Perceived Environmental Safety Buffers the Adverse Effect of Loneliness on The Subjective Well-Being of Urban Residents

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Article

Perceived Environmental Safety Buffers the Adverse Effect of Loneliness on the Subjective Well-Being of Urban Residents

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Abstract Loneliness, as a well-established risk factor of mental health, has been strongly associated with low subjective well-being (SWB). However, less is known about potential boundary conditions that may ameliorate this 'dark side' of loneliness. Social connections are critical to well-being from the standpoint that the lack of belonging was detrimental to human survival in the evolutionary past. We thus hypothesized that loneliness would exert a more pronounced influence on people's SWB when the need for others (social resource) is perceived to be high–the presence of environmental harshness. With a particular focus on urban (i.e., Seoul) residents who are presumed to be more vulnerable to loneliness, two studies examined whether feeling lonely matters less to SWB under favorable environmental conditions. As expected, loneliness was less harmful to the SWB of individuals who perceived their surroundings as relatively secure and favorable (Study 1). We then experimentally replicated the results by exposing people to cues of either a harsh (e.g., images of scarcity) or a favorable environment (Study 2).

Keywords: loneliness; subjective well-being; environmental safety; urban residents

1. Introduction

Belonging is a fundamental human need [1–3], and the perception of unmet or threatened social needs leads to feelings of pain known as loneliness [4,5]. Loneliness, as a risk factor of mental health, has been strongly associated with low subjective well-being (SWB); lonely individuals tend to experience lower levels of positive emotion and life satisfaction [6–8], and are more vulnerable to negative emotional experiences [9,10] than their less lonely counterparts. Lonely individuals even perceive their life as less meaningful [11]. This negative association between loneliness and SWB has been corroborated by both daily experience sampling studies and longitudinal investigations [12,13]. Although there has been considerable research on how loneliness undermines happiness, the potential boundary conditions that can mitigate this 'dark side' of loneliness are not well understood.

Social connections are critical to well-being from the standpoint that the lack of belonging was detrimental to human functioning in the evolutionary past [1,14]. Social bonds protect individuals against harsh environmental conditions by providing nutrition, shelter, security, and caregiving [15], making other individuals a vital '*resource*' for survival. Belonging brings advantages, while isolation carries significant drawbacks, including even the risk of mortality [16]. Not surprisingly, the experience of social pain activates neural regions linked to physical pain processing that is crucial for human survival [17]. Thus, individuals vigilantly monitor their inclusionary status and react strongly to signs of social isolation [18], as it is assumed to signal a lack of adequate resources for survival in a given environment [19,20].

Loneliness indeed reflects a sense of vulnerability and insecurity [21,22], which drives individuals to seek resources as a way to cope with life challenges [19,23,24]. Social connections have historically been the primary resource relied upon [25], but alternatives do exist. Money, for example,

can serve as a social substitute by enhancing self-sufficiency and reducing dependence on others [26,27]. Lonely individuals, lacking sufficient social resources, often display a strong inclination towards pursuing money [28], and even the mere thought of money can alleviate social pain [29]. Similarly, possessing power grants individuals the capacity to acquire resources independently without relying on social connection or cooperation [30–32]. Power has also been found to diminish feelings of loneliness [33] and enhances resilience in the face of risks [34–36]

These findings support the idea that when safety is ensured through alternative means within a given environment, individuals become less sensitive to social disconnection. In a study by Huang and colleagues [37], for example, it was demonstrated that lonely individuals assigned to an 'invulnerability' condition in which they imagined possessing superpowers that protected them from physical harm showed a decreased desire for social connection compared to those in control conditions. This suggests that the negative impact of loneliness on SWB may vary depending on the perceived threat within the surrounding environment. Indeed, the perceived sense of safety in one's environment plays a crucial role in human well-being [38]. Individuals who view their environment favorably generally report higher levels of life satisfaction and experience better health outcomes [39,40]. Conversely, individuals who perceive their surroundings as unsafe and threatening are more likely to experience negative health outcomes [41–43], and tend to exhibit higher levels of loneliness compared to their counterparts [44–46]. Given that environmental threat amplifies the need for social resources and their benefits, it is hypothesized that the negative impact of loneliness on SWB would be mitigated in relatively benign and favorable environments.

In summary, with a particular focus on residents of a densely populated urban area (i.e., Seoul), who are assumed to be more vulnerable to loneliness due to high levels of competition [47,48], two studies examined whether feeling lonely matters less to SWB in favorable environmental conditions. Study 1 utilized a panel dataset that included information on loneliness, perceived environmental safety, and SWB. Study 2 aimed to experimentally verify the results of Study 1 by manipulating the perception of environmental safety.

2. Study 1

A correlational study was conducted to provide initial evidence supporting our hypothesis. We predicted that the relationship between loneliness and SWB would be relatively weaker in environments perceived as benign (vs. threatening).

2.1. Participants

This study utilized the 'Seoul Survey Urban Policy Index Survey,' which incorporated data collected by the Korean Statistical Office to evaluate the quality of life of citizens in Seoul. The data collection period spanned from September 6th to November 8th, 2021, and involved conducting household interviews with Seoul residents aged 15 and above. The total sample size of household members was 40,441 (19,041 males, 21,400 females). Their age groups consist of 1,570 individuals in their teens (3.9%), 4,243 in their 20s (10.5%), 8,734 in their 30s (21.6%), 9,189 in their 40s (22.7%), 7,606 in their 50s (18.8%), and 9,099 individuals aged 60 and above (22.5%).

2.2. Measurement

Within the questionnaire, we analyzed the following items: loneliness, perceived environmental safety, and SWB. Two items were used to measure loneliness ("I sometimes feel lonely in my relationship with family," "I sometimes feel lonely in my relationship with people other than family"). Participants responded on a 5-point scale (1 = *not at all*, 5 = *very much*), and the ratings were averaged to create a single index of loneliness (M = 2.86, SD = 0.89; α = .84). Next, perceived environmental safety was assessed by asking participants to report the extent to which they perceive their environments as threatening across 4 categories as follows: economic environment (i.e., economic crisis, unemployment; M = 3.86, SD = 0.77; α = .75), natural environment (i.e., natural disasters, infectious diseases; M = 3.79, SD = 0.78; α = .57), social environment (i.e., accidents, violent

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crimes, social conflicts, and corruption; M = 3.77, SD = 0.73; α = .80), and internet environment (i.e., cyber security, personal information leakage; M = 3.71, SD = 0.84; α = .74). Participants responded on a 5-point scale (1 = *not at all*, 5 = *very severe*), and the ratings were reverse coded and averaged to create a single index of perceived environmental safety (M = 2.22, SD = 0.64; α = .88). Lastly, SWB was assessed by asking participants about their level of happiness across 5 life domains (i.e., Health, financial status, relationships with relatives and friends, family life, and work life). The scale ranged from 0 (*most unhappy*) to 10 (*most happy*), and the average value (M = 6.43, SD = 1.65; α = .91) was used for the analysis.

2.3. Results

As expected, loneliness was negatively correlated with perceived environmental safety (r = -.12, p < .001) and SWB (r = -.30, p < .001). Perceived environmental safety was positively correlated with SWB, r = .11, p < .001. To test whether the negative relationship between loneliness and SWB decreases with higher perceived environmental safety, the SPSS indirect macro program (Model 1: simple moderation analysis; bootstrap 10,000) was employed [49]. Loneliness was entered as the independent variable, perceived environmental safety as the moderating variable, and SWB as the dependent variable.

The results revealed a significant main effect of loneliness on SWB, b = -0.53, SE = 0.01, p < .001, CI_{95} [-0.55, -0.51]. Similarly, the main effect of perceived environmental safety on SWB was also statistically significant, b = 0.23, SE = 0.01, p < .001, CI_{95} [0.20, 0.26]. More importantly, the expected interaction effect was observed, b = 0.28, SE = 0.01, p < .001, CI_{95} [0.26, 0.31], indicating that the level of perceived environmental safety moderated the loneliness-SWB relationship. As shown in Figure 1, loneliness was negatively related to the SWB of individuals with low perceived environmental safety (-1 SD), b = -0.71, SE = 0.01, p < .001, CI_{95} [-0.73, -0.69]. By contrast, this association was weaker in individuals with relatively high perceived environmental safety (+1 SD), b = -0.35, SE = 0.01, p < .001, CI_{95} [-0.37, -0.33].

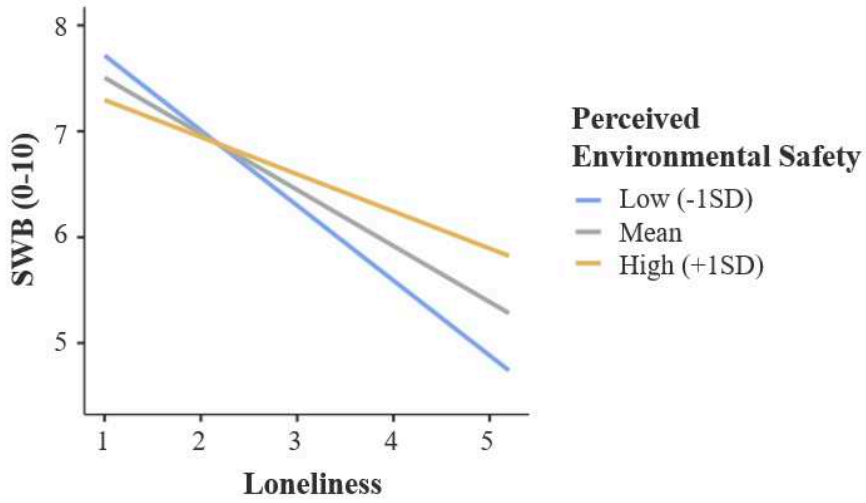

Figure 1. SWB (subjective well-being) as a function of loneliness and perceived environmental safety (Study 1).

3. Study 2

In Study 1, loneliness appeared less harmful to happiness when individuals were in relatively favorable environments. Study 2 aimed to experimentally manipulate perceptions of environmental safety to establish its causal role. In this study, we particularly focused on resource availability (scarcity vs. abundance), which was identified as the top-ranked environmental threat perceived in Study 1. Recognized as one of the most fundamental challenges faced by humans [50], scarcity significantly influences people's heightened value placed on social belongingness [51,52]. Based on

this, we posited that primed resource abundance would mitigate the negative association between loneliness and SWB.

3.1. Participants

We aimed to recruit young adults aged 20-39 from diverse backgrounds. We predetermined our sample size based on a power analysis for a one-way ANOVA (power = .80, f^2 = .025) [53]. We adjusted the number upward to account for the possibility of having to discard some cases, and 90 individuals participated via online survey platforms. Six participants were excluded due to missing values, leaving a final sample of 84 (female = 57.1%, M_{age} = 24.06, SD_{age} = 3.94). The majority were single (58.8%) and 41.2% were married or living together.

3.2. Materials and Procedure

After consent, participants reported their demographic characteristics (gender, age, and relationship status). Next, embedded within several filler questions (e.g., "Where do you prefer to spend your vacation, beach or mountain?"), loneliness was measured using a 10-item version of the revised UCLA loneliness scale (e.g., "I lack companionship," "I feel left out") on a 7-point scale (1 = *never*, 7 = *often*) [54]. 10 items (α = .83) were averaged to create a single index of loneliness.

Participants were then randomly assigned to either the scarcity (n = 43) or the abundance (n = 41) condition. Participants were shown a series of 10 resource-related photos, presented in a randomized order within conditions. In the scarcity condition, participants viewed photos depicting scarcity (e.g., fields devastated by drought and famine), while participants in the abundance condition viewed photos depicting abundance (e.g., fields full of crops and fresh fruits). To ensure that the priming procedure successfully induced differences in the perceptions of resource availability, participants were asked to rate their perceived scarcity of resources ("How scarce do you perceive the resources at this moment?"; adapted from [55]) on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

They then completed the 12-item Scale of Positive and Negative Experience (SPANE) as a measure of their affective well-being (Positive affect: α = .83, Negative affect: α = .82) [56]. Although this scale was developed to measure affect at the trait level, we adapted it to measure state-level affect, asking participants to report their current emotions (see [57]; 1 = *not at all*, 7 = *extremely*). To assess life satisfaction, we employed the Satisfaction With Life Scale (SWLS) [58], comprised of five items asking respondents to rate their overall life satisfaction using a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*, α = .87). The SWB score was computed by combining positive affect, negative affect, and life satisfaction.

3.3. Results

Manipulation check. As expected, participants reported higher levels of perceived resource scarcity in the scarcity (M = 4.48, SD = 0.98) than in the abundance condition (M = 3.52, SD = 0.91), $t(82)$ = 4.63, p < .001, d = 1.02. There were no significant differences between the conditions in overall positive affect (p = 0.56) or negative affect (p = 0.20).

Main analysis. We examined whether the loneliness-SWB relationship varies by the primed environmental safety (scarcity vs. abundance). The moderating effect was analyzed using the PROCESS macro (Model 1, 10,000 bootstrapped samples) [49]. The results indicated a significant main effect of loneliness on SWB, b = -3.04, SE = 0.79, p < .001, CI_{95} [-4.62, -1.47], while the main effect of primed environmental safety was not significant, b = -0.11, SE = 0.45, p = .81, CI_{95} [-1.00, 0.78]. More importantly, we found that the primed environmental safety moderated the relationship between loneliness and SWB, b = 1.02, SE = 0.49, p < .05, CI_{95} [0.04, 2.00]. As shown in Figure 2, loneliness negatively predicted SWB for participants in both the scarcity and the abundance conditions, but the association was stronger in the scarcity condition (abundance condition: b = -1.00, SE = 0.34, p < .01, CI_{95} [-1.68, -0.32], scarcity condition: b = -2.02, SE = 0.36, p < .001, CI_{95} [-2.73, -1.31]).

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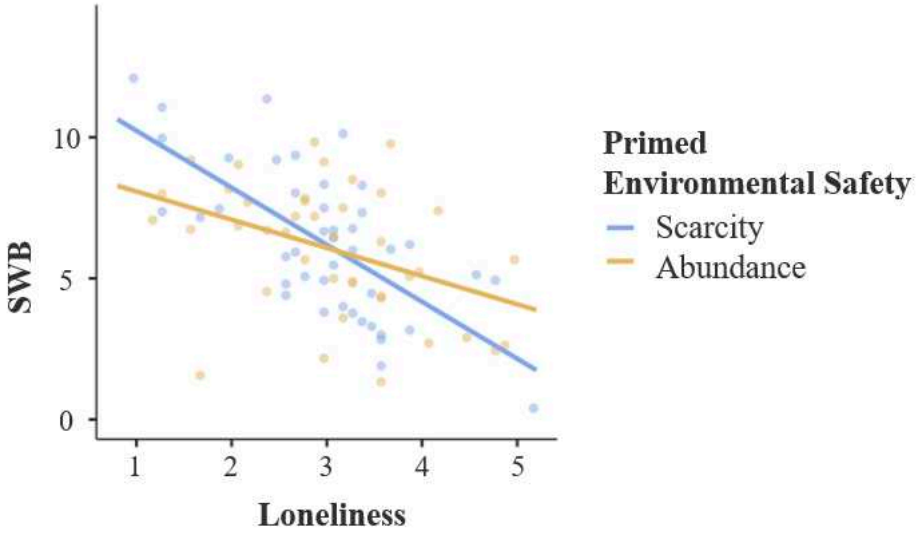

Figure 2. SWB (subjective well-being) as a function of loneliness and primed environmental safety (Study 2).

We further examined the moderation effect for each sub-factor of SWB. As for the positive affect (PA), we found that the main effect of loneliness was statistically significant, b = -1.43, SE = 0.35, p < .001, CI_{95} [-2.13, -0.73], confirming a negative relationship between loneliness and PA. The main effect of primed environmental safety was not significant, b = 0.29, SE = 0.20, p = .15, CI_{95} [-0.11, 0.69]. The moderation effect of primed environmental safety on the loneliness-PA link was statistically significant, b = 0.68, SE = 0.22, p < .01, CI_{95} [0.24, 1.11]. Although loneliness was negatively related to PA in the scarcity condition, b = -0.76, SE = 0.16, p < .001, CI_{95} [-1.07, -0.44], this relationship disappeared in the abundance condition, b = -0.08, SE = 0.15, p = .60, CI_{95} [-0.38, 0.22]. As for the negative affect (NA), we found a significant main effect of loneliness, b = 0.67, SE = 0.32, p < .05, CI_{95} [0.03, 1.32], whereas the main effect of primed environmental safety was not significant, b = 0.22, SE = 0.18, p = .23, CI_{95} [-0.14, 0.58]. The moderation effect of primed environmental safety on the loneliness-NA link was not significant, b = -0.05, SE = 0.20, p = .81, CI_{95} [-0.45, 0.35]. As for life satisfaction, the main effect of loneliness was statistically significant, b = -0.94, SE = 0.37, p < .05, CI_{95} [-1.68, -0.19], whereas the main effect of primed environmental safety was not significant, b =- 0.18, SE = 0.21, p = .40, CI_{95} [-0.60, 0.24]. The moderation effect of primed environmental safety on the relationship between loneliness and life satisfaction was not significant, b = 0.30, SE = 0.23, p = .21, CI_{95} [-0.17, 0.76]. Overall, our findings suggests that experimentally primed environmental safety primarily mitigated the negative association between loneliness and PA, within the broader context of SWB.

4. Discussion

As the severity and pervasiveness of loneliness increase, it is crucial to explore strategies for mitigating its negative consequences. Focusing on individuals residing in Seoul, this study discovered that individuals' perception of environmental safety could serve as a protective factor, reducing the negative association between loneliness and SWB. Specifically, individuals who perceived their living environments as relatively safe (vs. threatening) reported a smaller decrease in SWB related to loneliness (Study 1). Furthermore, experimentally inducing resource abundance (vs. scarcity), identified as the most prioritized aspect of environmental safety in Study 1, weakened the negative link between loneliness and SWB (Study 2).

Loneliness's reduced impact on SWB in benign environments aligns well with the recent functional perspective on interpersonal relationships, which proposes that other individuals serve as instrumental means for achieving important goals [59–61]. While traditionally understood as a social phenomenon resulting from unmet affiliation needs, loneliness may extend to encompass broader domains relevant to survival goals, indicating overall vulnerability or diminished adaptive fitness

within specific environments [19,20,62]. It seems that the influence of social connectedness or its absence may diminish when one's survival can be ensured through alternative substitutes, such as money, power, and a favorable environment [29,33,37,63].

This study uncovers new boundary conditions that can alleviate the detrimental effects of loneliness. Although previous research has primarily focused on individual-level characteristics associated with loneliness, this study sheds light on the role of macro-level environmental perception. This approach is in line with the recent trend that emphasizes the significance of ecological conditions as fundamental factors shaping individuals' thoughts, emotions, and behaviors [64,65]. For instance, regional characteristics have been found to play a vital role in various psychological outcomes, including health [66], life satisfaction [67], depression [68], and prosocial behavior [69]. By highlighting the significance of environmental safety in modulating the consequences of loneliness, this study suggests potential macroscopic prevention strategies, such as improving walkability, increasing the presence of green spaces, and enhancing security against criminal activities within urban areas [70–72].

Our findings open several promising avenues for future research. Firstly, recent studies have highlighted the role of the environment in fostering a sense of belonging [63,73,74], suggesting that lonely individuals may place a greater value on their surroundings as a whole. While it is well-established that lonely individuals exhibit heightened prosocial behavior in their pursuit of social connections [75,76], exploring whether this heightened prosociality extends to include non-human entities such as the environment and promotes pro-environmental behaviors would be fruitful. Secondly, the moderating effect of environmental safety on loneliness may be influenced by an individual's socioeconomic status (SES). Given that individuals with lower and higher SES significantly differ in their vigilance towards environmental threats [77], it is plausible that environmental safety may more effectively mitigate the adverse impact of loneliness among those with lower SES. Examining the interplay among environmental safety, SES, and loneliness can provide valuable insights into the complex nature of loneliness and guide targeted interventions for individuals of varying SES levels.

Limitations should also be acknowledged. Firstly, the generalizability of our findings may be constrained by our focus on residents of densely populated urban areas, and it would be desirable to replicate the study in diverse settings. Secondly, further investigation is needed to uncover the underlying mechanisms of the observed effects. One possibility is that environmental safety directly alleviates the threats associated with social isolation. As hypothesized, the distressing feelings linked to loneliness act as a signal of vulnerability to threats [19], and the urgency of this signal may diminish in a safe environment [37,45,46], leading to a reduced decline in hedonic well-being. Alternatively, a safe and resource-rich environment may indirectly facilitate social interaction and connectivity (e.g., by increasing a sense of control, correcting cognitive biases, etc.), thereby mitigating the negative effects of loneliness [78,79] and disrupting the vicious cycle of loneliness [21,80].

Author Contributions Ji-eun Shin: Conception and design, acquisition of data, drafting and revising the article; **Hyunseop Han**: drafting the article and acquisition of data; **Eunjung Park**: analysis and interpretation of data; **Jeoung-Gil Suh**: interpretation of data; **Hoon-Seok Choi**: revising the article. All authors reviewed the results and approved the final version of the manuscript.

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