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Climatic effects on the sociocultural and psychological adaptation of migrants within China: A longitudinal test of two competing perspectives

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Abstract

Little is known about how climatic differences may psychologically impact individuals who migrate from one geographical area to another. A climatic demand theory perspective suggests that migration from more demanding climatic areas to less demanding climatic areas would lead to better psychological outcomes while predicting the opposite for migration from less demanding to more demanding climates. In contrast, a climatic-fit perspective would predict that moving to areas that climatically are similar to one's home would lead to the best psychological outcomes, whereas any major deviation would lead to worse outcomes. To test these competing perspectives, a longitudinal, multi-site study was conducted with over thousand student migrants who moved from various areas in China to 12 cities. Participants' life satisfaction and perceived stress were assessed upon arrival and at the end of the semester together with their sociocultural adaptation. Supporting the climatic-fit perspective, multi-level analyses showed that participants reported the least stress and highest sociocultural adaptation when they migrated to host sites that were climatically similar to their homes. Conversely, individuals who migrated from very demanding to less demanding climatic regions and vice versa reported an increase in stress and lower sociocultural adaptation.

Keywords: acculturation; climatic demands theory; cultural fit hypothesis; longitudinal study; migration; psychological adaptation, sociocultural adaptation; stress

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From a cross-cultural psychological perspective, human behavior reflects an adaptation to eco-cultural contexts (Berry, Poortinga, Breugelmans, Chasiotis & Sam, 2011). In support of this perspective, people's affect, behavior and cognition are often systematically linked to their eco-cultural settings, particularly the cultural context (Oishi, 2014). However, although *climatic conditions* undoubtedly are part of individuals' eco-cultural environment, it is only in recent years that their effects on human behavior have started to receive attention (Fischer & Van de Vliert, 2011; Wei et al., 2017). This extant research has nevertheless been limited to the psychological impact of climate at in-situ contexts. Despite increasing human mobility in general, and increasing migration as a result of climatic disasters and increasing demands specifically, very little is known about the role of climate on the acculturation of individuals. In particular, knowledge is lacking about the impact that climatic differences can have on individuals who move from their habitual eco-cultural context to an unfamiliar one (Ward & Geeraert, 2016). To fill this gap, the present study investigated the effect of climatic demands and climatic-fit on the psychological and sociocultural adaptation of migrants over time, using the People's Republic of China (PRC) as the context of investigation.

Psychological and Sociocultural Adaptation of Migrants

Successfully transitioning and adapting to a new environment requires strategies to manage stressful situations such as the learning of new cultural norms in order to *do well* or *fit in* (i.e., sociocultural adaptation) and to *feel well* (i.e., psychological adaptation) in the receiving society (Ward, 2001). Psychological adaptation, hence, is defined by a lack of psychological problems (e.g., distress, depression, anxiety) and presence of well-being such as satisfaction with life. Sociocultural adaptation on the other hand refers to the degree to which individuals are competent in carrying out their daily lives in the new social and cultural

contexts and the larger society (Masgoret & Ward, 2006). To date, the bulk of acculturation research has focused on mental or physical health indicators as correlates or outcomes of acculturation. Moreover, prior studies have also tended to focus on how acquired values, practices, and beliefs about the cultures of inception improved individual's adaptation (Sam & Berry, 2016; Schwartz, Unger, Zamboanga & Szapocznik, 2010). The tide of acculturation research is however shifting. In a seminal theoretical review, Ward and Geeraert (2016) point to a research gap in this literature, arguing for the need of an *ecological acculturation framework.* Such a framework postulates that the acculturation process begins with a new cultural experience, and that successful adaptation is the *interaction* between factors of the *home* and *host* contexts including the compatibility of person and environmental fit. Although little researched, this eco-cultural fit should include aspects pertaining to the match of climate of the home and host contexts. However, while climate has been proposed as a major acculturative challenge (Berry, 1990), no study has examined how differences in climate can affect individuals' psychological and sociocultural adaptation during the migration process.

Psychological Effects of Climatic Demands: Two Alternative Perspectives

Already decades ago, climate was shown to affect emotions, stress responses and mental efficiency (Roberts, 1978). Newer research suggests that climatic effects depend on seasons and day-to-day temperature fluctuations. For instance, Keller et al. (2005) showed that higher temperatures and barometric pressure improved mood during spring but a hotter climate was associated with lower moods during the summer. Further, highlighting the varying impact of climatic conditions, observational reports from Texas during fall and spring found no consistent effect of weather on mood (Watson, 2000), whereas some researchers found temperature to predict negative emotions during winter in Germany (Denissen

Butalid, Penke & Van Aken, 2008). In recognizing that humans are warm-blooded and function best within a certain optimal temperature, Van de Vliert (2007) deviated from previous researchers who focused on absolute temperature as the basis for examining the relationship between climate and psychological functioning. This positioning helped resolve some of the inconsistencies in previous research. Van de Vliert (2008) describes this reasoning in the climatic demands theory (CDT).

At its core, CDT posits that the demands and resources of human habitats influence people's needs to survive and function in their natural environment. In poor regions with demanding winters and scorching summers, individuals suffer psychologically; while temperate climates tend to foster more freedom, autonomy, more openness and are usually appraised as more comfortable (Van de Vliert, 2013). CDT proposes a 22 °C (~72 °F) point of reference for optimal climatic livability in form of thermal comfort, nutrition, and positive health outcomes. Cross-national studies have revealed that climatic demands (i.e., climates that are colder than temperate and hotter than temperate) jointly with country wealth affect health outcomes (Van de Vliert, 2007). Single country regional variation studies, have also verified the effect of climatic demands on mood, collectivism and even personality (Wei et al., 2017). Analyzing data from 58 nations, Fischer and Van de Vliert (2011) found that climatic demands negatively influenced general evaluations of life satisfaction and subjective wellbeing. Their results further suggested that these climatic conditions first impact on overall evaluations of one's life, and that this in turn influences levels of stress, anxiety, and psychological ill-health.

Against this background of research and following a CDT perspective, one would thus expect that migrants moving from harsh to less climatically demanding environments would show improved psychological adaptation, whereas the opposite would be true for those moving to more demanding climatic environments. In contrast, a climatic-fit perspective

(Smit, Burton, Klien & Wandel, 2000) which builds on a cultural-fit perspective (Mesquita, De Leersyner & Jasini, 2017) would suggest that migration that entails remaining in climatic zones that are similar to one's home site – be they demanding or not – will lead to the best adaptation. At the same time, major climatic deviations from the home climatic conditions would be expected to adversely impact migrants' adaptation (Burton, 1996). Under changing climatic conditions, people need to develop new behavioral repertoires to cope and adjust to their environment (Sánchez-Rodríguez, 2008). Accordingly, when migrants face new climatic demands, their previous habitual adaptation may become mismatched to the new context, and in turn impair adaptation. A climatic-fit perspective would thus predict that when *home* and *host* climatic demands are congruent (i.e., when there is a "climatic match"), one would expect better psychological functioning because there is little need to alter previously adopted coping strategies. Conversely, when individuals migrate from harsh to less demanding climates or vice versa, one would expect less positive psychological outcomes at least in the short term.

The Chinese Cultural and Climatic Context

The diversity of China's geography is often underemphasized in social scientific research. In terms of size, PRC is about the same size as Europe and the country transverses a variety of climatic zones. For example, the Northeast region experiences hot and dry summers and bitter cold winters with temperatures reaching as low as -30°C. The north and central region experience temperate summers (26°C) and mild winters 0°C. In the southeastern and some parts of the southwestern regions of China, temperatures can reach 40°C in summer while winters are milder around 10°C. In the northwestern and in Tibetan region, temperatures also reach subarctic temperatures and summers are usually hot and dry (Domrös and Peng, 2012). Figure 1 provides a brief illustration of the climatic zones.

With her over 300 million intra-national migrants, China is an appropriate cultural context to examine the effects of climatic demands on migrant's adaptation as rates have drastically increased (Fan, 2008). Unlike earlier waves of migrants who tended to be factory-workers, nowadays about 6.5 million migrants annually move to new areas in the pursuit of higher education (English & Worlton, 2017).

The Present Research

To date, very little is known about the effects of changing climatic demands on the psychological and sociocultural adaptation of migrants. In a multi-site, longitudinal study, we therefore investigated the impact of differences in climatic demands in a larger sample of intra-national Chinese migrants. Specifically, using this design, we tested two competing hypotheses. On the one hand, a CDT perspective (Van de Vliert, 2007) would predict that migrating from more challenging[1] to less challenging climates leads to better psychological outcomes, while predicting worse psychological outcomes for those moving from less challenging to more challenging climates. On the other hand, a climatic-fit perspective (Smit, Burton, Klien & Wandel, 2000) would predict the best psychological outcomes when migrants move to environments that match the climatic demands of their home sites that they are used to, while predicting that any substantial climate change should impair psychological outcomes. Importantly, when testing these competing predictions, we control for the general collectivist orientation of participants, which likely would emerge as robust alternative predictor of adaptation following previous research (Du, Li, Lin, & Tam, 2015).

Method

Participants and Procedure

In total, 1723 first-year recent arrival (< 90 days) college students (see Table 1 for demographics across sites) were surveyed in twelve Chinese cities (see Figure 1). These individuals came from all the 32 provinces of the PRC and were part of a larger project called

"The China Longitudinal College Acculturation Study" (English, 2015). Within the first month of classes of the fall semester, students were asked to voluntarily participate in a longitudinal study. Students signed a consent form and completed a pencil and paper questionnaire during the first-year courses offered at the universities. Follow-up data was collected three to five months later in the winter before Chinese New Year, and 1118 of the original participants completed the survey a second time. The sample ranged from $n = 50 – 150$ between sites (42% to 85% response rate at Time 2 at each site) and the overall attrition rate was 36%. More males (31%) dropped out of the study compared to females (19%), $\chi^2 = 31.20$, $p = .001$. Individuals who dropped-out were slightly older, $M = 19.65$, $SD = 2.33$ *vs.* $M = 19.12$, $SD = 1.71$, $t(1721) = 4.27$, $p = .001$, and their mothers had fewer years of formal education, $M = 9.08$, $SD = 3.83$ *vs.* $M = 9.67$, $SD = 3.87$, $t(1721) = -2.35$, $p = .020$, compared to participants who remained in the study. Despite demographic differences in attrition, no differences were found between those who dropped out and those who participated in both waves on the key variables of stress, life satisfaction, length of sojourn in host city, and host and home climatic demands (all $ts < 1$).

Questionnaires were in Chinese and had been previously used and validated in acculturation research (English & Worlton, 2017). The survey included a unique four-item code (day of birth; month mother was born; 2nd Chinese character of the father's name, and year father was born) to identify and match participants to their follow-up data. This scheme ensured a high degree of anonymity and confidentiality as the code was the only way to match follow-up data. The survey also included measures related to academic adjustment and other scales for different research projects. The entire survey took 15 minutes and participants were free to drop-out at any time during the study.

Materials

In terms of demographic variables, participants were to indicate their age, gender, parents' education, the location type (i.e., city, town, village) of where they grew up and whether the location is rice or wheat in terms of agricultural product cultivated, previous mobility (i.e., number of moves in their life) and length of stay at current university.

In addition to demographic variables reported in Table 1, we measured the following constructs:

Collectivist orientation. A 14-item measure was adopted from Van de Vliert et al. (2013a) to measure participants' collectivist orientation, which was an important control variable in the present research. Participants were asked to indicate how much they agreed or disagreed with items such as, "I view myself as a member of a social group," and "My close interpersonal relationships reflect who I am." Responses were scored on 7-point Likert scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Reliability was acceptable to satisfactory across sites (α = .62 - .82). This variable was only assessed at T2 because it constituted a control variable.

Climatic demands. As in previous research (Van de Vliert, 2013a), climatic demands at the home and host site were operationalized as the sum of the absolute temperature deviation from 22ºC from the average lowest and highest temperature in the coldest and hottest month at the provincial capital. For one example in our study, Xinjiang's January temperature average ranges from -29.0 °C to -1.0 °C, and in July from 19.0 °C and 28.4 °C. Hence, Xinjiang's climatic demands is calculated as = (-29.0 – 22.0) + (-1.0 – 22.0) + (19.0 – 22.0) + (28.4 – 22.0) = 82.4 (see Van de Vliert, 2013a for details).

Sociocultural adaptation. The 12-item brief sociocultural adaptation scale (Demes & Geeraert, 2014) was used to assess the ease of adapting or behaviorally "fitting in" to social and cultural contexts of the university's host city that participants had moved to. This scale is highly used in acculturation research and has been validated in a Chinese context (Bata &

Zhixia, 2017). Among others, participants were asked to indicate how easy or difficult they found it to adapt to its "social norms," "population density," "climate" and "food." Responses were rated on a scale anchored at 1 (*very difficult*) and 7 (*very easy*). Reliability estimates ranged from α =.80 - .93 across sites. Due to the variable measuring sociocultural adaptation to the specific context of their host site, it was only assessed at T2.

Perceived stress. As the first measure of psychological adaptation, a brief version of the perceived stress scale (Cohen, Kamarck & Mermelstein, 1983) was administered. Participants were asked on a scale ranging from 1 (*never*) to 5 (*always*), "in the last 2 weeks how often have you felt…," which was followed by seven items such as "felt nervous or stressed?" The scale had acceptable reliability across sites ranging from α = .73 - .92 at Time 1 (T1) and α = .80 - .95 at Time 2 (T2)

Life satisfaction. The second measure of psychological adaptation was the satisfaction with life scale (Diener, Emmons, Larsen, Griffin, 1985). It included the standard five items that were rated on a 7-point Likert scale anchored at 1 (*strongly disagree*) and 7 (*strongly agree*). Participants were asked to complete items such as, "How satisfied are you with your present life?" Reliability ranged from α = .58 - .80 at T1 and α = .60 - .81 at T2.

Analyses. Means and standard deviations for the main study variables in the different sites are presented in Table 1. Correlations across participants and different sites are presented in Table 2. Meta-correlation analyses between both types of correlations (excluding level-2 variables that otherwise would inflate the correlation coefficient) showed sufficient measurement equivalence across levels, $r(89) = .58$, $p < .001$. We tested different multilevel models with sociocultural adaptation, stress, and life satisfaction at Time 2 (T2) as dependent variables. In each model, we tested the main effects of home climatic demands (Level 2) and host climatic demands (Level 2) and their interaction effect on the respective dependent adaptation variable (Level 1). Moreover, we controlled for the GDP at their home site (Level

2) and various demographic variables at the individual level (Level 1), including age, gender, years of parents' formal education, whether participants grew up in a rice or wheat area, whether they grew up urban or rural and their previous mobility. Moreover, we controlled for the time individuals had already stayed at the host site when completing the survey at T2 and their degree of collectivist orientation. Last, and importantly, for the models in which stress and life satisfaction were the dependent variables, we also controlled for their respective scores at arrival (i.e., at T1), such that the dependent variable represented change in adaptation. In all models, intercepts were allowed to vary for the host and home sites. The home and host climatic demands variables were grand-mean centered in accordance with recommendations for tests of interactions in multi-level models (Enders & Tofighi, 2007). All variables were then *z*-scored to obtain standardized effect estimates. Restricted maximum likelihood estimation was used.

Results

Sociocultural Adaptation

The between-group variance for the sociocultural adaptation model was relatively low (home site: $\sigma^2 = .09$; host site: $\sigma^2 = .03$; home site GDP: $\sigma^2 < .001$), while the within-group variance was relatively high ($\sigma^2 = .70$). The ICC was .11 for the home site and .04 for the host site climatic demands, while it was < .001 for host site GDP. The R^2 was .08. As displayed in Table 3, the longer participants had stayed at the host site when taking the survey and the higher their collectivist orientation, the higher sociocultural adaptation they showed. Importantly, the interaction between home and host climatic demands was significant. An inspection of the effects plot (see Figure 2) showed that higher climatic demands at the host site predicted less sociocultural adaptation for individuals from regions with low climatic demands. By contrast, host climatic demands had a positive effect on sociocultural adaptation

for individuals moving from regions with high climatic demands. An estimation of the simple slopes (see Figure 3) showed that for individuals moving from areas with low climatic demands, sociocultural adaptation was the highest when they arrived in sites that also had low climatic demands, but was predicted to be markedly lower when they arrived in host sites with high climatic demands. The exact opposite was observed for those arriving from highly demanding home climates.[2]

Stress

For the model with stress as dependent variable, the between-group variance was low (home site: $\sigma^2 < .001$; host site: $\sigma^2 = .01$; home site GDP: $\sigma^2 < .001$) compared to the within-group variance ($\sigma^2 = .76$). The Intraclass Correlation Coefficients (ICC) were accordingly low as well (home site climatic demands: ICC < .001; host site climatic demands: ICC =.01; home site GDP: ICC < .001). The R^2 was .25. As displayed in Table 4, in addition to the stress scores at T1, the interaction between home and host climatic demands was significant. An inspection of the effects plot (see Figure 2) showed that higher climatic demands at the host site predicted more stress for individuals coming from places with low climatic demands. In contrast, climatic demands at the host site tended to predict less stress for those coming from demanding climatic conditions, but this effect was only significant for those coming from places with the most extreme climatic demands (i.e., +4 *SD*). For visualization, we further estimated simple slopes of host climatic demands at different levels of home climatic demands using unstandardized stress scores as outcome variable. As displayed in Figure 3, individuals coming from average home climates were largely unaffected by the climate of the host site, be it more or less demanding than what they were used to. However, those coming from climatic regions with little demands but living in sites with high demands reported almost twice as much stress compared to their peers arriving in sites with low climatic

demands. For those coming from highly demanding climates, arriving in a host site with a similarly demanding climate seemed to produce the lowest stress levels.[3]

Life Satisfaction

The between-group variance for the model with life satisfaction as dependent variable was close to zero (home site: $\sigma^2 < .001$; host site: $\sigma^2 < .001$; home site GDP: $\sigma^2 < .001$), while the within-group variance was relatively high ($\sigma^2 = .69$). The ICCs were also close to zero (home site: ICC < .001; host site: ICC < .001; home site: ICC < .001). The R^2 for this model was .29. As displayed in Table 5, in addition to life satisfaction at T1, age and collectivist orientation both predicted higher levels of life satisfaction at T2. No main or interactive climatic effects were observed.[4]

Discussion

The present research aimed to investigate the effects of climatic differences on the adaptation of migrants, testing competing predictions derived from climatic demand theoretical perspective (Van de Vliert, 2009) and a climatic-fit perspective that builds on the culture fit hypothesis (De Leersnyder, Kim, & Mesquita, 2015). In support of the climatic-fit perspective, migrants generally showed the least stress and best sociocultural adaptation when they moved to areas that had a similar climate (be it relatively demanding or not) to what they were used to from home. Since our data failed to support climatic demands theory, it's possible the theory does not apply to migrants moving to new climates. We discuss this important question below.

Given the crucial importance of adjusting to climatic demands for survival (Van de Vliert, 2007), humans develop sophisticated and complex adaptations to cope with the climatic conditions at their place of living (Mahdavi, & Kumar, 1996). However, when people migrate to places with different climatic demands than what they are used to, their previous adaptations may become inapt, causing stress because they are required to change their

behavioral patterns. In line with this notion, Chinese migrants who moved to areas that climatically diverged from their homes seem to experience increased stress and lower sociocultural adaptation. This finding supports a climatic-fit hypothesis and extends previous research on the culture fit hypothesis (De Leersnyder, Kim, & Mesquita, 2015). Several studies have shown that a fit between immigrants' individual characteristics such as cultural norms, emotions, personality, and coping styles with those of the people living in the new host context predict successful adaptation (De Leersnyder, Mesquita, & Kim, 2011; Szabo et al., 2017; Ward & Chang, 1997). Our research supports the framework of the culture fit hypothesis as we attempted to answer the call for research investigating ecological and environmental factors between *home* and *host* context that contribute to successful acculturation.

However, while our results supported a climatic-fit perspective, it is important to note that we only followed participants over a relatively short period of time. It is likely that participants when surveyed during the second time in the winter were in the midst of the (arguably stressful) process of adapting to the new climatic demands for the first time. We would assume resulting lower sociocultural adaptation and increased stress to be temporary phenomena that decline back to their initial levels once an optimal level of adaptation is achieved after a longer period of time. Hence, in the long run, it is still possible that moving to less demanding climates may lead to better adaptation and that our findings only reflect short-term changes. As such, CDT and climatic-fit perspectives may in fact be reconcilable, addressing different stages of adaptation during the acculturation process.

No effects on satisfaction with life were observed, in spite of the fact that evidence often links climatic demands to subjective wellbeing (Rehdanz, & Maddison, 2005). Yet, our findings are consistent with evidence suggesting that people in pleasant climates do not appear to be any happier than people in harsh climates (Schkade & Kahneman, 1998). Life

satisfaction can also be seen as a measure that is more stable and less likely to fluctuate than for instance perceived stress. Similarly, given that sociocultural adaptation in essence is context dependent, it should be more sensitive to contextual changes in a new ecological environment than general life satisfaction. However, another possible psychometric explanation for why no significant effects were observed for life satisfaction may also be that it in the current study the measure had low reliability in many sites.

Implications for Theory and Future Research

Our findings underscore the notion that climatic influence on psychological functioning may be more pervasive for many social phenomena than previously assumed (Fischer & Van de Vliert, 2011) and, hence, contribute to the growing evidence of the role of climatic conditions on different areas of human behavior and functioning (Fischer, Lee & Verziden, 2018). Specifically, it did so for the process of acculturation. Whereas acculturation research tends to attribute migrants' adaptation primarily to cultural change (Sam & Berry, 2010), findings from this study suggest that climatic change may be another important factor to be considered. Acculturation researchers may probably have underestimated the climatic adaptation challenges many migrants face in their new eco-cultural contexts, despite the general acknowledgement that climatic change may be theoretically implicated (Berry, 1990). Nevertheless, it is important to note that generally effects were small in the present research. This suggests that climatic demands may play one role together with other established factors.

One reason for the generally small effect size of the host by home site climatic demands interaction may be that the sample represented a group of comparatively resourceful Chinese young adults who voluntarily moved to a new site to pursue higher education. These migrants may have the socio-economic means to adapt to their new climatic environment, which is in line with previous research (Berry, 1997). Also, future analyses should consider measuring climatic demands at the county-level as other studies have begun to reveal cultural

variation across counties in China (Dong, Talhelm & Ren, 2018; English et al., under review). Another important point to note is that parts of northern China have centralized heating in winter, while winters in southern China Moreover, being students, their main daily activities likely took place inside (e.g., within buildings with air conditioning and/or heating) and, hence, are relatively unaffected by climatic factors. Future research should, thus, investigate changes in adaptation among groups from diverse socio-economic backgrounds and whose occupations are impacted by, or even dependent on, climatic factors (i.e., farmers). Similarly, it may be important to assess subjective experience of the objective climatic demand on the individual.

Moreover, future research should test the impact of shifting climates among the over 25 million migrants who have involuntarily left their homes due to increasing climatic demands (i.e., "environmental refugees"; Biermann & Boas, 2010). As global warming proceeds, this number is likely to grow drastically in the future. Hence, we believe that considering the effects of climate on adaptation, which currently are understudied in acculturation research, will become increasingly important in future research. Our research is to our knowledge the first to establish the link between climate and acculturation, but future research is needed to explore its complex dynamics.

Our research may also point to some interesting issues that policymakers as well as social workers should consider when receiving and accommodating refugees and immigrants. Although further longitudinal research over longer periods of time is needed to fully establish the temporal trajectories of adaptation to climatic differences, our findings suggest that migrants who experience large climatic differences may experience an increase in stress and lowered sociocultural adaptation – at least temporarily. This finding may guide interventions. For instance, integration programs that mostly focus on cultural differences may also educate

migrants (and especially those arriving from climatic regions different from the host site) about how to best adapt (such us choice of clothing) to the climatic challenges they face.

Because the present study dealt with intra-national migrants, we did not measure perceived discrimination and acculturation strategies, which are two of the major individual difference variables affecting socio-cultural adaptation (Berry et al., 2006). However, given the large cultural and ethnic variety of the PRC, such measures should optimally have been included to parse out the unique effects that climate exerts on adaptation over and above acculturation strategies. Also, given the lack of research on the climatic fit hypothesis that we proposed and tested for the first time, future studies may profitably use qualitative interviews to gather in-depth insights into with the climate experiences of migrants.

Conclusion

Migration and global warming are two of the leading challenges of our time (UN, 2015). The present study has important ramifications for gaining a deeper understanding of one aspect of the relationship between these challenges, namely how shifting climatic demands impact the adaptation of migrants. In support of a climatic-fit perspective, it showed that any divergence from the climate that migrants are used to from their home sites, at least temporarily in the short-term, may impair their psychological and socio-cultural adaptation.

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Table 1. *Variable Descriptives for the Different Host Sites*

	Jiujiang		Nanjing		Shanghai		Changsha		Luzhou		Shaoxing		Shenzhen		Jinzhou		Zhoukou		Hangzhou		Shihezi		Beijing	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1. Age	18.8	.79	18.3	.69	19.9	2.54	18.9	.88	18.3	.72	18.8	.81	20.7	2.38	18.9	1.13	18.9	.96	19.2	1.92	18.7	1.06	23.1	1.74
2. Gender (% female)	89.2		63.3		65.3		23.9		54.3		68.6		76.0		55.1		67.9		43.2		66.4		78.9	
3. Rice Area Home (%)	37.5		19.2		72.3		60.0		70.7		87.5		18.8		11.2		41.1		49.2		31.7		25.6	
4. Mother Education	5.1	.9	3. 9	1.2	3.7	1.1	5.2	1.0	5.0	1.0	5.0	1.1	4.4	1.2	4.7	1.0	5.2	.9	4.7	1.2	4.7	1.3	4.5	1.1
5. Father Education	4.6	.7	3.7	1.0	3.5	1.0	4.7	.9	4.7	1.0	4.8	1.0	4.0	1.2	4.6	1.0	4.9	.9	4.3	1.1	4.5	1.1	4.2	1.1
6. Home Site GDP	12.8	1.6	15.4	4.2	18.1	4.5	15.5	2.0	15.7	2.7	19.7	4.5	15.1	2.9	13.5	2.3	15.7	3.2	18.6	5.4	15.2	2.2	14.9	3.0
7. Grew Up Urban %	32.4		50.0		58.3		25.4		30.1		25.7		32.0		48.0		22.0		32.5		36.1		35.6	
8. Previous Mobility	1.5	.8	1.2	.6	1.5	.7	1.4	.8	1.3	.8	1.6	.8	1.9	.8	1.2	.6	1.2	.5	1.4	.7	1.2	.5	1.8	.7
9. Time Stayed (days)	.9	.6	4.2	2.4	30.1	101	36.8	244	16.4	114	3.4	.8	162	284	12.6	93.2	4.8	.2	31.5	137	25.8	83.2	37.6	103
10. Collect Orient.	4.5	.6	4.5	.5	4.3	.5	4.3	.6	4.4	.6	4.5	.7	4.2	.5	4.1	.7	4.3	.6	4.5	.5	4.3	.7	4.4	.6
11. Home Climate	49.8	7.6	60.2	13.9	52.0	9.4	47.6	10.1	43.2	9.4	47.1	8.2	49.4	14.1	66.5	12.7	56.7	15.8	51.3	9.7	60.4	16.4	57.6	12.7
12. Host Climate	48.5		51.2		48.2		48.5		39.7		49.0		29.9		74.4		53.9		49.0		84.2		61.0	
13. Sociocult. Adapt.	4.5	.8	4.5	1.1	4.6	1.2	4.1	1.1	4.9	1.0	5.0	1.1	4.0	1.2	4.3	1.2	4.0	1.2	4.8	1.2	4.4	1.3	4.3	1.1
14. Stress T1	3.6	1.1	3.2	.9	3.3	.8	3.2	.9	3.2	.7	3.1	.8	3.4	1.1	3.5	1.1	3.4	.9	3.4	.9	3.5	.7	3.6	.8
15. Stress T2	3.5	1.0	3.1	.7	3.3	.9	3.1	1.0	3.2	.8	3.5	1.1	3.3	.7	3.3	.9	3.4	.8	3.6	.9	3.4	.8	3.4	.9
16. Life Satisfaction T1	3.7	1.0	4.4	1.1	4.3	1.0	4.0	1.1	4.4	.9	4.2	.9	4.3	1.1	4.1	1.1	3.9	1.0	4.4	1.0	4.3	.9	4.4	1.0
17. Life Satisfaction T2	4.0	.8	4.1	1.1	4.3	1.1	3.9	1.0	4.3	1.1	4.1	.8	4.3	.9	4.0	1.1	4.0	.9	4.2	1.0	4.1	1.1	4.3	1.0
N (T1)	37		30		148		72		147		35		26		98		209		457		204		260	
N (T2)	21		27		148		62		103		25		16		97		141		199		108		171	

Note. Due to space limitations, only up to three digits and one decimal are displayed.

Table 2

Pearson's Correlations Across Participants (Presented Above Diagonal) and Spearman Correlations Across Sites (Presented Below Diagonal) Between the Main Study Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. Age	-	-.11***	-.17***	.04	-.00	-.06*	-.04	.29***	.10***	.04	.12***	.08**	-.07**	.04	.04	.03	.12***
2. Gender[1]	-.21	-	.03	-.00	-.02	.03	.03	-.03	-.01	-.02	-.04	-.09***	-.01	-.01	-.03	-.05*	-.08*
3. Aggr. Region Home[2]	-.23	.22	-	-.01	-.07*	.47***	-.01	.03	.01	.01	-.62***	-.28***	.12***	-.06	-.00	.00	-.01
4. Mother Education	-.38	.03	.36	-	.69***	.03	-.32***	-.02	-.05	-.03	-.15***	-.01	-.05	.02	-.01	-.12***	-.10**
5. Father Education	-.43	.10	.34	.89***	-	.02	-.27***	-.04	-.04	-.03	-.05	.03	-.03	.03	-.03	-.14***	-.10**
6. Home GDP	-.15	.39	.78**	.12	.21	-	-.01	.02	.07**	.05	-.33***	-.20***	.26***	-.03	.01	.07**	.06
7. Grew Up Urban	.15	.03	-.36	-.83***	-.78**	-.27	-	.06	.06*	-.02	.07**	.04	.04	-.05	.00	.08**	.04
8. Previous Mobility[3]	.50	-.51	.19	-.26	-.36	.04	-.08	-	.05	.05	-.06	-.08**	-.05	.05	.03	.05	.07*
9. Time Stayed	.69*	.18	-.15	-.36	-.41	-.03	.04	.37	-	-.02	-.06*	-.03	.14***	.01	-.01	.03	.00
10. Collect Orient.	-.26	-.06	.48	.13	.02	.36	-.08	.39	-.34	-	-.02	-.08**	.14***	-.01	-.01	.14***	.22***
11. Home Climate	.15	-.06	-.66**	-.38	-.35	-.41	.66*	-.50	-.04	-.40	-	.36***	-.09***	.02	.01	.03	.01
12. Host Climate	-.08	-.05	-.40	.07	.13	-.21	.27	-.54	-.20	-.12	.80**	-	-.09***	.09***	.02	-.02	-.04
13. Sociocult. Adapt.	-.41	.17	.59*	-.10	.01	.45	.20	.15	-.40	.69*	-.36	-.22	-	-.16***	-.14***	.25***	.22***
14. Stress T1	.43	-.49	-.56	.00	-.10	-.71**	.20	-.03	.15	-.35	.51	.40	-.43	-	.48***	-.31***	-.21***
15. Stress T2	.25	-.48	.22	.21	.08	.13	-.08	.37	-.11	.46	-.04	.17	.29	.40	-	-.23***	-.35***
16. Life Satisfaction T1	.06	.27	.01	-.57	-.43	.24	.31	.24	.45	.22	-.10	-.18	.36	-.20	-.09	-	.51***
17. Life Satisfaction T2	.34	-.11	.02	-.70*	-.57	.13	.44	.42	.52	.01	.03	-.17	.24	.08	.08	.83***	-

Note. [1]coded as 0 = female, 1 = male. [2]coded as 0 = wheat, 1 = rice. [3]Previous mobility represents the time participants have moved in their life. *p < .05, **p < .01, ***p < .001.

Table 3

Multi-level Model for Socio Cultural Adaptation at T2 is Presented

Variable	β	*SE*	*df*	*t*	*p*
Level 1					
Intercept	-.03	.09	18.10	-3.34	.003
Age	-.08	.04	184.50	-1.81	.072
Gender[1]	-.05	.03	779.40	-1.70	.090
Agriculture region at home [2]	.06	.05	457.50	1.08	.282
Mother education	-.01	.04	790.60	-.16	.872
Father education	.01	.04	789.50	.18	.855
Grew up urban (vs rural)	.03	.03	787.40	1.07	.283
Previous mobility[3]	-.03	.03	793.90	-1.08	.282
Time stayed at host site	.11	.03	798.90	3.06	.002
Collectivist orientation	.11	.03	789.30	3.77	<.001
Level 2					
GDP at home site	.11	.07	41.30	1.60	.118
Home climatic demands	.03	.06	37.00	.53	.598
Host climatic demands	-.04	.06	8.90	-.07	.530
Home X Host climatic demands	.16	.04	709.50	4.37	<.001

Note. [1]coded as 0 = female, 1 = male. [2]coded as 0 = wheat, 1 = rice. [3]Previous mobility represents the time participants have moved in their life.

Table 4

Multi-level Model for Stress at T2 is Presented

Variable	β	*SE*	*df*	*t*	*p*
Level 1					
Intercept	-.01	.04	7.30	-.34	.747
Stress at T1	.49	.03	801.00	15.85	<.001
Age	.02	.04	49.00	.62	.539
Gender[1]	-.03	.03	682.80	-1.03	.305
Agriculture region at home[2]	.03	.04	769.30	.79	.433
Mother education	.03	.05	757.80	.75	.454
Father education	-.06	.04	776.80	-1.35	.178
Grew up urban (vs rural)	.03	.03	800.10	1.02	.306
Previous mobility[3]	-.01	.03	801.00	-.47	.642
Time stayed at host site	-.02	.04	800.40	-.47	.640
Collectivist orientation	-.01	.03	799.60	-.38	.701
Level 2					
GDP at home site	.03	.04	683.60	.72	.472
Home climatic demands	.03	.04	629.00	.71	.479
Host climatic demands	.02	.04	12.30	.57	.582
Home X Host climatic demands	-.08	.03	346.30	-2.32	.021

Note. [1]coded as 0 = female, 1 = male. [2]coded as 0 = wheat, 1 = rice. [3]Previous mobility represents the time participants have moved in their life.

Table 5

Multi-level Model for Life Satisfaction at T2 is Presented

Variable	β	*SE*	*df*	*t*	*p*
Level 1					
Intercept	.03	.03	803	1.02	.309
Life satisfaction at T1	.47	.03	803	15.61	<.001
Age	.10	.03	803	3.13	.002
Gender[1]	-.04	.03	803	-1.31	.191
Agriculture region at home[2]	.00	.04	803	.01	.991
Mother education	-.05	.04	803	-1.08	.279
Father education	.01	.04	803	.32	.752
Grew up urban (vs rural)	.00	.03	803	-.08	.934
Previous mobility[3]	.04	.03	803	1.30	.194
Time stayed at host site	-.02	.03	803	-.64	.520
Collectivist orientation	.15	.03	803	4.90	<.001
Level 2					
GDP at home site	.05	.04	803	1.15	.249
Home climatic demands	.03	.04	803	.84	.401
Host climatic demands	.00	.03	803	-.56	.573
Home X Host climatic demands	.00	.03	803	.27	.784

Note. [1]coded as 0 = female, 1 = male. [2]coded as 0 = wheat, 1 = rice. [3]Previous mobility represents the time participants have moved in their life.

Footnotes

[1] Please note that, although the CDT distinguished between "threatening" climatic demands (when inhabitants are poor) and "challenging demands" (when inhabitants are rich), we consistently use the term "challenging" in this paper because the present research focuses on a comparatively privileged population for which the climate hardly can be seen as threatening.
[2]As suggested by one of the reviewer, we estimated an extended model in which collective income (assessed by the proxy variable GDP of home province) was expected to interact with climatic demands at the home and at the host site. The three-way interaction was significant (p=.016). Simple slopes presented in the supplementary materials (see Figure S1) suggested that the effect, which home and host climatic demands interactively had on sociocultural adaptation, was particularly pronounced among participants with high incomes (+1*SD*).
[3] As with the previous dependent outcome, we also estimated an extended model to test whether income would interact with home and host climatic demands. However, this three-way interaction did not reach significance (p = .46[2])
[4]Also for this dependent outcome, we tested whether income would interact with home and host climatic demands in an extended model. The three-way interaction was non-significant (p =.691)

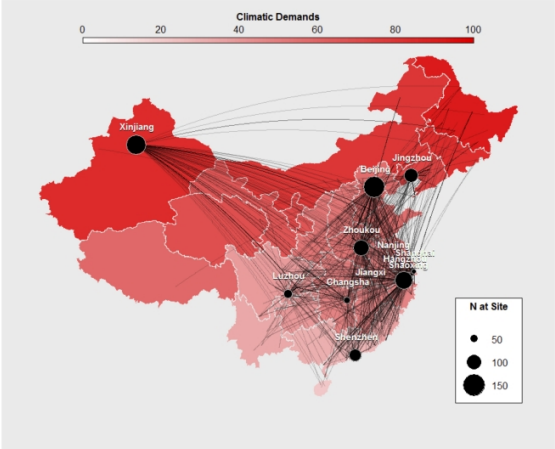

Figure 1. Migration patterns of participants to destination sites are displayed.

Figure 1. Migration patterns of participants to destination sites are displayed.

209x296mm (300 x 300 DPI)

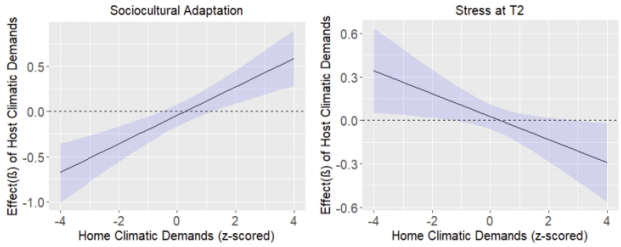

Figure 2. Standardized effects of host climatic demands on sociocultural adaptation and stress are displayed. Ribbon represent 95% confidence intervals

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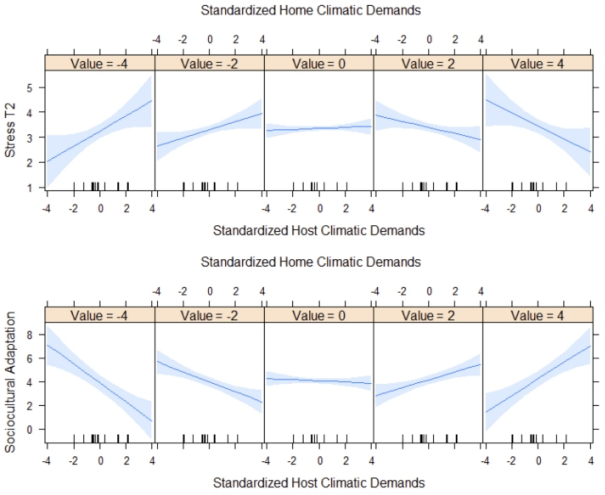

Figure 3. Simple slopes of host climatic demands on unstandardized stress and sociocultural adaptation are displayed for different level of home climatic demands. Ribbons represent 95% confidence intervals.

Figure 3. Simple slopes of host climatic demands on unstandardized stress and sociocultural adaptation are displayed for different level of home climatic demands. Ribbons represent 95% confidence intervals.

209x296mm (300 x 300 DPI)

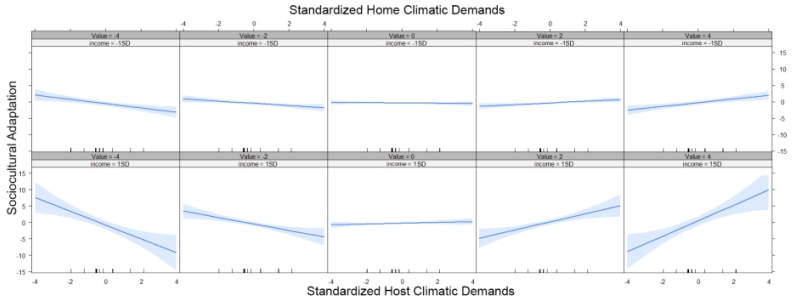

Figure S1. Simple slopes of host climatic demands on sociocultural adaptation are displayed at different level of home climatic demands and for participants with low (upper panel) and high (lower panel) income. Ribbons represent 95% confidence intervals.

Figure S1. Simple slopes of host climatic demands on sociocultural adaptation are displayed at different level of home climaticdemands and for participants with low (upper panel) and high (lower panel) income. Ribbons represent 95% confidence intervals.

279x215mm (300 x 300 DPI)