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Impact of Naturalistic and Urban Environment on Mindfulness Practice in Reducing Rumination

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Mindfulness intervention is commonly employed to lower rumination due to its ability to target the components of the ruminative process. The current study attempts to examine how environmental settings, nature vs. urban, are able to affect the outcome of mindfulness practices in its ability to reduce rumination. A total of 316 participants completed a survey regarding their mindfulness practices, trait mindfulness, dysfunctional attitude, attention control and rumination. Data was analysed using block variable analysis. Results indicate during the initial stages of one's practice, a naturalistic environment could help reduce rumination better than an urban environment. However, people who meditate in urban environments can better reduce their rumination levels as they persist in their practice over time.

1. Introduction

Popularity of employing mindfulness intervention as a means to lower rumination has been growing in the modern world. With the number of meditation classes and nature retreats increasing, it is important to examine what could potentially optimize the benefit one gains from mindfulness practices, and in turn inform the investment strategy of people who wish to engage in mindfulness meditation. The aim of the current study is to examine the possible benefit that exposure to a naturalistic environment, compared to an urban environment, may have on mindfulness practices and the impact of mindfulness on rumination reduction.

Mindfulness is defined as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to things as they are" (Williams et al., 2007, p. 47). In the last 30 years there has been substantial evidence that demonstrates that increasing mindfulness is conducive to reducing rumination (Eberth & Sedlmeier, 2012; Gu et al., 2015). Most relevant, studies have documented that the processes through which mindfulness practises reduce rumination, and ruminative related conditions such as anxiety and depression, are indirect via increases in trait mindfulness (Desrosiers et al., 2013; Deyo et al., 2009). Indeed, the more frequent one engages in formal mindfulness practice the greater the reduction in rumination (Hawley et al., 2014) and depression (Mathew et al., 2010).

Engaging in mindfulness meditation could be conducted in a variety of environments. While most city residents often practice in an urban environment, some people may choose to engage in meditative retreats that take place in naturalistic settings. This difference in practice location could potentially confer an indirect effect on the reduction of rumination by increasing mindfulness levels. Such an effect would inform the investment strategy for practitioners to maximize the benefits they gain when utilizing mindfulness to reduce rumination. The significance of ascertaining such an effect is in its ability to inform practitioners and policy makers of what type of training program they should enrol in, given their location and budget.

The aim of this study is to investigate whether practicing mindfulness in a naturalistic setting, compared to an urban setting, reduces rumination via improving trait mindfulness. We hypothesize an interactive effect between the environmental setting and the level of mindfulness practice, on rumination levels. Specifically, we speculate that compared to people who practiced mindfulness in urban environments, people who have practiced mindfulness in a naturalistic environment will experience a greater increase in trait mindfulness levels, leading to a greater decrease in rumination levels. Given the relation between the level of mindfulness practice and the benefit one gains from it, the level of practice shall be employed as a manipulation check.

1.1. Effects of Environment on Mindfulness and Rumination

Rumination is defined as repetitively and passively thinking about one's negative emotions and the events that caused them (e.g., Nolen-Hoeksema et al., 2008). To engage in rumination is to increase access to a dysfunctional mental attitude while simultaneously triggering a process by which attentional control capacity becomes increasingly impaired (De Lissnyder et al., 2011; De Raedt & Koster, 2010; Nolen-Hoeksema & Morrow, 1993). Attentional control impairment is a reduced capacity to maintain, inhibit, or switch attention away from specific mental or environmental content (Anderson et al., 2007; Lyubomirsky et al., 1998), while a dysfunctional mental attitude is conceptualized as maladaptive beliefs about oneself, the world, and the future (C. C. Conway et al., 2015; e.g. "If I fail at my work, then I am a failure as a person"). There exists evi-

dence to suggest a combined effect of attentional control and dysfunctional attitude on rumination (Everaert et al., 2014; Watkins, 2004).

Evidence supports that the regular training and practice of mindfulness meditation is able to improve one's day-to-day, or trait, mindfulness level (Bishop et al., 2004). Increasing one's trait mindfulness could impact both improve attention control (Jha et al., 2007; Semple, 2010) and reduce dysfunctional attitude (Gilbert & Christopher, 2010; Ramel et al., 2004) simultaneously. From a theoretical standpoint, as attention control and dysfunctional attitudes are both components of rumination, they therefore mediate the effects of mindfulness on rumination. They are in turn mediated by trait mindfulness that is influenced by meditative practices. There are ample studies which demonstrate that practicing mindfulness meditation has an indirect effect that results in reducing people's rumination levels (Gu et al., 2015; Hawley et al., 2014; Lykins & Baer, 2009).

While the literature of mindfulness has established its effects on dysfunctional attitude, attentional control and rumination, it is important to examine what variables may affect the efficacy of mindfulness. Mindfulness meditation may exert different effects based on the circumstances of the meditator, resulting in different outcomes. One possible variable may be the environment one is in when practicing mindfulness. Studies have found that exposure to naturalistic environment could impact mindfulness, or mindfulness-related practices. For example, Shin et al. (2013) found that meditative walking in naturalistic environment resulted in better psychological outcomes such as anxiety, self-esteem, and happiness, than meditative walking in a gymnasium. Similarly, people were able to derive more satisfaction from meditative walking when in naturalistic environments (Duvall, 2011).

Studies have also that found rumination, and rumination-related variables such as attention control and dysfunctional attitudes, could be reduced through exposure to stimuli that illustrates naturalistic settings. For example, the simple act of a 90-minute walk through a naturalistic environment significantly reduced both physiological and self-report measures of rumination (Bratman et al., 2015). Similarly Laumann et al. (2003) discovered that people who watched a 20-minute video of naturalistic images were better at attention control compared to people who watched a video of urban environments.

Taken together, the evidence indicates that a naturalistic environment may augment one's mindfulness benefits and thereby decrease one's rumination levels. Given the relationship between mindfulness practices and rumination, it is conceivable that mindfulness practices and the type of environment could potentially have an interactive effect whereby practicing in a naturalistic environment augments the positive effects on rumination. This is significant in that it informs the investment strategy of practitioners when they take part in a mindfulness-based intervention program for the purpose of reducing rumination. If naturalistic environments have the quality of enhancing the rumination reducing effect of mindfulness practices, then in order to optimize the outcome, individuals living in urban areas should enroll in mindfulness intervention programs that takes place in naturalistic settings as much as possible. If however, environmental setting conveys negligible effect on the intervention's outcome, people living in the cities may wish to avoid programs that include nature retreats as they are superfluous. If the current study finds that the interactive effect results in the greatest improvement of trait mindfulness and most decrease in rumination, then city-dwellers may prefer a mindfulness practice that has elements of both retreat and home practice.

2. Method

A total of 322 participants were recruited for this study. Among them, 6 were removed due to significant portions of responses missing, leaving a total of 316 participants (m=113, f=182, others=3) of age range of 18-56. Among them, 229 participants reported that they engaged in mindfulness practice. Recruitment came from two sources, including Australian undergraduate students and a community sample recruited from an online surveying website over a period of four months.

Participants needed to log on to the website and were guided by instructions to the survey questions. An information page about the study and a consent form was available to read. Participants who clicked the 'yes' option indicated that they had read and understood the information, and consented to this study. Participants were then required to answer a series of questions involving their mindfulness practice experience, dysfunctional attitude, attention control, rumination, and trait mindfulness levels. Completion of the survey should take no more than 45 minutes. Undergraduate student participants received 6 participation points for their participation while the community sample received $3.00 per hour for their participation.

2.1. Instruments

Rumination. The Rumination on Sadness Scale (RSS; M. Conway et al., 2000) is a 13 item self-report questionnaire that measures depressive rumination levels. Items are rated on a 5-point likert scale measuring from 1 (*not at all*) to 5 (*very much*). Total scores on the RSS ranged from 13 to 60. The internal reliability of the RSS has been reported to be excellent with a Cronbach's alpha of 0.91.

Dysfunctional Attitude. Dysfunctional Attitude Scale (DAS-17; De Graaf et al., 2009) is a 17 item self-report questionnaire that measures dysfunctional attitude levels. Items are rated on a 7-point likert scale. It was designed to measure cognitive distortions, especially those in relation to the aetiology of depression. Responses to each item are given in the form of score including 1 (*totally disagree*) to 7 (*totally agree*). Total scores on the DAH ranged from 17 to 119 if no questions are omitted. If there are any items that are not answered, a score of 0 is given for that item. The internal reliability of the DAS-17 has been reported to be excellent with a Cronbach's alpha of 0.86.

Attention Control. Adult Temperament Questionnaire (ATQ-Short form; Evans & Rothbart, 2007) measures the temperament of adults. Items are rated on a 7-point likert scale with an option of not applicable for each item. Responses ranged from 1 (*extremely untrue of you*) to 7 (*extremely true for you*). The Attention Control subscale of the Effortful Control domain was included in this study, which

accounts for a total of 19 items with score ranging from 0 to 133. The scale demonstrated strong reliability with most dimensions having a Cronbach's alpha of 0.80 or higher.

Trait Mindfulness. The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) was developed to measure five dimensions of mindfulness within an individual. Fifteen items are rated on a 5-item likert scale measuring from 1 (*Never or very rarely true*) to 5 (*Always true*). Scores ranged from 15 to 75 with higher scores representing a higher level of trait mindfulness. FFMQ can be differentiated into five different facets of mindfulness, including Nonreactivity, Observing, Acting with Awareness, Describing and Nonjudging. The FFMQ has acceptable internal reliability with Cronbach's alpha into a single trait mindfulnesss values between 0.75 and 0.91 for the various facets with the global scale having a Cronbach's alpha value of 0.87. The global scale, which was employed in the current study, is found to be positively correlated with the life satisfaction ($r=0.52$, $p<0.001$) and emotional intelligence ($r=0.64$, $p<0.001$), and negatively correlated with the depression ($r=-0.58$, $p<0.001$;) (Christopher et al., 2012).

Mindfulness Practice. We designed a series of questions, split into two sections, to measure levels of mindfulness engagement. All questions in the first section examined the frequency and intensity of mindfulness practice. Questions from this section included 'How long ago did you begin mindfulness training?' with answers measured from 1 (*Within the last month)* to 4 (*Within the last 5 years*), 'On average, how often do you practice in a typical week?' with answers measured from 1 (*7 days per week)* to 7 (*None*), 'How long do you practice per session' which answers measured from 1 (*Less than 5 minutes)* to 5 (*30 minutes or longer*), and 'How many sessions of mindfulness do you do per day, on average' with answers measuring from 1(*1 session per day*) to 3 (*3 or more sessions per day*). The second section revolved around the environmental settings practice. To assess the location of their practice, we then asked: "Where did you learn or receive the training?" In order to illustrate the differences between urban and a naturalistic environment, we provided examples to each of the choices, including 1 (In an urban environment (*A city or a town, home)*), 2 (*In a natural environment (Nature reserve, Park, forest)*) or 3. (*Both environments*). Furthermore, questions regarding the frequency of their practice in each environment were asked separately, such as "On average, how often do you practice in urban environments in a typical week?" Responses to this question measured from 1 (*7 days a week*) to 5 (*None*). For the purpose of the current study, the total mindfulness practiced in each environment was acquired by multiplying the frequency of their practice sessions in said environment with how long since they've begun practicing mindfulness.

2.2. Analytic Strategy

The current study employed a two-step mediation model to examine the indirect effect that mindfulness practices in different environments had on rumination. In accordance with our hypothesis and relevant literature (Bratman et al., 2015; Duvall, 2011; Laumann et al., 2003; Shin et al., 2013), mindfulness practise in urban or naturalistic environment will reduce rumination levels because mindfulness training

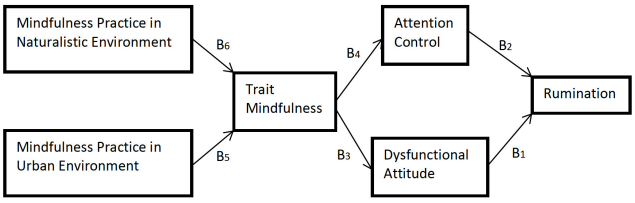

Figure 1. Proposed Model of Rumination Variables

in naturalistic and urban settings increase trait mindfulness that in turn reduce factors that increase rumination such as dysfunctional attitude and attention control.

We employed a "block variable" method as outlined in Edwards and Cable (2009). For effects of mindfulness practice in naturalistic and urban environments on rumination levels, a path coefficient (2[B5(U) + B6(N)]) was obtained by treating the two environments as separate block variables (Heise, 1972; Igra, 1979). Details of how the path coefficient was obtained could be found in appendix A.

The coefficient estimate was then employed separately for mindfulness practices in naturalistic and urban environment by further splitting each environment into high-low practice levels and substiting mean score for the environment of interest with by 1 or -1 respectively. This resulted in four blocks of high and low level of practices in naturalistic and urban environment. Each block was then ultilized as the independent variable in a separate regression analysis via model 6 of the PROCESS extension program for SPSS (Hayes, 2012). The difference in rumination levels between the two levels within an environment represented the change in rumination as one changes the level meditation practice within that environment.

Given that the block variables were calculated from the coefficient estimates of the original variables, the variances explained by the equation using the block variable were the same, as such the other predictors were not affected (Edwards & Cable, 2009; Lambert et al., 2012; Zhang et al., 2012). We also used bias-corrected confidence intervals constructed from estimates based on 5,000 bootstrap samples (Efron & Tibshirani, 1993; MacKinnon et al., 2004).

3. Results

3.1. Corroborating Variable Check

Bivariate correlations were conducted between trait mindfulness and mindfulness practices in the naturalistic and urban environments. Trait mindfulness was found to be significantly correlated to rumination ($r=-.429$, $p<.001$) as well as both mindfulness practices in the naturalistic ($r=.13$, $p=.025$) and urban ($r=.19$, $p=.002$) environment. Furthermore, rumination was found to be significantly correlated to its compositional parts of attention control ($r=-.435$, $p<.001$) and dysfunctional attitude ($r=.510$, $p<.001$).

3.2. Main Analysis with Block Variable

The primary hypothesis was tested to examine the indirect effect of total mindfulness practiced on rumination.

In order to construct the block variable, hierachical re-

Table 1. Descriptive Statistics of Measured Variables

	N	Mean	Std. Deviation	Minimum	Maximum
Trait Mindfulness	316	49.924	6.998	29.00	71.00
Rumination	316	36.810	10.716	13.00	63.00
Dysfunctional Attitude	316	52.035	18.620	17.00	105.00
Attention Control	316	19.616	5.287	6.00	35.00
Nature Weekly Practice	316	4.420	.858	1.00	5.00
Urban Weekly Practice	316	3.610	1.052	1.00	5.00
How Long Since Started Practicing.	316	2.840	1.074	1.00	4.00

gression was used to determine the interactive effect and regression coefficients for mindfulness practice in naturalistic and urban environments on trait mindfulness. Results of the regression analysis found that beta coefficients for the mindfulness practice in naturalistic environment was not significant, β = .099, t = 1.323, p = .187 but urban environment was, β = -.171, t =2.393, p = .018. In addition, results also indicated a marginally significant interactive effect on trait mindfulness (β = -.119, t = -1.714, p = .088.).

In the condition that people engage in high practice of mindfulness in naturalistic environment, the point estimate for the direct effect of the total mindfulness practiced equated to .007 (*SE* =.03, p = .782); indicating that total mindfulness practiced did not exert a direct effect on rumination. The point estimate for the sequential indirect effect was -.003 (*SE* =.002). The 95% bias corrected confidence intervals for the indirect (mediated) effect of the model that included both mediating variables did not include zero [-.008, -.004], indicating that the indirect effect was significantly different from 0 at p = .050. Therefore, the effect of environmental setting on rumination was mediated by trait mindfulness, attention control and dysfunctional attitude.

In the condition that people engage in high practice of mindfulness in urban environment, the point estimate for the direct effect of the total mindfulness practiced equated to.011 (*SE* =.03, p = .678); indicating that total mindfulness practiced did not exert a direct effect on rumination. The point estimate for the sequential indirect effect was -.004 (*SE* =.002). The 95% bias corrected confidence intervals for the indirect (mediated) effect of the model that included both mediating variables did not include zero [-.010, -.001], indicating that the indirect effect was significantly different from 0 at p = .050. Therefore the effect of environmental setting on rumination was mediated by the variables.

In the condition that people engage in low practice of mindfulness in naturalistic environment is low, the point estimate for the direct effect of the total mindfulness practiced equated to -.005 (*SE* =.03, p = .865); indicating that total mindfulness practiced did not exert a direct effect on rumination. The point estimate for the sequential indirect effect was .002 (*SE* =.002). The 95% bias corrected confidence intervals for the indirect (mediated) effect of the model that included both mediating variables did include zero [-.003, .008], indicating that the indirect effect was not significantly different from 0 at p = .050. Therefore, the effect of environmental setting on rumination was not mediated by the variables.

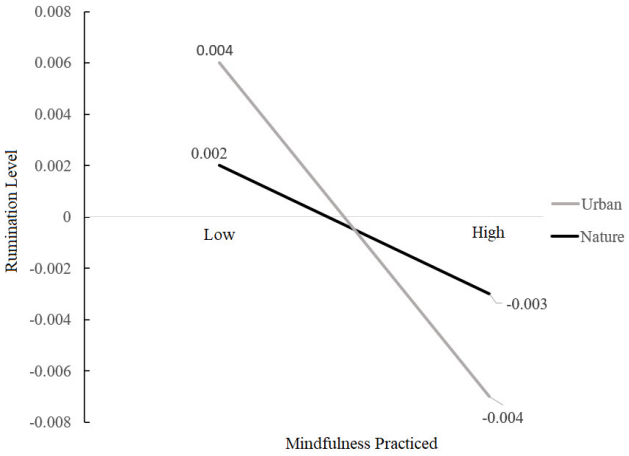

Chart 1. Effect of Mindfulness Practice in Different Environment on Rumination Levels

In the condition that people engage in low practice of mindfulness in naturalistic environment, the point estimate for the direct effect of the total mindfulness practiced equated to -.012 (*SE* =.03, p = .688); indicating that total mindfulness practiced did not exert a direct effect on rumination. The point estimate for the sequential indirect effect was .004 (*SE* =.002). The 95% bias corrected confidence intervals for the indirect (mediated) effect of the model that included both mediating variables did not include zero [.001, .012], indicating that the indirect effect was significantly different from 0 at p = .050. Therefore, the effect of environmental setting on rumination was mediated by trait mindfulness, attention control, and dysfunctional attitude.

Current evidence indicates that when one has low levels of practice, mindfulness is less effective when practicing in urban environment compared to naturalistic environment, resulting in higher levels of rumination. At high levels of total mindfulness practiced however, the levels of rumination from practicing in urban were lower than that of practicing in naturalistic environment (Chart 1).

4. Discussion

The current study employed measures of mindfulness levels, rumination (and its components), and mindfulness practice to assess whether the environment where one

practices affects the outcome of mindfulness in its capacity to reduce rumination. Against our hypothesis, people who practice in an urban environment were able to derive greater benefits in lowering their rumination levels over time compared to those who practiced in a naturalistic environment as they increase the amount of mindfulness meditation they engaged in.[1]

Although previous studies investigated the effects of environment on mindfulness (Jha et al., 2007) and rumination (Bratman et al., 2015), none has examined the effect of type of environment, mindfulness and rumination together. Our current study adds to the literature by demonstrating how the level of practice in each environment affects the benefit one is able to gain in terms of reducing rumination. When previous studies examined naturalistic environment's benefits on mindfulness, they measured variables that are connected to one's mindfulness levels (Jha et al., 2007; Kozasa et al., 2015; Lutz et al., 2008) which by evidence are correlated to one's rumination levels (Deyo et al., 2009). Although the current findings do not contradict previous research in nature's benefits to mindfulness practice, these benefits are mediated by level of practice. That is, a naturalistic environment only confers a benefit to mindfulness' effect on rumination reduction beyond that of an urban environment during the initial stages of practice. As one increases the amount of mindfulness practice over time however, the benefits that an urban setting is able to offer to mindfulness practitioners surpasses that of a naturalistic environment. Given this pattern, the preferred investment strategy for people who plans to participate in a short-term intervention program would be participating in one that is set in a naturalistic retreat would be more beneficial. If however, one intends to maintain a long-term practice, then one would gain greater benefits from mindfulness practice if they practiced in urban environment as the rate of rumination reduction would be higher in that setting.

One important implication of the current study is how one may optimize the effects a mindfulness intervention program by utilizing both naturalistic and urban environmental settings. Given the lower levels of rumination that naturalistic environment provides during the initial stages of mindfulness intervention, and the great level of rumination reduction offered by practicing in an urban environment, the optimal way to invest one's time in a mindfulness intervention is to begin with a nature retreat to allow the participant/client to start with a lowered rumination level. As the program progresses, a switching to an urban environment at the midpoint of the program may allow participants to capitalize on the more efficient rumination reduction properties of the urban environment. Given that studies indicate that rumination may be a variable that could increase mindfulness intervention dropout rates (Banerjee et al., 2018; Crane & Williams, 2010), this arrangement may help practitioners new to mindfulness meditation during the initial phase to maintain their diligence of practice.

It is worth examining why the benefits of naturalistic environments are eventually surpassed by that of urban environments. One possible answer is the role that stresses play when one is practicing mindfulness. While an urban environment may evoke greater levels of stress, there is evidence to suggest the impact of mindfulness practice benefits more those who experience greater stress levels. Reviews on mindfulness efficacy (e.g. Baer, 2003; Grossman et al., 2004) found that meditative practices improved the condition of clinical population mildly better than non-clinical ones. Given that there is increased stress associated with suffering from mental/physical disorders it is possible that people with greater stress benefit more from mindfulness intervention than those who are healthy. What these studies do not examine however, is how much practice the individuals had undertaken could affect how much stress impacts their mindfulness outcome. It is possible that mindfulness, as a skill or trait, has a threshold that one must attain in order to more efficiently engage, process and overcome stress. Indeed, as stress is known to be correlated to rumination (Alloy et al., 2000) and mindfulness was developed to target the components of rumination, the presence of stress allows for a more targeted approach to one's practice, once this threshold has been reached. Analogously, a moderately trained mountain climber can benefit from a mountain climbing training program most if one was training on a mountain, but would be less effective for someone who is a complete beginner. A similar possibility is that undergoing mindfulness practice in urban environment may be more difficult due to the distraction of daily life. One must therefore work harder and be more diligent in their practice to gain the benefits they expected. Consequently, they are able to attain a greater proficiency compared to those who begins in a naturalistic environment. The benefits that this proficiency bring becomes more apparent as time goes on, resulting in those who practices in urban environment eventually surpassing those in naturalistic environment in reducing rumination.

The current study possesses some limitations that should be mentioned. The use of surveys and cross section design, makes it impossible to infer a causal relationship between the environmental setting and rumination levels. In order to more reliably test the present effect, future research should attempt employ an intervention design that examines the rumination level of those who practice mindfulness in different environments as they progress in their mindfulness program. Secondly, the current study does not differentiate between different forms of mindfulness practices. It is unknown whether one who practices mindfulness through an established program such as Mindfulness-Based Stress Reduction would differ in their results compared to a casual practitioner. Lastly, there was no definition as to what constituted a "naturalistic" or "urban" environment. Participants were allowed to interpret these terms as they chose. Ambiguous areas such as the suburbs where one

1 We also measured the sources of stress for the participants. However we did not include it into the analysis as it was not correlated with any of the variables

could experience nature in their backyard or local parks could have potentially affected the data.

In conclusion, the current study adds to previous research by demonstrating the moderating effect of overall mindfulness practice on the environment's benefit on mindfulness' ability to reduce rumination. Although practicing in a naturalistic environment enhances the outcome of mindfulness, urban environmental benefits actually surpass those of the naturalistic environment when one engages in long term practice. The implication is that urban environment may contain a variable that increases mindfulness efficacy with time, and that mindfulness teachers could design rumination-reducing mindfulness interventions based on how long their program is expected to run.

Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Contribution to the field statement

This study examined how practicing mindfulness in different environments (nature vs.urban) could impact how well one could reduce their rumination levels. Results indicated that while practicing mindfulness in a naturalistic environment is able to reducing rumination more effectively during the early stages of practice, the benefits of practicing in an urban environment surpasses that of a naturalistic environment over time.

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SUPPLEMENTARY MATERIALS

Appendices

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