://doi.org/10.3389/fpsyg.2021.647756

Chamorro-Premuzic, T., & Furnham, A. (2007). Personality and music: Can traits explain how people use music in everyday life? *British Journal of Psychology*, *98*(2), 175–185. https://doi.org/10.1348/000712606X111177

Chervonsky, E., & Hunt, C. (2019). Emotion regulation, mental health, and social wellbeing in a young adolescent sample: A concurrent and longitudinal investigation. *Emotion*, *19*(2), 270–282. https://doi.org/10.1037/emo0000432

Chin, T., & Rickard, N. S. (2014). Emotion regulation strategy mediates both positive and negative relationships between music uses and well-being. *Psychology of Music*, *42*(5), 692–713. https://doi.org/10.1177/0305735613489916

Cole, P. M., Michel, M. K., & Teti, L. O. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development*, *59*(2–3), 73–102. https://doi.org/10.1111/j.1540-5834.1994.tb01278.x

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology*, *56*(5), 815. https://doi.org/10.1037/0022-3514.56.5.815

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, *10*, 85.

DeFrance, K., & Hollenstein, T. (2022). Emotion regulation strategy use and success during adolescence: Assessing the role of context. *Journal of Research on Adolescence*, *32*(2), 720–736. https://doi.org/10.1111/jora.12672

Denora, T. (2000). Music as a technology of the self. In *Music in everyday life* (pp. 31–56). Cambridge University Press.

Diamond, L. M., & Aspinwall, L. G. (2003). Integrating diverse developmental perspectives on emotion regulation. *Motivation and Emotion*, *27*(1), 1–6. https://doi.org/10.1023/A:1023670208060

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D.-w., Oishi, S., & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research*, *97*(2), 143–156. https://doi.org/10.1007/s11205-009-9493-y

Eerola, T., Vuoskoski, J., Peltola, H. R., Putkinen, V., & Schäfer, K. (2018). Towards a more explicit account of the transformation. *Physics of Life Reviews*, *25*, 100–121. https://doi.org/10.1016/j.plrev.2018.06.013

Eerola, T., & Vuoskoski, J. K. (2013). A review of music and emotion studies: Approaches, emotion models, and stimuli. *Music Perception*, *30*(3), 307–340. https://doi.org/10.1525/mp.2012.30.3.307

Eisenberg, N., Fabes, R. A., Guthrie, I. K., & Reiser, M. (2000). Dispositional emotionality and regulation: Their role in predicting quality of social functioning. *Journal of Personality and Social Psychology*, *78*(1), 136–157. https://doi.org/10.1037/0022-3514.78.1.136

Elvers, P., Fischinger, T., & Steffens, J. (2018). Music listening as self-enhancement: Effects of empowering music on momentary explicit and implicit self-esteem. *Psychology of Music*, *46*(3), 307–325. https://doi.org/10.1177/0305735617707354

Fink, L. K., Warrenburg, L. A., Howlin, C., Randall, W. M., Hansen, N. C., & Wald-Fuhrmann, M. (2021). Emotional

conflict and trauma: The recovery of stolen memory using a mixed-methods approach. *Humanities and Social Sciences Communications*, *8*(1), 1–11. https://doi.org/10.1057/s41599-020-00684-8

Fox, N. A., & Calkins, S. D. (2003). The development of self-control of emotion: Intrinsic and extrinsic influences. *Motivation and Emotion*, *27*(1), 7–26. https://doi.org/10.1023/A:1023622324898

Fuhrmann, D., Knoll, L. J., & Blakemore, S.-J. (2015). Adolescence as a sensitive period of brain development. *Trends in Cognitive Sciences*, *19*(10), 558–566. https://doi.org/10.1016/j.tics.2015.07.008

Garrido, S., & Schubert, E. (2013). Adaptive and maladaptive attraction to negative emotions in music. *Musicae Scientiae*, *17*(2), 147–166. https://doi.org/10.1177/1029864913478305

Garrido, S., & Schubert, E. (2015). Music and people with tendencies to depression. *Music Perception*, *32*(4), 313–321. https://doi.org/10.1525/mp.2015.32.4.313

Goethem, A. v., & Sloboda, J. A. (2011). The functions of music for affect regulation. *Musicae Scientiae*, *15*(2), 208–228. https://doi.org/10.1177/1029864911401174

Greasley, A. E., & Lamont, A. (2011). Exploring engagement with music in everyday life using experience sampling methodology. *Musicae Scientiae*, *15*(1), 45–71. https://doi.org/10.1177/1029864910393417

Greb, F., Steffens, J., & Schlotz, W. (2019). Modeling music-selection behavior in everyday life: A multilevel statistical learning approach and mediation analysis of experience sampling data. *Frontiers in Psychology*, *10*, 390. https://doi.org/10.3389/fpsyg.2019.00390

Gross, J. J. (1999). Emotion regulation: Past, present, future. *Cognition & Emotion*, *13*(5), 551–573. https://doi.org/10.1080/026999399379186

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281–291. Article number: 390. https://doi.org/10.1017/S0048577201393198

Hanser, W. E., ter Bogt, T. F. M., Van den Tol, A. J. M., Mark, R. E., & Vingerhoets, A. J. J. M. (2016). Consolation through music: A survey study. *Musicae Scientiae*, *20*(1), 122–137. https://doi.org/10.1177/1029864915620264

Hatzenbuehler, M. L., McLaughlin, K. A., & Nolen-Hoeksema, S. (2008). Emotion regulation and internalizing symptoms in a longitudinal study of sexual minority and heterosexual adolescents. *Journal of Child Psychology and Psychiatry*, *49*(12), 1270–1278. https://doi.org/10.1111/j.1469-7610.2008.01924.x

Hektner, J. M., Schmidt, J. A., & Csikszentmihalyi, M. (2007). *Experience sampling method: Measuring the quality of everyday life*. Sage Publications.

Hiekkaranta, A. P., Kirtley, O. J., Lafit, G., Decoster, J., Derom, C., de Hert, M., Gülöksüz, S., Jacobs, N., Menne-Lothmann, C., Rutten, B. P. F., Thiery, E., van Os, J., van Winkel, R., Wichers, M., & Myin-Germeys, I. (2021). Emotion regulation in response to daily negative and positive events in youth: The role of event intensity and psychopathology. *Behaviour Research and Therapy*, *144*. Article number: 103916. https://doi.org/10.1016/j.brat.2021.103916

Juslin, P. N., Liljeström, S., Västfjäll, D., Barradas, G., & Silva, A. (2008). An experience sampling study of emotional reactions to music: Listener, music, and situation. *Emotion*, *8*(5), 668. https://doi.org/10.1037/a0013505

Juslin, P. N., & Sloboda, J. A. (2010). Introduction: Aims, organization, and terminology. In P. N. Juslin & J. A. Sloboda (Eds.), *Handbook of music and emotion: Theory, research, applications* (pp. 3–12). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199230143.001.0001

Juslin, P. N., & Västfjäll, D. (2008). Emotional responses to music: The need to consider underlying mechanisms. *Behavioral and Brain Sciences*, *31*(5), 559–575. https://doi.org/10.1017/S0140525X08005293

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition & Emotion*, *23*(1), 4–41. https://doi.org/10.1080/02699930802619031

Koole, S. L., & Aldao, A.. (2016). The self-regulation of emotion: Theoretical and empirical advances. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of Self-Regulation* (3rd ed., pp. 101–112). Guilford.

Kovacs, M., Lopez-Duran, N., Mayer, L., George, C., Baji, I., Kiss, E., Vetro, A., & Kapornai, K. (2019). The development of mood repair response repertoires: I. Age-related changes among 7- to 14-year-old depressed and control children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, *48*(1), 143–152. https://doi.org/10.1080/15374416.2017.1399399

Krueger, J. (2018). Music as affective scaffolding. In D. Clarke, R. Herbert, & E. Clarke (Eds.), *Music and consciousness II: Worlds, practices, modalities* (pp. 55). Oxford University Press. https://doi.org/10.1093/oso/9780198804352.003.0004

Lacourse, E., Claes, M., & Villeneuve, M. (2001). Heavy metal music and adolescent suicidal risk. *Journal of Youth and Adolescence*, *30*(3), 321–332. https://doi.org/10.1023/A:1010492128537

Laiho, S. (2004). The psychological functions of music in adolescence. *Nordic Journal of Music Therapy*, *13*(1), 47–63. https://doi.org/10.1080/08098130409478097

Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development*, *73*(4), 1151–1165. https://doi.org/10.1111/1467-8624.00464

Lennarz, H. K., Hollenstein, T., Lichtwarck-Aschoff, A., Kuntsche, E., & Granic, I. (2019). Emotion regulation in action: Use, selection, and success of emotion regulation in adolescents' daily lives. *International Journal of Behavioral Development*, *43*(1), 1–11. https://doi.org/10.1177/0165025418755540

Linnemann, A., Wenzel, M., Grammes, J., Kubiak, T., & Nater, U. M. (2018). Music listening and stress in daily life—a matter of timing. *International Journal of Behavioral Medicine*, *25*(2), 223–230. https://doi.org/10.1007/s12529-017-9697-5

Marik, M., & Stegemann, T. (2016). Introducing a new model of emotion dysregulation with implications for everyday use of music and music therapy. *Musicae Scientiae*, *20*(1), 53–67. https://doi.org/10.1177/1029864915622055

Martin, G., Clarke, M., & Pearce, C. (1993). Adolescent suicide: Music preference as an indicator of vulnerability. *Journal of the American Academy of Child & Adolescent Psychiatry*, *32*(3), 530–535. https://doi.org/10.1097/00004583-199305000-00007

McFerran, K. S., Garrido, S., O'Grady, L., Grocke, D., & Sawyer, S. M. (2015). Examining the relationship between self-reported mood management and music preferences of Australian teenagers. *Nordic Journal of Music Therapy*, *24*(3), 187–203. https://doi.org/10.1080/08098131.2014.908942

McFerran, K. S., Hense, C., Koike, A., & Rickwood, D. (2018). Intentional music use to reduce psychological distress in adolescents accessing primary mental health care. *Clinical Child Psychology and Psychiatry*, *23*(4), 567–581. https://doi.org/10.1177/1359104518767231

McFerran, K. S., & Saarikallio, S. (2014). Depending on music to feel better: Being conscious of responsibility when appropriating the power of music. *The Arts in Psychotherapy*, *41*, 89–97. https://doi.org/10.1016/j.aip.2013.11.007

Miranda, D. (2013). The role of music in adolescent development: Much more than the same old song. *International Journal of Adolescence and Youth*, *18*(1), 5–22. https://doi.org/10.1080/02673843.2011.650182

Miranda, D. (2019). A review of research on music and coping in adolescence. *Psychomusicology: Music, Mind, and Brain*, *29*(1), 1–9. https://doi.org/10.1037/pmu0000229

Miranda, D., & Claes, M. (2004). Rap music genres and deviant behaviors in French-Canadian adolescents. *Journal of Youth and Adolescence*, *33*(2), 113–122. https://doi.org/10.1023/B:JOYO.0000013423.34021.45

Miranda, D., Gaudreau, P., Debrosse, R., Morizot, J., & Kirmayer, L. J. (2012). Music listening and mental health: Variations on internalizing psychopathology. In R. MacDonald, G. Kreutz, & L. Mitchell (Eds.), *Music, health, and wellbeing* (pp. 514–530). New York: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199586974.003.0034

Mulder, J., Ter Bogt, T. F. M., Raaijmakers, Q. A. W., Nic Gabhainn, S., Monshouwer, K., & Vollebergh, W. A. M. (2010). Is it the music? Peer substance use as a mediator of the link between music preferences and adolescent substance use. Journal of Adolescence, *33*(3), 387–394. https://doi.org/10.1016/j.adolescence.2009.09.001

Muthén, L. K., & Muthén, B. O. (2015). *Mplus user's guide* (7th ed.). Muthén & Muthén.

North, A. C., Hargreaves, D. J., & O'Neill, S. A. (2000). The importance of music to adolescents. *British Journal of Educational Psychology*, *70*(2), 255–272. https://doi.org/10.1348/000709900158083

Panteleeva, Y., Ceschi, G., Glowinski, D., Courvoisier, D. S., & Grandjean, D. (2018). Music for anxiety? Meta-analysis of anxiety reduction in non-clinical samples. *Psychology of Music*, *46*(4), 473–487. https://doi.org/10.1177/0305735617712424

Papinczak, Z. E., Dingle, G. A., Stoyanov, S. R., Hides, L., & Zelenko, O. (2015). Young people's uses of music for well-being. *Journal of Youth Studies*, *18*(9), 1119–1134. https://doi.org/10.1080/13676261.2015.1020935

Pelletier, C. L. (2004). The effect of music on decreasing arousal due to stress: A meta-analysis. *Journal of Music Therapy*, *41*(3), 192–214. https://doi.org/10.1093/jmt/41.3.192

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big five inventory in English and German. *Journal of Research in Personality*, *41*(1), 203–212. https://doi.org/10.1016/j.jrp.2006.02.001

Randall, W. M., & Rickard, N. S. (2013). Development and trial of a mobile experience sampling method (m-ESM) for personal music listening. *Music Perception*, *31*(2), 157–170. https://doi.org/10.1525/mp.2013.31.2.157

Randall, W. M., & Rickard, N. S. (2017a). Personal music listening. Music Perception, *34*(5), 501–514. https://doi.org/10.1525/mp.2017.34.5.501

Randall, W. M., & Rickard, N. S. (2017b). Reasons for personal music listening: A mobile experience sampling study of emotional outcomes. *Psychology of Music*, *45*(4), 479–495. https://doi.org/10.1177/0305735616666939

Randall, W. M., Rickard, N. S., & Vella-Brodrick, D. A. (2014). Emotional outcomes of regulation strategies used during personal music listening: A mobile experience sampling study. *Musicae Scientiae*, *18*(3), 275–291. https://doi.org/10.1177/1029864914536430

Reybrouck, M., Podlipniak, P., & Welch, D. (2020). Music listening as coping behavior: From reactive response to sensemaking. *Behavioral Sciences*, *10*(7), 119. https://doi.org/10.3390/bs10070119

Rubin, K. H., Cheah, C. S. L., & Fox, N. (2001). Emotion regulation, parenting and display of social reticence in preschoolers. *Early Education & Development*, *12*(1), 97–115. https://doi.org/10.1207/s15566935eed1201_6

Russell, J. A. (1980). A circumplex model of affect. Journal of Personality and Social Psychology, *39*(6), 1161–1178. https://doi.org/10.1037/h0077714

Russell, J. A. (2003). Core affect and the psychological construction of emotion. Psychological Review, *110*(1), 145–172. https://doi.org/10.1037/0033-295X.110.1.145

Saarikallio, S. (2011). Music as emotional self-regulation throughout adulthood. *Psychology of Music*, *39*(3), 307–327. https://doi.org/10.1177/0305735610374894

Saarikallio, S. (2017). Musical identity in fostering emotional health. In R. MacDonald, D. J. Hargreaves, & D. Miell (Eds.), *Handbook of musical identities* (pp. 602–623). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199679485.003.003

Saarikallio, S. (2019). Access-awareness-agency (AAA) model of music-based social-emotional competence (MuSEC). *Music & Science*, *2*, 205920431881542–16. https://doi.org/10.1177/2059204318815421

Saarikallio, S., & Baltazar, M. (2018). Music as a forum for social-emotional health. In L. O. Bonde & T. Theorell (Eds.), *Music and public health: A Nordic perspective* (pp. 101–113). Springer International Publishing. https://doi.org/10.1007/978-3-319-76240-1

Saarikallio, S., Baltazar, M., & Västfjäll, D. (2017). Adolescents' musical relaxation: Understanding related affective processing. *Nordic Journal of Music Therapy*, *26*(4), 376–389. https://doi.org/10.1080/08098131.2016.1276097

Saarikallio, S., & Erkkilä, J. (2007). The role of music in adolescents' mood regulation. Psychology of Music, *35*(1), 88–109. https://doi.org/10.1177/0305735607068889

Saarikallio, S., Gold, C., & McFerran, K. (2015). Development and validation of the healthy-unhealthy music scale. *Child and Adolescent Mental Health*, *20*(4), 210–217. https://doi.org/10.1111/camh.12109

Schubert, E., Halpern, A. R., Kreutz, G., & Garrido, S. (2018). Attraction to sad music: The role of imagery, absorption, and rumination. Psychology of Aesthetics, Creativity, and the Arts, *12*(3), 251–258. https://doi.org/10.1037/aca0000160

Schwartz, K. D., & Fouts, G. T. (2003). Music preferences, personality style, and developmental issues of adolescents. Journal of Youth and Adolescence, *32*(3), 205–213. https://doi.org/10.1023/A:1022547520656

Sheppes, G., & Gross, J. J. (2011). Is timing everything? Temporal considerations in emotion regulation. Personality and Social Psychology Review, *15*(4), 319–331. https://doi.org/10.1177/1088868310395778

Silk, J. S., Steinberg, L., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. Child Development, *74*(6), 1869–1880. https://doi.org/10.1046/j.1467-8624.2003.00643.x

Stewart, J., Garrido, S., Hense, C., & McFerran, K. S. (2019). Music use for mood regulation: Self-awareness and conscious listening choices in young people with tendencies to depression. Frontiers in Psychology, *10*(May), 1–12. https://doi.org/10.3389/fpsyg.2019.01199

Tamir, M. (2009). What Do people want to feel and Why? *Current Directions in Psychological Science*, *18*(2), 101–105. https://doi.org/10.1111/j.1467-8721.2009.01617.x

Terry, P. C., Karageorghis, C. I., Curran, M. L., Martin, O. V., & Parsons-Smith, R. L. (2020). Effects of music in exercise and sport: A meta-analytic review. *Psychological Bulletin*, *146*(2), 91. https://doi.org/10.1037/bul0000216

Thoma, M. V., Ryf, S., Mohiyeddini, C., Ehlert, U., & Nater, U. M. (2012). Emotion regulation through listening to music in everyday situations. *Cognition & Emotion*, *26*(3), 550–560. https://doi.org/10.1080/02699931.2011.595390

Tol, A. J. M van den. (2016). The appeal of sad music: A brief overview of current directions in research on motivations for listening to sad music. The Arts in Psychotherapy, *49*, 44–49. https://doi.org/10.1016/j.aip.2016.05.008

Vuoskoski, J. K., & Eerola, T. (2011). Measuring music-induced emotion. *Musicae Scientiae*, *15*(2), 159–173. https://doi.org/10.1177/1029864911403367

Vuoskoski, J. K., & Eerola, T. (2012). Empathy contributes to the intensity of music-induced emotions. In *Proceedings of the 12th international conference on music perception and cognition (ICMPC)* (pp. 1112–1113). University of Thessaloniki.

Appendix

Mean absolute changes from initial states for all measures and goal types

Change Measure	Emotional Goal	Group	*M*	*SD*	Mann-Whitney U *U*	*p*
Valence	Primary	Adol.	.324	.296	990	< .001
		Adults	.422	.318	741	< .001
	Secondary	Adol.	.355	.233	1891	< .001
		Adults	.355	.197	1176	< .001
	None	Adol.	.287	.269	1176	< .001
		Adults	.362	.274	465	< .001
	All	Adol.	.321	.199	2485	< .001
		Adults	.362	.160	1275	< .001
Arousal	Primary	Adol.	.297	.226	1081	< .001
		Adults	.323	.256	630	< .001
	Secondary	Adol.	.267	.216	1711	< .001
		Adults	.281	.147	1128	< .001
	None	Adol.	.225	.244	780	< .001
		Adults	.298	.221	465	< .001
	All	Adol.	.288	.181	2556	< .001
		Adults	.291	.115	1275	< .001
Intensity	Primary	Adol.	.207	.230	861	< .001
		Adults	.244	.260	465	< .001
	Secondary	Adol.	.197	.211	1431	< .001
		Adults	.197	.137	990	< .001
	None	Adol.	.178	.158	1035	< .001
		Adults	.174	.166	276	< .001
	All	Adol.	.187	.116	2346	< .001
		Adults	.189	.104	1176	< .001