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No Place Like Home: Home Tours Correlate With Daily Patterns of Mood and Cortisol

Darby E. Saxbe[1] and Rena Repetti[1]

Abstract

The way people describe their homes may reflect whether their time at home feels restorative or stressful. This article uses linguistic analysis software (Linguistic Inquiry and Word Count) to analyze 60 dual-income spouses' self-guided home tours by calculating the frequency of words describing clutter, a sense of the home as unfinished, restful words, and nature words. Based on a principal components analysis, the former two categories were combined into the variable stressful home and the latter two into restorative home. Over 3 weekdays following the home tours, wives with higher stressful home scores had flatter diurnal slopes of cortisol, a profile associated with adverse health outcomes, whereas women with higher restorative home scores had steeper cortisol slopes. These results held after controlling for marital satisfaction and neuroticism. Women with higher stressful home scores had increased depressed mood over the course of the day, whereas women with higher restorative home scores had decreased depressed mood over the day.

Here's the little sitting area especially in the winter where I sit and light a fire and read. It's really peaceful and nice when the kids are asleep . . . and this is the family room which we all love and relax and play in.

　　　　　　　—Home tour given by mother, Family 3

These are the windows, which won't shut, and if I had more money, I would replace. Here are the holes in the wall, which don't get repaired. . . . And I get to come home and I always reflect on all the holes in the wall and all the things that aren't done.

　　　　　　　—Home tour given by father, Family 1

The home can be a place to unwind from the workday, but when housework and home repairs compete for the attention of time-strapped working parents, home can become more of a source of demands than a haven from the outside world. Women, who often assume more responsibility for maintaining the household (Hertz, 1988), may be especially likely to find their time at home more stressful than soothing. Both quantitative and qualitative researchers have found evidence that the transition from work to home may be less restorative for working women than for working men. For example, a study that tracked men's and women's physiological stress levels during and after the workday found sharp decreases in working men's arousal, whereas women had flat or even increased arousal after work (Frankenhaeuser et al., 1989). A study of *Fortune* 500 employees (Hochschild, 1997) found that the women described their home environments as demanding and stressful and sometimes opted for longer workdays because they felt overwhelmed by obligations awaiting them at home.

Researchers have long recognized that people's experiences and perceptions of their everyday environments can inform their well-being. For example, the physical characteristics of living and work spaces, including features like crowding, clutter, noise, and artificial light, have been shown to affect mood and health in populations ranging from young children to senior citizens (e.g. Evans, 2006; Molony, McDonald, & Palmisano-Mills, 2007). There is a large body of research suggesting that individuals under stress tend to gravitate to natural environments, such as parks and outdoor spaces, and find them restorative (Kaplan & Kaplan, 1989; Hartig & Staats, 2006; Van den Berg, Hartig, & Staats, 2007). It is

[1]University of California–Los Angeles

Corresponding Author:
Darby E. Saxbe, PhD, University of California–Los Angeles, Franz Hall, Box 951563, Los Angeles, CA 90095
Email: dsaxbe@ucla.edu

likely that individuals' feelings about their homes also shape their everyday fluctuations in stress and mood. Many studies of the home environment have relied on checklist-style rating forms completed by inhabitants or outside observers. However, such methods cannot fully capture how people feel about their home environments or what aspects of those environments matter the most to them. This study uses an open-ended language sample of participants' descriptions of their homes to explore the interconnections between stress, emotions, and the home environment among working parents. More specifically, we examine whether words that may indicate a stressful or restorative experience of the home are linked with patterns of mood and cortisol over several weekdays and whether these patterns differ for men and women.

This article is based on a study documenting a week in the life of 30 middle-class, dual-income families living in a large U.S. city. Data were collected through family interviews, videotaping, psychosocial questionnaires, and salivary sampling of the stress hormone cortisol. In addition, family members were given camcorders and asked to conduct self-guided tours of their homes, describing spaces and possessions that were meaningful to them. These home tours became the source of the stressful and restorative word counts that were used to predict patterns of depressed mood and cortisol in this study. To analyze the word use patterns shown in the home tours, we used the software program Linguistic Inquiry and Word Count (LIWC; Pennebaker, Francis, & Booth, 2001). LIWC contains a dictionary of more than 2,000 English words and counts the frequency of words in both preset and custom categories. LIWC has been used to examine many different types of language samples, from expressive writing to course assignments to marital interactions (Pennebaker & Francis, 1996; Pennebaker & King, 1999; Sillars, Shellen, McIntosh, & Pomegranate, 1997). Word counts with the preset LIWC categories have shown intraindividual stability and external validity, correlating with measures of personality, relationship satisfaction, and physical health (see Pennebaker, Mehl, & Niederhoffer, 2003). For example, previous LIWC research has found links between word usage and biomarkers that appear to reflect chronic stress and immunity, like CD4 counts and liver enzymes (Slatcher & Pennebaker, 2006; Smyth, 1998).

Assessing the Stressful and Restorative Qualities of the Home Environment

For this study, custom word count categories were created in LIWC that reflected themes of a priori interest that related to the home environment. These themes emerged chiefly from prior qualitative analysis of these data, particularly researchers' observations of families' homes and the concerns families expressed about their homes during the interview portion of the study. For example, researchers found families' homes to be overflowing with possessions, a clutter crisis so pressing that more than 75% of families in the study used their garages exclusively for extra storage (Arnold & Lang, 2007). Families also frequently reported a desire to remodel and repair their

homes, and many families felt their homes were unfinished in their current state (Graesch, 2006). Because they so often surfaced as families' chief concerns about their homes, our stressful home variable includes home tour words describing clutter and the need for repair or renovation. Some, but not all, families described their homes as relaxing and comfortable places. Additionally, although many families invested in carefully landscaped patios and yards, families varied widely in their use of outdoor home spaces during the study week (Arnold & Lang, 2007; Beck & Arnold, 2007). Natural environments have been reliably linked with stress reduction, as mentioned above. Therefore, our restorative home variable includes both words describing the home as relaxing or pleasant and words describing natural features of the home and yard.

Working from the assumption that people's experiences of their environments help shape their well-being, we expected that participants' descriptions of the stressful and restorative features of their homes would predict their everyday mood and stress states. This study focuses on two possible correlates of home tour word use: daily patterns of depressed mood, as measured by questionnaires completed throughout the day, and the diurnal slope of cortisol.

Diurnal Cortisol Slope and Its Links to Health and Psychosocial Functioning

Cortisol, a hormone produced by the HPA (hypothalamic-pituitary-adrenal) axis, shows a strong diurnal rhythm, with levels typically peaking within the first hour after awakening, declining rapidly over the morning hours, and then tapering off over the rest of the day before reaching a nighttime nadir. The shape of this pattern, which tends to show intraindividual stability and can be conceptualized as a trait-level measure (Adam, 2006; Saxbe, 2008), has been linked with psychological and physical well-being across multiple studies (reviewed by Miller, Chen, & Zhou, 2007; Saxbe, 2008). In general, flat slopes, in which cortisol levels are low in the first few hours of the morning and/or fail to show the normal diurnal decline across the course of the day, have been associated with greater chronic stress, disease progression, and even mortality risk (Bower et al., 2005; Matthews, Schwartz, Cohen, & Seeman, 2006; Sephton, Sapolsky, Kraemer, & Spiegel, 2000). A recent meta-analysis focusing on the HPA axis found chronic stress burden to be consistently associated with a flatter diurnal rhythm of cortisol and with its correlates, lower morning cortisol values and higher afternoon and evening values (Miller et al., 2007). Additionally, several studies have found flatter diurnal cortisol slopes to be specifically linked with greater psychological distress including symptoms of depression and post-traumatic stress disorder, poor coping skills, a perceived lack of social support, and compromised relationship functioning (Abercrombie et al., 2004; Adam & Gunnar, 2001; Giese-Davis, Sephton, Abercrombie, Duran, & Spiegel, 2004; Lauc, Zvonar, Vuksic-Mihaljevic, & Flögel, 2004; Sjögren, Leanderson, & Kristenson, 2006). In

keeping with these findings, a previous study using the data set employed in the current study found wives' marital dissatisfaction to be associated with a significantly flatter slope of diurnal cortisol (Saxbe, Repetti, & Nishina, 2008).

Hypotheses

This study is designed to assess whether individuals' perceptions of their homes will affect their everyday patterns of physiological stress and depressed mood. Therefore, we expect higher rates of stressful home words to be associated with a flatter diurnal slope of cortisol and restorative home words with a steeper slope. We also predict that stressful home words will be linked with higher levels of depressed mood over the course of the day and restorative home words with lower levels.

As mentioned above, wives may assume more responsibility for maintaining the household than their husbands do (Hochschild, 1997). For that reason, women's well-being may be more closely linked to their perceptions of the home environment; women who report that the home environment is stressful, for example, may be more likely to also show adverse patterns of mood and cortisol. This study employs a dyadic multilevel modeling approach that generates separate model estimates for husbands and wives, allowing us to examine associations between home tour words, mood, and cortisol separately for each spouse. We expect women to show stronger associations between home tour words and our outcome variables compared to men.

Because of the above-mentioned, previously reported association between marital satisfaction and cortisol slope in this sample (Saxbe et al., 2008), we will control for marital satisfaction in all cortisol analyses. Another potential confound is negative affectivity: It is possible that participants who tend to describe things more negatively overall will also show adverse patterns of mood and cortisol. Therefore, we also examine the home tour variables in conjunction with a measure of neuroticism.

Method

Participants

Thirty families in a West Coast U.S. city were recruited for a week-in-the-life study of dual-earner middle-class families. Each family included two cohabitating adults, both of whom worked full-time (>30 hours per week), and two to three children, one between 7 and 12 years old; all families held a mortgage on their home. The sample is described in more detail by Saxbe et al. (2008), as are the procedures for collection and analysis of cortisol and mood data.

Procedure and Measures

Spouses conducted home tours before the study week began, and they completed questionnaires both before and after the study week. During the study week, on each of three weekdays (not necessarily consecutive), spouses completed four self-report measures of mood and collected four saliva samples for cortisol analysis.

Cortisol data. Spouses were instructed to self-collect saliva samples and fill out mood reports just after awakening (mean collection time 6:25 a.m.), just before lunch (mean 12:20 p.m.), just before leaving work (mean 4:30 p.m.), and just before going to bed (mean 10:10 p.m.). Saliva vials were picked up from families' homes, frozen, and shipped under climate-controlled conditions to Salimetrics (State College, PA), a research facility specializing in saliva immunoassay testing. The average of duplicate assays for each sample was used in all analyses.

All data were analyzed using Hierarchical Linear Modeling (HLM) version 6.01 (Raudenbush, Bryk, Cheong, & Congdon, 2004). Each participant's mood and cortisol were modeled using data from all 12 sampling occasions, with the time of day at which each sampling occasion occurred used as a predictor variable. In other words, the three days of data collection, each with four saliva or mood sampling time points, can be conceptualized as one day with 12 sampling time points, which is used to estimate the overall slope of mood and cortisol across the day. This strategy has been adopted often by researchers using multilevel modeling to study cortisol (Adam, 2006; Adam & Gunnar, 2001; Saxbe et al., 2008; Smyth et al., 1997) and was adopted in this study after high intraindividual stability in levels of mood and cortisol over the three days was established. Time of day was centered around the earliest morning waking time (5 a.m. in this sample) so that the intercept value returned by HLM would reflect the early morning value of cortisol. The slope coefficients returned by HLM then reflect the rate of change in cortisol that is attributable to time of day or the typical diurnal slope.

To account for statistical interdependence within couples, all analyses were conducted using the dyadic analysis model presented by Laurenceau and Bolger (2005) based on the model described by Raudenbush, Brennan, and Barnett (1995). Models used input data files with husband and wife data on separate lines and nested within couple-level identifications. Separate intercept and slope terms were created for husbands and wives, with spouses denoted by dummy variables that were used to calculate intercepts. This approach, described in more detail in Saxbe and Repetti (in press), allowed us to model husbands' and wives' cortisol simultaneously but generate separate intercept and slope results for each spouse.

HLM is able to calculate slopes and intercepts even when some values are missing, so individuals do not need equal numbers of observations or evenly spaced observations for data analysis to be performed (Hrushka et al., 2005). In this case, 70 cortisol observations, or 9.7% of the 720 sampling occasions, were missing, either because the participant skipped that saliva collection time point or sampled incorrectly (e.g., within 30 minutes of eating).

All HLM results reported here represent the final estimation of fixed effects, with robust standard errors. To correct

for positive skewness, a natural log transformation was performed on cortisol data before analysis, a standard procedure in HPA axis research (Cruz, 2007).

Depressed mood. The mood rating scales asked how well a series of adjectives described one's current mood. Developed and revised in other daily report studies (Repetti, 1989; Repetti & Wood, 1997), the eight-item depressed mood scale included adjectives like *miserable*, *sad*, and *discouraged*, rated on a response scale from 0 to 3. Cronbach's alpha ranged from .79 to .85 over the 3 days. The range for both husbands and wives was 0 to 2.88, with a mean of 0.51 ($SD = 0.56$) for husbands and 0.50 ($SD = 0.57$) for wives.

Neuroticism. Before the study week, family members filled out the Neuroticism Scale from the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992), a well-validated measure that captures proneness to negative affect (Cronbach's alpha in this study = .80; range 0–34, $M = 16.43$, $SD = 7.67$).

Martial adjustment. After the study week ended, parents filled out the Marital Adjustment Test (MAT; Locke & Wallace, 1959), a well-validated measure assessing marital satisfaction (Cronbach's alpha in this study = .82, range 64–153.75, $M = 111.30$, $SD = 22.27$).

Home features. Before the study week, spouses answered a questionnaire about objective features of their home (e.g., size, age); these data were subsequently confirmed by a researcher who examined blueprints of the homes. Home sizes ranged from 735 to 3,055 sq ft ($M = 1,601$ sq ft), and with garages included, from 875 to 3,365 sq ft ($M = 1,947$ sq ft). Homes were built between 1923 and 2003 (median = 1950) and had a median of 8 original rooms (range 5–19), with a median of 2 rooms added since the home was built (range 0–6 rooms). Since purchasing their home, families had engaged in a median of 1 remodeling event (defined as a specific project, e.g., bedroom or kitchen expansion; $M = 0.95$, range = 0–6).

Home tours. Before the study week began, camcorders were left at participating households, and each family member was asked to conduct an individual home tour, emphasizing home spaces and possessions that were meaningful to them. Every spouse ($n = 60$) completed a separate home tour. Spouses' tours ranged from 89 words to 9,164 words, with a median of 1,842 words and a mean of 2,024 words (about a 15–20 minute tour). Most tours were continuous, although in several cases tours were stopped and then resumed a few minutes or a few hours later. Several tours included some dialogue between family members (for example, a child interrupting the tour to ask a question). In these cases, tours were edited to remove the non-tour-giver's words, so that each family member's transcribed tour included only that family member's actual speech. In the rare instances in which dialogue extended beyond a simple exchange of one or two lines, the tour-giver's responses (after their first reply) were also removed.

The transcribed tours were entered into the LIWC program, which generates counts based on the frequency of word use in multiple categories. Four custom categories representing a priori areas of interest were used in this study. To formulate the categories, all tour transcripts were reviewed by this study's first author to identify recurrent themes or concerns expressed by the tour givers. With the exception of restful, the four themes that emerged had also all been previously discussed in published qualitative analyses of other data (particularly interview and video data) from the larger study (e.g., Arnold & Lang, 2007; Beck & Arnold, 2007; Graesch, 2006), as described in the introduction. These categories were developed independently of their relationships with mood and cortisol—that is, no analyses were conducted examining the relationships between linguistic variables, cortisol, and mood until after the categories had been fully developed and the words selected for each category. The categories were cluttered, including words referring to a sense of messiness or chaos; house unfinished, including words implying that the home is a work in progress that requires additional repair or renovation; restful, including words suggesting that the home is relaxing; and nature, including words describing the backyard or natural features such as trees or plants. After the categories were identified, the tour transcripts were re-reviewed and words appropriate to each category were flagged and used to create the dictionaries for each category; all of these words, along with descriptive statistics for each category, are shown in Table 1.

Results

We begin by describing our LIWC word count variables and present associations between our home tour variables and other predictor or control variables. We then report associations between home tour variables and the patterns of cortisol and depressed mood measured during the study week.

Home Tour Variables: Base Rates and Factor Analysis

LIWC's word counts in each category represent the number of words in that category as a percentage of total words used in the tour. For example, the mean of .22 for clutter shown in Table 1 means that, on average, 0.22% of all home tour words were clutter words; given the mean tour length of about 2,000 words, that would amount to about 4.5 clutter words per tour. Except for one word (*expansion*, from the house unfinished category), used in only one tour, every word was used in at least two home tours. The mean base rate was 22%, meaning that each word included in the custom dictionaries appeared (at least once) in an average of 13 tour transcripts (22% of 60 tours). The most widely used words were *backyard* (44 tours) and *mess* (40 tours). Base rates were also calculated by tour (the number of different target words used in each tour). The mean number of distinct target words used per tour was 7.8 (maximum = 16, $SD = 4.12$), and two tours did not include any target words. In summary, the words included in the custom categories were used widely across tours; almost all words were included in

Table 1. Percentage of Words in Home Tour Custom Categories

Category	Clutter words	House unfinished words	Restful words	Nature words	Stressful home	Restorative home
Words included	Mess(y); clutter(ed); junk; disarray; unorganized; disorganized; disorder(ly/ed); overflow(ing); disaster; haphazard; trash(y/ed); sloppy; chao(s/tic)	Unfinished; half-finished; repair; fix; redo; remodel; expansion; addition; project; (re) build; redesign; redecorate; revamp	Relax(ed/ing); loung (e/ing); rest(ful/ ed); calm(ing/ed); comfort(ing/able); soothing; peaceful; solace; seren(e/ity); pleasur(e/able); quiet; homey; hangout	Outside; outdoor; backyard; patio; deck; barbeque; garden; plant (s/ed/ing); jungle; hedges; nature; tree(s); foliage	Clutter and house unfinished words	Restful and nature words
Range	0 to 1.86	0 to 1.15	0 to 0.68	0 to 3.24	0 to 2.04	0 to 3.24
Mean	0.22	0.19	0.12	0.64	0.40	0.76
Median	0.16	0.15	0.08	0.53	0.28	0.62
Standard deviation	0.31	0.19	0.15	0.54	0.39	0.58

Only present or future tense verbs were used in the house unfinished category to minimize the possibility of capturing descriptions of past renovation efforts. Parentheses denote variants of the word that were also included in the Linguistic Inquiry and Word Count dictionaries.

more than one tour, and almost all tours included more than one target word.

After the four custom dictionaries were loaded into the LIWC program and word counts in each category were calculated for each participant, these four word counts were entered together into a principal components analysis. Two components with eigenvalues more than 1 emerged: The first component included high loadings (>.7) for the clutter and house unfinished categories, whereas the other had high loadings (>.6) for the restful and nature categories. For parsimony, the four categories were, therefore, collapsed into two, also shown in Table 1; the clutter and house unfinished categories were combined to create the stressful home category and the restful and nature categories were combined to create the restorative home category. As an additional check on the principal components approach, the analyses reported here were also conducted using the four separate categories, and the overall patterns of results were similar. The home tours variables were log-transformed before analyses to correct for positive skewness, although the pattern of results using nontransformed variables was the same.

Associations Between Home Tour Variables and Other Descriptive Variables

We began by exploring associations between our home tour variables and our other predictor and control variables, with results shown in Table 2. Husbands' and wives' average stressful home and restorative home ratings did not differ, and there were no significant husband–wife correlations between these variables. Participants' stressful home and restorative home ratings were not correlated with each other.

Wives' stressful home variable was marginally negatively correlated with wives' marital adjustment. Stressful

home was not correlated with wives' neuroticism or husbands' marital satisfaction or neuroticism, and restorative home was not correlated with either spouses' marital satisfaction or neuroticism. Husbands' stressful home scores were positively correlated with the number of rooms added to the house since it was built. Otherwise, spouses' stressful home and restorative home variables were not correlated with any objective features of the home, including year built, square footage, or number of remodeling events.

Associations Between Home Tour Characteristics and Cortisol Patterns

This study's first main aim was to model the association between home tour variables and the diurnal slope of cortisol. Diurnal cortisol slopes were estimated by a dyadic multilevel (HLM) model that predicted cortisol values (at all 12 time points) from the sampling time at each time point. In other words, the steeper the slope of cortisol, the larger the negative coefficient associated with the predictor variable of sampling time. Sampling time^2 was also added as a predictor variable because prior research (e.g., Adam & Gunnar, 2001), has suggested that including time^2 better represents cortisol's curvilinear decline. With repeated measures data, Level 2 in HLM is typically used for between-person variables. There are three markers that would suggest a variable is contributing to flattened diurnal cortisol slope: a negative coefficient on the intercept of cortisol (indicating lower morning values), a positive coefficient on the slope of cortisol change by time (indicating a decrease in the overall drop in cortisol across the day), and a negative coefficient on the slope of change by time^2 (indicating less of a curvilinear decline). Adding home tour variables and marital

Table 2. Correlations Between Stressful Home, Restorative Home, and Other Descriptive Variables (*N* = 30 couples)

	Husbands' Stressful Home	Wives' Stressful Home	Husbands' Restorative Home	Wives' Restorative Home
Husbands' variables				
Stressful home	1	.27	.21	.06
Restorative home	.21	.27	1	−.04
Marital satisfaction	−.23	−.22	.05	.02
Neuroticism	.25	.15	−.02	−.13
Wives' variables				
Stressful home	.27	1	.27	−.10
Restorative home	.06	−.10	−.04	1
Marital satisfaction	−.28	−.35*	−.28	−.03
Neuroticism	.07	.13	−.11	.12
Home features				
Year built	−.05	.21	.16	−.14
Square footage	.27	.07	.28	.14
Original number of rooms	−.12	−.03	.13	.00
Rooms added since built	.48***	.15	.01	−.04

*p < .10. ***p < .01.

Table 3. Stressful Home Word Counts and Marital Satisfaction Predicting Diurnal Cortisol Slope (*N* = 30 couples)

Fixed effect	Coefficient (*SE*)	*T* ratio
Husbands' intercept	−0.49 (0.09)	−5.31****
Level 2 effect of husbands' marital satisfaction (MAT)	0.00 (0.00)	0.12
Level 2 effect of husbands' stressful home	0.15 (0.07)	2.14**
Husbands' time slope (change in cortisol per hour)	−0.22 (0.03)	−8.33****
Level 2 effect of husbands' marital satisfaction (MAT)	0.00 (0.00)	0.42
Level 2 effect of husbands' stressful home	0.01 (0.02)	0.44
Husbands' time^2 slope	0.01 (0.00)	3.39****
Level 2 effect of husbands' marital satisfaction (MAT)	−0.00 (0.00)	−0.26
Level 2 effect of husbands' stressful home	−0.00 (0.05)	−0.82
Wives' intercept	−0.51 (0.09)	−6.06****
Level 2 effect of wives' marital satisfaction (MAT)	0.01 (0.10)	1.91*
Level 2 effect of wives' stressful home	−0.26 (0.11)	−2.28**
Wives' time slope (change in cortisol per hour)	−0.22 (0.02)	−12.04****
Level 2 effect of wives' marital satisfaction (MAT)	−0.00 (0.00)	−1.46
Level 2 effect of wives' stressful home	0.08 (0.02)	3.35****
Wives' time^2 slope	0.01 (0.00)	3.98****
Level 2 effect of wives' marital satisfaction (MAT)	0.00 (0.00)	1.63
Level 2 effect of wives' stressful home	−0.01 (0.00)	−3.16****

*p < .10. **p < .01. ****p < .001.

satisfaction at Level 2 allows us to estimate the impact of these variables on all three markers. This approach is also described in Saxbe et al. (2008) and Saxbe and Repetti (in press). Whereas spouses' marital adjustment ratings were added at Level 2 in the following analyses, the home tour results were essentially unchanged when marital satisfaction was omitted from the model, or when neuroticism was substituted for marital satisfaction (results available on request). Results, including all Level 1 and Level 2 effects, appear in Table 3 (stressful home) and Table 4 (restorative home).

Husbands' starting value, or intercept, of cortisol was significantly moderated by the stressful home variable, suggesting that husbands who described their homes as being more stressful had higher levels of morning cortisol on average. Otherwise, neither word count variable was associated with husbands' cortisol parameters, nor was husbands' marital adjustment a predictor of cortisol. For wives, consistent with our hypotheses, a higher restorative home word count was associated with a steeper, and stressful home word count with a flatter, diurnal slope of cortisol. Specifically, wives' stressful home score was associated with a lower cortisol intercept,

Table 4. Restorative Home Word Counts and Marital Satisfaction Predicting Diurnal Cortisol Slope ($N = 30$ couples)

Fixed effect	Coefficient (SE)	T ratio
Husbands' intercept	−0.49 (0.10)	−5.04****
Level 2 effect of husbands' marital satisfaction (MAT)	−0.00 (0.00)	−0.45
Level 2 effect of husbands' restorative home	0.04 (0.07)	0.59
Husbands' time slope (change in cortisol per hour)	−0.22 (0.03)	−8.25****
Level 2 effect of husbands' marital satisfaction (MAT)	0.00 (0.00)	0.69
Level 2 effect of husbands' restorative home	0.02 (0.02)	0.79
Husbands' time^2 slope	0.01 (0.00)	3.31****
Level 2 effect of husbands' marital satisfaction (MAT)	−0.00 (0.00)	−0.52
Level 2 effect of husbands' restorative home	0.00 (0.00)	0.16
Wives' intercept	−0.52 (0.10)	−5.29****
Level 2 effect of wives' marital satisfaction (MAT)	0.01 (0.00)	2.40**
Level 2 effect of wives' restorative home	0.11 (0.10)	1.16
Wives' time slope (change in cortisol per hour)	−0.22 (0.02)	−10.46****
Level 2 effect of wives' marital satisfaction (MAT)	−0.00 (0.00)	−1.26
Level 2 effect of wives' restorative home	−0.06 (0.02)	−2.95***
Wives' time^2 slope	0.01 (0.00)	3.66****
Level 2 effect of wives' marital satisfaction (MAT)	0.00 (0.00)	1.48
Level 2 effect of wives' restorative home	0.01 (0.00)	2.19**

**$p < .05$. ***$p < .01$. ****$p < .001$.

or morning value of cortisol. The Level 2 time coefficient of cortisol, a marker of how swiftly cortisol decreases over the course of the day, was moderated by both stressful home and restorative home words, in opposite directions; restorative home score was associated with a steeper drop in cortisol and stressful home with a flatter drop. Finally, for the time^2 coefficient, a significantly positive value, characteristic of a steeper slope with a greater curvilinear decline, appeared for restorative home words, whereas a negative coefficient, characteristic of a flatter slope, appeared for stressful home words. Wives' stressful home results are depicted in Figure 1, which illustrates cortisol levels across the day for women above and below the mean for the stressful home word count.

In both the stressful home and restorative home models, wives' marital adjustment was associated with a higher cortisol intercept. Marital satisfaction did not moderate the time or time^2 coefficient of either model.

Associations Between Home Tour Characteristics and Depressed Mood During the Study Week

This study's second aim was to explore associations between home tour variables and repeated measures of depressed mood. Multilevel models were constructed with depressed mood score (again, at all 12 time points) as the outcome variable and time of day as a Level 1 predictor variable. As shown in Table 5, the first model included the stressful home variable, and the second model included the restorative home variable as a Level 2 predictor of depressed mood.

Stressful home and restorative home words did not moderate the starting value (intercept) or trajectory of husbands' depressed moods across the day, nor did they moderate the
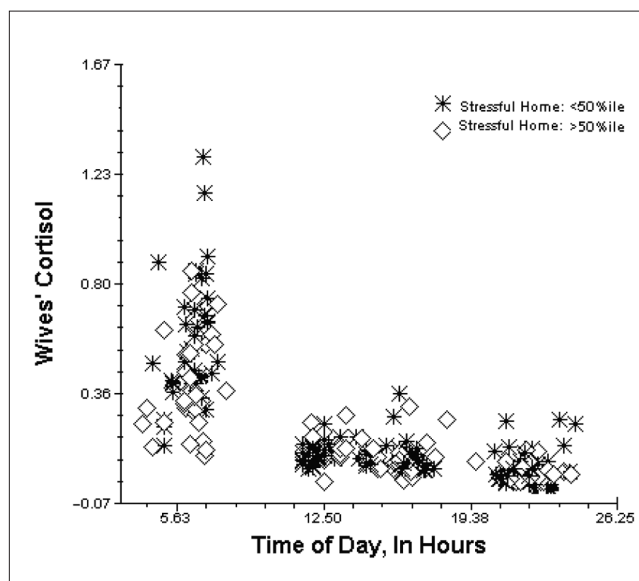

Figure 1. Wives' Cortisol Levels by Time of Day for Women Above and Below the Mean for Stressful Home Word Count
This figure depicts nontransformed cortisol levels at all time points for all 30 wives participating in the study. Time of day is expressed in military time and is shown in hours.

intercept of wives' depressed moods. However, for women, both stressful home and restorative home words moderated the time slope of depressed mood across the day. The stressful home variable had a positive coefficient, suggesting that wives with higher scores tended to report more depressed mood as the day went on. In contrast, the restorative home variable had a negative coefficient, such that wives with higher scores tended to report less depressed mood as the day went on.

Table 5. Home Tour Variables Predicting Depressed Mood Reports (*n* = 30 couples)

Fixed effect	Coefficient (*SE*)	*T* Ratio
Stressful home word counts predicting depressed mood reports		
Husbands' intercept	1.10 (0.03)	37.90****
Level 2 effect of husbands' stressful home	−0.00 (0.03)	0.10
Husbands' time slope (change in depressed mood per hour)	−0.00 (0.00)	−1.39
Level 2 effect of husbands' stressful home	−0.00 (0.00)	0.30
Wives' intercept	1.10 (0.04)	24.44****
Level 2 effect of wives' stressful home	0.03 (0.02)	−1.60
Wives' time slope (change in depressed mood per hour)	0.00 (0.00)	−1.51
Level 2 effect of wives' stressful home	0.01 (0.00)	3.09**
Restorative home word counts predicting depressed mood reports		
Husbands' intercept	1.10 (0.03)	38.03****
Level 2 effect of husbands' restorative home	−0.03 (0.04)	−0.79
Husbands' time slope (change in negative mood per hour)	−0.00 (0.00)	−0.83
Level 2 effect of husbands' restorative home	0.00 (0.00)	0.49
Wives' intercept	1.08 (0.04)	27.72****
Level 2 effect of wives' restorative home	0.13 (0.08)	1.52
Wives' time slope (change in negative mood per hour)	−0.00 (0.00)	−0.96
Level 2 effect of wives' restorative home	−0.01 (0.00)	−4.20****

**p < .05. ****p < .001.

These results were unchanged whether marital satisfaction or neuroticism was included as control variables at Level 2.

Discussion

The results of this study suggest that women's descriptions of their homes may predict their everyday experiences of stress and negative mood. Wives who described their homes as being more stressful (that is, who talked more about clutter and unfinished projects) had marginally lower marital satisfaction. Wives who described their homes as more stressful also had flatter diurnal slopes of cortisol, an indicator of chronic stress that has been linked with adverse health outcomes. They also tended to show greater increases in depressed mood across the day, consistent with greater fatigue in the evening and a more difficult transition from work to home. In contrast, wives who described their homes as more restorative (that is, who talked more about their yards and outdoor home features, and who used more words connoting relaxation at home) had steeper diurnal cortisol slopes and showed decreased depressed mood across the day. Results held whether marital satisfaction or neuroticism were included in the models. The size, age, and renovation histories of couples' homes were not associated with their stressful home or restorative home ratings, with the exception that husbands with higher stressful home scores reported that more rooms had been added to their houses.

Husbands with higher stressful home scores also had a higher intercept (morning value) of cortisol, a result that counters expectations because higher morning cortisol is consistent with a steeper diurnal slope of cortisol. However,

neither restorative home nor stressful home scores moderated any other cortisol or mood parameters for husbands. Our largely null results for husbands, contrasted with significant results for wives, suggest that women may be more sensitive to the home environment or may feel a greater sense of responsibility for the home (for example, feeling guilty about clutter); this finding would be consistent with other research suggesting that the home is traditionally perceived as women's domain and ultimate responsibility, even in couples where both partners are employed (e.g., Hertz, 1988; Hochschild & Machung, 1989). Given that the home tours had a social component—that is, participants were presenting their homes to others, specifically the study researchers—women might have been particularly sensitive to the imagined judgments of their audience.

This study contributes to the literature on environments and health by showing that individuals' subjective descriptions of their homes were linked with their subsequent patterns of mood and cortisol. Even an admittedly crude technique such as word counting seemed to unearth correlates of wives' everyday experiences of stress, underlining the importance of the home environment to well-being and psychosocial functioning—and, in turn, the possible role of well-being in the perception or maintenance of a pleasant home environment. There are a number of mechanisms, both direct and indirect, that could account for these results. For example, perceiving one's home as being cluttered or unfinished could directly trigger stress reactions and depressed mood, whereas viewing the home as more restorative might alleviate these negative states. Alternately, the perceived stressfulness and restorativeness of the home might moderate

daily adaptation to the environment in such a way that affects daily patterns of stress and mood. For example, women who see their homes as a source of demands (the need to straighten up clutter or complete unfinished projects) might have more difficulty unwinding effectively from the workday. In other words, feelings about the home might moderate everyday adaptation to the environment. An additional possibility is that both the home descriptions and patterns of mood and cortisol reflect an underlying variable, such as difficulty managing everyday tasks, a overall perceived lack of self-efficacy, or frustration with gender roles that place greater responsibility for household management on women.

Our results suggest interesting possibilities for researchers looking to understand phenomena that might not translate readily into closed-ended questionnaires. Notably in this study, LIWC variables were tested along with the MAT, a well-validated measure of marital satisfaction that previously had been shown to predict women's cortisol patterns in this sample (Saxbe et al., 2008). The word-count variables remained strong predictors of diurnal cortisol. In fact, marital satisfaction became a nonsignificant predictor of two of the three markers of wives' diurnal slope, cortisol slope by time and time[2], suggesting that the previously reported association between marital satisfaction and cortisol may be at least partially explained by the overlap between women's marital dissatisfaction and their experience of the home as cluttered and unfinished. This study is the first to examine home tours using LIWC and the first to establish a link between descriptions of the home environment and the diurnal slope of cortisol.

This study has a number of limitations. The sample was small (60 adults) and included only dual-income middle-class parents. A larger sample or one representing a wider range of ages, lifestyles, and family compositions might unearth different results. However, we believe that the study's focus on full-time working parents offers several advantages: First, it standardized participants' daily routines in a way that might have been relevant to their diurnal cortisol slope; additionally, the fact that our participants were transitioning daily from work to home may have suited this study's focus on the restorative (or stressful) qualities of the home environment.

An additional limitation is in the interpretation of the stressful home and restorative home variables. For example, it remains unclear how much the word count variables reflect objective or subjective perceptions of home. Within-couple correlations did not emerge for the word count variables, nor were they associated with characteristics like house size or age, suggesting that the tours did not reflect only objective features of participants' homes. Because these are novel dictionaries, they have not been validated in other samples, making it difficult to assess their psychological correlates. To address this point, we tried substituting negative emotion words, one of the preexisting LIWC categories, for stressful home words, and found results that closely paralleled the

results we report in this article: For wives, a higher rate of negative emotion word use predicted a flatter slope of diurnal cortisol. When we entered negative emotion words and stressful home words together in the same analyses, both variables appeared to moderate the trajectory of women's cortisol slope such that both were associated with flatter slope. Additionally, controlling for neuroticism and marital satisfaction did not alter our results, which indicates that the word counts did not fully overlap with other psychosocial variables that might have contributed to self-presentational biases. Longitudinal research could further explore this issue and also the issue of causality—that is, whether participants experiencing stress or depressed mood had negatively biased perceptions of their homes or actually maintained less pleasant homes.

Another concern extends from possible ambiguities around the home tour words themselves. For example, some of the words counted might reflect negations or other unintended uses of language ("this space is not cluttered"). However, tours were carefully reviewed before LIWC analyses and few cases of contradiction, irony, and other possible sources of distortion were found. Additionally, occasional negations might reflect a preoccupation with the concepts in each category (for example, describing the home's lack of mess and clutter might belie concerns about keeping the house clean). The home tour portion of the study was not planned with LIWC analysis in mind, which is both a strength and a weakness of this study: a strength because the home tours represent truly open-ended, minimally prompted language samples; a weakness because the possibility of linguistic imprecision was not fully controlled.

In conclusion, this study found intriguing links between wives' descriptions of their homes and their patterns of cortisol and depressed mood. Given that everyday levels of cortisol and depressed mood may influence long-term physical and psychological health outcomes, these results illustrate the importance of individuals' perceptions of the home environment for both proximal and distal well-being. When coming home from work means noticing piles of clutter or a long list of to-do projects, it is perhaps no surprise that cortisol levels fail to show a normal diurnal decline and that ratings of depressed mood increase over the course of the day. Similarly, focusing on those features of the home that are restful or that incorporate nature may ease the transition from work to home, explaining a stronger diurnal pattern of cortisol and an across-the-day decrease in depressed mood levels. These results suggest not only that impressions of the home environment may inform everyday health but that these impressions may be especially important for women. Future studies can explore why wives may be more sensitive than their husbands are to the stressful and restorative properties of their homes or why stress might be more likely to influence women's perceptions and evaluations of their home environments. Ultimately, families' linguistic styles, daily cortisol fluctuations, and daily patterns of work–home

transitioning all represent a vantage on contemporary life underrepresented in psychological research: a slice of every-day reality that, when enlarged under the microscope of systematic analysis, may shed light on the multiple interconnections between stress, relationships, and well-being.

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