The Dark and Bright Sides of Being Alone: Moderators and Covariates of General Loneliness

Abstract

Background. Solitude is often associated with loneliness and hence is typically seen as a negative state. Research has begun to consider the positive potential of being alone. Framing this potential as a kind of *prism model* in light of existential and self-determination theory perspectives, the present research tests predictions implied by the structure of a recent scale, the Differential Test of Aloneness: that the impact of loneliness on well-being and affect should be moderated by attitudes toward solitude, after controlling for solitude motivation.

Methods. Two online, self-report studies with U.S. samples ($N = 408$ and $N = 266$, respectively), using regression analysis tested the association of loneliness with outcomes (well-being, affect), moderated by attitude toward solitude, controlling for dispositional and situational motivation. In Study 1 participants anticipated an imagined solitude experience; in Study 2 participants recalled an actual solitude experience they recently had.

Results. The impact of loneliness was moderated by Solitude Intolerance both with respect to general well-being and to positive affect after solitude. The direction of the effect however was opposite to that predicted. Solitude Appreciation moderated the impact of loneliness on well-being (in one study only) but not on affect.

Conclusions. Paradoxically, Solitude Intolerance buffered people from the negative impact of loneliness. Although not the focus, motivational variables accounted for variance in outcomes throughout. Future research as well as practical application should explore the utility of positive solitude interventions that target attitudes and motivation rather than loneliness reduction techniques *per se*.

Keywords: loneliness, solitude, self-determination theory, motivation, affect, well-being

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1. Introduction

The state of being alone is typically viewed as undesirable or even unhealthy. Most people strive to be around others at least some of the time, engage readily in activities with family and friends, spend considerable amounts of time on social media (and may feel pride at the number of 'friends' they have), and may even experience discomfort during times when they find themselves alone. Yet, in recent decades scholars in psychology and other disciplines started paying attention to the multifaceted nature of the phenomenon of being alone, which can produce not only suffering but also psychological benefits. "Solitude can be differentially characterized along the full range of a continuum from a form of punishment (e.g., time-outs for children, solitary confinement for prisoners) to a less than ideal context (e.g., no man is an island, one is the loneliest number, misery loves company), all the way to a desirable state (e,g,, taking time for oneself, needing your space or alone time)" (Coplan & Bowker,2014, p.3). Indeed, most of us can probably recall an occasion when the thought of having some 'quiet time,' alone and with no external pressures or demands, seemed like the proverbial oasis in the desert. The global pandemic which began in 2020 has compelled people around the world to come to grips with social distancing, isolation, and quarantine, thus increasing the urgency of better understanding the implications for well-being of being alone. This gradual acknowledgement that being alone might have beneficial effects has not, however, resulted in theoretical or methodological innovations that would integrate both the bright and dark sides of this phenomenon into a unified explanatory model.

In the present study we adopted a conceptualization of being alone as multidimensional (Leontiev, 2019), including the potential for both positive and negative aspects, a conceptualization which has been operationalized in the Differential Test of Aloneness (DTA; Osin & Leontiev, 2013, 2016). Building on this two-fold operationalization, in line with recent

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theoretical and empirical work exploring the role of motivation, we tested whether the impact of loneliness on outcomes like well-being and affect might be moderated by one's positive or negative attitudes toward being alone, after controlling for motivation. The following sections briefly describe the literature which provides the basis for the study's predictions, to be described more fully below.

1.1. The construct of being alone: Loneliness and solitude

Both *loneliness* and *solitude* have been used to capture some aspect of the experience of being alone. Although the two concepts are sometimes conflated, generally speaking *solitude* refers to the psychological condition of being alone (Larson, 1990; Long, Seburn, Averill, & More, 2003). Typically, there are no other people in physical proximity to the solitary person (Coplan et al., 2021; Weinstein et al., 2023). One's attitude and motivation with respect to solitude seem to be important (Rodriguez et al., 2023). Maslow (1970) provided a humanistic basis suggesting that a positive attitude toward being alone was characteristic of the self-actualizing person, and Winnicott similarly considered the capacity to be alone (understood as tolerance or even appreciation of solitude) to be a key aspect of emotional maturity (see Storr, 2005, pp. 18-20; Weinstein et al., 2023). Solitude may be externally imposed, deliberately chosen or, at least, consciously accepted; hence, its emotional tone can conceivably range from negative to neutral and even to positive. This suggests the important role of attitude, motivation, and affect, to which we will return. Here, however, we suggest that attitude, motivation, and affect are orthogonal dimensions with respect to the experience of being alone.

Loneliness, on the other hand, implies that the perception of being alone is accompanied by a particular, and, generally speaking, *unpleasant*, emotional tone, such as sadness or wistfulness. Loneliness may occur in the absence of other people, or in the presence of other people (Averill & Sundararajan, 2014; Coplan & Bowker, 2014). It is the feeling that

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accompanies the awareness that social contact with others is desired, but not available (Coplan et al., 2019; Peplau & Perlman, 1982). Thus, it is clear that the construct of *loneliness* is already affectively and motivationally valenced: it would be difficult to imagine a person for whom loneliness is either a pleasant or consciously chosen experience.

However, as Leontiev (2019) has argued, that which is unpleasant may still be positive: from the existential perspective, loneliness provides the person an opportunity for dialogue with the self which, if embraced, can lead to growth (Moustakas, 1972). Psychodynamic theory suggests that loneliness can conduce toward personality development (Jung, 1954), and indeed perhaps it is the emotional discomfort associated with loneliness that might prompt a person to engage in meaningful, personal reflection. It could potentially move a person to think about their relationships in particular, and their attitudes toward being with others versus being alone more generally. For some, entering reflectively into the experience of loneliness might facilitate choice: perhaps to seek relationships, perhaps to accept solitude. Thus, even loneliness can serve the beneficial purpose of a spur toward personal growth. Hence, a question we wish to explore is not only whether solitude – the mere fact of being alone – can be positive, but whether even loneliness can be positive or, at least, less negative, and under what conditions. We are, in other words, interested in disentangling the 'paradox of solitude' (e.g., Coplan et al., 2019; Galanaki, 2015; Larson, 1999; Merton, 1958).

We consider the experience of being alone to be dimensional, best conceptualized as including the possibility for both positive and negative aspects, following recent work by Osin and Leontiev (2013, 2016), who developed the Differential Test of Aloneness (DTA) to measure these dimensions, with initial validation of the scale done on Russian samples.

Although a complete review is beyond the scope of the current paper, we note that culture is an important consideration. Specifically, it is likely that the experience and implications of

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both solitude and loneliness are relevant across cultures, but that there will be important differences. For example, it might be expected that people from individualistic cultures might value solitude more than those from collectivist cultures (Triandis & Gelfand, 1998). Hence, the focus of the present research on samples from the United States, traditionally considered to be an exemplar of the individualistic nation, but with demonstrable regional variation (Vandello & Cohen, 1999), should provide an important initial test of the scale's functioning in a culture that differs from the initial validation studies. We emphasize however that the present study is not a cross-cultural test of the DTA.

1.2. The Differential Test of Aloneness

The Differential Test of Aloneness (DTA; Online Resource 1), developed on a variety of samples (Salikhova, et al., 2006; Osin & Leontiev, 2013, 2016), includes three dimensions: *General Loneliness*, *Solitude Intolerance*, and *Solitude Appreciation*. The first, *General Loneliness*, taps feelings of being socially isolated, abandoned, and alienated. The second, *Solitude Intolerance*, reflects feelings of dysphoria during solitude, loneliness beliefs, and the need for company. The final dimension, *Solitude Appreciation*, taps contented feelings when alone and viewing solitude as a kind of resource. Thus, the scale taps the affective experiences associated with current loneliness, as well as negative and positive attitudes toward solitude, more properly speaking. Importantly, and in contrast to other scales (e.g., Burger, 1995), these positive and negative attitudes are treated separately and not as poles on a continuum. Although they are expected to be inversely related, a person could score high (or low) on both dimensions.

Thus far, research has tested links between these three dimensions and a number of factors. With respect to demographic variables, Osin and Leontiev (2013) reported that men had higher scores on *General Loneliness*, whereas women scored slightly higher on *Solitude Intolerance*. Further, scores on *General Loneliness* and *Solitude Intolerance* tended to decrease

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with age, and people scored higher on *Solitude Appreciation* during adolescence and again in adulthood, but showed lower scores during the period between (i.e., early adulthood), although these findings were cross-sectional rather than longitudinal (Osin & Leontiev, 2013). Associations with level of education were weak, but tended to be negative (people experienced the negative aspects of aloneness less, the higher their education) (Osin & Leontiev, 2013). Further, both *General Loneliness* and *Solitude Intolerance* showed negative associations with subjective happiness, life satisfaction, and meaning in life, whereas *Solitude Appreciation* was unrelated to these indicators (Osin & Leontiev, 2013, 2016).

More recently, Ishanov, Osin, and Kostenko (2018) found that those who scored higher on Loevinger's test of ego development reported lower scores on *Solitude Intolerance* but higher scores on *Solitude Appreciation*. As well, they found that both *General Loneliness* and *Solitude Intolerance* were negatively associated with positive affect but positively with negative affect as measured by the PANAS, while *Solitude Appreciation* showed the inverse pattern. Thus far, the DTA has only been tested with samples in Russia. The present research attempted to extend its usage to a new country, the United States.

Importantly, the structure of the DTA, with its three subscales, suggests a prediction which, to date, has not yet been tested: that the impact of general loneliness on important, relevant outcomes should be moderated by the attitudes one holds toward the experience of being alone, represented, in the scale, by the conceptually opposite attitudes of *Solitude Intolerance* and *Solitude Appreciation*. In particular, we would expect that during times of solitude the negative impact of loneliness would be stronger for those high in intolerance, but weaker for those high in appreciation. Study hypotheses will be specified more fully in a subsequent section.

1.3. Research on emotion and motivation in experiences of solitude

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As previously noted, we consider that attitude, affect, and motivation are distinct constructs, with respect to solitude. The DTA addresses attitude, but not, explicitly, motivation or affect. Nguyen, Ryan, and Deci (2018) conducted a series of studies in which they explored the role of solitude in regulating affect, and the moderating role of motivation in this process. Building on prior research (e.g., Larson, 1990, 1997) which found that people tend to experience less positive affect when alone than when with other people, Nguyen and colleagues recognized the importance of distinguishing not only between the valence of affect (positive versus negative) but also between the type of arousal (high versus low). They reasoned that solitude might have a deactivating effect, such that when alone, people should experience less high-arousal affect, whether positive or negative.

Nguyen and colleagues deemed it critical also to consider the role of motivation in the experience of solitude. Extending earlier work by Chua and Koestner (2008), which found that people who felt forced to spend time alone reported more negative outcomes (such as greater loneliness and less life satisfaction) compared to those who engaged in solitude voluntarily, Nguyen and colleagues explored whether the quality of people's motivation for solitude – whether more autonomous (i.e., internal), or more controlled (i.e., external) – might moderate the impact of solitude on affect. Based on self-determination theory (SDT; Ryan & Deci, 2017), they suspected that for those who approached solitude autonomously, the experience might be more positive or at least less negative. Across four studies, they found a decrease in high-arousal affect, both positive and negative, in conditions of solitude (strictly defined, as being alone for a period of time, with no access to devices, personal interactions, external stimuli, or activities). As well, they found increases in low-arousal affect, positive and negative, under solitude conditions, but wondered whether there might be moderators as yet untested that could distinguish between when solitude might deactivate positive versus negative affect. In terms of motivation, they did

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not find as clear an effect for autonomy as they had expected: choice to engage in solitude volitionally did not quite moderate the deactivation effect they were exploring. However, they found that having choices about what to do *during* solitude seemed to be important to participants and suggested that the role of autonomy or choice with respect to experiences of being alone should be further studied.

In this respect, one additional consideration is the role of dispositional autonomy in experiences of solitude. Dispositional autonomy reflects the tendency to act in a self-determined way (Weinstein et al., 2012). In particular, people high in dispositional autonomy are more likely to take interest in their experiences, including internal ones; value congruence, or authenticity, and authorship in their experiences; and in general are less likely to be susceptible to external forms of control. In their research, Nguyen and colleagues (2021) have found that people high in dispositional autonomy were more likely to engage in solitude for autonomous reasons and to derive both enjoyment and need satisfaction from the experience. Thus, both situational and dispositional autonomy seem to matter in terms of how people experience times of solitude.

We note that in some recent research, the constructs of solitude, affective valence, and motivation have been bundled together: Palgi and colleagues (2021), for example, reported development of a scale to measure a construct they termed Positive Solitude (PS). In their conceptualization, PS represents a "volitional positive experience that people may seek or enjoy" (p.3358), and is considered a "stand-alone ability that is both volitional and positive" (p.3378). As such, its operationalization essentially assigns a motivational quality, and a valence, to the experience of solitude. In line with self-determination theory (Ryan & Deci, 2017), we believe that both conceptually and practically it is more useful to keep the construct of solitude distinct from the attitudes, affective valence, and motivation that may be used to describe its experience. Following Nguyen and colleagues (2018, 2021), we do this by asking people to imagine or to

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report an experience of solitude, and then to assess, as orthogonal constructs, the quality of their motivation for, their affect in response to, and their attitudes toward, the solitude experience (see also Weinstein et al., 2023).

2. The current studies

Drawing on existential (Leontiev, 2019; Yalom, 1980) and SDT (Ryan, 2023; Lynch et al., 2026) theoretical perspectives, the present studies sought to disentangle the impact of loneliness from one's attitude toward and motivation for being alone, focusing on two US samples. Although we agree that loneliness is typically affectively unpleasant, we believe its impact, both on general well-being and on affect after experiences of solitude, can be moderated by the attitudes one has toward being alone. The Differential Test of Aloneness (DTA), which assesses current feelings of loneliness as well as one's positive and negative associations with being alone, allows a unique opportunity to test these conjectures. We make thus the following predictions:

Hypothesis 1 (H1): Current feelings of loneliness, as indicated by high scores on the General Loneliness dimension of the DTA, will be negatively associated with general well-being (Study 1, Study 2) and with affect after solitude (i.e., more negative, less positive, affect) (Study 2).

Hypothesis 2 (H2): When thinking about a solitude experience (whether anticipating one, or recalling one), the impact of current feelings of loneliness on both well-being in general (Study 1, Study 2) and affect after solitude (Study 2) will be moderated by one's attitudes toward being alone, such that for those high in Solitude Intolerance the impact of General Loneliness will be more negative, while for those high in Solitude Appreciation the impact will be less negative.

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Hypothesis 3 (H3): The predictions in H1 and H2 will hold, after controlling for one's dispositional level of autonomy and quality of motivation (internal, external) for solitude (Study 1, Study 2).

H1 thus serves as a check on prior findings in the loneliness literature, but using the recently developed DTA. H2 tests new predictions implied by the three dimensions of the DTA; the expected moderation can be illustrated by the Prism Model (see Figure 1). H3 incorporates insights from recent work on motivation for solitude, as well as a general call to control for dispositional motivation in motivational research (Lynch, 2013; Vansteenkiste, Niemiec, & Soenens, 2010). Study 1 tested predictions in a U.S. sample approximately 2 years prior to the 2020 global pandemic; Study 2 tested predictions in a U.S. sample in August of 2020, approximately four months after the pandemic had been declared in the U.S. Importantly, Study 2 tested actual, self-reported experiences of solitude in the context of one's daily life (albeit under pandemic circumstances), thus increasing the ecological validity of findings when compared to the experimental conditions tested by Nguyen et al. (2018). Both studies received prior ethical approval from the RSRB of the first author's home institution.

3. Method: Study 1

3.1. Participants and procedures

Participants (N = 408; 55.15% female) in this cross-sectional survey consisted of adults (M_{age} = 38.95 years, SD_{age} = 13.00) from the United States enlisted from Mechanical Turk (MTurk), an online crowdsourcing platform that has been demonstrated to provide adequate subject pool diversity (Mason & Suri, 2012), to be useful in increasing sample size and thus statistical power and to yield data "that met or exceeded the psychometric standards set by data collected using other means" (Buhrmester, Talaifar, & Gosling, 2018, p. 149). Taking into account the multiple

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predictors in the study, in order to ensure adequate statistical power we conducted an *a priori* power analysis (Cohen, Cohen, West, & Aiken, 2003). Using the G*Power program (Faul, Erdfelder, Buchner & Lang, 2009), we calculated the required sample size for multiple regression analysis with an effect size of 0.15 (medium), an alpha level of 0.05 and a desired power of 0.80. This analysis indicated a minimum sample size of approximately 92 participants would be necessary. Additionally, to verify the adequacy of the collected sample size, a post hoc (observed) power analysis was conducted. Given the total sample size of 408, and 8 predictors, the achieved power was about 1.00, indication that our sample size is more than sufficient for detecting the anticipated effects. Participants were offered a small financial incentive. After providing informed consent, participants completed a number of measures, some of which are not reported in this article, and provided demographic information.

3.2. Measures

Solitude and loneliness measures

Differential Test of Aloneness (DTA; Osin & Leontiev, 2013, 2016). The DTA (see Appendix) consists of 21 items tapping three dimensions: *General Loneliness* (6 items), *Solitude Intolerance* (6 items), and *Solitude Appreciation* (9 items). As noted, the first of these, *General Loneliness*, taps feelings of being socially isolated, abandoned, and alienated; representative items include, “there is no one to whom I could turn,” “I feel abandoned,” and “I have little in common with those around me.” *Solitude Intolerance* reflects feelings of dysphoria during solitude, loneliness beliefs, and the need for company (i.e., dependence on company), and includes items such as, “when I am alone, I experience discomfort,” “lonely people need help,” and “I handle the absence of company poorly.” *Solitude Appreciation* taps contented feelings when alone and solitude as a kind of resource, and includes items such as, “I love being alone by myself,” and “the head works better when one is alone.” Internal consistency reliabilities

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(Cronbach alphas) for the three dimensions in the present sample were .90, .89, and .89, respectively. Items are scored on a four-point scale (1 = disagree, 4 = agree).

UCLA Loneliness Scale (Oshagen & Allen, 1992). As a check on the DTA, we included the well-validated UCLA Loneliness Scale. Following Oshagen and Allen (1992), we used an abbreviated, 7-item version of the scale, which has been found to provide a unidimensional measure of "feelings of loneliness due to privation in close personal relationships" (p.402). Internal consistency reliability in the present sample was α = 93. Items are scored on a four point scale (1 = Never, 4 = Often). We expected scores to be positively associated with the General Loneliness dimension of the DTA.

Motivation and emotion measures

Index of Autonomous Functioning (IAF; Weinstein, Przybylski, & Ryan, 2012). In order to control for individual differences in orientation toward autonomy (Vansteenkiste, et al., 2010), the IAF was used as a measure of dispositional autonomy. It taps three dimensions: feelings of authorship and self-congruence (4 items, α = .83 in the current sample), susceptibility to control (5 items, α = .82), and interest-taking (5 items, α = .88). Items were scored on a 5-point scale (1 = not at all true, 5 = completely true). In the interest of simplicity, 'susceptibility' items were reverse-scored, and items from all three subscales were summed to compute a trait autonomy index (see, e.g., Sheldon, et al., 2018) with a composite α = .85.

Motivation for Solitude. Following Nguyen et al. (2018), we considered it essential to examine the quality of people's motivation for being alone. Accordingly, we asked participants in Study 1 to "imagine that you will have an opportunity later today to spend 5 – 10 minutes sitting with yourself, alone, while not being occupied by any tasks or activities, but awake, not sleeping." Then they were asked, "If you were to do this – to sit with yourself for 5 – 10 minutes, alone –

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what would be your reason for doing so?" They were then presented a set of 8 reasons, drawn from existing motivational measures (Nguyen et al., 2018), to tap the continuum of reasons ranging from external (e.g., "because I worry that I might get in trouble if I do not") to internal (e.g., "because it sounds like something I would enjoy"), and were asked to rate each reason on a scale of 1 (not at all true) to 5 (completely true). Responses were combined to form two motivational subscales, autonomous (4 items, reflecting intrinsic and identified motivation) and controlled (4 items, reflecting introjected and external motivation). Cronbach alphas in the present sample were .93 for autonomous and .91 for controlled motivation.

Well-being measures

Mental Health Continuum Short Form (MHC-SF; Keyes, 2007). As a general measure of well-being, we included the 14-item short form of the Mental Health Continuum, based on Ryff's (1989) model of psychological well-being. Three items tap emotional well-being, six reflect psychological well-being, and five represent social well-being. In the present sample, alphas were .90, .90, and .89, respectively. Items are scored on a six-point scale (1 = Never, 6 = every day), reflecting how often the person had felt this way during the past month. In the interest of simplicity, a single well-being index was computed by combining the three MHC subscales (overall Cronbach's alpha = .95).

Descriptive statistics are presented in Table 1.

3.3. Analytic approach

Omnibus correlations provided an initial check of bivariate associations among study variables, and differences on the key demographic variable, gender, were also examined. Hypothesis testing (H1, H2, H3) was conducted by means of the PROCESS macro in SPSS (Hayes & Rockwood, 2017). Specifically, the three dimensions of the DTA (General Loneliness,

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Solitude Intolerance, and Solitude Appreciation) were tested as direct effects and as two-way interactions, and the motivational variables (dispositional autonomy, motivation for solitude) were entered as covariates, for the outcome of well-being. Explanatory variables were mean-centered.

3.4. Results

3.4.1 Preliminary analyses

Results of an independent samples t-test found that men (M = 2.18, SD = .79) were higher than women (M = 2.00, SD = .7) on General Loneliness (GL; t = 2.36, p < .05, df = 402). Men (M = 2.02, SD = .67) were also higher than women (M = 1.82, SD = .62) on Solitude Intolerance (SI; t = 3.03, p < .01, df = 366). Men and women did not however differ on Solitude Appreciation (SA).

Results of omnibus correlation are shown in Table 2. The DTA subscales correlated with each other as expected: General Loneliness with Solitude Intolerance (r = .51, p < .01) but not with Solitude Appreciation (p > .05). Solitude Intolerance and Solitude Appreciation were inversely associated (r = -.21, p < .01). As expected, the General Loneliness subscale of the DTA correlated robustly with the UCLA Loneliness scale (r = .76, p < .01). Other associations can be seen in Table 2.

3.4.2 General Loneliness and well-being: Direct and moderated effects

We predicted that the impact of General Loneliness (GL) on well-being would be moderated by the other two dimensions of the DTA, Solitude Intolerance (SI) or Solitude Appreciation (SA) (H1, H2), after controlling for dispositional and situational motivation (H3). These predictions were tested by means of the PROCESS command in SPSS. Results are shown in Table 3. As expected, General Loneliness had a negative association with well-being (b = -.78,

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$p < .001$), whereas Solitude Intolerance was positively associated with that outcome (b = .29, $p < .001$); Solitude Appreciation was unassociated with well-being ($p > .05$). The three motivational variables (dispositional autonomy, autonomous and controlled motivation for solitude) were all positively associated with well-being (b = .16, .17, and .19, respectively, $p < .001$). In addition, the impact of General Loneliness on well-being was moderated by Solitude Intolerance (b = .20, $p < .01$), such that for those high in Solitude Intolerance, the impact of General Loneliness on well-being was less, after controlling for Solitude Appreciation, dispositional autonomy, and quality of motivation for solitude (see Figure 2).

3.4.3 Discussion

The negative association between General Loneliness and well-being was expected and confirms findings in the literature (H1). As predicted, after controlling for dispositional and situational motivational variables (H3), the impact of General Loneliness on well-being was moderated by Solitude Intolerance, but, contrary to prediction, not by Solitude Appreciation (H2). The direction of the interaction effect that was detected was not, however, what we expected: at face value, we had expected that for those lower in Solitude Intolerance, the negative impact of General Loneliness on well-being would be less, but in fact we found the opposite result.

4. Study 2

4.1 Overview

Study 1 did not assess an actual experience of solitude; rather, participants were asked to imagine that they would have an opportunity to experience solitude later that day, and then to report on the quality of motivation they would anticipate having for engaging in that solitude experience. Further, the outcome tested was general well-being, rather than an outcome specifically linked to

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a solitude experience. Accordingly, Study 1 results with respect to solitude, *per se*, are limited. Hence, an important aspect of Study 2 was to ask participants to report on their attitude and motivation with respect to an actual, self-reported experience of solitude, and to assess an outcome (in this case, affect) directly linked to that experience.

4.2 Method

4.2.1 Participants and Procedure

As with Study 1, MTurk was used to recruit participants living in the United States to an online survey. The present sample (N = 266, 36.1% female; M_{age} = 38.95 years, SD_{age} = 13.00) was offered a small monetary incentive for their participation.

4.2.2 Solitude Check

In Study 2, participants were presented with the following prompt: "When you stay at home in order to minimize social contact in a pandemic situation, you may have opportunities to spend time alone, by yourself, without contact or communication with other people, but awake, not sleeping." This prompt followed the solitude formulation used by Nguyen and colleagues (2018). Then participants were asked: "In the past 24 hours, have you spent time alone, by yourself?" and could select a response of either 'No' (coded as 0) or 'Yes' (coded as 1). This item served as a solitude check. After removing those who responded 'No,' the remaining sample of those who said 'Yes' to the solitude check (N = 169, 34.9% female, M_{age} = 36.35 years, SD_{age} = 10.71) was used in subsequent analyses.

4.2.3 Measures

Study 2 used the same measures as Study 1. In the present sample (N = 169), Cronbach's internal consistency alphas were: 0.90 for General Loneliness, 0.90 for Solitude Intolerance, 0.84 for Solitude Appreciation, 0.93 for the Mental Health Continuum, 0.91 for the Index of Autonomous

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Functioning, 0.84 for autonomous motivation for solitude, 0.90 for controlled motivation for solitude, and 0.87 for the UCLA Loneliness scale.

Affect after Solitude. Following Nguyen and colleagues (2018), we wanted to test the role of affect after solitude. Accordingly, we administered a 14-item version of the PANAS distinguishing between high- and low-arousal affect (see Nguyen et al., 2018). Participants received the instruction, "You were [just] asked about your experience of spending time alone, by yourself, during the past 24 hours. With this in mind, please indicate how you felt immediately after that time spent alone, even if it is not yet over (that is, you are still alone)." Items for high-arousal negative affect included *worried, angry, afraid*, whereas low-arousal negative affect included *sad, lonely, bored, drained, depressed*; high-arousal positive affect included *excited, elated, happy*, whereas low-arousal positive affect included *calm, relaxed, at ease.* Items were scored from 1 (very slightly or not at all) to 5 (extremely). Cronbach alphas for the four affect after solitude variables ranged from 0.74 to 0.92 in the present sample.

Descriptive statistics are presented in Table 4.

4.3 Analytic Approach

The same general strategy was used as in Study 1. Here, however, the analysis testing hypotheses H1, H2 and H3 was repeated five times, using either general well-being or one of the four affect after solitude variables as the outcome. Explanatory variables were mean-centered.

4.4 Results

4.4.1 Preliminary analyses

Results of an independent samples t-test found that men ($M = 2.92$, $SD = .73$) were higher than women ($M = 2.59$, $SD = .92$) on General Loneliness (GL; $t = 2.57$, $p < .05$, $df = 164$). Men ($M = 2.86$, $SD = .69$) were also higher than women ($M = 2.51$, $SD = .92$) on Solitude Intolerance (SI; *t*

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= 2.78, $p < .01$, $df = 164$). Men and women did not however differ on Solitude Appreciation (SA).

Omnibus correlations are presented in Table 5. In this sample, the DTA subscales correlated with each other: General Loneliness with Solitude Intolerance ($r = .78$, $p < .01$) and with Solitude Appreciation ($r = .43$, $p < .01$). Solitude Intolerance and Solitude Appreciation were associated ($r = .36$, $p < .01$). As expected, the General Loneliness subscale of the DTA correlated robustly with the UCLA Loneliness scale ($r = .82$, $p < .01$).

4.4.2 General Loneliness and well-being: Direct and moderated effects

As in Study 1, we predicted that the impact of General Loneliness (GL) on well-being would be moderated by one's attitude toward solitude, as measured by the other two subscales of the DTA (H1, H2), after controlling for dispositional and situational motivation (H3). As in Study 1, these predictions were tested in Study 2 by means of the PROCESS command in SPSS. Results are shown in Table 6. As expected, General Loneliness had a negative association with well-being (b = -1.11, $p < .001$); associations with well-being were negative for Solitude Intolerance (b = -0.58, $p < .05$) and positive for Solitude Appreciation (b = 0.29, $p < .05$). Two of the motivational variables had positive associations with well-being (dispositional autonomy: b = 0.14, $p = .01$; controlled motives: b = 0.28, $p < .01$), but autonomous motivation for solitude was unassociated with that outcome ($p > .05$). As in Study 1, the negative impact of General Loneliness on well-being was moderated by Solitude Intolerance (b = 0.31, $p < .01$), such that it was significantly stronger at low levels of Solitude Intolerance (see Figure 3). Put differently, at *high* levels of Solitude Intolerance, the impact of General Loneliness on well-being ceased to be significant. There was also a significant moderation of General Loneliness by Solitude Appreciation (b = 0.25, $p < .05$; Table 7), such that, at higher levels of Solitude Appreciation, the effect of General Loneliness on well-being became significantly weaker (Figure 4).

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4.4.3 General Loneliness and affect after solitude: Direct and moderated effects

In Study 2, we also assessed affect (positive and negative, high and low activation) after a self-reported experience of solitude. Although we expected that General Loneliness would be associated with more negative and less positive affect after solitude, we predicted that these associations also would be moderated by one's attitudes toward solitude, with those high in Solitude Intolerance expected to have less favorable outcomes, whereas those high in Solitude Appreciation should have more favorable outcomes, after controlling for motivational variables. The results of these analyses can be seen in Tables 8 through 15. To summarize and simplify the direct effects, General Loneliness was not associated with high arousal negative affect (*worried*, *angry*, *afraid*; Tables 8 and 9), but was associated with greater levels of low arousal negative affect (*sad*, *lonely*, *bored*, *drained*, *depressed*; Table 10) after a solitude experience. Of the other variables tested, only controlled motives for solitude were consistently associated with negative affect after solitude, specifically with higher levels of both high arousal (Tables 8, 9) and low arousal negative affect (Tables 10, 11): those who reported engaging in a solitude experience for externally motivated reasons were more likely to report feeling negative affect afterwards. The effect of General Loneliness on negative affect after solitude was unmoderated by attitudes toward solitude (Tables 8 – 11 in Online Resource 3).

The picture is a bit more interesting with respect to positive affect after solitude (Tables 12 – 15). General Loneliness was associated with less positive affect, both high arousal (*excited*, *elated*, *happy*; Table 12) and low arousal (*calm*, *relaxed*, *at ease*; Table 14). Although Solitude Intolerance did not have any direct association with high arousal positive affect (Table 12; Table 13), it was negatively associated with low arousal positive affect (Table 14). Solitude Appreciation was positively associated with both high arousal (Table 12) and low arousal (Table 14) positive affect. Solitude Intolerance significantly moderated the impact of General

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Loneliness on both high arousal (Table 12) and low arousal (Table 14) positive affect: for people low in Solitude Intolerance, the negative impact of General Loneliness was stronger on both high arousal positive affect (Figure 5) and low arousal positive affect (Figure 6), after controlling for the motivational variables. Phrased differently, at high levels of Solitude Intolerance, the impact of General Loneliness on positive affect after solitude was no longer negative. In terms of the motivational variables, contrary to expectations based on SDT, controlled motives for solitude were consistently associated with greater positive affect, both high- and low-arousal, after a solitude experience (Tables 12 – 15), whereas (and consistent with SDT) autonomous motives for solitude were associated only with more low-arousal positive affect after solitude (Tables 12 – 15). Dispositional autonomy showed some modest association with greater high arousal (Tables 12, 13) and low arousal (Tables 14, 15) positive affect after solitude (Tables 13, 15).

4.4.4 Discussion

Study 2 went beyond the first study by asking participants to recall a recent experience of solitude, and to report the affect they were feeling just after that experience. Our hope was that in this way we could obtain a better understanding of how loneliness, characterized by feelings of social isolation, abandonment, and alienation (as measured by the General Loneliness subscale of the Differential Test of Aloneness), would affect people during times when they were, quite literally, alone, that is, during periods of solitude, properly speaking. We reasoned that people who are already lonely would probably fare worse during times of solitude (because the very fact of being alone could amplify the isolation and abandonment that characterize their loneliness), but that loneliness, which typically is associated with negative or at least unpleasant outcomes, would affect people differently, depending on their attitudes toward being alone. We found limited support for this notion. Specifically, of the two attitudes toward solitude assessed by the

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DTA, only Solitude Intolerance proved to be a moderator of the impact of loneliness on affect after solitude, and this only with respect to positive affect.

5. General Discussion

The present research sought to disentangle the effects of loneliness from one's attitudes toward solitude and the quality of one's motivation for solitude. We proposed the Prism Model as a way to conceptualize the anticipated moderation effect (Figure 1). Indeed, in two studies, we found that, controlling for motivational variables and for attitude toward solitude, people's feelings of loneliness remained significantly and negatively associated with their overall well-being (Study 1, Study 2), thus confirming H1 with respect to well-being. The findings were a bit more nuanced with respect to the association between loneliness and the affect that people reported after an actual experience of solitude (Study 2), particularly if we look beyond the bivariate correlations (Table 5) to the regression analyses. Notably, when motivational variables were taken into account, feeling lonely did not contribute to high-arousal negative affect after a solitude experience (Tables 8, 9), but its associations with LANA, HAPA, and LAPA varied, depending on whether it was pitted against Solitude Intolerance or Solitude Appreciation as the other direct effect tested in the PROCESS command (Tables 10-15). This suggests the importance of teasing apart the contributions of these attitudes toward solitude, for which purpose we turn now to results of the tests of moderation (H2).

In both studies, the impact of General Loneliness on overall well-being was moderated by Solitude Intolerance (SI); the direction of the effect however was the opposite of what we predicted: for those who were higher in SI, the negative impact of being lonely was *weaker* (Figures 2 and 3). On the other hand, in Study 2, we found a moderation effect in the predicted direction: for those who expressed *appreciation* for solitude, the negative impact on their well-being of feeling lonely was weaker (Figure 4). Notably, these findings pertained to an outcome,

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well-being, that was not specific to a solitude experience. When we assessed participants' affective responses to an actual, self-reported solitude experience (Study 2), we found that of the two attitudes tapped by the DTA, only Solitude Intolerance moderated the impact of loneliness, and this was only with respect to positive affect: at low levels of Solitude Intolerance, the negative impact of being lonely was stronger, both for high-arousal and for low-arousal positive affect (Figures 5 and 6). Again, this moderation effect was in the opposite direction from what we expected.

As noted, for some time there has been discussion about the positive potential of solitude, and indeed, empirical evidence has supported this idea (Coplan et al., 2019; Nguyen et al., 2018; Palgi et al., 2021). Some have pushed the conversation further, wondering whether even loneliness – the affectively unpleasant experience of a perceived gap between desired and actual social contact – could yield positive potential (Leontiev, 2019; Moustakas, 1961). We set out in this research to test whether the impact of loneliness, on both well-being and affect after solitude, might be moderated by one's attitude toward solitude. We fully expected that having a positive attitude toward solitude – referred to as Solitude Appreciation in the Differential Test of Aloneness (DTA; Osin & Leontiev, 2013) – would lessen the negative impact of loneliness, and that having a negative attitude toward solitude – referred to as Solitude Intolerance – would intensify the negative impact of loneliness. Instead, we found that Solitude Appreciation modified the impact of loneliness in only one of two studies, and that Solitude Intolerance, rather than magnifying the negative impact of loneliness, served as a kind of buffer.

We struggle to interpret these findings and suggest that perhaps there is a way in which Solitude Intolerance, which includes feelings of dysphoria when alone, an intense negative appraisal of being alone, and a felt need for the company of other people, serves as a kind of psychological buffer to the impact of loneliness. Perhaps those with an intense aversion to

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solitude, as assessed by the DTA's Solitude Intolerance subscale, when anticipating or experiencing an episode of solitude (as our participants did, in both studies), use that psychic energy to sublimate or convert the affective discomfort that accompanies loneliness into something positive. It is possible that the present findings point to the complimentary psychological roles played by these two seemingly opposing attitudes toward being alone. Specifically, perhaps Solitude Appreciation serves an underlying *integrative* process, whereas Solitude Intolerance serves an underlying *defensive* process, both in the service of bolstering or maintaining (at least at the surface level) one's well-being during times of loneliness, when one desires the presence of others but feels, deeply, their absence. Alternatively, perhaps there is some other variable, not assessed in the current research, that can clarify the role of Solitude Intolerance in moderating the impact of loneliness. These of course are speculations; much more research needs to be done in order to test these and other possible explanations of the puzzling moderation effect that we found in two, independent U.S. samples. In the end, it is clear that loneliness is a powerful experience, perhaps overriding even the effects of one's attitude toward being alone.

Although not the focus of the present study, we considered it important to control for motivational factors that could impact the quality of people's solitude experiences, in line with recent SDT-informed research (Nguyen et al., 2018, 2021). In our analyses, we entered dispositional autonomy, together with autonomous and controlled motives for solitude, as covariates, allowing us to focus on the effects of loneliness and of one's attitudes toward solitude (the three subscales of the DTA) on well-being and affective outcomes. From a self-determination theory perspective (Ryan, 2023; Ryan & Deci, 2017), however, motivation would typically be given a more central role when examining intra- and interpersonal processes. The inclusion of motivation in the present research underscores its importance in understanding

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loneliness as well as solitude: dispositional autonomy (measured by the Index of Autonomous Functioning) significantly accounted for variance in seven of the eleven regressions that were performed; autonomous motivation for solitude accounted for variance in three of the eleven regressions; while controlled motivation accounted for variance in all eleven regressions. Clearly, and in line with SDT, motivation is critical in understanding these processes.

5.1 Limitations and future directions

The present research was cross-sectional and self-report in nature, limiting the conclusions that can be drawn, especially with respect to causality. To tease apart the causal processes, longitudinal, daily diary / experience sampling, and experimental designs will need to be used. As well, we looked in this research only at samples drawn from the United States, a traditionally individualistic culture; as usual, it will be important to test similar models in other countries, to explore whether there might be important cultural differences – as we expect there will be – in the way that people experience both loneliness and solitude.

In addition, it is important to note that data for Study 2 were collected during a time of global pandemic, when people in the United States, as elsewhere in the world, were still coming to terms with what things like quarantine, isolation, social or physical distancing, and so on, would mean for their lives. This fact could well have impacted the results that we obtained, although we note that findings were on the whole similar between Study 1 (for which data were collected approximately two years prior to the pandemic) and Study 2 (for which data were collected approximately four months after the pandemic had been declared). We reflect briefly on the wider issue of culture below.

5.2 Cultural context

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Even people in an individualistic society like the United States experienced loneliness, and for them, too, it was an unpleasant experience. This perhaps is to state the obvious, but it is borne out in the present research. Living in an individualistic society does not in itself buffer one from the desire for social connection or from the consequences when such connections are less than what one desires. The present research also demonstrated that one's attitude toward solitude – whether intolerant, or appreciative – seems to matter to people in the United States, as indicated by the associations in Tables 2 and 5. That said, in the wider literature expectations for relationships and the family in particular seem to play an important role in the prevalence and trajectories of loneliness, with the data suggesting a higher prevalence of loneliness within familialistic versus individualistic countries (Sheftel et al., 2024). However, there remains a pressing need for research to examine "the role of cultural norms and expectations for solitude experiences across the lifespan" (Hoppmann & Pauly, 2022, p.477). Nevertheless, as predicted by SDT the experience of *choice* seems to play a consistent role in the subjective meaning of solitude in countries where this variable has been explored (Weinstein et al., 2023).

5.3 Practical implications

Loneliness is and remains an unpleasant experience associated with negative outcomes for well-being and affect. The present research suggests there may be utility in exploring the role of one's attitudes toward being alone – toward solitude, in other words – as a potential buffer to the impact of loneliness. Framing the present results from an existential (Leontiev, 2019; Moustakas, 1972; Yalom, 1980) and self-determination theory (Ryan, 2023) perspective, we might suggest that rather than trying to eliminate the lonely condition itself, perhaps interventions can be designed to help people to reflect on their attitudes toward being alone, and on their motivation for entering into moments of solitude when they present themselves. Such reflection may serve as the springboard for acceptance, or for change, in either of which cases *personal choice*, it

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seems, plays a key role. Indeed, deliberate choice is considered to be a characteristic mark of authentic solitude (Averill & Sundararajan, 2014, p.91).

5.4 Conclusion

The present research tested whether the negative impact of loneliness, well-established in the literature, might be moderated by one's attitude toward solitude, after taking into account important motivational variables such as dispositional autonomy (Vansteenkiste et al., 2010) and the quality of motivation for time spent in solitude (Nguyen et al., 2018). The combination of existentialist and self-determination theory views seems to be fruitful, allowing one to specify the conditions in which being alone may cause harmful effects, and those in which it might be beneficial for the person. These conditions include one's attitude toward being alone, which can be successfully measured with the help of DTA, the instrument described in the paper. We found that loneliness was negatively associated with the well-being people experienced, whether before or after the pandemic, and with the affect they experienced in connection with actual, daily solitude experiences, during the pandemic. Given the importance of understanding the impact of loneliness on well-being and more serious indicators such as depression and suicidality (Armitage & Nellums, 2020; Brooks et al., 2020; Kaur & Rani, 2023), especially during a time of enforced isolation and social distancing, the finding of a potential moderator, albeit a paradoxical one such as Solitude Intolerance, is important. This is only the tip of the iceberg.

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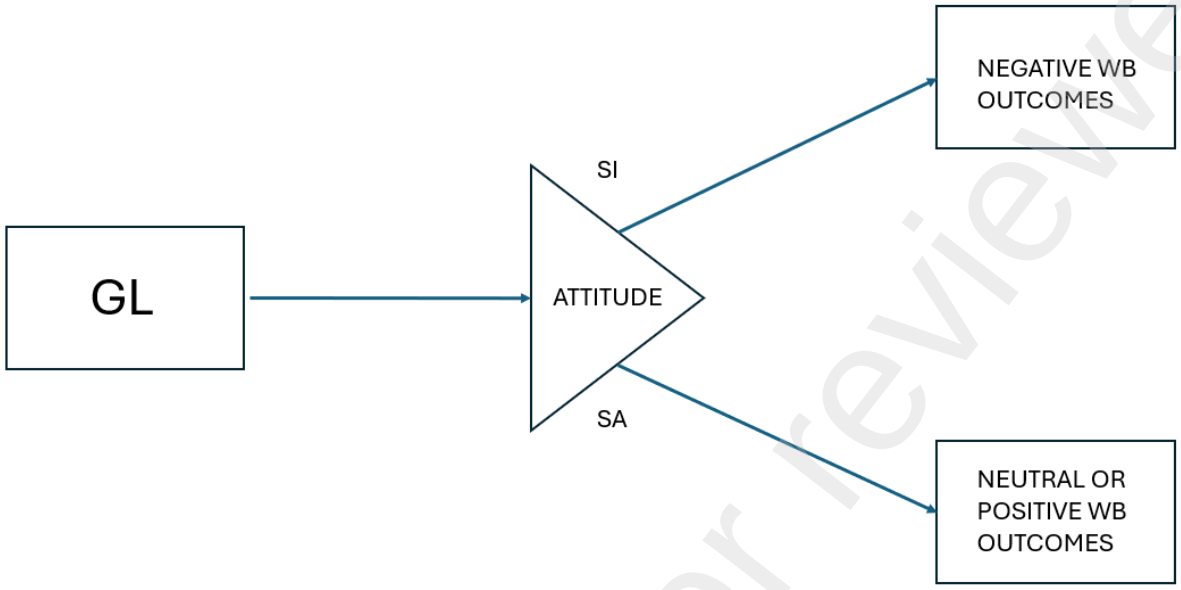
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Fig. 1 Prism model: The impact of general loneliness (GL) on either well-being (WB) or affect after solitude, moderated by attitudes of solitude intolerance (SI) and solitude appreciation (SA)



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Table 1. Descriptive Statistics (Study 1, N = 408)

Variables	n	Mean	Std. Deviation	Cronbach's Alpha	Skewness	Kurtosis
Age		38.95	13.00		0.79	-0.41
Index of Autonomous Functioning	14	4.31	1.54	0.848	0.22	-0.22
Autonomous Motives for Solitude	4	3.38	1.13	0.925	-0.36	-0.64
Controlled Motives for Solitude	4	2.00	1.08	0.908	0.75	-0.60
UCLA Loneliness	7	2.36	0.86	0.932	0.13	-0.86
DTA_General Loneliness	6	2.00	0.82	0.897	0.50	-0.66
DTA_ Solitude Intolerance	6	1.80	0.71	0.887	0.70	-0.17
DTA_ Solitude Appreciation	9	2.88	0.63	0.890	-0.21	-0.23
Mental Health Continuum	14	3.00	1.08	0.946	-0.32	-0.57

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Table 2. Correlations between main variables (Study 1, N = 408)

		1	2	3	4	5	6	7	8	9	10
1	Age	1									
2	Education	-.071	1								
3	Index of Autonomous Functioning	.098	-.026	1							
4	Autonomous Motives for Solitude	.013	-.045	.396**	1						
5	Controlled Motives for Solitude	-.231**	.096	-.336**	-.068	1					
6	UCLA Loneliness	-.049	.065	-.280**	-.149**	.172**	1				
7	DTA_ General Loneliness	-.184**	.121*	-.381**	-.139**	.383**	.762**	1			
8	DTA_ Solitude Intolerance	-.258**	.220**	-.256**	-.184**	.572**	.303**	.509**	1		
9	DTA_ Solitude Appreciation	.114*	-.023	.345**	.361**	-.196**	.145**	.078	-.214**	1	
10	Mental Health Continuum	.085	.051	.403**	.295**	.007	-.549**	-.588**	-.068	-.021	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

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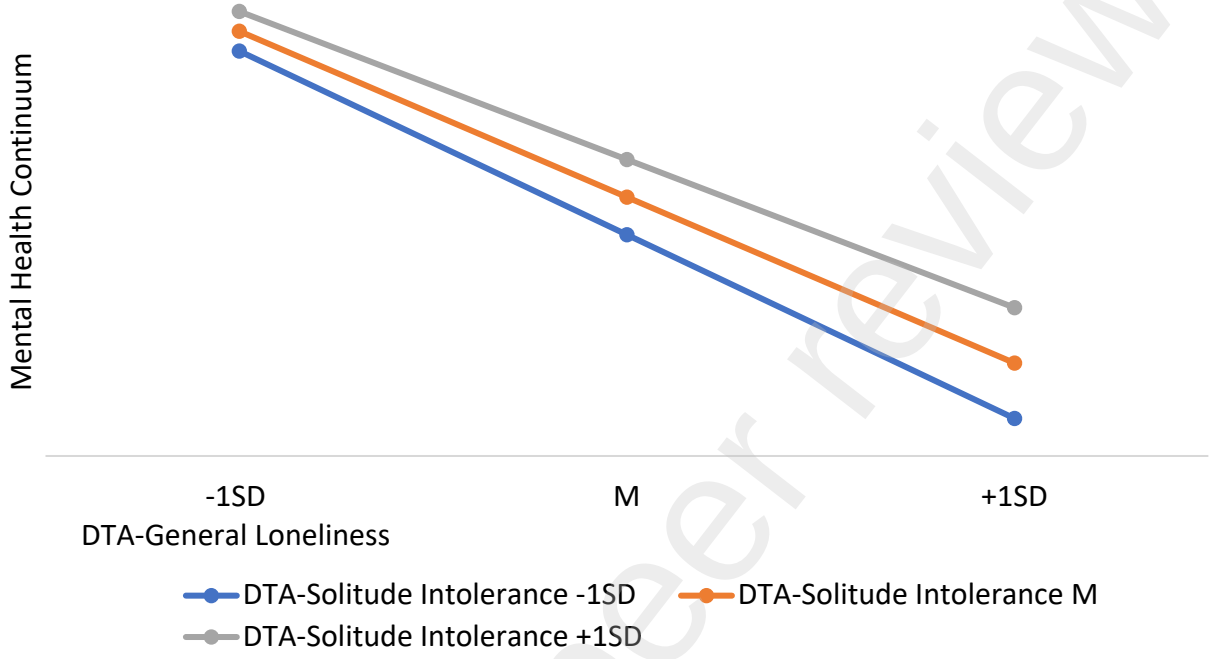
Table 3. Interaction effect of the Differential Test of Aloneness (DTA) on General Well-being (Study 1, N = 408))

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	-0.78	0.06	-12.27	0.000	-0.909	-0.658
DTA_ Solitude Intolerance (DTA_SI)	0.29	0.08	3.76	0.000	0.138	0.440
DTA_ Solitude Appreciation (DTA_SA)	-0.04	0.08	-0.51	0.610	-0.190	0.112
DTA_GL X DTA_SI	0.20	0.06	3.24	0.001	0.081	0.329
DTA_GL X DTA_SA	0.10	0.08	1.30	0.194	-0.053	0.259
constant	1.25	0.20	6.37	0.000	0.867	1.642
Index of Autonomous Functioning	0.16	0.03	5.00	0.000	0.098	0.226
Autonomous Motives for Solitude	0.17	0.04	4.20	0.000	0.091	0.251
Controlled Motives for Solitude	0.19	0.05	4.05	0.000	0.098	0.283
R^2 =46.87%, F (8, 357) = 39.37, p <.000						
Conditional effect of DTA-GL on General Well-being of DTA-SI after controlling DTA-SA						
DTA-IA	Effect	*se*	*t*	*p*	LLCI	ULCI
-1SD	-0.99	0.10	-9.82	0.000	-1.194	-0.795
M	-0.85	0.09	-9.54	0.000	-1.024	-0.674
+1SD	-0.70	0.10	-7.16	0.000	-0.896	-0.510

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Fig. 2 Moderation effect plot of DTA- Solitude Intolerance (DTA-SI) on DTA-General Loneliness (DTA-GL) and General Well-being after controlling DTA- Solitude Appreciation (DTA-SA), Index of Autonomous Functioning, Autonomous Motives for Solitude, and Controlled Motives for Solitude



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Table 1. Descriptive Statistics (Study 2, N=169)

Variables	n	Mean	Std. Deviation	Cronbach's Alpha	Skewness	Kurtosis
Age		36.35	10.71		0.86	-0.19
Index of Autonomous Functioning	15	3.86	1.15	.910	0.38	1.13
Autonomous Motives for Solitude	4	3.61	0.84	.837	-0.84	1.29
Controlled Motives for Solitude	4	3.23	1.15	.903	-0.76	-0.45
UCLA Loneliness	7	2.70	0.72	.874	-0.86	0.40
DTA_General Loneliness	6	2.80	0.82	.897	-0.86	-0.08
DTA_Solitude Intolerance	6	2.73	0.80	.896	-0.83	-0.17
DTA_Solitude Appreciation	9	3.07	0.53	.843	-0.68	0.99
Mental Health Continuum	14	3.40	0.86	.929	-0.43	-0.30
High-arousal Negative Affect: Worried, Angry, Afraid	3	2.91	1.19	.887	-0.15	-1.01
Low-arousal Negative Affect: Sad, Lonely, Bored, Drained, Depressed	3	3.09	1.16	.781	-0.37	-0.86
High-arousal Positive Affect: Excited, Elated, Happy	5	3.38	1.03	.919	-0.37	-0.44
Low-arousal Positive Affect: Calm, Relaxed, At ease	3	3.58	0.87	.742	-0.51	0.16

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Table 2. Correlations between main variables (Study 2, N = 169)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Age	1													
2	Education	-.105	1												
3	Index of Autonomous Functioning	.056	.014	1											
4	Autonomous Motives for Solitude	-.021	.104	.396**	1										
5	Controlled Motives for Solitude	-.254**	.308**	.013	.439**	1									
6	UCLA Loneliness	-.241**	.243**	-.057	.327**	.665**	1								
7	DTA_ General Loneliness	-.278**	.267**	-.082	.350**	.761**	.823**	1							
8	DTA_ Solitude Intolerance	-.174*	.261**	.027	.286**	.761**	.632**	.779**	1						
9	DTA_ Solitude Appreciation	.067	-.002	.330**	.581**	.285**	.305**	.426**	.359**	1					
10	Mental Health Continuum	.085	.120	.411**	.435**	.341**	.130	.157*	.295**	.421**	1				
11	High-arousal Negative Affect: Worried, Angry, Afraid	-.152	.273**	-.004	.379**	.760**	.672**	.728**	.700**	.357**	.262**	1			
12	Low-arousal Negative Affect: Sad, Lonely, Bored, Drained, Depressed	-.181*	.209**	-.073	.352**	.696**	.755**	.764**	.644**	.314**	.126	.876**	1		
13	High-arousal Positive Affect: Excited, Elated, Happy	-.077	.139	.289**	.518**	.639**	.394**	.468**	.549**	.462**	.616**	.613**	.503**	1	
14	Low-arousal Positive Affect: Calm, Relaxed, At ease	.123	.038	.417**	.534**	.293**	.126	.112	.149	.455**	.576**	.369**	.275**	.659**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

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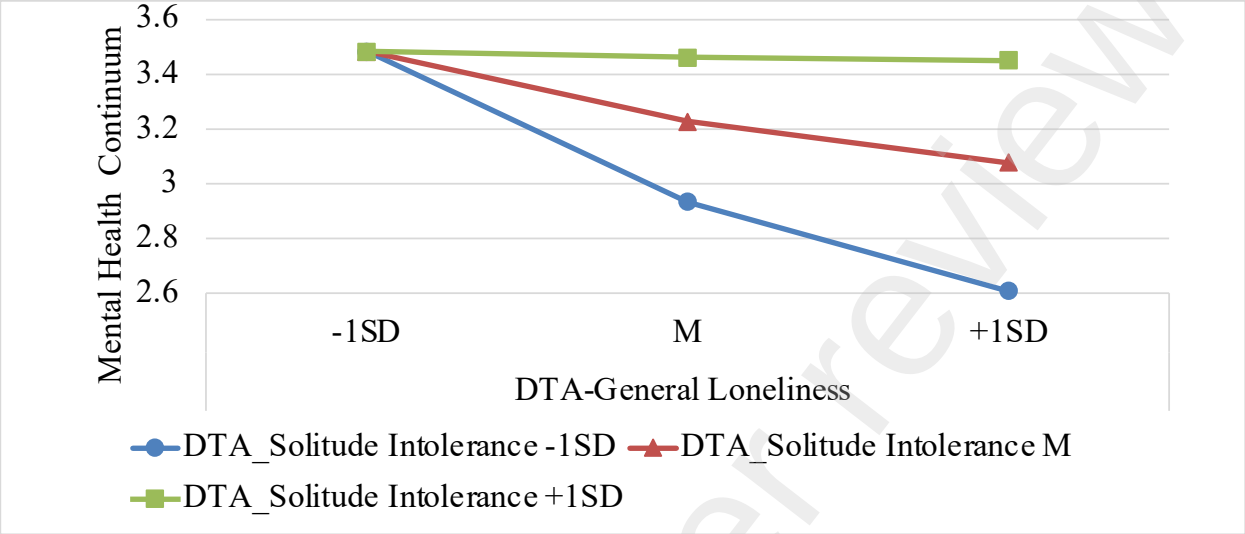
Table 3. Interaction effect of the Differential Test of Aloneness (DTA) on General Well-being (Study 2, N=169)

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA General Loneliness (DTA_GL)	-1.11	0.22	-5.11	0.000	-1.534	-0.679
DTA Solitude Intolerance (DTA_SI)	-0.58	0.25	-2.36	0.020	-1.069	-0.094
DTA_GL * DTA_SI	0.31	0.09	3.61	0.000	0.141	0.481
constant	2.98	0.71	4.17	0.000	1.566	4.386
DTA Solitude Appreciation (DTA_SA)	0.29	0.14	2.03	0.044	0.008	0.573
Index of Autonomous Functioning	0.14	0.05	2.62	0.010	0.034	0.241
Autonomous Motives for Solitude	0.07	0.09	0.82	0.416	-0.101	0.244
Controlled Motives for Solitude	0.28	0.08	3.34	0.001	0.113	0.440
R^2 =42.92%, F (7, 161) = 17.29, p <.000						
Conditional effect of DTA-GL on General Well-being of DTA-SI after controlling DTA-SA						
DTA-SI	Effect	*se*	*t*	*p*	LLCI	ULCI
-1SD	-0.48	0.12	-4.07	0.000	-0.719	-0.250
M	-0.23	0.13	-1.68	0.096	-0.490	0.040
+1SD	-0.02	0.17	-0.10	0.917	-0.351	0.316

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Fig. 3 Moderation effect plot of DTA-Solitude Intolerance (DTA-SI) on the relationship between DTA-General Loneliness (DTA-GL) and General Well-being (Mental Health Continuum) after controlling DTA-Solitude Appreciation (DTA-SA), Index of Autonomous Functioning, Autonomous Motives for Solitude, and Controlled Motives for Solitude (Study 2, N = 169)



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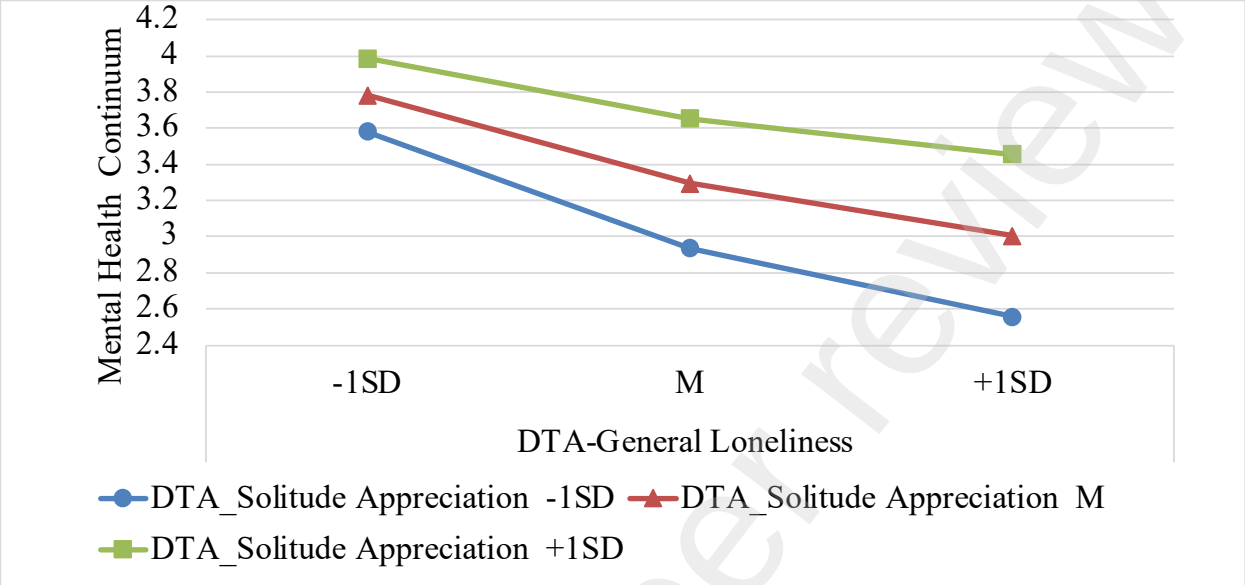
Table 7. Interaction effect of the Differential Test of Aloneness (DTA) on General Well-being (Study 2, N=169)

Variables	**coeff**	**se**	***t***	***p***	**LLCI**	**ULCI**
DTA-General Loneliness (DTA-GL)	-1.20	0.33	-3.61	0.000	-1.853	-0.543
DTA-Solitude Appreciation (DTA-SA)	-0.09	0.27	-0.34	0.732	-0.630	0.444
DTA-GL * DTA-SA	0.25	0.10	2.41	0.017	0.045	0.448
constant	2.50	0.82	3.03	0.003	0.873	4.129
DTA-Solitude Intolerance (DTA-SI)	0.15	0.12	1.29	0.199	-0.082	0.390
Index of Autonomous Functioning	0.17	0.05	3.13	0.002	0.061	0.269
Autonomous Motives for Solitude	0.11	0.09	1.27	0.205	-0.062	0.289
Controlled Motives for Solitude	0.28	0.08	3.34	0.001	0.115	0.450
R^2 =40.45%, F (7, 161) = 17.29, p <.000						
Conditional effect of DTA-GL on General Well-being of DTA-SA after controlling DTA-SI						
DTA-SA	Effect	*se*	*t*	*p*	LLCI	ULCI
-1SD	-0.57	0.13	-4.37	0.000	-0.826	-0.311
M	-0.43	0.12	-3.56	0.001	-0.671	-0.192
+1SD	-0.30	0.14	-2.15	0.033	-0.566	-0.024

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Fig. 4 Moderation effect plot of DTA-Solitude Appreciation (DTA-SA) on the relationship between DTA-General Loneliness (DTA-GL) and General Well-being (Mental Health Continuum) after controlling DTA-Solitude Intolerance (DTA-SI), Index of Autonomous Functioning, Autonomous Motives for Solitude, and Controlled Motives for Solitude (Study 2, N = 169)



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Table 8. Interaction effect of the Differential Test of Aloneness (DTA) on HANA (Study 2, N=169)

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	0.15	0.24	0.64	0.522	-0.315	0.619
DTA_Solitude Intolerance (DTA_SI)	0.00	0.27	0.00	1.000	-0.532	0.532
DTA_GL * DTA_SI	0.09	0.09	1.00	0.319	-0.092	0.280
constant	0.05	0.78	0.06	0.951	-1.493	1.589
DTA_Solitude Appreciation (DTA_SA)	0.09	0.16	0.57	0.568	-0.219	0.398
Index of Autonomous Functioning	-0.04	0.06	-0.74	0.460	-0.155	0.071
Autonomous Motives for Solitude	0.05	0.10	0.51	0.612	-0.140	0.237
Controlled Motives for Solitude	0.43	0.09	4.75	0.000	0.251	0.609
R^2 =64.67%, F (7, 161) = 42.11, p <.000						

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Table 9. Interaction effect of the Differential Test of Aloneness (DTA) on HANA (Study 2, N=169)

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	0.12	0.36	0.34	0.737	-0.582	0.821
DTA_Solitude Appreciation (DTA_SA)	-0.03	0.29	-0.10	0.918	-0.606	0.545
DTA_GL * DTA_SA	0.08	0.11	0.69	0.488	-0.140	0.292
constant	-0.08	0.88	-0.10	0.924	-1.829	1.660
DTA_Solitude Intolerance (DTA_SI)	0.22	0.13	1.73	0.085	-0.031	0.475
Index of Autonomous Functioning	-0.03	0.06	-0.60	0.548	-0.146	0.078
Autonomous Motives for Solitude	0.06	0.10	0.64	0.521	-0.127	0.249
Controlled Motives for Solitude	0.43	0.09	4.76	0.000	0.253	0.611
R^2 =64.56%, F (7, 161) = 41.90, p <.000						

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Table 10. Interaction effect of the Differential Test of Aloneness (DTA) on LANA (Study 2, N=169)

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	0.97	0.24	4.06	0.000	0.497	1.436
DTA_Solitude Intolerance (DTA_SI)	0.31	0.27	1.15	0.251	-0.223	0.848
DTA_GL * DTA_SI	-0.10	0.09	-1.05	0.293	-0.287	0.087
constant	-0.71	0.79	-0.91	0.366	-2.262	0.839
DTA_Solitude Appreciation (DTA_SA)	0.00	0.16	-0.01	0.995	-0.312	0.310
Index of Autonomous Functioning	-0.05	0.06	-0.90	0.367	-0.166	0.062
Autonomous Motives for Solitude	0.14	0.10	1.47	0.144	-0.049	0.330
Controlled Motives for Solitude	0.23	0.09	2.55	0.012	0.052	0.412
R^2 =62.30%, F (7, 161) = 38.01, p <.000						

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Table 11. Interaction effect of the Differential Test of Aloneness (DTA) on LANA (Study 2, N=169)

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	0.45	0.36	1.27	0.205	-0.251	1.160
DTA_Solitude Appreciation (DTA_SA)	-0.29	0.29	-0.99	0.324	-0.869	0.289
DTA_GL * DTA_SA	0.10	0.11	0.91	0.365	-0.117	0.317
constant	0.77	0.89	0.86	0.390	-0.989	2.519
DTA_Solitude Intolerance (DTA_SI)	0.04	0.13	0.30	0.765	-0.216	0.293
Index of Autonomous Functioning	-0.06	0.06	-1.14	0.257	-0.177	0.048
Autonomous Motives for Solitude	0.14	0.10	1.42	0.157	-0.053	0.325
Controlled Motives for Solitude	0.22	0.09	2.44	0.016	0.043	0.403
R^2 =62.24%, F (7, 161) = 37.90, p <.000						

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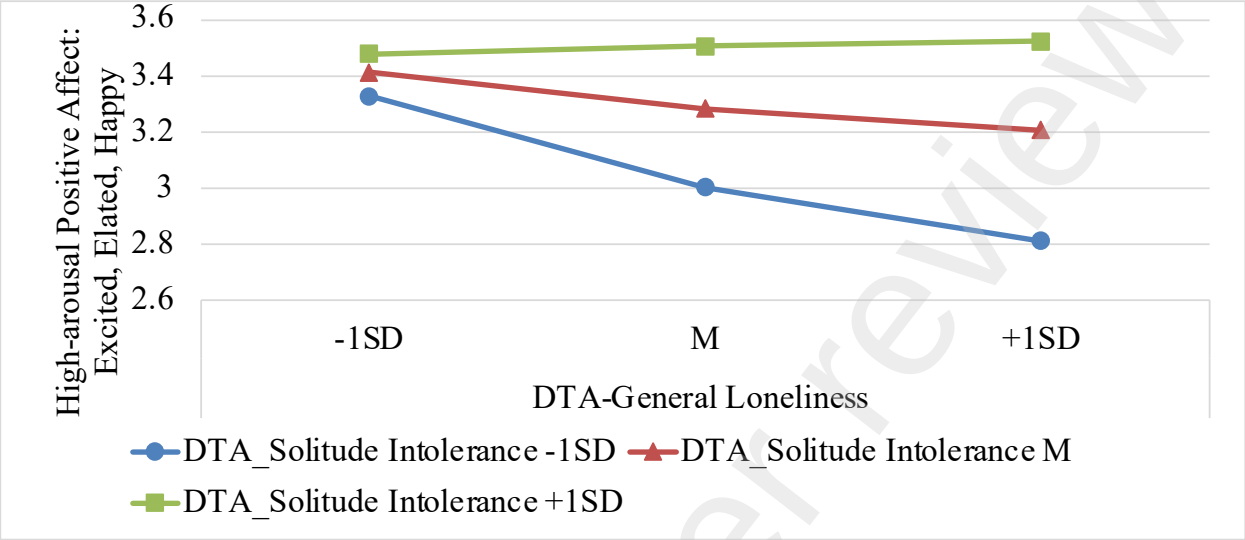
Table 12. Interaction effect of the Differential Test of Aloneness (DTA) on High-arousal Positive Affect (HAPA) (Study 2, N=169)

Variables	**coeff**	**se**	***t***	***p***	**LLCI**	**ULCI**
DTA_General Loneliness (DTA_GL)	-0.70	0.23	-3.08	0.002	-1.148	-0.252
DTA_Solitude Intolerance (DTA_SI)	-0.29	0.26	-1.10	0.271	-0.797	0.225
DTA_GL * DTA_SI	0.21	0.09	2.29	0.023	0.029	0.385
constant	1.12	0.75	1.50	0.135	-0.354	2.603
DTA_Solitude Appreciation (DTA_SA)	0.30	0.15	1.98	0.049	0.001	0.594
Index of Autonomous Functioning	0.10	0.05	1.89	0.060	-0.004	0.213
Autonomous Motives for Solitude	0.13	0.09	1.39	0.165	-0.053	0.308
Controlled Motives for Solitude	0.48	0.09	5.47	0.000	0.304	0.647
R^2 =56.57%, F (7, 161) = 29.96, p <.000						
Conditional effect of DTA-GL on HAPA of DTA-SI after controlling DTA-SA						
DTA-SI	Effect	*se*	*t*	*p*	LLCI	ULCI
-1SD	-0.29	0.12	-2.30	0.023	-0.532	-0.040
M	-0.11	0.14	-0.81	0.420	-0.392	0.164
+1SD	0.02	0.18	0.14	0.891	-0.326	0.374

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Fig. 5 Moderation effect plot of DTA-Solitude Intolerance (DTA-SI) on the relationship between DTA-General Loneliness (DTA-GL) and High-arousal Positive Affect (HAPA; Excited, Elated, Happy) after controlling DTA-Solitude Appreciation (DTA-SA), Index of Autonomous Functioning, Autonomous Motives for Solitude, and Controlled Motives for Solitude (Study 2, N = 169)



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Table 13. Interaction effect of the Differential Test of Aloneness (DTA) on HAPA (Study 2, N=169)

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	-0.54	0.35	-1.57	0.118	-1.224	0.139
DTA_Solitude Appreciation (DTA_SA)	0.21	0.28	0.74	0.463	-0.351	0.768
DTA_GL * DTA_SA	0.09	0.11	0.86	0.390	-0.118	0.301
constant	0.27	0.86	0.32	0.750	-1.421	1.968
DTA_Solitude Intolerance (DTA_SI)	0.22	0.12	1.76	0.081	-0.027	0.465
Index of Autonomous Functioning	0.12	0.05	2.26	0.025	0.016	0.232
Autonomous Motives for Solitude	0.15	0.09	1.64	0.103	-0.031	0.335
Controlled Motives for Solitude	0.48	0.09	5.48	0.000	0.309	0.656
R^2 =55.36%, F (7, 161) = 28.52, p <.000						

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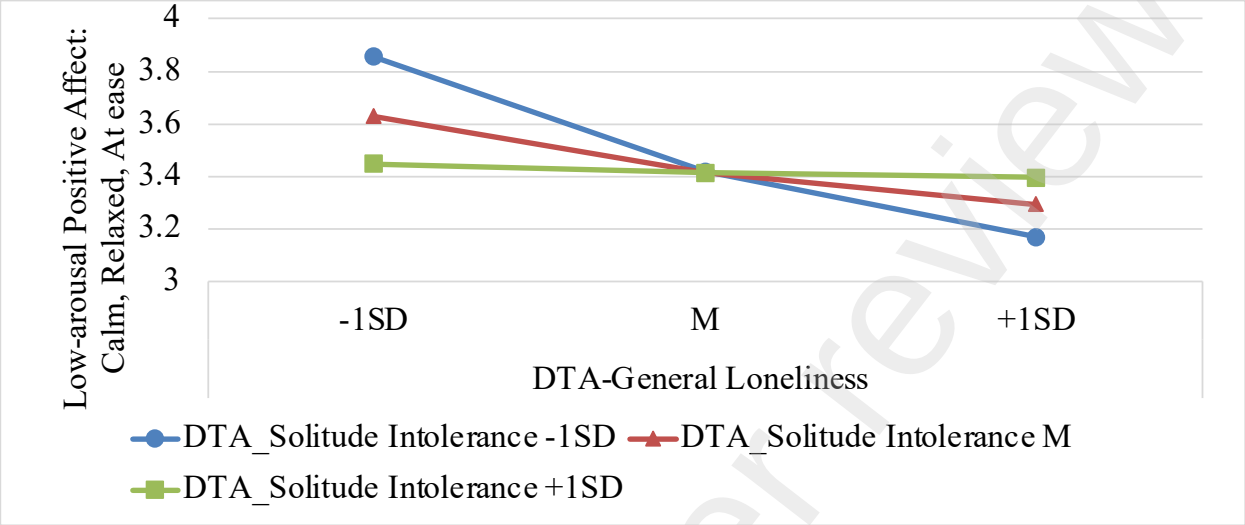
Table 14. Interaction effect of the Differential Test of Aloneness (DTA) on LAPA (Study 2, N=169)

Variables	**coeff**	**se**	***t***	***p***	**LLCI**	**ULCI**
DTA_General Loneliness (DTA_GL)	-0.84	0.22	-3.89	0.000	-1.271	-0.414
DTA_Solitude Intolerance (DTA_SI)	-0.70	0.25	-2.83	0.005	-1.189	-0.213
DTA_GL * DTA_SI	0.23	0.09	2.69	0.008	0.062	0.403
constant	2.52	0.71	3.53	0.001	1.109	3.932
DTA_Solitude Appreciation (DTA_SA)	0.38	0.14	2.67	0.009	0.099	0.666
Index of Autonomous Functioning	0.12	0.05	2.26	0.025	0.015	0.222
Autonomous Motives for Solitude	0.22	0.09	2.51	0.013	0.047	0.392
Controlled Motives for Solitude	0.31	0.08	3.79	0.000	0.151	0.479
R^2 =44.53%, F (7, 161) = 18.35, p <.000						
Conditional effect of DTA-GL on LAPA of DTA-SI after controlling DTA-SA						
DTA-SI	Effect	*se*	*t*	*p*	LLCI	ULCI
-1SD	-0.38	0.12	-3.17	0.002	-0.612	-0.143
M	-0.18	0.13	-1.37	0.174	-0.449	0.082
+1SD	-0.03	0.17	-0.17	0.867	-0.363	0.306

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Fig. 6 Moderation effect plot of DTA-Solitude Intolerance (DTA-SI) on the relationship between DTA-General Loneliness (DTA-GL) and Low-arousal Positive Affect (LAPA; Calm, Relaxed, At ease) after controlling DTA-Solitude Appreciation (DTA-SA), Index of Autonomous Functioning, Autonomous Motives for Solitude, and Controlled Motives for Solitude



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Table 15. Interaction effect of the Differential Test of Aloneness (DTA) on LAPA ***(N=169)***

Variables	coeff	se	*t*	*p*	LLCI	ULCI
DTA_General Loneliness (DTA_GL)	-0.37	0.33	-1.10	0.273	-1.023	0.292
DTA_Solitude Appreciation (DTA_SA)	0.51	0.27	1.87	0.064	-0.029	1.047
DTA_GL * DTA_SA	0.00	0.10	0.04	0.969	-0.198	0.206
constant	0.83	0.83	1.01	0.314	-0.797	2.467
DTA_Solitude Intolerance (DTA_SI)	-0.11	0.12	-0.94	0.350	-0.349	0.124
Index of Autonomous Functioning	0.14	0.05	2.70	0.008	0.039	0.247
Autonomous Motives for Solitude	0.24	0.09	2.72	0.007	0.066	0.418
Controlled Motives for Solitude	0.33	0.08	3.84	0.000	0.159	0.494
R^2 =42.02%, F (7, 161) = 16.56, p <.000						

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The Dark and Bright Sides of Being Alone:
Moderators and Covariates of General Loneliness

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Declaration of Generative AI Use

No generative AI tools were used in the writing or analysis of this manuscript.

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