

The Emergence and Volatility of Homesickness in Exchange Students Abroad: A Smartphone-Based Longitudinal Study

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Abstract

Previous research on the determinants of homesickness has tended to produce inconsistent results and relied mostly on cross-sectional assessments. To capture the longitudinal perspective, we conducted a smartphone app-based study, monitoring the emergence and volatility of homesickness in international university exchange students ($n = 148$). Applying an experience sampling method (ESM), homesickness was measured every second day over a period of 3 months followed by a post hoc questionnaire to assess potential moderators. Multilevel modeling revealed that whereas age, Extraversion, Conscientiousness, Openness to Experience, voluntariness, previous stays abroad, support from host university, geographical distance, co- and host national identification, language proficiency, and pre-data collection duration of stay did not yield any effects, being male, scoring high on Neuroticism as well as Agreeableness, having difficulties in sociocultural adaptation, and being at the beginning of the stay (as opposed to later on) were related

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to higher levels of homesickness. Corroborating the latter finding, curve estimation regression analyses showed that homesickness normally peaks immediately after relocation and fades away afterward. Together with the low overall intensities of homesickness found in the present sample, the results suggest that homesickness is a common but mild adverse by-product of international student mobility.

Keywords

homesickness, international student mobility, temporary settlement, environmental psychology, science apps, experience sampling, multilevel modeling

Introduction

Humankind has never been more mobile than it is today (Thurber, 2005). Beginning in the late 20th century, the world has witnessed a drastic increase in mobility (Furnham, 2005; Hendrickson, Rosen, & Aune, 2011), affecting groups as diverse as businessmen, refugees, and exchange students on nationwide and cross-border levels alike (Duru & Balkis, 2013). A global phenomenon, the new mobility prompts scholars to claim that a traditional philosophy of life, assuming that one lives and dies at a single place, seems to be an increasingly outdated notion for more and more people (Vingerhoets, 2005).

Leaving home may have positive and negative consequences. On one hand, it can pose a unique opportunity for personal growth (Thurber & Walton, 2007). Usually, relocation brings about an interruption that requires reorientation and successful adaptation. If being dealt with effectively, it harbors the potential to boost one's sense of self-efficacy, broadens personal horizons, and may mark a leap in individual development (Furnham, 2005; Paul & Brier, 2001).

On the other hand, moving away from home might elicit distressing and impairing sequelae, such as homesickness, self-doubt, disappointment, loneliness, rejection, alienation, conflict, anxiety, depression, loss of connections to friends and family, hopelessness, and low self-esteem (e.g., Fisher, 2005; Furnham, 2005; Paul & Brier, 2001; Poyrazli & Lopez, 2007; Terry, Leary, & Mehta, 2013; Thurber & Walton, 2007). While not everybody suffers from these adverse side effects, some of them are fairly common, for example, homesickness (Baier & Welch, 1992; Brewin, Furnham, & Howes, 1989; Flett, Endler, & Besser, 2009; Thurber & Walton, 2012; van Tilburg, Vingerhoets, & van Heck, 1996).

Among other variables, homesickness can be linked to negative affect, health complaints, cognitive failures (van Tilburg, Vingerhoets, van Heck, & Kirschbaum, 1999), somatic complaints, academic difficulties, behavioral withdrawal, low satisfaction (Thurber & Sigman, 1998), stress and maladaptation in the new environment (Stroebe, Schut, & Nauta, 2016), and psychological disturbance in general (Fisher & Hood, 1987). In spite of its pervasiveness and power to cause people considerable discomfort, homesickness seems to be an underresearched phenomenon (Stroebe, Vliet, Hewstone, & Willis, 2002; Watt & Badger, 2009).

Further complicating the matter, in the absence of a binding definition and a universal standard to measure homesickness, a comprehensive theoretical framework to integrate previous findings and guide future research is still missing (Carden & Feicht, 1991; van Tilburg, 2005; Vingerhoets, 2005; Watt & Badger, 2009).

Nonetheless, there is some consensus concerning homesickness. In essence, homesickness represents a multifaceted cognitive-motivational-affective state of distress (Eurelings-Bontekoe, 2005; Fisher & Hood, 1987; Scopelliti & Tiberio, 2010), distinguished by a strong preoccupation with the home environment following relocation (Verschuur, Eurelings-Bontekoe, Spinhoven, & Duijsens, 2003). Homesickness is believed to result from a complex interplay of personality, situational circumstances, and environmental factors (Thurber & Sigman, 1998), and may also manifest itself on somatic and social levels (Stroebe, Schut, & Nauta, 2015). Mild, highly prevalent and more pathological, severely debilitating forms of homesickness have been distinguished (Eurelings-Bontekoe, 2005; Thurber & Walton, 2007).

Meanwhile, disagreement prevails with respect to other issues, such as whether to include adjustment difficulties related to the new environment into the definition of homesickness. Fisher, Murray, and Frazer (1985) have put forward an influential two-stage multicausal risk model. While relocation is deemed a necessary, yet not sufficient condition for the emergence of homesickness, it is posited to arise from an interaction between personality factors and inherent features of the new place (Fisher et al., 1985). On the contrary, drawing from the bereavement literature, Stroebe and colleagues (2016) proposed an alternative conceptualization, the Dual Process Model of Homesickness (DPM-HS). According to the DPM-HS, blending home- and new-place-related phenomena into a singular concept may falsely merge two constructs, which ought to be studied independently (Stroebe et al., 2016). Instead, homesickness is conceived of as a separation phenomenon only, which coincides with new place stressors and adjustment difficulties, but is nonetheless a distinct concept in its own right.

Likewise, with respect to the trajectories of homesickness, uncertainty persists. In general, homesickness tends to be a transitory state, peaking almost immediately following relocation and fading away thereafter (Brewin et al., 1989; Fisher et al., 1985; Furnham, 2005; Stroebe et al., 2015; Tartakovsky, 2007). This decline is assumed to occur due to successful adaptation and commitment to the new place (Burt, 1993; Stroebe et al., 2002). Concordant with the DPM-HS, Paul and Brier (2001) have argued that upon relocation, students initially go through a period of grief, mourning the loss of precollege social ties before being able to form new bonds that foster adjustment.

Yet, several studies have found no change of homesickness over time (Watt & Badger, 2009), or even an increase in reported homesickness (Fisher & Hood, 1987; Thurber & Walton, 2007). The latter aligns well with the idea that once initial euphoria wears off, people start perceiving negative aspects of a new environment, which they had been unaware of before (Poyrazli & Lopez, 2007).

To disentangle the underlying mechanisms of homesickness, scholars have sought to identify common moderators of homesickness. We review demographic variables first, before turning to personality traits and circumstantial factors.

In contrast with popular lay beliefs, the current body of knowledge does not unequivocally support the notion that women are more vulnerable to homesickness than are men (Stroebe et al., 2015). Instead, some studies reported significant sex differences in the expected direction (e.g., Archer, Ireland, Amos, Broad, & Currid, 1998; Hannigan, 2005; Stroebe et al., 2002; Verschuur et al., 2003), whereas others could not replicate these patterns (e.g., Brewin et al., 1989; Fisher & Hood, 1987; Flett et al., 2009; Kazantzis & Flett, 1998; Schmitz, 2005; Scopelliti & Tiberio, 2010).

Mixed results have also been reported for age as a moderator of homesickness. While information on age effects in the homesickness literature is generally rare, studies that looked into it suffered from restricted age ranges and produced inconclusive outcomes (Stroebe et al., 2015). Henceforth, some studies support the idea that age is negatively associated with homesickness (Baier & Welch, 1992; Kazantzis & Flett, 1998; Poyrazli & Lopez, 2007; Thurber, 1995; Thurber & Sigman, 1998; Thurber & Walton, 2012), whereas others did not detect any correlations at all (Fisher & Hood, 1987; Scopelliti & Tiberio, 2010; Verschuur et al., 2003).

Overall, the picture is mostly similar for core concepts of individual differences in psychology such as the Big Five personality traits. There is ample evidence that Neuroticism exacerbates homesickness (e.g., Schmitz, 2005; Stroebe et al., 2015; van Heck et al., 2005; van Tilburg, Vingerhoets,

van Heck, & Kirschbaum, 1999; van Tilburg et al., 1996; Verschuur et al., 2003). Beyond that, Extraversion appears to attenuate the experience of homesickness (Eurelings-Bontekoe, 2005; van Heck et al., 2005; van Vliet, 2001).

While Openness to Experience seems to ameliorate the intensity of homesickness (van Heck et al., 2005; Verschuur et al., 2003), additional research is needed. In a similar vein, both Agreeableness and Conscientiousness lack the empirical grounding to draw confident conclusions. Multiple scholars have therefore urged the scientific community to further elucidate the role of dispositional personality traits (Fisher et al., 1985; van Heck et al., 2005; van Tilburg, Vingerhoets, van Heck, & Kirschbaum, 1999; van Tilburg et al., 1996).

In prior research, it has proven fruitful to account for external circumstances that shape the nature of the relocation, and in turn, the homesickness experience. For example, it appears that having freely chosen to leave the home environment instills a sense of control over the situation that buffers against homesickness (Burt, 1993; Fisher et al., 1985; Flett et al., 2009; Stroebe et al., 2015; Tartakovsky, 2007; Thurber & Sigman, 1998; van Tilburg et al., 1996). Moreover, language skills have been shown to be an asset that alleviates homesickness (Hannigan, 2005; Poyrazli & Lopez, 2007; Tartakovsky, 2007). Also, it has been suggested that efforts offered by individuals in the new environment to facilitate the integration (e.g., orientation day at the host university for exchange students abroad) may serve as a protective factor against homesickness (Hannigan, 2005; Poyrazli & Lopez, 2007; Tartakovsky, 2007). To our knowledge, no empirical investigation on this topic has been conducted so far, but this claim seems plausible and would be worthwhile investigating.

In addition to all the aforementioned circumstances of the new environment, it seems advisable to consider home-related factors. Preserving a high degree of accessibility to one's old home may lower homesickness (Carden & Feicht, 1991; Stroebe et al., 2015; Stroebe et al., 2002). Accordingly, it appears reasonable to assume that on average homesickness will rise as geographical distance from home increases, jeopardizing the maintenance of accessibility of home. However, previous research has produced mixed results (Brewin et al., 1989; Carden & Feicht, 1991; Fisher, 2005; Fisher, Frazer, & Murray, 1986; Scopelliti & Tiberio, 2010; Stroebe et al., 2002). To sum up, in spite of recent advances in homesickness research, additional efforts should be mounted to shed light upon the underpinnings of homesickness.

On a methodological note, the majority of studies on homesickness have relied upon cross-sectional, retrospective measurements, even though

researchers were aware of the biases that might result therefrom. It has been noted that retrospective collections of homesickness experiences show significant estimation errors (Thurber & Walton, 2007; van Tilburg, Vingerhoets, van Heck, & Kirschbaum, 1999), and might differ qualitatively from reports of present homesickness (Stroebe et al., 2015). Furthermore, Burt (1993) has pointed out that homesickness is probably less of a persistent and much more of an episodic phenomenon. As it might only surface occasionally, single cross-sectional appraisals of homesickness might fail to detect its actual intensity. It seems thus imperative to harness the power of longitudinal studies. To this end, we implemented an experience sampling method (ESM), as called for by Stroebe and colleagues (2016).

Aside from answering a call for prospective, longitudinal measurements of homesickness that had been raised multiple times (e.g., Eurelings-Bontekoe, Vingerhoets, & Fontijn, 1994; Stroebe et al., 2016; van Tilburg, Vingerhoets, & van Heck, 1999b), we set out to overcome previous drawbacks of research on homesickness among college students.

To this end, we longitudinally administered the Utrecht Homesickness Scale (UHS), a psychometrically sound measure of homesickness (Duru & Balkis, 2013; Watt & Badger, 2009). We further collected data on demographic variables, individual circumstances of the move, and dispositional personality traits. In recognition of the inconsistent findings reported on most of the relevant variables under consideration in the present article, we refrain from formulating any specific hypotheses a priori. Instead, we opt for an exploratory approach.

Method

Participants

Spanning a time frame of approximately 18 months, five independent subsamples were recruited. Recruitment ensued online through custom-tailored advertisement on social networks (e.g., Facebook groups for international exchange students) and mailing lists (e.g., mailing list of all incoming and outgoing exchange students at the University of Konstanz, courtesy of the university's international office).

The respective subsamples entered the study consecutively, until final data collection was completed in April 2016. Upon completion, the final sample consisted of 148 university students studying abroad, thereof 98 female (66%) and 50 male (34%) who had met the study's inclusion requirements (i.e., providing informed consent, participating in at least 80% of data collection

waves). Reported age ranged from 18 to 29 years ($M = 22.83$, $SD = 2.05$). Participants differed widely with respect to nationality, representing students from all continents. However, the vast majority was of German origin (71.6%). Regarding host countries, a more evenly balanced pattern emerged with students studying at foreign universities in 37 countries all across the globe (e.g., United States: 10.8%, United Kingdom: 10.8%, Sweden: 8.8%).

Duration of stay in host countries varied between 2.4 months and 46.9 months (median = 8.3 months). On principle, we attempted to recruit exchange students early on during their stay to monitor as much of the initial adaptation process as possible. However, due to the widespread geographical distribution of our sample and the resulting multitude of different academic calendars (and henceforth semester dates) that had to be incorporated at once, participants had spent an average of 3.5 months abroad (median = 2.6) prior to the initial data collection. To account for this shortcoming, we included the pre-data collection time as a potential moderator in all subsequent analyses.

Materials

Homesickness was assessed longitudinally, employing a shortened version of the UHS (Stroebe et al., 2002; 0 = *not at all*, 4 = *very strong*; see online appendix for scale items). Having been designed as a cross-cultural measure of homesickness, the UHS was deemed well suited for our purposes, given the sample's multinational composition. Moreover, the UHS has consistently demonstrated good psychometric properties across various cultural contexts (e.g., Duru & Balkis, 2013; Watt & Badger, 2009).

Paralleling the approach adopted by Watt and Badger (2009), we shortened the inventory to 10 items by dropping the two items with the lowest respective factor loadings from each factor to reduce participant burden. Nevertheless, the scale maintained satisfying reliabilities with an overall Cronbach's α of .89. Likewise, all subscales exhibited acceptable reliabilities (Missing Family: $\alpha = .88$, Loneliness: $\alpha = .80$, Missing Friends: $\alpha = .68$, Adjustment Difficulties: $\alpha = .86$, Ruminations About Home: $\alpha = .80$; see online appendix for scale items).

In addition, a cross-sectional posttest questionnaire was administered to collect data on an array of potential moderators and other variables of interest. It included the Mini-IPIP (Donnellan, Oswald, Baird, & Lucas, 2006), a 20-item measure of the Big Five personality traits, whereby respondents rate how accurately the respective items describe their personality (1 = *very inaccurate*, 5 = *very accurate*). Despite its short length, the Mini-IPIP has repeatedly proven to yield sufficiently high-reliability estimates to justify its usage (Baldasaro, Shanahan, & Bauer, 2013; Cooper, Smillie, & Corr, 2010).

Furthermore, we monitored sociocultural adaptation by implementing the 10 core items of the Sociocultural Adaptation Scale (SCAS, $\alpha = .70$; Ward & Kennedy, 1999). The SCAS measures the experienced degree of adjustment difficulties abroad across various domains of daily life (1 = *no difficulty*, 5 = *extreme difficulty*). Of note, we removed one item revolving around religious practices (“worshipping in your usual way”) as we felt that this might be perceived as difficult to answer for people who do not identify themselves as religious (see online appendix for scale items).

Also, we assessed how strongly participants identified with the experiences of average members of their host, respectively home culture, using the corresponding single-item measures on a 7-point Likert-type scale (“Are your experiences and behaviors similar to those of typical members of your home/host culture?” 1 = *not similar at all*, 7 = *very similar*; Ward & Kennedy, 1994).

Furthermore, participants were asked to self-report linguistic ability in the official language of their host country and the host country’s region that they were living in, respectively, both at the beginning and at the end of their sojourn (“How well did you master your host country’s official language at the beginning/end of your stay?”; 1 = *poor*, 4 = *excellent*), as originally put forward by Poyrazli and Lopez (2007).

Also, participants indicated whether they had gone abroad for an extended period of time before. Analogously, they were asked whether they had gone abroad voluntarily this time, framed dichotomously, and provided an estimate of how much their host university had facilitated their integration: “How strongly did your host university facilitate your integration (e.g., by means of orientation days)?”; 1 = *not at all*, 5 = *very much*.

In keeping with previous research (Stroebe et al., 2015), we also included self-reports of the accessibility of one’s home. Concretely, participants indicated whether they had received visitors from home, and whether they had gone home themselves throughout their stay.

Finally, they self-reported the geographical distance between their home and host university, measured in kilometers.

As, to the best of our knowledge, no published research in the home-sickness literature has included German-speaking samples, established German versions of most scales were lacking. Exceptions, which have been successfully translated and implemented in previous research, were the Mini-IPIP (Swami et al., 2012) and the SCAS (Renner, Salem, & Menschik-Bendele, 2012). However, Renner and colleagues (2012) based their translation on a longer form (30 items) of the SCAS and added some self-developed items tailored to their specific Austro-German research context, which is why their version was not deemed well suited for

adoption within our study. Henceforth, in the absence of established German versions, all scales except for the Mini-IPIP were translated from the original English by the first and second author using the parallel-blind technique (Behling & Law, 2000).

Smartphone App

To streamline data collection, a smartphone app called “Psychology Goes Approad”¹ was specifically developed for this study. It was launched on the Google App Store, whereupon participants could freely download the app onto their smartphones. As an inbuilt feature, we programmed back-end server software that allowed for direct communication with the electronic devices upon which the app was installed, enabling continuously updated data storage and the display of user statistics (e.g., individual mean homesickness, geographical distribution of participants, see Figures 1 and 2).

When the app was initially accessed, participants chose to conduct the survey either in German or in English. Thereafter, a one-time screen popped up with a detailed outline of the study’s terms and conditions, asking participants to provide informed consent. Next, a brief battery of demographic questions was administered (i.e., sex, age, home country, and host country). Adequate completion of these two pages was made a prerequisite to proceed to the prospective part of the study, which entailed the aforementioned 10-item-short version of the UHS (see Figure 3). Once informed consent and demographic variables were provided, the app would immediately open the UHS on every subsequent trial (i.e., the first two screens were only shown once during the first administration). Below the UHS, participants could browse through a compilation of personal statistics in graphical form as shown in Figures 1 and 2.

Procedure

The research project was carried out across a time frame of 18 months, with five subsamples (Cohort 1: November 2014-January 2015, Cohort 2: February-May 2015; Cohort 3: March-June 2015, Cohort 4: September-December 2015, Cohort 5: January-April 2016). Each cohort was subject to the exact same procedure to ensure comparability across cohorts. Every cohort was monitored for a period of 3 months. Participants were asked to complete the UHS every second day via the science app, resulting in 45 to 48 measurements per person. Mirroring an approach that has proved effective in minimizing attrition and missing values in previous smartphone-based ESM research (e.g., Stieger, Götz, & Gehrig, 2015), participants

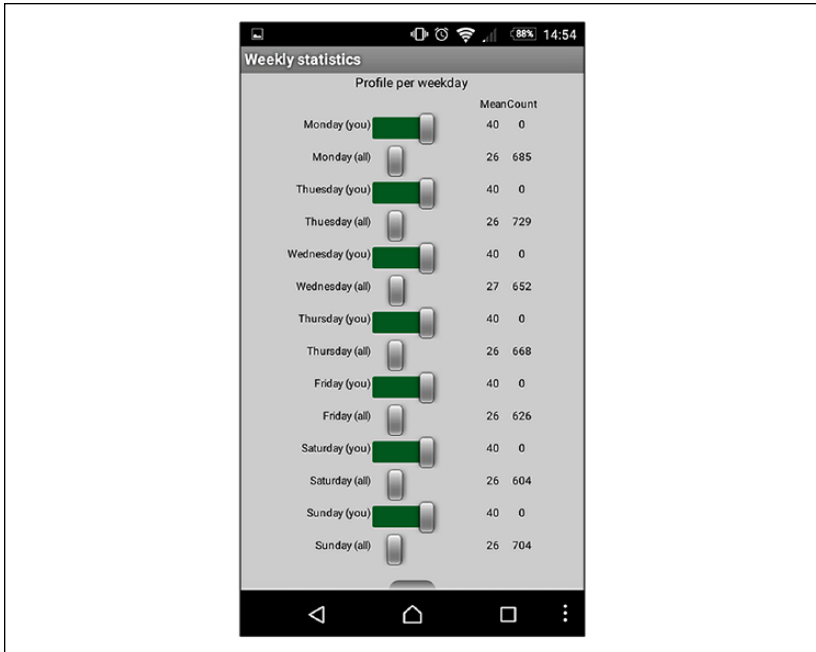


Figure 1. Weekly homesickness statistics.

received reminders via email to complete the questionnaire. The exact hours of data collection, as indicated by virtue of said reminders, were varied randomly to offset potential biases due to fluctuations in homesickness toward the beginning and the end of the day as reported by van Tilburg and colleagues (1996). As soon as the longitudinal data collection had ended, an online posttest questionnaire was administered, covering background variables and presumed moderators as outlined above. Both the science app and the posttest online questionnaire were available in German and English.

In principle, participation was completely voluntary, and no form of compensation was offered. However, as a small incentive, participants of every cohort had the chance to win Amazon gift cards up to 100€ (or the respective equivalent amount in any other preferred currency) by taking part in a lottery, which they entered automatically, unless they had explicitly refused to do so.

Anonymity of Data

To guarantee anonymity, the science app was designed to assign a random participant number to every device upon installation. As statistical analysis

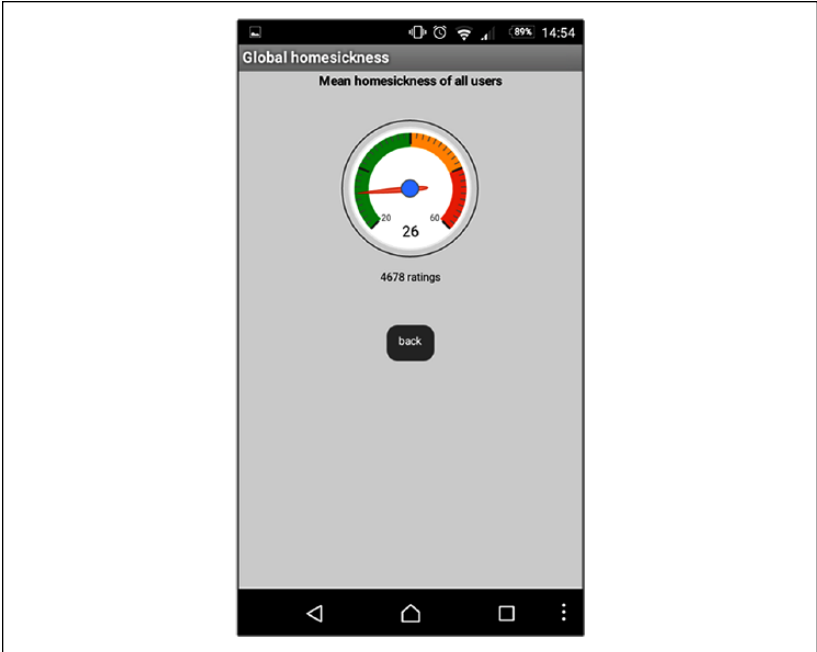


Figure 2. Mean homesickness of all users.

required linking the data obtained through different measurement modes (longitudinal app data, cross-sectional online survey data), this participant number was key to connect the datasets. Participants were asked to submit their participant number in the posttest questionnaire, which only they could retrieve within the app on their own smartphone. Due to this procedure, no one, not even the experimenter, could identify individual datasets and relate them to specific participants. When sending out the reminders via email, it was assured that recipients' email addresses would be invisible to everyone but themselves. Furthermore, the whole communication between the app and the back-end server used a secure protocol (i.e., https), and the participant number was additionally encrypted.

Ethics

The present study has been conducted in accordance with the Declaration of Helsinki and ethical guidelines of the authors' institution. To be considered eligible, all participants provided written consent and returned a digital copy

Figure 3. Sample items of the Utrecht Homesickness Scale (UHS).

to the experimenter. When opening the science app for the first time, they were confronted with the terms of the study again, agreement with which was mandatory to proceed to the UHS. Participants were made aware that they could revoke their consent and withdraw from the study any time without any personal disadvantages arising from it. Furthermore, anonymity was ensured as specified above, and no harmful procedures were applied.

Results

Descriptive Results

The mean homesickness score aggregated over all participants and data collection waves ($n = 4,575$), was remarkably low, both on a broad and on the subscale level (composite UHS homesickness score: $M = 0.64$, $SD = 0.63$; Missing Family: $M = 0.74$, $SD = 0.81$; Loneliness: $M = 0.59$, $SD = 0.82$; Missing Friends: $M = 0.78$, $SD = 0.85$; Adjustment Difficulties: $M = 0.59$, $SD = 0.83$; Ruminations About Home: $M = 0.51$, $SD = 0.85$).

Examining Trajectories of Homesickness

To illuminate the normative trajectory of homesickness, we conducted a curve estimation regression analysis. Thereby, we assumed a linear decline to pit our data against.² In view of the recent distinction between home-related and new-place-related stressors by the DPM-HS (Stroebe et al., 2016), only the former of which is considered an integral part of homesickness, we investigated the respective trajectories both on a broad mean score level and on a subscale level. This way, we hoped to gain a preliminary understanding of the possible differences in onset and development between adjustment difficulties, as captured by one facet of the UHS and feelings of home-related grief.

The resulting model, depicted in Figure 4, was statistically significant, albeit, merely accounting for a small fraction of variance; $F(1, 3985) = 80.87$, $p < .001$, $R^2 = 2\%$. An almost identical pattern was found at the subscale level on all facets of homesickness, despite slight variation in explained variance. The obtained curve estimation for the subscale Adjustment Difficulties looked very much like the other facets with respect to both its onset and development over time.³ Table 1 provides a comprehensive overview of the above-mentioned outcomes.

Multilevel Modeling

At the second stage of our statistical analysis, we carried out a multilevel modeling procedure (MLM) using software packages in R. Examining the relationships between affective states, personality traits, situations, and behaviors inherently means studying multilevel phenomena, which is most effectively done through multiple, longitudinal assessments as implemented in our design (Nezlek, 2007).

Regarding the present study, in close conceptual resemblance to diary studies (Nezlek, 2008), we can construe the repeated ESM homesickness measures (Level 1, also called micro-level) as being nested within the respective participants (Level 2, also called macro-level). Fundamentally, implementing an MLM means calculating an estimated Level 1 model (in our case, the emergence and volatility of homesickness) for every Level 2 unit (in our case, every student abroad who took part in the present study) that describes the relationships among the variables of interest (Nezlek, 2008). Against this backdrop, employing MLM is especially beneficial when exploring within-person variability in psychological states (Nezlek, 2008), such as homesickness.

In the absence of a methodological gold standard for MLM procedures, we primarily relied on the recommendations and guiding principles assembled by Nezlek (2001, 2007, 2008). We standardized all variables prior to

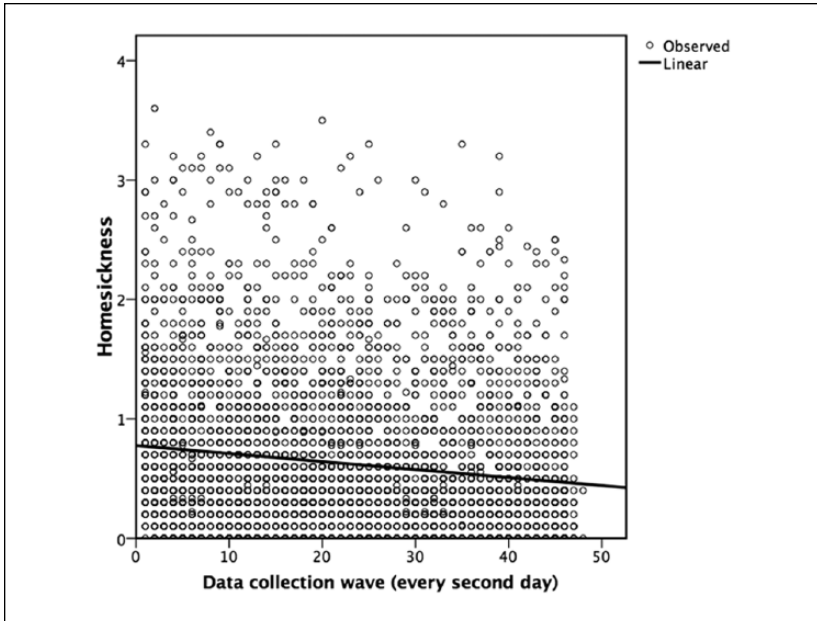


Figure 4. Linear curve estimation model for homesickness mean score.

Table I. Summary of Curve Estimation Regression Model Assuming a Linear Model.

	$F(1, 3985)$	R^2 (%)
Homesickness mean score	80.87***	2.0
Subscale Missing Family	25.52***	0.6
Subscale Loneliness	34.48***	0.9
Subscale Missing Friends	101.03***	2.5
Subscale Adjustment Difficulties	58.58***	1.4
Subscale Ruminations About Home	31.23***	0.8

*** $p < .001$.

analyses for easier interpretation of the resulting coefficients (standardized beta). Furthermore, we chose to adopt a fixed-slopes-random-intercepts model. Although it is generally recommended to run a fully random model, exceptions are justifiable, based on theoretical and statistical grounds (Nezlek, 2001). Thorough scrutiny of the respective slopes of all participants

suggested a fair homogeneity in individual trajectories (notably a decline in homesickness over time), despite considerable variety in initial levels of homesickness (i.e., intercepts). Nezlek (2001) argued that if the time frame under consideration can be conceived of as unique and thus not sampled from a specific population of days, it is tenable to fix slopes. In keeping with this, the present investigation covered 3 of 4 possible months of a semester abroad, which we argue should be sufficient to opt for a fixed-slopes-random-intercepts model.

Due to the computational strain that overly complex models impose, following Nezlek (2008) who highlights the advantages of tight, parsimonious models, we chose not to run a complete model, including all variables that we had collected, but to remove some variables instead. Namely, we eliminated visits from home and visits at home from the equation, acknowledging the danger of both of them being systematically related to geographical distance between home and host university, which may result in informational redundancy (visits from home: $r = -.257$, $p < .001$; visits at home: $r = -.553$, $p < .001$) and pose problems in the MLM (i.e., multicollinearity). Other than that, we kept the previous set of variables.

The obtained results demonstrated that being male, high on Agreeableness and Neuroticism, having difficulties in sociocultural adaptation, and the chronological time of the respective data collection (i.e., the data collection wave; the later the lower the intensity of homesickness) emerged as significant predictors of heightened homesickness with confidence intervals (CIs) excluding 0. More to the point, standardized beta coefficients allow direct comparisons of predictive power across the variables in question. Accordingly, difficulties in sociocultural adaptation emerged as most powerful predictor ($\beta = .23$) of homesickness, closely followed by Neuroticism ($\beta = .21$) and Agreeableness ($\beta = .20$). Being male ($\beta = .14$) and time of data collection ($\beta = -.09$) were comparatively less influential predictors. Summarizing the present results, Table 2 gives an overview of the outcomes of the MLM.⁴

Furthermore, there seems to be a conceptual overlap between the subscale Adjustment Difficulties of the Homesickness scale (UHS) and the measure of adjustment difficulties (SCAS) itself. Therefore, we excluded the Adjustment Difficulties subscale from the UHS and recalculated the model. As can be seen in Table S1 in the online appendix, the conclusions remain essentially the same. Only the sex difference failed to reach the alpha level of .05.

To calculate the variance explained by the overall model (i.e., the model that contains all the parameters of interest), we applied the approach by Nakagawa and Schielzeth (2013). The $R^2_{\text{GLMM(m)}}$ represents the marginal R^2 describing the variance explained by fixed factors only. The $R^2_{\text{GLMM(c)}}$ presents the conditional R^2 representing both the variance explained by fixed and

random factors (see Table 2). Interestingly, the fixed factors explain only $R^2_{\text{GLMM}(m)} = 3.9\%$ of variance, whereas the whole model explains $R^2_{\text{GLMM}(c)} = 50.0\%$; that is, participants differed substantially in their mean homesickness level.

Discussion

Overview

Homesickness is a puzzling state of mind for those who are afflicted with it and those who try to study it alike. In the age of global citizenship, cosmopolitanism, and mass migration, the widespread individual uprooting is likely to give rise to homesickness in many people all across the globe, making the investigation of its temporal dynamics and psychological underpinnings a worthwhile endeavor.

Against this backdrop, the present study found that over a period of 3 months, university students on exchange abroad tended to experience relatively mild levels of homesickness, which mostly regressed to a steady, low intensity once an initial peak had subsided. Addressing the impact of presumed moderators, a set of variables was examined as summarized in the following.

Age did not appear to be linked to homesickness. However, the age range of 11 years in our sample might have been too narrow to detect effects. Interestingly, sex predicted homesickness insofar as being male was associated with higher homesickness scores. At first glance, this is a puzzling finding as previous research has usually reported higher values for women (e.g., Archer et al., 1998; Hannigan, 2005; Stroebe et al., 2002; Verschuur et al., 2003) or no differences at all (e.g., Brewin et al., 1989; Fisher & Hood, 1987; Flett et al., 2009; Kazantzis & Flett, 1998; Schmitz, 2005; Scopelliti & Tiberio, 2010). However, our result does not necessarily reflect a meaningful difference in homesickness, especially in light of the low overall intensity of homesickness for both sexes (men: $M = 0.68$, $SD = 0.69$, women: $M = 0.62$, $SD = 0.60$). Also, it should be noted that sex ranked among the weaker predictors of homesickness and dropped to statistically nonsignificant levels once UHS mean scores were computed without the Adjustment Difficulties subscale (see Table S1 in the online appendix).

With respect to the Big Five, consistent with previous research (e.g., Schmitz, 2005; Stroebe et al., 2015; van Heck et al., 2005; van Tilburg, Vingerhoets, van Heck, & Kirschbaum, 1999; van Tilburg et al., 1996; Verschuur et al., 2003), our results support the claim that Neuroticism compounds homesickness, yielding the second strongest effect across the

Table 2. Results From the Multilevel Model With the Utrecht Homesickness Scale as the Criterion.

	M (SD)	Range	α	β	t	95% CI of β	
						UL	LL
Age	22.83 (2.05)	18-29	^a	<.01	0.05	-.13	.14
Sex			^a	.14	2.05*	.02	.27
Extraversion	3.32 (0.86)	1.00-5.00	.83	-.07	-0.96	-.19	.06
Agreeableness	4.22 (0.77)	1.50-5.00	.85	.20	2.16*	.03	.36
Conscientiousness	4.00 (0.81)	1.75-5.00	.78	-.09	-1.24	-.22	.04
Neuroticism	2.81 (0.87)	1.00-5.00	.77	.21	2.79*	.08	.34
Openness to Experience	4.11 (0.66)	1.25-5.00	.65	-.14	-1.65	-.28	.01
Voluntariness			^a	-.02	-0.22	-.16	.12
Previous stays abroad	2.36 (1.25)	1-5	^a	-.12	-1.64	-.24	.01
Support from host university	3.36 (1.12)	1-5	^a	-.08	-1.09	-.21	.05
Geographical distance between home and host university (km)	3,809.35 (4,150.69)	80-16,400	^a	-.07	-1.00	-.20	.06
Sociocultural adaptation	1.77 (0.45)	1.00-2.89	.70	.23	2.55*	.07	.38
Conational identification	4.27 (1.63)	1-7	^a	-.02	-0.27	-.14	.11
Host national identification	4.64 (1.20)	2-7	^a	-.02	-0.32	-.15	.11
Language proficiency at the end of the stay	3.81 (1.25)	1-5	^a	.04	0.51	-.09	.16
Time (data collection wave)	22.22 (13.19)	1-48	^a	-.09	-8.43*	-.11	-.07
Duration of pre-data collection stay (months)	3.5 (3.8)	0-18	^a	.04	0.60	-.07	.15

Note. Applying a Bonferroni correction results in an adjusted p value of .004; only the variable Time (data collection wave) is significant.

α = Cronbach's α ; β = standardized B; CI = confidence interval; UL = upper limit; LL = lower limit.

^aSingle-item measure, sex: female = 0, male = 1; voluntariness: freely chosen = 0, not freely chosen = 1.

* $p < .05$.

present set of predictors. Meanwhile, Extraversion, Conscientiousness, and Openness to Experience did not predict homesickness, although the latter approached statistical significance, suggesting a negative relationship with homesickness that is in line with prior research (van Heck et al., 2005; Verschuur et al., 2003). Of note, Agreeableness was positively linked to homesickness, which might seem slightly confusing at first. Yet, one might argue that highly agreeable people may try to attend to everybody's needs and suffer from their inability to do so regarding their friends and family members at home during their stay abroad, which causes them increased homesickness.

Turning to circumstantial variables and factors related to the new environment, previous stays abroad, support from host university, voluntariness of going abroad, and conational identification all exhibited a trend, albeit with confidence intervals including 0 and thus nonsignificant, to attenuate homesickness, unlike previous findings that revealed statistically significant relationships with homesickness (e.g., Hannigan, 2005; Poyrazli & Lopez, 2007; Tartakovsky, 2007). On one hand, these differences might be due to different sample characteristics. For instance, we looked at university students rather than high school students (e.g., Tartakovsky, 2007), most of whom had been abroad before and had an average level of English proficiency that was much higher than that in prior research (on the same scale, present study: $M = 3.81$, $SD = 1.25$; Poyrazli & Lopez, 2007: $M = 2.74$, $SD = 0.95$). Moreover, our sample came from a predominantly German rather than American (Hannigan, 2005; Poyrazli & Lopez, 2007) or Eastern European (Tartakovsky, 2007) cultural background, hinting at potential cultural differences in vulnerability, adaptation, and resilience with regard to homesickness. On the other hand, noting that all of the studies cited above were published more than 10 years ago, it appears plausible that the different results could at least in part be due to the consequences of technological developments in the past decade. For example, support from host university may no longer be as important to facilitate transition abroad as students can now turn to alternative sources of information even before their arrival (e.g., university websites, self-created Facebook groups for exchange students at their specific host institution) that may not have been equally available 10 years ago.

Meanwhile, difficulties in sociocultural adjustment were found to be the strongest predictor of homesickness, providing support for the main premise of the DPM-HS (Stroebe et al., 2016) that homesickness and stressors stemming from the new environment are closely tied together and may reciprocally influence each other. Offering promising avenues for future research, it should hereby be highlighted that successful sociocultural adaption seems to depend just as much on environmental factors of the new place (e.g., getting

used to the pace of life, shopping norms, and transport systems) as it depends on social factors.

Geographical distance between home and host university had no influence at all, which might reflect the predominant mind-set of students abroad who fully commit and immerse themselves into the foreign environment, thereby temporarily neglecting their home environment regardless of how far away they are. Conversely, this finding may also hint at the transforming dynamics of global communication, where geographical distance is successively becoming inconsequential for the maintenance of social ties (including those back home), thanks to the ubiquity of social media (e.g., Facebook, Twitter) and international telecommunications services that come at no or close to no cost (e.g., WhatsApp, Skype).

Language proficiency in the host country's official language at the end of the stay was not related to homesickness either, nor was the amount of time that participants had spent in their respective host country prior to the initial data collection. Finally, the chronological time of the respective data collection was negatively associated with homesickness, further corroborating the claim that homesickness tends to decrease over time as shown in the curve estimation regression model before. However, timing of data collection emerged as a comparatively weak significant predictor, suggesting that while homesickness seems to soften with the passing of time, its peak levels and overall intensity may be primarily rooted in personality and the specific dynamics of successful adaptation.

In summary, the present research provides an extensive, yet not exhaustive list of actual and presumed determinants of homesickness in university exchange students abroad, shaping its intensity on a day-to-day basis while taking the idiosyncratic nature of the phenomenon into account.

Moreover, consistent with prior research (Brewin et al., 1989; Fisher et al., 1985; Furnham, 2005; Stroebe et al., 2015; Tartakovsky, 2007), our results compile longitudinally collected evidence for a linear decline of homesickness after peaking in the very beginning of the stay abroad.

Examining the trajectory of homesickness with curve estimation regression models provided additional support for those findings. After no notable differences in fit were found when assuming other shapes, we settled for a linear model, which was statistically significant yet could not account for much variance ($R^2 = 2\%$). Inferring from the respective trajectories of the subscale Adjustment Difficulties and the home-related facets of homesickness, our results did not lend any support to the existence of an incremental relationship between home and new place stressors, as suggested by Stroebe and colleagues (2016).

Strengths and Limitations

Homesickness continues to be an underresearched and rather ill-understood phenomenon (Stroebe et al., 2002; Watt & Badger, 2009), and the accumulation of inconclusive findings and calls for future research, highlighted in the introduction, speak loudly of that. In view of this gap in research, we believe that the current study marks the next step toward a more comprehensive understanding of homesickness and the way that it is embedded in human psychology. We assembled a large number of previously insufficiently or completely unstudied potential predictors of homesickness to examine their interplay with homesickness. Moreover, albeit having been limited to student populations, our research design allowed for a high variance in study settings, featuring diverse living environments (ranging from small college towns to metropolises, Californian summer to Scandinavian winter, and well-connected transportation hubs to secluded campuses) across the globe. Therefore, our work may help pinpoint the common denominators of the homesickness experience that remain invariant in the face of substantially varying surroundings.

Furthermore, homesickness research has continuously suffered from a paucity of longitudinal studies, while those that exist examined relatively short periods (e.g., 2 weeks) and focused mainly on children (e.g., Thurber, 1995; Thurber, 2005; Thurber & Sigman, 1999). Expanding this strand of research to a conveniently sized adult sample that was closely monitored across 3 months using an ESM, we aimed to gain new knowledge on the chronicity of homesickness, as called for by multiple scholars in the field (e.g., Eurelings-Bontekoe et al., 1994; Stroebe et al., 2016; Verschuur et al., 2003). As we are not aware of any previous studies on homesickness that applied MLM techniques, the present research may be the first to trace back individual heterogeneity in the homesickness experience, which seems to be a rather useful approach as indicated by the large portions of variance explained through individual heterogeneity ($R^2_{\text{GLMM}(m)} = 3.9\%$, $R^2_{\text{GLMM}(c)} = 50.0\%$). In addition, implementing multiple measurements in a naturalistic setting seems especially fruitful as it might rule out potential biases that affected previous research.

For instance, a neuropsychological experiment using frontal electroencephalogram asymmetry (EEG) found different brain activity patterns for feeling-based self-reports of current homesickness as opposed to belief-based recollections of past bouts of homesickness (Steiner & Coan, 2011). This suggests that retrospective reports, shown to be vulnerable to memory errors (van Tilburg, Vingerhoets, van Heck, & Kirschbaum, 1999), may differ qualitatively from live reports of homesickness (Stroebe et al., 2015). Moreover,

longitudinal measurements of homesickness as in our study can capture homesickness accurately, even if it may be a highly fluctuating affective state that waxes and wanes considerably over time (Burt, 1993).

As international students abroad are a rather narrow target population that is difficult to reach and as we further required a sufficiently large sample to conduct MLM analyses properly (Maas & Hox, 2005), we recruited an ad hoc sample. In consequence, we obtained an unevenly distributed sample, being predominantly female and of German nationality. Similarly, prior experience in living abroad was widespread in our sample (55.1%), which contributed to the reported low overall intensity of homesickness, as participants who had lived abroad before exhibited significantly lower levels of average homesickness than those who had not ($t = -6.73, p < .001$). Curiously, the duration of pre-data collection stay, that is, the amount of time that participants had spent in their host country, irrespective of any prior mobilities, before being recruited to partake in our study, was not related to their homesickness experience.

In a similar vein, we recognize that in spite of methodological advances and a wide coverage of living environments around the world, the composition of our sample, consisting of young, well-educated college students, freely deciding to move abroad imposes a limitation to our study, and in turn the generalizability of our findings.

On a design-related note, the use of graphic feedback as an inbuilt feature of our science app may have prompted participants to tweak their self-reports in allegedly socially desirable ways or—in extreme cases—even seek treatment, thereby altering the reported homesickness experience (Harmon, Hawkins, Lambert, Slade, & Whipple, 2005; Shimokawa, Lambert, & Smart, 2010). However, this concern appears to be most pronounced among severe pathological cases and may henceforth be less relevant in the given sample which—as mentioned above—was comprised of young, well-educated college students who had freely chosen to move abroad and consistently produced low-intensity homesickness estimates.

From a methodological vantage point, one might argue that the post hoc assessment of the majority of the predictors of homesickness may be at odds with prospective interpretation. This being said, in accordance with basic tenets of personality psychology, we argue that most of our key predictors (i.e., Big Five) are stable, dispositional personality constructs that would not change over the course of the study. Likewise, many of the circumstantial variables that were assessed in retrospect would yield the same values as before the beginning of the study (e.g., sex, previous stays abroad, geographical distance between home and host university). Nevertheless, we concede that there is one exception among the significant

moderators of homesickness in our study, namely difficulties in sociocultural adaptation, which could only be appraised once the study came to an end. Against this backdrop, in this case the term predictor is used to conform to the standard nomenclature of regression analyses and indicates correlation only, without implying causality. This position is very much in line with the DPM-HS that posits bidirectional, reciprocal influences, between homesickness and sociocultural adaptation, rather than monodirectional causation.

While the UHS reached high-reliability estimates in the present study and in previous investigations (Duru & Balkis, 2013; Stroebe et al., 2002; Watt & Badger, 2009), it does treat the subscale Adjustment Difficulties as an inherent subcomponent of homesickness, which conflicts with the premises of the DPM-HS (Stroebe et al., 2016). Unfortunately, data collection had already started when the DPM-HS was introduced, keeping us from accommodating it in our study design to put the theory to an empirical test. Instead, we computed curve estimation analyses on a subscale level to explore potential differences in trajectory between the subscale Adjustment Difficulties and home-related facets of the UHS, finding none. Furthermore, the outcomes of our MLM remained largely unchanged when the subscale Adjustment Difficulties was removed from the UHS mean score (see Table S1 in the online appendix). Still, no definite conclusions can be drawn with respect to the validity of the DPM-HS at this point, and future research is needed to assess its merit.

Future Research

Despite having done our best to compile as many determining factors of homesickness from the literature as possible, we need to be cognizant that other factors have been neglected and should be addressed in future research: Through the advent of the Internet, smartphones, and social media, human communication has been revolutionized since the early days of homesickness research (Fisher et al., 1986; Fisher & Hood, 1987, 1985). Transcending life in every domain, this may ultimately affect how people live abroad and stay in touch with their home environments (e.g., via Skype, WhatsApp, Facebook, Snapchat), and should henceforth be accounted for. Heretofore, the homesickness literature also failed to delve more deeply into the physical features of one's new living environment and how these may contrast with those at home. While our findings indicate that soft environmental factors such as growing accustomed to local transport systems are critical determinants of sociocultural adaptation, this line of research should be further extended. Therefore, future research should examine how deviations from the home environment in

population density, degree of urbanicity, and other environmental factors, such as weather conditions and altitude, affect homesickness. This strand of research appears especially promising as recent technological advances have empowered researchers to independently collect such environmental data from public online databases (e.g., Stieger & Lewetz, 2016; Stieger, Voracek, & Nader, 2014), once participants' exact geographical locations are known, supplying additional data without raising participant burden.

It is thus by pursuing these avenues for future investigation while offsetting the shortcomings of existing research that we aim to move ahead in the search of how to counteract homesickness and, ultimately, help people build themselves a home-away-from-home.

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Notes

1. Available at https://play.google.com/store/apps/details?id=appinventor.ai_Stefan_Stieger_10.Psychology_Goes_Approad&hl=de
2. For completeness sake, we also ran models that assumed other nonlinear shapes. However, none of them provided a significantly better fit, and are henceforth not followed up upon in the frame of the present research.
3. Due to the principle of parsimony, we do not exhibit the graphs for the individual facets of homesickness here.
4. Level 1 variables represent data from multiple retests that are often correlated. Therefore, we additionally calculated the multilevel modeling procedure (MLM) by controlling for autocorrelations. None of the results changed substantially by leading to a different conclusion, that is, these results are omitted for brevity.

Supplemental Material

Supplemental material for this article is available online.

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