Social Structure, Infectious Diseases, Disasters, Secularism, and Cultural Change in America

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Abstract
Why do cultures change? The present work examined cultural change in eight cultural-level markers, or correlates, of individualism in the United States, all of which increased over the course of the 20th century: frequency of individualist themes in books, preference for uniqueness in baby naming, frequency of single-child relative to multichild families, frequency of single-generation relative to multigeneration households, percentage of adults and percentage of older adults living alone, small family size, and divorce rates (relative to marriage rates). We tested five key hypotheses regarding cultural change in individualism-collectivism. As predicted by previous theories, changes in socioeconomic structure, pathogen prevalence, and secularism accompanied changes in individualism averaged across all measures. The relationship with changes in individualism was less robust for urbanization. Contrary to previous theories, changes in individualism were positively (as opposed to negatively) related to the frequency of disasters. Time-lagged analyses suggested that only socioeconomic structure had a robust effect on individualism; changes in socioeconomic structure preceded changes in individualism. Implications for anthropology, psychology, and sociology are discussed.

Psychologists who study culture tend to do so by comparing distinct populations to determine universal and culture-specific patterns of behavior. Research in this tradition has revealed that Westerners tend to be individualist; they emphasize personal autonomy, self-fulfillment, and uniqueness. In contrast, East Asians and Eastern Europeans tend to be collectivist; they emphasize strong family ties, in-group cohesion, and a focus on duty (for reviews, see Markus & Kitayama, 1991; Triandis, 1995). Yet cultures are not static, as suggested by recent studies on cultural change in individualism in the United States (Greenfield, 2013; Twenge, Campbell, & Gentile, 2012) and elsewhere (Hamamura, 2012). In the present research, using the United States as a case study, we aimed to systematically test five socio-ecological hypotheses addressing why the individualism of cultures changes over time.

Why Is Individualism on the Rise?

Since Hofstede (1980), researchers have discussed individualism and collectivism as *cultural syndromes*—shared patterns of attitudes, preferences, values, and products organized around a theme (Triandis, 2009; also see Na et al., 2010). Other names for the individualism-collectivism dimension include independence-interdependence, individualism-sociocentrism, and Gesellschaft-Gemeinschaft. The cultural syndrome of individualism is characterized by endogenous factors including cultural products (Morling & Lamoreaux, 2008), practices (e.g., Varnum & Kitayama, 2011), and the structure of relationships (e.g., Vandello & Cohen, 1999). Features of individualism include a focus on the personal self, an emphasis on

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uniqueness (as opposed to conformity), and relatively weak ties to family. Features of collectivism include a focus on close relationships, a desire to fit in, and strong ties to family (Grossmann & Na, 2014).

Although there has been limited empirical work on cultural shifts in individualism-collectivism, theoretical speculations about these shifts are abundant. Most are based on cross-cultural observations. The *pathogen-prevalence theory* holds that in areas where the prevalence of infectious disease is high, psychological and behavioral tendencies that reduce the risk of infection should also be apparent (Schaller & Murray, 2011). Collectivism is adaptive in environments where pathogen prevalence is high because it limits contact outside a small in-group, thus reducing the probability of infection (Fincher & Thornhill, 2012). Greater levels of in-group favoritism and collectivist behaviors are found in countries (and U.S. states) that have higher pathogen prevalence (Fincher & Thornhill, 2012), and conformity is higher in countries that have greater pathogen loads (Murray, Trudeau, & Schaller, 2011). These findings suggest that if the prevalence of infectious disease increases in a culture, one should expect that culture to become more collectivist, and if the prevalence of infectious disease decreases in a culture, one should expect that culture to become more individualist.

Another hypothesis posits that disasters reduce individual agency and people's sense of autonomy and strengthen their need to rely on close others (Triandis, 2009). Thus, an increase in the frequency of disasters should promote greater collectivism. However, case studies of disaster survivors (Withey, 1962) and experiments suggest that disaster-induced anxiety and stress lead to reduced focus on social-contextual information (e.g., Wachtel, 1968), a key correlate of collectivism (Varnum, Grossmann, Kitayama, & Nisbett, 2010). Thus, it is possible that an increase in the frequency of natural disasters would in fact lead to greater individualism.

The remaining three hypotheses concern shifts in social structure that are often viewed as reflecting a general modernization process (Inglehart & Baker, 2000). In this view, the shift from a traditional to a modern society (with higher levels of urbanization, secularism, education, and income) promotes individualism. Urbanization in particular has been proposed as a key component of modernization in Greenfield's (2013) theory of social change and human development, which holds that the transition from smaller-scale community-centered environments to the more autonomous and complex environments of large cities fosters individualism. In line with this theory, the "city air" hypothesis (Yamagishi, Hashimoto, Li, & Schug, 2012) suggests that social constraints prevalent in rural life are weaker in urbanized areas, freeing urban residents from pressure to suppress

their pursuit of individual goals. The empirical evidence for this hypothesis is based on cross-sectional urban-rural comparisons, which suggest that individuals living in urban settings are more likely than their rural counterparts to show individualism-related preferences for unique choices (e.g., Yamagishi et al., 2012).

According to the fourth hypothesis, religion promotes conformity, tradition, communal values, and in-group favoritism, all of which are linked to a collectivist orientation. Thus, a rise in religiosity should lead to greater collectivism, whereas shifts toward secularism should lead to greater individualism. This hypothesis is based on cross-cultural research linking individualism to secularism (Triandis & Singelis, 1998). However, it is worth noting that surveys from 1980 through 1998 found that a rise in the value Americans placed on individualism did not correspond to an increase in secularism (Inglehart & Baker, 2000), which suggests that at least in the United States, changes in these variables may be orthogonal.

Finally, changes in individualism may be linked to socioeconomic factors. Compared with blue-collar occupations, white-collar occupations afford and demand more autonomy and self-direction (Hofstede, 1980; Kohn & Schooler, 1969), and greater affluence enables individuals to pursue their own interests without consulting or depending on the in-group (Triandis, 1995). A number of psychological studies have suggested that differences in socioeconomic status (SES) are linked to individuals' social orientation, with higher SES individuals behaving in a more individualist fashion and lower SES individuals behaving in a more collectivist fashion (e.g., Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012; Na et al., 2010). Thus, if the proportion of white-collar workers increases in a population, then one would expect a corresponding increase in individualism.

Although some research has explored factors linked to short-term cultural changes (e.g., Inglehart & Baker, 2000), the ability of these five hypotheses to account for long-term cultural-level shifts in individualism has not been tested. The distinction between cultural change over shorter versus longer time spans is important for at least two reasons. First, it is unlikely that cultural change occurs only through "billiard ball" determinism, in which a change in one variable (e.g., a rise in secularism in year X) corresponds to an immediate change in a different variable (e.g., a rise in individualism in year X). It is more likely that cultural change is complex (Klingman, 1980; also see Erez & Gati, 2004; Simonton, 1975), which implies that it may take time for a cause to produce an effect. Second, long-term trends are more reliable than short-term trends because they are derived from data points over a longer time span, which reduces their likelihood of being affected by idiosyncratic temporal fluctuations. Hence, using data points limited to periods of 20 to

Table 1. The Individualist and Collectivist Words Selected as Markers of Individualism in Published Books

Individualist theme	Collectivist theme
able (adjective)	belong (verb)
achieve (verb)	duty (noun)
differ (verb)	give (verb)
own (verb)	harmony (noun)
personal (adjective)	obey (verb)
prefer (verb)	share (verb)
special (adjective)	together (adjective)

Note: We used the part-of-speech tagging capability of the 2012 Ngram data set (Lin et al., 2012) to identify frequencies reflecting each word's specific part of speech. The part-of-speech tags of the selected words are indicated in parentheses.

30 years (which has been typical in research on cultural change so far) may be insufficient to capture the impact of lagged relationships between socio-ecological and endogenous factors.

In the research reported here, we quantified shifts, over the past 150 years, in eight cultural-level indicators or correlates of individualism in the domains of cultural products (i.e., individualist and collectivist themes in books), behavioral patterns of uniqueness (i.e., baby-naming practices), and previously explored behavioral and demographic correlates of individualism-collectivism reflecting the strength of family ties (e.g., family size, percentage of single-person households and multigenerational households, and divorce rate). In line with the seminal work by Hofstede (1980), as well as more recent work (e.g., Na et al., 2010; for a review, see Grossmann & Na, 2014), we focused on relative cultural-level preference for individualism over collectivism, acknowledging that on the individual level, these dimensions may be independent. To shed light on which factors are associated with rising individualism in the United States, we tested the relationship between these indicators and trends in pathogen prevalence, the number of disasters, urbanization, secularism, and socioeconomic structure.

Method

Endogenous components of individualism

Individualist versus collectivist words in published books. Recent advances in computer science have allowed for massive content analyses of published books (e.g., Greenfield, 2013) with help of the Google Ngram project. The 2012 edition of the Google Ngram database (Lin et al., 2012; also see Michel et al., 2011) includes frequency information for usage of words and phrases in American fiction and nonfiction books by year through

2008. Note that the Google Ngram procedure provides scores that are adjusted for the number of books (and words) published in the given year. The resulting scores are percentages, and thus control for annual fluctuations in the total number of books and words published.

To quantify cultural change in individualism using word frequency in books, we followed a two-step approach. Our goal was to select words that are associated with individualism and collectivism in the view of cultural psychologists and that also showed a substantial level of reliability over time (see Table 1 for the words we selected). In the theoretically driven first step, we perused common scales of individualism (e.g., Singelis, 1994) to identify words loosely reflecting meaning structures matching the individualism and collectivism themes, excluding words that take on different meanings depending on the context in which they appear (e.g., *get*). We also excluded negations (e.g., *not special*), because it is unclear if negation of a word reflects more or less focus on individualism. Preliminary analyses indicated that results were similar regardless of whether negations were included or excluded. We took care to include adjectives and verbs, which often act as linguistic carriers of concepts of individualist and collectivist agency (see Table 1). Using raw data from the Google Ngram project, we quantified the percentage of words reflecting individualism and collectivism (relative to total word count) for each year from 1860 through 2006. We did not collect data for more recent years because the combination of self-publishing together with the introduction of mass-market e-book readers in 2006 (e.g., Amazon Kindle) had a dramatic impact on subsequent sampling in the Google Ngram project.

Because we were interested in common aspects of the meaning structures associated with individualism and collectivism, in the second step we analyzed the reliability of change in word frequency over time within each theme. These analyses revealed similar degrees of change for each theme (individualism: $\alpha = .77$; collectivism: $\alpha = .73$). Therefore, we collapsed the data across words to create separate indices for use of individualist and collectivist words in each year. The individualist and collectivist indices were negatively correlated (Kendall's $\tau = -.77$, $p < .001$). Therefore, we also subtracted the collectivist index from the individualist index for each year to obtain a relative index of individualism versus collectivism in published books.

Unique versus common baby names. Baby-naming practices are a behavioral reflection of preference for uniqueness (e.g., Varnum & Kitayama, 2011). Therefore, our second measure dealt with preferences for baby names. Since 1880, the Social Security Administration has collected data on naming practices in the United States,

and we used these data to determine the percentage of children receiving any of the 20 most popular names for their gender in each year from 1880 through 2012 (Social Security Administration, 2013). By focusing on the 20 most popular names in each year, we controlled for changes in the popularity of specific names over time. For each gender in each year, we calculated a uniqueness score by subtracting from 100% the percentage of babies receiving top-20 names.

Interpersonal structure. Numerous studies have previously linked differences in individualism-collectivism to differences in strength of family ties and structure of interpersonal relationships (e.g., Markus & Kitayama, 1991; Vandello & Cohen, 1999). Individualism is linked to smaller family size and preference for living alone, whereas collectivism is linked to multigenerational households with grandparent and grandchild living under the same roof (Triandis, 1989). Individualists' focus on uniqueness is further linked to a preference for having one child, which allows parents to provide a unique social environment to the child (Falbo, 1992). Finally, greater cultural-level individualism is also related to higher divorce rates (Hamamura, 2012; Triandis, 1995). Therefore, we obtained relevant cultural-level data for each of these indicators.

Household variables: people living alone and three- versus single-generation families. Household-specific data have been collected as part of the decentennial U.S. Census since 1900 and as part of the annual American Community Survey (ACS) in the 2000s. From these data (Ruggles et al., 2010–2014), we derived three variables. First, we determined the proportion of American adults who lived alone in the years 1880 through 2012. Second, we determined the proportion of older adults (i.e., over 59 years of age) who lived alone (i.e., in a single-generation household and not with a partner or a sibling) in the years 1880 through 2012. Third, we looked at the generational structure of households, because another index of family ties concerns how many older adults live with their grandchildren. Although the percentage of households in which parents are missing (and thus grandparents are raising grandchildren) can be taken as a sign of parental individualism, households in which all three generations live together are consistent with the notion of filial piety and can be taken as an indicator of collectivism. Using the household-specific Census and ACS data, we calculated the ratio of three-generation households relative to single-generation households in the years 1880 through 2012.

Family-specific data: family size and single-child families. Family-specific data have been collected as part of the decentennial U.S. Census since the 18th century and as part of the annual ACS in the 2000s. From these data

(Ruggles et al., 2010–2014), we calculated the size of the average family and the ratio of single-child families relative to multichild families for the years 1860 through 2012.

Divorce-to-marriage ratio. Because the rate of divorce is proportional to the rate of marriages, we standardized our divorce variable by calculating a divorce-to-marriage ratio. We obtained rates of divorce (including annulments) and marriage from the National Center for Health Statistics at the U.S. Department of Health and Human Services. The center has collected this information for each year since the late 19th century. We included data for the years 1900 through 2009 in our analyses (Pearson Education, 2000–2015).

Socio-ecological factors

Endogenous factors that make up a cultural syndrome of individualism-collectivism stand in contrast to socio-ecological factors that contribute toward changes in that syndrome. In this section, we describe the socio-ecological data included in our study.

Infectious diseases. We obtained data on the annual prevalence of specific infectious diseases from the U.S. Census Bureau (2003) and the Centers for Disease Control and Prevention (2014). Data were available for 10 of the most frequent infectious diseases: tuberculosis, syphilis, gonorrhea, malaria, typhoid and paratyphoid fever, diphtheria, pertussis, measles, poliomyelitis, and AIDS. Because data for AIDS were not available before 1984, we did not include this disease in the final analyses, although including AIDS did not alter the results. The analyses reported here included prevalence rates from 1912 through 2012 for the 9 other diseases.

Disasters. We obtained data on disaster prevalence in the United States for each year from 1900 to 2012 from the Centre for Research on the Epidemiology of Disasters, Belgium (Guha-Sapir, Below, & Hoyois, 2014). All events categorized as disasters in this data set satisfied at least one of the following criteria established by the World Health Organization: Ten or more people were reported to be killed, 100 or more people were reported to be affected, or a state of emergency was declared. The database included natural disasters (e.g., earthquakes, storms and floods, extreme temperatures) and technological disasters (e.g., fires, chemical spills, transportation incidents). The number of disasters ranged from 20 in the first decade of the 20th century to more than 300 in the first decade of the 21st century.

Urbanization. Defining urbanization in the United States is complex for at least two reasons. First, when country borders are stable, indicators of urbanization,

such as general population density, are almost perfectly correlated with the growth of the population as a whole. Second, one has to account for migration to the suburbs—a U.S. phenomenon that began in the 1950s and that is very different from urbanization (cf. urban sprawl; Squires, 2002). To control for suburbanization trends, we relied on the U.S. Census distinction between the nonsuburban population living in the central city and the total population of a metropolitan area, data for which were available from 1900 to 2010 (Hobbs & Stoops, 2002, Figs. 1–15 and Table 8; Mather, Pollard, & Jacobsen, 2011, Fig. 6).

Secularism. The Gallup organization has been conducting representative surveys on religiosity annually since 1948. These surveys include the question "What is your religious preference—Protestant, Roman Catholic, Jewish, another religion, or no religion?" In the analyses reported here, we used yearly aggregated data from these Gallup polls from 1948 through 2012 (Gallup, 2014), focusing on the percentages of individuals whose responses were coded as "none" or "no answer." Preliminary analyses suggested that results were comparable when we examined only the percentage of participants whose responses were coded as "none."

Socioeconomic status. Occupational information has been collected as part of the U.S. Census since the 18th century. In the late 1950s, this information was quantified by the U.S. Census Bureau in terms of harmonized occupational status (i.e., the Nam-Powers-Boyd scale; Nam & Boyd, 2004). Specifically, each occupational category was ranked by median education and median income; scores were averaged and divided by the total workforce population, which resulted in a scale from 1 to 100. Thus, the Nam-Powers-Boyd method took into account the shape of the distribution (the density function) as well as the absolute difference between occupations in median education or income. We obtained occupational scores for each U.S. Census and ACS, beginning with the 1860 sample and finishing with the 2011 sample (Ruggles et al. 2010–2014), and calculated the population estimate of this indicator for each available year. These population estimates reflect the averaged occupational status of American society in a given year, weighted by the median education and median income of each occupation group in the late 1950s.

Results

All analyses were performed in the R language for statistical computing (R Development Core Team, 2014). Additional details on our analytic approach are available in the Supplemental Material.

Quantifying cultural-level shifts in individualism

As Table 2 shows, our indicators of individualism were interrelated in a coherent fashion: The frequency of individualist themes in books was positively correlated with uniqueness-oriented baby naming, whereas the frequency of collectivist themes in books was negatively correlated with uniqueness-oriented baby naming. Further, these measures were substantially correlated with each aspect of interpersonal and family structure in the predicted direction.

Table 2. Zero-Order Correlations Between the Indicators of Cultural-Level Individualism

Component	2	3	4	5	6	7	8	9	10	11
Themes in books ($n = 147$)										
1. Individualist words (% of total)	−.78	.84	.33	.21	.19	.18	−.48	.43	−.45	.44
2. Collectivist words (% of total)	—	−.94	−.43	−.29	−.44	−.47	.66	−.59	.67	−.69
3. Individualist words minus collectivist words (%)		—	.42	.28	.33	.37	−.61	.54	−.63	.62
Cultural practices										
4. Unique naming: boys (%; $n = 133$)			—	.69	.45	.78	−.77	.78	−.38	.44
5. Unique naming: girls (%; $n = 133$)				—	.41	.78	−.76	.78	−.37	.43
Interpersonal structure										
6. Divorce rate/marriage rate ($n = 40$)					—	.61	−.62	.65	−.52	.59
7. People living alone (%; $n = 22$)						—	−.78	.79	−.39	.55
8. Family size ($n = 26$)							—	−.81	.58	−.61
9. Single-child/multichild families ($n = 113$)								—	−.45	.54
10. Three-generation/one-generation households ($n = 24$)									—	−.81
11. Older adults living alone (%; $n = 24$)										—

Note: As is customary for time-series frequency data analysis, the correlation coefficients reported here are ordinal-level Kendall's τ. The *n*s indicate the number of years for which data were available.
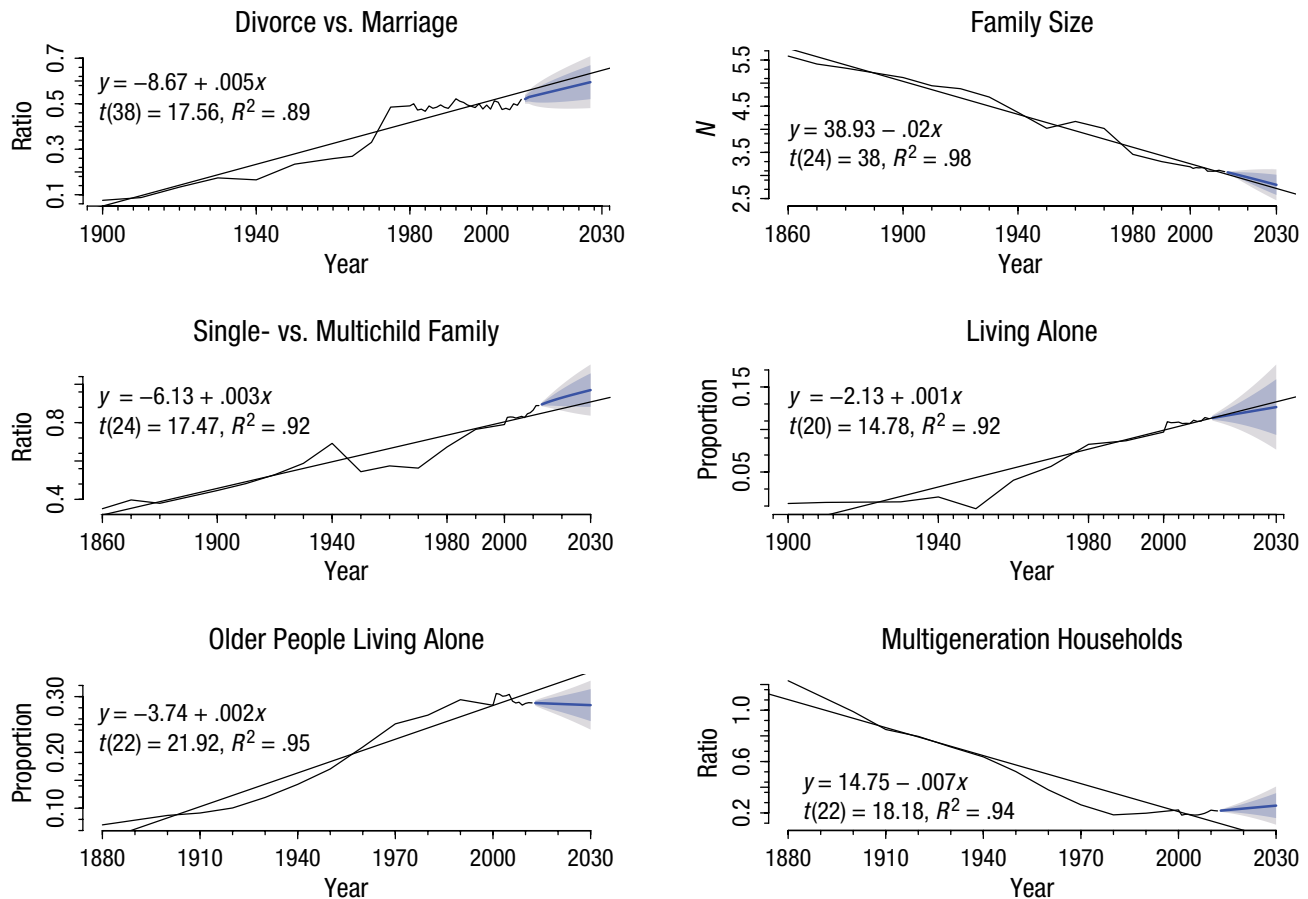
Divorce vs. Marriage

$y = -8.67 + .005x$
$t(38) = 17.56, R^2 = .89$

Family Size

$y = 38.93 - .02x$
$t(24) = 38, R^2 = .98$

Single- vs. Multichild Family

$y = -6.13 + .003x$
$t(24) = 17.47, R^2 = .92$

Living Alone

$y = -2.13 + .001x$
$t(20) = 14.78, R^2 = .92$

Older People Living Alone

$y = -3.74 + .002x$
$t(22) = 21.92, R^2 = .95$

Multigeneration Households

$y = 14.75 - .007x$
$t(22) = 18.18, R^2 = .94$

Fig. 1. Interpersonal trends in the United States: divorce-to-marriage ratio, average family size, ratio of single- to multichild families, proportion of people living alone, proportion of older people living alone, and ratio of three-generation to single-generation households as a function of year. Each graph shows the line of best linear fit to the data, as well as forecasts for 2013 through 2030. The forecasts are from optimal autoregressive moving-average models; the shaded areas correspond to 80% and 95% prediction intervals.

Figure 1 shows a steady rise in individualist interpersonal trends over time: a steady decrease in family size since 1860, $R^2 = .98$; an increase in the proportion of individuals living alone since at least the 1950s, $R^2 = .92$; an increase in divorce rates (relative to marriage rates) since 1900, $R^2 = .89$; and an increase in the prevalence of single- compared with multichild families since 1860, $R^2 = .92$. The proportion of older adults living alone increased steadily from the 1880s until the 2000s, $R^2 = .95$, and the ratio of three- to single-generation households declined steadily from the 1880s through the 20th century until the 1980s, $R^2 = .94$. Figure 2 shows comparable trends in the relative preference for individualist versus collectivist words in published books at least until the 1990s; the frequency of individualist words rose, $R^2 = .88$, while that of collectivist words declined, $R^2 = .95$. Similarly, uniqueness preferences in baby naming rose, with effect sizes in the medium to high range, $R^2 = .57$ for girls and .63 for boys.

For several indicators—single-child families, single-person households, and baby-naming practices—we observed local interruptions of the trend around the time of World War II. Also, it is evident from Figure 2 that in the past 15 years, word use strongly deviated from previous trends, reflecting a sampling bias likely due to a shift toward e-books and mass self-publishing. The number of published books almost doubled from 1990 to 2000, and more than quadrupled from 1990 to 2009. Overall, though, the visual illustrations of the trends suggest a consistent cultural shift toward greater individualism over the course of the past 150 years.

Note that linear models present a challenge for the study of cultural change (e.g., Klingman, 1980), because a time-series trend may not only represent a difference between time points (d), but also involve an autoregressive component (p), as well as lagged forecast errors (q). To quantify the direction and the magnitude of change in each indicator of individualism while simultaneously accounting for autoregressive components and potential forecast errors, we calculated optimal autoregressive moving-average (ARIMA) models via an automatic forecasting algorithm (Hyndman & Khandakar, 2008) and
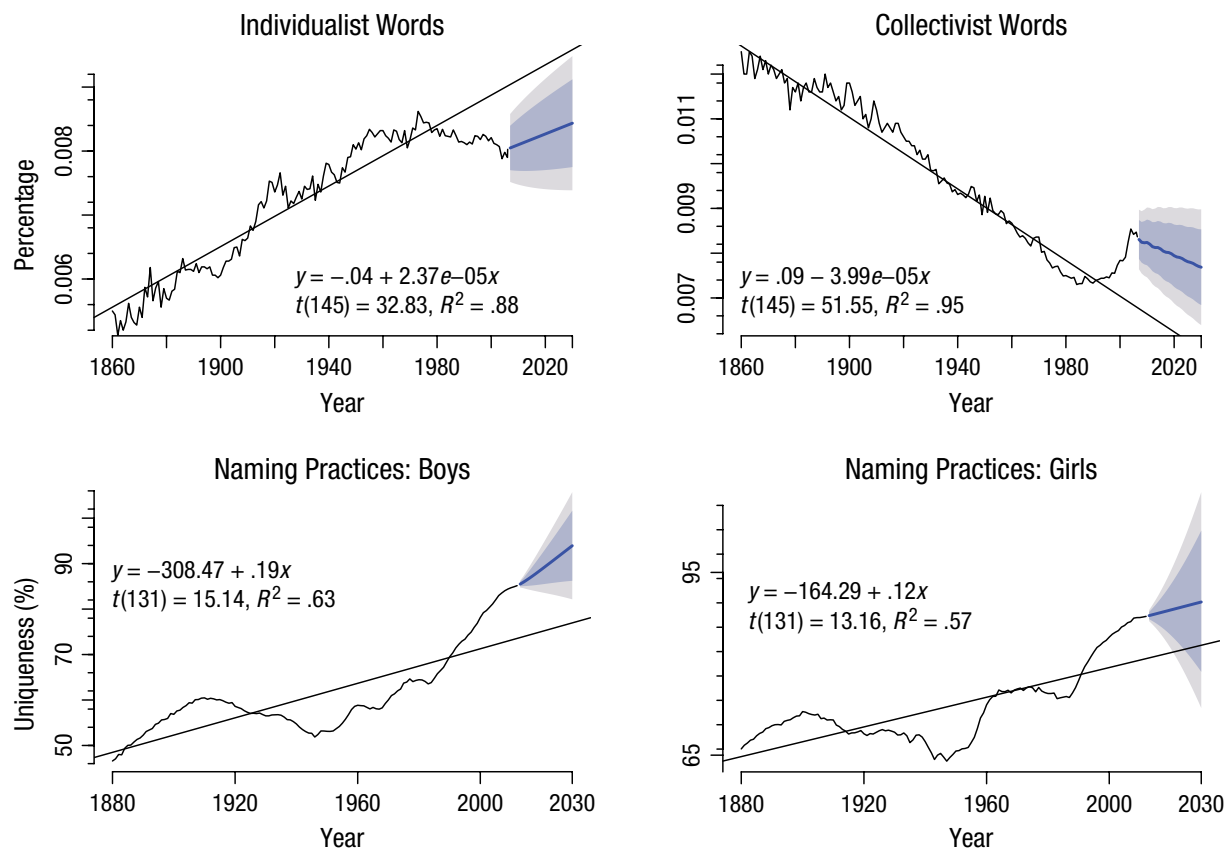
Fig. 2. Frequencies of individualist and collectivist words in U.S. books from 1860 through 2006 and preference for unique baby names (i.e., those not among the 20 most common names in a given year) from 1880 through 2012. Each graph shows the line of best linear fit, as well as forecasts through 2030. The forecasts are from optimal autoregressive moving-average models; the shaded areas correspond to 80% and 95% prediction intervals.

arrived at a forecast for each indicator up through the year 2030 (see Figs. 1 and 2). We then compared the forecasts for 2030 with the data from 2000 to calculate the expected percentages of increase. Table 3 presents these values for each model, along with the *p, d,* and *q* estimates reflecting the type of each estimated ARIMA model. The table indicates that, with one exception, the contemporary trends in the United States are toward increasing individualism. For five aspects of interpersonal structure, estimated ARIMA models predicted shifts toward greater individualism. The only exception to these consistent trends was that the ratio of three- to single-generation households was predicted to increase (rather than decrease). Yet, even for this indicator, a trend toward greater individualism was within the 95% confidence interval.

Exogenous socio-ecological factors and cultural shifts in individualism

Our central question concerned the association between socio-ecological indicators and cultural-level change in individualism (see Table S1 in the Supplemental Material for intercorrelations between socio-ecological predictors). As Table 4 indicates, the prevalence of infectious diseases and SES were coherently linked to each aspect of individualism, with moderate to high effect sizes, $\tau = |.30|-|.72|$ for infectious diseases and $|.43|-|.75|$ for SES. Secularism and urbanization were related to individualism in a similar fashion, though these relationships were less robust, $\tau = |.06|-|.83|$ for secularism and $|<.01|-|.42|$ for urbanization, and some correlations were in the direction opposite what was predicted. Finally, for each indicator, frequency of disasters was associated with greater (rather than less) individualism, $\tau = |.40|-|.72|$. Supplementary analyses indicated that the frequency of disasters was more strongly correlated with individualism-related shifts than was the magnitude of disasters or the frequency of disasters qualified by the number of deaths (see Supplementary Analyses and Table S2 in the Supplemental Material available online). On average, shifts in SES, disease and disaster prevalence, and secularism were most closely related to shifts in individualism.

Table 3. Results of the Autoregressive Moving-Average (ARIMA) Models

Variable	ARIMA model classification (*p, d, q*)	Predicted change from 2000 to 2030 (%)
Interpersonal structure		
Divorce rate/marriage rate	(2, 2, 1)	16.56
People living alone	(0, 2, 1)	30.30
Family size	(2, 1, 0) with drift	−12.25
Single-child/multichild families	(1, 1, 1) with drift	22.72
Three-generation/one-generation households	(0, 2, 1)	16.72
Older adults living alone	(0, 2, 1)	1.69
Averaged score	(1, 1, 2) with drift	99.11
Themes in books		
Individualist words	(2, 1, 0) with drift	2.74
Collectivist words	(3, 2, 1) with drift	−1.95
Cultural practices		
Unique naming: boys	(2, 2, 1)	20.20
Unique naming: girls	(0, 2, 1)	6.81

Note: For estimation of the time series, we used linear interpolation between census data points. *p = n* autoregressive terms; *d = n* nonseasonal differences; *q = n* lagged forecast errors.

Predictive causality, lagged effects, and partial correlations

It is possible that the correlations observed between these exogenous factors and individualism-related variables are spurious. In preliminary analyses, we examined the trends in socio-ecological variables over time. As Figure S1 in the Supplemental Material indicates, these trends were not monotonic, which suggests that the correlations between exogenous and endogenous variables are not likely due to collinearity with the time variable.

To further test the possibility of spurious relationships between exogenous and endogenous variables, we performed a Granger test of predictive causality, with socio-ecological indicators as statistical predictors of cultural-level change in individualism. This test examined whether lagged information on an exogenous variable Y provided any statistically significant information about an endogenous individualism variable X in the presence of lagged X. Data for some of the socio-ecological indicators were not available before 1900, so we used 1900 as the starting data point for these analyses. For parsimony,

Table 4. Correlations Between the Socio-Ecological Factors and the Markers of Cultural-Level Individualism

Variable	SES	Urbanization	Secularism	Prevalence of infectious diseases	Prevalence of disasters
Interpersonal structure					
Divorce rate/marriage rate	.55	.20	.09	−.37	.49
People living alone	.52	.13	.65	−.72	.43
Family size	−.65	−.42	−.70	.69	−.50
Single-child/multichild families	.59	.39	.83	−.69	.43
Three-generation/one-generation households	−.72	−.30	.09	.34	−.60
Older adults living alone	.75	.39	.06	−.40	.72
Themes in books					
Individualist words	.48	.31	−.15	−.30	.40
Collectivist words	−.58	−.27	.52	.49	−.62
Cultural practices					
Unique naming: boys	.44	−.06	.80	−.68	.41
Unique naming: girls	.43	< .01	.60	−.72	.44
Average τ	.57	.24	.40	−.54	.50

Note: The table reports ordinal-level Kendall's τs. Average τ is based on all indicators, with frequency of collectivism words, the ratio of multigeneration to single-generation households, and family size reverse-scored in the direction of high individualism. SES = socioeconomic status.

Table 5. *F* Statistics From the Granger Test of Predictive Causality at 1- and 5-Year Lags

Individualism index	SES		Urbanization		Secularism		Prevalence of infectious diseases		Prevalence of disasters	
	1-year	5-year	1-year	5-year	1-year	5-year	1-year	5-year	1-year	5-year
Interpersonal structure	$F(1, 28) = 3.94^{\dagger}$	$F(5, 16) < 1$	$F(1, 27) = 2.76$	$F(5, 15) < 1$	$F(1, 29) = 1.85^{**}$	$F(5, 17) = 3.09^{*}$	$F(1, 29) = 3.31^{\dagger}$	$F(5, 17) = 2.72^{\dagger}$	$F(1, 29) = 2.43$	$F(5, 17) = 1.69$
Words in books	$F(1, 103) = 1.13$	$F(5, 91) = 3.50^{**}$	$F(1, 97) < 1$	$F(5, 85) = 1.4$	$F(1, 55) = 1.29$	$F(5, 43) < 1$	$F(1, 91) < 1$	$F(5, 79) < 1$	$F(1, 103) = 2.02$	$F(5, 91) = 1.61$
Naming practices	$F(1, 108) = 9.46^{**}$	$F(5, 96) < 1$	$F(1, 107) = 6.12^{*}$	$F(5, 95) < 1$	$F(1, 61) = 1.98$	$F(5, 49) < 1$	$F(1, 97) = 16.95^{***}$	$F(5, 85) = 1.05$	$F(1, 109) = 20.71^{***}$	$F(5, 97) = 2.17^{*}$

Note: To perform the Granger test, we performed a linear interpolation of missing data for certain years of the time series of the exogenous variables. SES = socioeconomic status.
$^{\dagger}p < .10.$ $^{*}p < .05.$ $^{**}p < .01.$ $^{***}p < .001.$

we standardized all indicators of individualism such that higher values indicated greater individualism and averaged these standardized scores to create indices of individualism in cultural products (relative frequency of individualist vs. collectivist words in books), naming practices, and interpersonal structure.

SES positively predicted each marker of individualism at either a 1- or a 5-year lag, but the pattern was less clear for other indicators (see Table 5). Prevalence of infectious diseases was linked to preference for uniqueness in baby-naming practices at a 1-year lag and to shifts in interpersonal structure at both lags. Urbanization was linked to preference for uniqueness in baby-naming practices at a 1-year lag, secularism was linked to individualist shifts in interpersonal structure at both lags, and disaster prevalence was linked to more unique naming practices at both lags.

Because increases in individualism may promote subsequent shifts in socio-ecological factors, and because the relationship between individualism and socio-ecological factors may be bidirectional, we also examined the directionality of the lagged effects using cross-correlation function analysis. Negative lags suggested that shifts in an exogenous factor preceded shifts in individualism, whereas positive lags suggested that shifts in an exogenous factor followed shifts in individualism. As Figure 3 indicates, cross-correlations between shifts in SES and individualism yielded a coherent structure. For word use, we observed a bidirectional relationship, with shifts in SES both preceding and following shifts in use of individualist versus collectivist words. Shifts in SES preceded shifts in naming practices and relationship structure by at least 30 years, and there was little evidence of shifts in SES following shifts in naming practices and relationship structure. Results for urbanization were similar. Shifts in urbanization significantly preceded shifts in individualism 30 years in advance; there was little evidence for concurrent shifts in urbanization and individualism or for shifts in urbanization to follow shifts in individualism. Shifts in

secularism, pathogen prevalence, and disaster frequency were mainly concurrent with shifts in individualism, the only significant exceptions being a 15-year lagged effect of reduced pathogen prevalence following increase in use of individualist (relative to collectivist) words in books and a 30-year lagged effect of secularism preceding reduced frequency of individualist (relative to collectivist) words in books.

We assessed the relative contribution of exogenous factors to increasing individualism using partial correlation analyses. Because SES was highly correlated with urbanization and disease prevalence, $|r\text{s}| > .92$, we ran separate sets of analyses in each of which one of these variables was included as a predictor along with secularism and disaster prevalence. As Table 6 indicates, the relative contribution of SES was moderate to high and was robust across the indicators of individualism. In contrast, secularism and disaster prevalence contributed mainly to shifts in naming practices. Tables S3 and S4 in the Supplemental Material show results of corresponding analyses with urbanization and disease data replacing SES data. It is noteworthy that for interpersonal structure and individualist (relative to collectivist) themes in books, the SES models explained more variance than the urbanization and disease-prevalence models.

Replication

To assess the robustness of our findings, we tested whether our results would be replicated with two entirely different lists of individualist and collectivist words that have been used in previous studies on cultural change (see the Replication section in the Supplemental Material). These alternative lists showed shifts in individualism that were highly similar to those observed with our word list (see Fig. S2). Moreover, the patterns of lagged correlations between exogenous variables and these two alternate operationalizations of individualist cultural products were virtually identical, as can be seen in Figures 3 and 4.
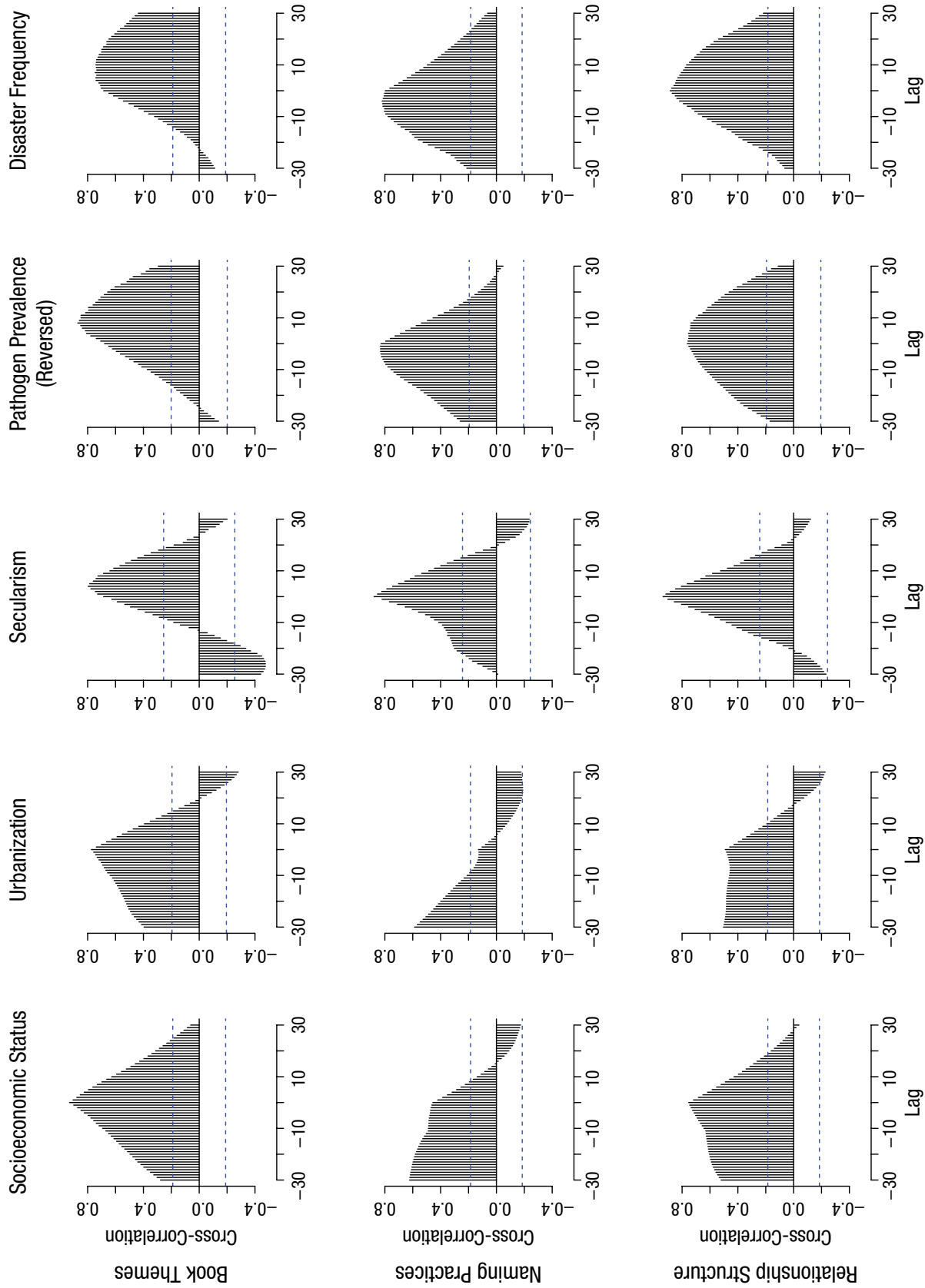
Fig. 3. Cross-correlations between exogenous factors and cultural-level components of individualism from 1900 to 2010, one lag per year. Values outside the bands indicated by the dashed horizontal lines are significant, α = .05. Negative lags indicate that shifts in the exogenous variable led shifts in the endogenous variable, whereas positive lags indicate that shifts in the exogenous variable followed shifts in the endogenous variable.

Table 6. Partial Correlation Results and Model Fit From Multiple Regression Analyses: Socioeconomic Status (SES), Secularism, and Disasters as Simultaneous Correlates of Cultural-Level Individualism

Individualism index	SES (r_p)	Secularism (r_p)	Prevalence of disasters (r_p)	Model fit (R^2)
Interpersonal structure	.79	.48	.19	.84
Words in books	.94	.34	−.39	.93
Naming practices	.36	.73	.47	.84

Discussion

Changes in individualism-collectivism have many implications in domains ranging from business practices (Franke, Hofstede, & Bond, 1991) to public policy (Chong & Druckman, 2007). Little is known about the processes underlying these changes. Psychologists like us (e.g., Varnum et al., 2010; also see Talhelm et al., 2014; Triandis, 2009) have been quick to draw on cross-cultural and cross-regional research to generate hypotheses about changes in individualism-collectivism, even though models accounting for cross-sectional variability are not necessarily adequate as models of cultural change.
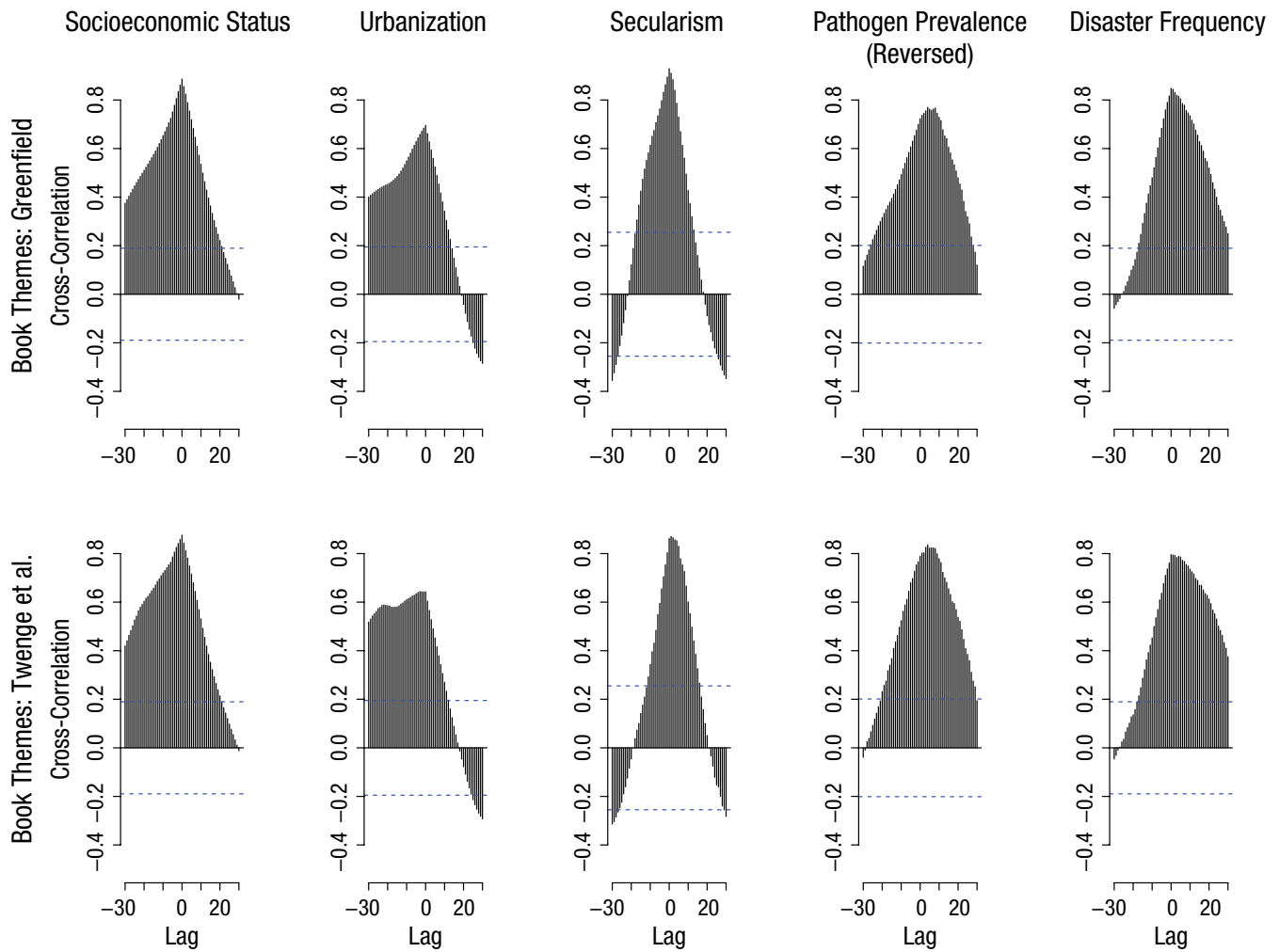

Fig. 4. Cross-correlations between exogenous factors and alternative characterizations of individualist-collectivist themes in U.S. books from 1900 to 2010 (Greenfield, 2013; Twenge, Campbell, & Gentile, 2012), one lag per year. Values outside the bands indicated by the dashed horizontal lines are significant, α = .05. Negative lags indicate that shifts in the exogenous variable led shifts in the endogenous variable, whereas positive lags indicate that shifts in the exogenous variable followed shifts in the endogenous variable.

We have provided a temporal analysis of cultural change in individualism in the United States over a time span of 150 years. We tested the relationship between multiple socio-ecological factors and cultural change in likely markers of individualism-collectivism. Our indicators of individualism were intercorrelated in a coherent fashion and showed that the shift toward greater individualism has been fairly steady for more than a century. Unique cohort effects (e.g., the relative collectivism of the World War II generation and the individualism of the current generations of U.S. youth; Twenge & Campbell, 2001) do not appear to offer a complete account of the increases in individualism over the course of the past 150 years. This is not to say that previously documented cohort differences are not important; rather, these changes appear to have begun long before the birth of Generation Me.

We found that changes in SES, the prevalence of infectious diseases, disaster prevalence, and secularism are linked to changes in individualism (see the Supplemental Material for tests of the relation between climatic demands and individualism). Moreover, time-lagged analyses suggested that changes in SES preceded changes in individualism, and provided little evidence that changes in cultural-level indicators of individualism preceded changes in SES. Finally, partial correlation analyses indicated that SES shifts were the most potent predictor of changes across a wide range of individualism-related markers. This cultural-level analysis complements and extends a growing body of research on the importance of SES in individual psychologies (Grossmann & Varnum, 2011; Kraus et al., 2012; Na et al., 2010), suggesting that SES has a similar relationship to individualism at the cultural and individual levels of analysis.

In contrast, as Table 4 indicates, we observed limited evidence that urbanization was linked to rising individualism. Moreover, and contrary to previous theorizing (Triandis, 2009), increases in the frequency of disasters were positively linked to increases in individualism. This finding is consistent with individual-level research on coping with the stress and anxiety produced by disasters (Wachtel, 1968) and with terror-management theory, which suggests that disasters cause people to cling more tightly to their dominant cultural values (Halloran & Kashima, 2006). If that is the case, one might expect that disasters would promote greater collectivism in cultures where that value is predominant.

Although we were able to conduct time-lagged analyses to determine whether shifts in socio-ecological variables preceded shifts in measures of individualism (or vice versa), such analyses do not allow for unequivocal causal inference. For instance, socio-ecological factors may work interactively to influence changes in individualism over time. Given the complexity and the dynamic nature of such temporal effects, the inferences drawn in the present study might be strengthened by other methodological approaches (e.g., simulations: Oishi & Kesebir, 2012; cross-temporal surveys of values: Hamamura, 2012). To the extent that similar temporal data can be obtained at a more micro level (e.g., states or counties), it would be important to examine changes in individualism at that scale and how they are related to socio-ecological factors. For instance, it would be worth examining whether within-state changes in individualism follow within-state changes in pathogen prevalence. Unfortunately, such temporal data are largely unavailable at present. If different lines of evidence converge, then one may be more confident in drawing conclusions about causality.

Note that some caution is in order when comparing results from such different approaches. For instance, although it seems likely that value surveys would show trends similar to those reported here for cultural-level aggregates of practices and products, it need not be the case that changes in cultural products and practices directly map onto changes in values or traits (for a similar argument, see Na et al., 2010). As individual- and regional-level data continue to be collected, simultaneous measurement of practices and products at cultural, regional, and individual levels will shed light on the interaction among national-, regional-, and individual-level changes in individualism and the relationship of these changes to socio-ecological factors.

We should also note that other factors, such as technology use and environmental complexity, may make meaningful contributions to rising individualism. As of now, such factors are difficult to operationalize in a consistent fashion over a long time span. For instance, how should one compare use of cutting-edge technology in the 1870s (e.g., the telegraph) with use of cutting-edge technology in 2014 (e.g., the driverless car)? Nor is it clear that use of the same technology has the same meaning in different time periods (e.g., use of landline telephones). If future researchers devise methods to quantify the use of technology over long time spans, one would be able to empirically test how technological changes relate to changes in individualism-collectivism.

Finally, as our study was confined to the United States, the relationships we observed may not generalize to other cultural contexts, especially those that are more collectivist in orientation and those in which the patterns of social and ecological changes over the past century have not been the same as in the United States. For example, China has seen a tremendous increase in living standards and the percentage of the population employed as white-collar workers in the past 30 years. If rising SES leads to higher levels of individualism, then one would expect individualism to have increased in China over these years. Yet since the death of Mao, China has also seen a rise in

religiousness. This suggests that individualism may have declined during this period. Thus, examining societal levels of individualism in China may further elucidate the relative strength of SES and secularism as predictors of individualism. Further, although many societies have seen decreases in rates of infectious disease over the past century, others (including some sub-Saharan African countries) have seen increases in pathogen prevalence. It would be informative to examine trends in individualism in the latter countries. Expanding this work to other cultures will help clarify the robustness of our model and may bring to light additional factors that are linked to cultural shifts in individualism-collectivism.

Author Contributions

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Declaration of Conflicting Interests

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Supplemental Material

Additional supporting information can be found at http://pss.sagepub.com/content/by/supplemental-data

Open Practices

All data have been made publicly available via Open Science Framework and can be accessed at osf.io/g2t36. The computer code for the analyses is also available via Open Science Framework, at osf.io/qt6kp. The complete Open Practices Disclosure for this article can be found at http://pss.sagepub.com/content/by/supplemental-data. This article has received the badge for Open Data. More information about the Open Practices badges can be found at https://osf.io/tvyxz/wiki/view/ and http://pss.sagepub.com/content/25/1/3.full.

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