Abstract Previous research addressing the association between leisure and happiness has given rise to the hypothesis that informal social activities might contribute more to happiness than solitary activities. In the current study, we tested how the two types of leisure—social and solitary—contribute to a person’s...
subjective sense of well-being. For the empirical estimate, we used four consecutive quarters of data collected from 533 people over the age of 16, from 13 Tsimane’ hunter-farmer villages in the Bolivian Amazon. Results suggest that only social, not solitary, leisure has a positive and statistically significant association with subjective well-being. The association between solitary leisure and subjective well-being was negligible or negative. Future research should focus on emic definitions of social and solitary time, for solitary time might not always be equivalent to leisure and productive group activities might substitute for social leisure.

Keywords Tsimane’ (Bolivia) · Leisure · Scan observations · Happiness

Happiness, or subjective well-being, refers to how people feel and think about their own lives; it includes their emotional reactions, moods, and judgments regarding their life satisfaction and fulfillment (Argyle 2001; Campbell et al. 1976; Diener 1984; Diener et al. 1999; Kagan 2008; Kahneman et al. 1999; Pavot and Diener 1993). Despite variations across societies and individuals in the value attached to happiness (Biswas-Diener et al. 2005; Eid and Diener 2001; Lloyd and Little 2005; Oishi and Diener 2001; Suh and Oishi 2004), researchers agree that most people value happiness (Diener 2000; Scollon et al. 2002). Previous research has attempted to measure the association between leisure and happiness (Diener 2000; Diener and Lucas 1999; Power et al. 1999; Sirgy et al. 2006; Vittersø 2003; World Health Organization 1998). Researchers have hypothesized that informal social activities (hereafter referred to as social leisure) contribute more to happiness than formal or solitary activities (hereafter referred to as solitary leisure) (Lemon et al. 1972; Longino and Kart 1982; Ryff and Singer 2000). The differential effects of social and solitary leisure on happiness may be explained by the material and psychological benefits that can arise from social activities and interactions (Auld and Case 1997; Iwasaki 2007). For example, Putnam (2000) documents the trend, beginning in the USA at the end of World War II, of spending more and more leisure time alone. Putnam finds evidence that the increase in solitary leisure is related to the breakdown of social capital—trust, safety nets, and norms of reciprocity that enable people to act collectively. Similarly, Csikszentmihalyi (1997) finds that the most positive experiences people report are usually those that involve family and friends, and Lloyd and Auld (2002) find that people who engage in social activities more frequently are more satisfied with the psychological benefits they derive from leisure and experience higher levels of happiness than people who participate less often in social activities.

Examples of leisure activities that include social interactions are conversations with friends and family and participation in community or religious activities (Fernandez-Ballesteros et al. 2001; Leung and Lee 2005; Lloyd and Auld 2002). Commonly, ordinary daily events offer opportunities for social leisure. For example, in her study in India, Nagla found that the consumption of food is “an important part of leisure” because “meal times are usually social occasions when people not only satisfy their appetites but also converse and enjoy each other’s company” (Nagla 2005:24). Social leisure activities have been shown to have a positive influence on subjective well-being across a diverse range of social groups, including middle-aged
at-risk women (Benum et al. 1987), the aged (Siegenthaler and Vaughan 1998), the unemployed (Iwasaki and Smale 1998), and the dissatisfied employed (Winefield et al. 1992). Although researchers have highlighted the contribution of social leisure to happiness, the field still lacks research on the differential contributions of social and solitary leisure to happiness.

Here we test how the two types of leisure—social and solitary—contribute to happiness. To do so, we draw on panel information from the Tsimane’, a highly autarkic and low-income society of foragers and farmers in the Bolivian Amazon. For the empirical analysis, we used panel data collected over 15 months (August 2002–October 2003), which we aggregated into quarterly observations. Quarterly data included spot observations of behavior (hereafter, scans) and two measures of happiness.

Definitions and Estimation Strategy

We use the terms “happiness” and “subjective well-being” synonymously (Diener et al. 2002). Previous research has measured subjective well-being in a variety of ways, including survey measures for the emotional components, sampling of moods and emotions over time, observations of smiling, and informant reports from family and friends. We measured subjective well-being through self-reports and frequency of smiles during interviews. Our first indicator of subjective well-being measures an individual’s achievement of what the culture defines as a good life. We first asked Tsimane’ what made them happy and then developed a metric to measure each individual’s attainment of the locally defined ideal of happiness. Our second measure of subjective well-being is based on observations of smiling. Social psychologists and ethologists have found that, across cultures, the frequency of smiling is positively associated with self-reported happiness (Ekman 2002; Ekman and Davidson 1993; Fridlund 1994) and enjoyment (O’Quin and Arono 1981).

According to Chick (1998:115), researchers have conceptualized leisure in three distinct ways (see Chick 1998 for a full list of references). First, leisure has been defined as free or unobligated time. Second, leisure has been described as activities apart from obligations. Last, leisure has also been considered a state of mind, a condition defined by the individual. For this article, we follow previous research on the topic (Rubin et al. 1986) and operationally define leisure as the frequency count of observed activities that—to the eye of the Western coder—make no direct contribution to production or reproduction. We use this operationalization because, as in many other societies (Chick 1998), the Tsimane’ do not have a specific term that translates as leisure, although they understand the concept when it is explained to them. The Tsimane’ term jam jun’taqui is used when a person has nothing to do or is doing nothing in particular; similarly the terms itsi unedye and tupudy’e vavsi describe situations in which a person does not have any obligation. We differentiate between solitary and social leisure. Under solitary leisure we included observations in which subjects were resting alone and not engaged in any social interaction (but not people who were ill). Under social leisure we included observations of behaviors such as visiting kin and friends, talking, playing soccer, and social drinking.
We used the following equation to explore the link between happiness and solitary versus social leisure:

\[ Y_{ihvt} = \alpha + \gamma SL_{ihvt} + \lambda AL_{ihvt} + \delta I_{ihvt} + \zeta H_{hvt} + \eta C_v + \varepsilon_{ihv} \]  

(1)

\( Y_{ihvt} \) captures the happiness of a person: \( i \) is the person, \( h \) the household, \( v \) the village, and \( t \) the time of observation. \( SL_{ihvt} \) and \( AL_{ihvt} \) refer to the amount of time in a particular quarter that a person spent in social (SL) and solitary (AL) leisure. \( I_{ihvt} \) is a vector of observed variables for the individual, which directly affects the outcome and the allocation of time to leisure. \( H_{hvt} \) stands for household size. \( C_v \) is a set of village dummy variables to control for variables that could directly affect happiness and leisure (e.g., proximity to towns). \( \varepsilon_{ihv} \) is a random, person-specific error term.

We used three types of regressions to ensure robustness: ordinary least-squares (OLS), individual fixed-effect, and two-stage least squares. We used OLS as a benchmark, and an individual fixed-effect model (Biddle and Hamermesh 1998; Roszell et al. 2001) to remove from the estimation all traits that remained stable over time and might affect leisure and happiness (Diener et al. 2003). Finally, after a standard test for the adequacy of the instrument, we used a two-stage instrumental variable model to reduce endogeneity biases (Angrist and Krueger 2001). We used the number of tools (e.g., machete, axe) owned or borrowed by the subject as instrumental variables for leisure. Access to production technologies might increase labor productivity and therefore change the amount of time allocated to work and leisure, but it should not affect happiness (except by increasing leisure). Furthermore, some production technologies (i.e., bows) improve the ability to capture wildlife, which in turn is associated with social drinking and happiness among the Tsimane’ (Huanca 2008).

The Setting and the People

The Tsimane’ are a native Amazonian society of about 8,000 people, most of whom live in the department of Beni, Bolivia. Tsimane’ subsistence centers on hunting, fishing, and slash-and-burn farming (Vadez et al. 2004). Several recent publications have described the ethnographic and historical background of the people (Daillant 2003; Huanca 2008), so here we provide a short description of how Tsimane’ define happiness and how they allocate their time.

Tsimane’ View of Happiness

We used free listings to elicit the full range of items that Tsimane’ associate with a happy life (Weller 1998). We asked 35 individuals from 12 villages to list “things that make you happy.” Individuals were selected across age and gender (Bernard 1995).

From the responses, we calculated the percentage of people who mentioned each reason, the average rank of each reason across lists, and the saliency (Smith’s S) of each reason, which is an index that captures, on a scale from zero to one, the importance of an item across all of the lists (Bernard 1995). Tsimane’ listed 37
causes of happiness (Table 1). Spending time with close family, a type of social leisure, was ranked first ($S=0.56$), followed by having a good crop ($S=0.46$) and enough to eat ($S=0.35$), particularly meat ($S=0.35$). Other types of social leisure that contributed to Tsimane’ happiness included drinking a home-fermented native beverage ($S=0.24$), receiving visitors ($S=0.21$), and visiting kin ($S=0.19$). Our findings agree with ethnographic research in the area which suggests that visiting is a key aspect of conviviality among the Tsimane’ and that temporary visits allow for the establishment and maintenance of social relations (Ellis 1996). Respondents did not mention any solitary leisure activity as a source of happiness.

Leisure

We used scans (described shortly) to characterize the Tsimane’ time budget (Table 2). Analysis of these scans suggested that Tsimane’ allocate a large share of time to both solitary and social leisure, a finding consistent with much that has been said about the amount of leisure time enjoyed by part- and full-time foragers (Sackett 1996). Tsimane’ spend almost a third (31.78%) of their day in solitary and social leisure, with men having slightly more leisure time (34.91%) than women (28.53%).

Tsimane’ spent 13.7% of their time in solitary leisure and slightly more time (18.1%) in social leisure activities. For example, the Tsimane’ spend 12.3% of their day visiting friends and kin and 3.6% drinking home-brewed beverages. Households prepare and invite guests to partake in home-brewed beverages when they have game or fish to share. In the absence of excess meat, many households continue to make the beverage, and any villager can walk into a house serving a home-brewed beverage and expect to be served. Other social leisure activities include visiting

Table 1 The ten major sources of happiness for the Tsimane’. Free listing ($n=35$; Tsimane’ 16 years of age or older)

<table>
<thead>
<tr>
<th>Source of happiness</th>
<th>Observations</th>
<th>% a</th>
<th>Average ranking b</th>
<th>S c</th>
</tr>
</thead>
<tbody>
<tr>
<td>To spend time with close family</td>
<td>24</td>
<td>69</td>
<td>2.75</td>
<td>0.56</td>
</tr>
<tr>
<td>To have a good crop</td>
<td>25</td>
<td>71</td>
<td>4.00</td>
<td>0.46</td>
</tr>
<tr>
<td>To have good food</td>
<td>19</td>
<td>54</td>
<td>3.89</td>
<td>0.35</td>
</tr>
<tr>
<td>To succeed in the hunt</td>
<td>23</td>
<td>66</td>
<td>5.26</td>
<td>0.35</td>
</tr>
<tr>
<td>To drink home-brewed beverage</td>
<td>14</td>
<td>40</td>
<td>4.93</td>
<td>0.24</td>
</tr>
<tr>
<td>To succeed in fishing</td>
<td>16</td>
<td>46</td>
<td>4.87</td>
<td>0.23</td>
</tr>
<tr>
<td>To have good health</td>
<td>15</td>
<td>43</td>
<td>6.00</td>
<td>0.21</td>
</tr>
<tr>
<td>To have visitors</td>
<td>12</td>
<td>34</td>
<td>4.75</td>
<td>0.21</td>
</tr>
<tr>
<td>To acquire commercial goods</td>
<td>17</td>
<td>49</td>
<td>6.71</td>
<td>0.19</td>
</tr>
<tr>
<td>To visit kin living in another house</td>
<td>10</td>
<td>29</td>
<td>2.00</td>
<td>0.19</td>
</tr>
</tbody>
</table>

a Percentage of people who mentioned each reason
b Average rank in which each reason was mentioned across lists
c Saliency or weighted average of the inverse rank of an item across multiple free lists, where each list is weighted by the number of items on the list
people who are not Tsimane’ (1%), playing soccer (0.5%), drinking commercial alcoholic beverages (0.5%), and chatting (0.2%).

**Methods**

Our data are taken from a longitudinal biocultural study in progress since 2002 on the effect of expanding markets on conservation and well-being within a highly autarkic population that is gaining a foothold in the market economy (http://people.brandeis.edu/~rgodoy/). For the current study, we used data collected over 15 months (or 5 quarters, from August 2002 to October 2003). Except for the variables of sex, age, and schooling, we dropped all information from the first quarter because this period was used to pilot-test methods of data collection, train interviewers and translators, and validate instruments. Scans were done once a week and survey data were collected once a quarter. We used Tsimane’ translators for the interviews.
Sample

The information comes from the 13 Tsimane' villages along the river Maniqui, in the department of Beni. Villages differed in their proximity to the market town of San Borja (population ~19,000) and degree of market exposure. We interviewed all adults (age 16 and older) in these villages, for a total of 533 subjects (280 women and 253 men). The population in the 13 villages accounts for ~20% of the total Tsimane’ population. Because we used information from four quarters disaggregated by quarter, the sample for the regression analysis includes about 1,860 observations.

Dependent Variable: Happiness

We used information from the listing exercise to generate a questionnaire. We first selected the seven most salient items from free listing (Table 1) and then generated seven questions about the occurrence of those events in the week prior to the interview. For example, Tsimane’ listed “to succeed in the hunt” as a factor that makes them happy, so we asked, “During the last week, how many times did you/your husband succeed in the hunt?” and coded responses as (1) none, (2) a few times, or (3) many times. We used the same questionnaire with all of the participants at every quarter so we could generate an individual/quarterly score of happiness. To generate the score we multiplied responses to the questionnaire by the saliency (Smith’s S) of the reason; items that contribute more to Tsimane’ happiness are weighted more heavily in the score of happiness.

Our second measure of happiness was based on observations of the subjects. Every quarter, we conducted individual-level interviews lasting about 45 min on a variety of topics related to the socioeconomic condition and health of the person and her/his family. At the end of the quarterly interviews, interviewers noted whether the subject: (1) neither laughed nor smiled during the interview (somber), (2) only smiled, (3) smiled and laughed, or (4) laughed openly and frequently (guffaw). The variable “smile” thus captures a range of intensity in emotive expressions. We made a distinction between laughter and smile because people might use the two responses in different contexts (Kraut and Johnston 1979), but unfortunately we did not train surveyors to distinguish between voluntary and involuntary smiles (Ekman et al. 1990). All quarterly interviews were performed by the same interviewer. In a previous publication, we tested whether the propensity to smile or laugh was affected by the interviewer, and found that it was not (Godoy et al. 2005). In regression analysis, we used each of the quarterly observations independently.

A Pearson correlation between the two measures of happiness across the four quarters show that the two variables were correlated in a positive, weak, but statistically significant way ($r=0.07, p=0.002, n=2041$).

Explanatory Variable: Leisure

To operationalize leisure, we used data generated by a combination of scans and short surveys. Every week on a day chosen at random, we conducted scans during 3-hour blocks of time between 7AM and 7PM, also chosen at random. Half of the
villages were scanned 1 day and the other half on a different day. We performed 7.27 days of spot observations each month (median=7.00 days; SD=1.73; total=80 days of spot observations for the 11 months of research), so our measure captures variation in time allocation throughout the year. Following standard practice (Sackett and Johnson 1998), we noted what subjects were doing at the instant we spotted them. We then asked the subjects to list their main activities during the previous 24 h. On average, we scanned participants 4.1 times/quarter (SD=3.05). In the regressions, we entered leisure as a percentage of all observations (from scans and recalls) in nonproductive activities during the quarter.

Control Variables

During the first quarter of research, we collected data on age, sex, and maximum school grade attained. For each quarter, we recorded income (or the monetary earnings from wage labor and the sale of goods, as well as the value of goods received in barter during the 2 weeks before the day of the interview) and health (or the self-reported number of days ill during the 2 weeks prior to the day of the interview). Other controls in the regression analysis included dummy variables for quarters (n=4–1=3) and villages (n=13–1=12).

Instrumental Variables

We carried out formal tests for the adequacy of production technologies as instrumental variables for leisure. In a society where the maximization of production might not be the main goal, production technologies might be associated with leisure because they should reduce the amount of time allocated to work, potentially increasing the time devoted to leisure. To test the assumption, we regressed solitary leisure against production technologies and found that the number of carrying bags, grinding stones, and bows owned by the individual bore a statistically significant positive relation to solitary (joint test, F=5.43, p=0.0001) but not to social leisure. None of the instrumental variables (alone or in combination) bore a statistically significant relation with smiles or reported happiness at the 10% significance level or lower, so we concluded that production technologies are reasonable instrumental variables for solitary leisure.

Results

Table 3 contains the definitions and summary statistics of the variables used in the regression analysis, as well as representative data from the second quarter of observations.

Table 4 shows two important findings. First, social leisure bears a positive association with both measures of happiness, particularly after we use an instrumental variable for leisure. Second, solitary leisure has no significant association with happiness as measured by smiles. In the models using instrumental variables for solitary leisure, solitary leisure has a negative and statistically significant association with happiness as measured by self-reports.
We found that social leisure has a positive association with both measures of happiness in the naive OLS estimates. For example, in Table 4 column [a], the result of the OLS regression with smiles suggests that a 10% increase in the amount of social leisure is associated with a 0.039-point increase in the measure of smiles (e.g., going from somber to smiling, or going from smiling to laughter; \( p=0.02 \)). When using results from the survey as the outcome variable, we found that a 10% increase in the amount of social leisure is associated with a 0.023-point increase in the score of happiness. When we remove individual fixed effects, the magnitude of the coefficients decreases and loses statistical significance, although it remains positive. In the fixed-effect models, the coefficient from social leisure drops from 0.39 to 0.29 when smile is used as the outcome and from 0.23 to 0.20 when answers to the survey are used as the outcome. Once we use an instrumental variable for solitary leisure, we find that social leisure bears a positive association with both measures of happiness (columns [e] and [f]). The coefficient for social leisure when using smile as the outcome resembles the coefficient of the benchmark model. A 10% increase in the amount of social leisure time is associated with a 0.035-point increase in the smile variable (\( p=0.04 \)) versus a 0.039-point increase in the benchmark mode (column [e]). When results from the survey are used as explanatory variables, the

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### Table 3 Definition and summary statistics of variables used in regression analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Observations</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Outcome variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smiling</td>
<td>Smiling during quarterly interviews</td>
<td>537</td>
<td>2.54</td>
<td>0.77</td>
</tr>
<tr>
<td>Somber</td>
<td></td>
<td>39</td>
<td>7.26%</td>
<td></td>
</tr>
<tr>
<td>Smiling</td>
<td></td>
<td>223</td>
<td>41.53%</td>
<td></td>
</tr>
<tr>
<td>Laughter</td>
<td></td>
<td>223</td>
<td>41.53%</td>
<td></td>
</tr>
<tr>
<td>Guffaw</td>
<td></td>
<td>52</td>
<td>9.68%</td>
<td></td>
</tr>
<tr>
<td>Happiness</td>
<td>Score based on self-report of events that contribute to Tsimane’ happiness. Range: 0–4</td>
<td>531</td>
<td>2.23</td>
<td>0.66</td>
</tr>
<tr>
<td><strong>II. Explanatory variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leisure (measured during scans)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>Total number of times the participant was observed in social activities unrelated to work</td>
<td>498</td>
<td>0.066</td>
<td>0.142</td>
</tr>
<tr>
<td>Solitary</td>
<td>Total number of times the person was idle</td>
<td>498</td>
<td>0.095</td>
<td>0.181</td>
</tr>
<tr>
<td>Age</td>
<td>Age of participant in years</td>
<td>533</td>
<td>35.17</td>
<td>15.99</td>
</tr>
<tr>
<td>Schooling</td>
<td>Maximum school grade achieved</td>
<td>533</td>
<td>1.816</td>
<td>2.23</td>
</tr>
<tr>
<td>Sex</td>
<td>Sex of subject: male=1; female=0</td>
<td>533</td>
<td>0.471</td>
<td>0.499</td>
</tr>
<tr>
<td>Health</td>
<td>Total number of self-perceived days ill in preceding 2 weeks</td>
<td>528</td>
<td>5.308</td>
<td>7.044</td>
</tr>
<tr>
<td>Income</td>
<td>Monetary earnings and value of barter in preceding 2 weeks in bolivianos ($1 US=7.45 bolivianos)</td>
<td>529</td>
<td>91.464</td>
<td>387.73</td>
</tr>
<tr>
<td>Household size</td>
<td>Number of people living in the household during the quarter</td>
<td>56</td>
<td>6.0</td>
<td>3.04</td>
</tr>
</tbody>
</table>

Note: Values are only for the second quarter of observations.
Table 4 Results of regressing happiness against solitary and social leisure. Regressions include dummy variables for quarters and villages, and a constant (not shown)

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>OLS [a]</th>
<th>[b]</th>
<th>Fixed-effect [c]</th>
<th>[d]</th>
<th>Instrumental Variables for Solitary Leisure [e]</th>
<th>[f]</th>
<th>[g]²</th>
<th>[h]²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smile</td>
<td>Survey</td>
<td>Smile</td>
<td>Survey</td>
<td>Smile</td>
<td>Survey</td>
<td>Smile</td>
<td>Survey</td>
</tr>
<tr>
<td>Social</td>
<td>0.392** (0.163)</td>
<td>0.230* (0.133)</td>
<td>0.295 (0.193)</td>
<td>0.206 (0.152)</td>
<td>0.359* (0.201)</td>
<td>0.463** (0.204)</td>
<td>0.353** (0.175)</td>
<td>0.277 (0.173)</td>
</tr>
<tr>
<td>Solitary</td>
<td>−0.059 (0.125)</td>
<td>−0.079 (0.101)</td>
<td>0.109 (0.137)</td>
<td>0.088 (0.107)</td>
<td>0.235 (1.104)</td>
<td>−2.704** (1.33)</td>
<td>0.188 (1.111)</td>
<td>−2.678** (1.324)</td>
</tr>
<tr>
<td>Age</td>
<td>0.002 (0.001)</td>
<td>0.003*** (0.001)</td>
<td><em>b</em></td>
<td><em>b</em></td>
<td>0.002* (0.001)</td>
<td>0.002* (0.001)</td>
<td>0.002* (0.001)</td>
<td>0.002* (0.001)</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.001 (0.010)</td>
<td>−0.018** (0.008)</td>
<td><em>b</em></td>
<td><em>b</em></td>
<td>0.001 (0.009)</td>
<td>−0.019** (0.008)</td>
<td>0.0009 (0.009)</td>
<td>−0.019** (0.008)</td>
</tr>
<tr>
<td>Male</td>
<td>0.145*** (0.044)</td>
<td>0.162*** (0.036)</td>
<td><em>b</em></td>
<td><em>b</em></td>
<td>0.162** (0.066)</td>
<td>0.160** (0.066)</td>
<td>0.033 (0.075)</td>
<td>0.014*** (0.002)</td>
</tr>
<tr>
<td>Days ill</td>
<td>−0.002 (0.003)</td>
<td>−0.013*** (0.002)</td>
<td>−0.004 (0.003)</td>
<td>−0.006 (0.002)**</td>
<td>−0.002 (0.003)</td>
<td>−0.014*** (0.002)</td>
<td>−0.002 (0.003)</td>
<td>−0.014*** (0.002)</td>
</tr>
<tr>
<td>Income</td>
<td>&lt;0.0001 (0.003)</td>
<td>&lt;−0.0001 (0.00007)</td>
<td>&lt;−0.0001 (0.00001)</td>
<td>&lt;0.0001* (0.00009)</td>
<td>&lt;0.0001 (0.0001)</td>
<td>&lt;−0.0001 (0.00009)</td>
<td>&lt;0.0001 (0.0001)</td>
<td>&lt;−0.0001 (0.00009)</td>
</tr>
<tr>
<td>Household size</td>
<td>−0.003 (0.006)</td>
<td>0.003 (0.005)</td>
<td>−0.008 (0.040)</td>
<td>−0.008 (0.031)</td>
<td>−0.002 (0.005)</td>
<td>0.004 (0.005)</td>
<td>−0.001 (0.005)</td>
<td>0.0007 (0.005)</td>
</tr>
<tr>
<td>Observations (N)</td>
<td>1,860</td>
<td>1,852</td>
<td>1,860</td>
<td>1,852</td>
<td>1,859</td>
<td>1,851</td>
<td>1,859</td>
<td>1,851</td>
</tr>
</tbody>
</table>

For definition of variables see Table 3. Standard errors in parentheses

*a In columns [g] and [h] the definition of social leisure includes communal labor activities

*b Variables intentionally dropped from the analysis

*, **, and *** significant at the 10%, 5%, and 1% levels, respectively
coefficient of the association between social leisure and happiness doubles the coefficient of the benchmark model: a 10% increase in the amount of social leisure time is associated with a 0.046-point increase in the self-reports of happiness \((p=0.02)\) versus a 0.023-point increase in the OLS estimates (column [f]).

Second, we found that solitary leisure did not contribute to either measure of happiness in the OLS and fixed-effect regressions. In those models, the magnitude of the coefficient for solitary leisure was lower than the effect of social leisure. For example, in column [b], the coefficient for social leisure is almost four times larger than the coefficient for solitary leisure. When using instrumental variables, solitary leisure is not associated with happiness measured by smiles, but it is associated with happiness as measured by self-reports. For example, in column [f] we found that a 10% increase in the variable that measures solitary leisure is associated with a 0.27-point decrease in self-reports of happiness \((p=0.04)\). Since the average informant was observed 9.5% of the time in solitary leisure and self-reports of happiness ranged from 0 to 4, an increase of the magnitude of the average amount of solitary leisure would be associated with about a 5% decrease in self-reports of happiness.

In columns [g] and [h], we ran additional instrumental variable models while changing the definition of social leisure. The division between leisure and productive time is individually and culturally constructed. For example, among the Tsimane’ we do not find a marked division between leisure and work activities. When Tsimane’ gather together to drink home-brewed beverages, productive activities such as fixing arrows or weaving palm often take place at the same time. We do not have data to evaluate what activities are considered leisure, so to test the robustness of the results we ran an additional instrumental variable model while changing the definition of social leisure. To our initial definition we added communal and cooperative activities, such as communal meetings or work or providing help to kin or friends (columns [g] and [h]). We did so because time spent in socially productive activities might be a substitute for social leisure time. When the new definition of social leisure was employed, results that used smiles as a proxy for happiness resembled results in column [e], but there was a decrease in the coefficient and statistical significance of the regression using self-reports as a measure of happiness (column [f]). The coefficient and statistical significance of solitary leisure resemble those in columns [e] and [f].

Discussion and Conclusion

We now discuss four major substantive findings: First, leisure time bears a positive and statistically significant association with happiness only when leisure includes a social component. Second, depending on the model and the proxy for happiness used, we found no association, or a negative association, between solitary leisure and happiness. Third, neither social nor solitary leisure is associated with happiness once we control for time-invariant characteristics of the subject with the fixed-effect models. Last, among the Tsimane’ the use of technology bears a positive association to solitary, but not to social, leisure.

Our first finding, that social leisure bears a positive association with happiness, dovetails with findings from previous research in industrial societies suggesting that
measures of participation in social leisure activities (e.g., frequency of visiting, going out with friends, and attending clubs and organizations) are good predictors of subjective well-being (Lloyd and Auld 2002; McCormick and McGuire 1996; Russell 1987). Engagement in social leisure serves to integrate people into groups and networks, providing opportunities for both social interactions and material exchanges. Social interactions are a potential source of numerous psychological benefits, including improved self-esteem, and personal and social competencies (Auld and Case 1997). Material exchanges can be an outcome of the increase in social capital associated with social leisure. As noted above, growing evidence suggests that in industrial societies, the increase in solitary leisure is associated with the breakdown of social capital. Research in industrial societies also suggests that social capital bears a positive association with indicators of well-being, such as health (Kawachi 2002) and economic growth (Knack and Keefer 1997). Social leisure might contribute to social capital, which in turn is associated with well-being.

Second, we found that the association between solitary leisure and subjective well-being was negligible, except when measuring subjective well-being through self-reports. In that case, the association was found to be negative. Ethnographic information provides a potential explanation for the finding. When inquiring about sources of happiness, we found that Tsimane’s sense of happiness is centered around spending time with others and being successful in productive activities that often take place in a group (e.g., hunting, fishing). Tsimane did not mention any solitary leisure activity as a source of happiness. Because we lack an emic definition of leisure, our measure of leisure had to be based on researchers’ observations and on our own definition of leisure. It is possible that for the Tsimane, time spent alone does not represent a form of leisure. If so, there should be no reason to expect a positive association between time spent alone and subjective well-being.

The third finding that deserves discussion is the fact that the association between social leisure and happiness loses its statistical significance after we control for fixed effects. Researchers debate the stability of happiness or subjective well-being over time. A growing literature in psychology suggests that subjective well-being is fairly stable over time, that it is strongly correlated with stable personality traits (DeNeve and Cooper 1998; Diener et al. 1999), and that socioeconomic factors such as health, income, and educational background account for only a small amount of the variance in measures of subjective well-being (Diener et al. 2003). For example, people with traits such as agreeableness, conscientiousness, self-esteem, and optimistic dispositions often report higher levels of subjective well-being than people who lack those traits (DeNeve and Cooper 1998). However, other researchers have found that subjective well-being does not rebound after major life events. For example, individuals seem not to be able to recover from losing a job, although they do adapt to losing a partner (Clark et al. 2008; Kahneman et al. 1999). Our data appear to support the hypothesis that the personality of the subject can help to explain the association between leisure and subjective well-being. However, the finding must be read with caution because our estimations are based on a panel spanning only four quarters and might mainly be picking up seasonal variation. Fixed-effect models rely on changes within individuals, and those might take a longer time to develop.

The last finding that deserves discussion relates to the association found between use of technology and leisure. Following clues from a classical work (Sharp 1952)
we assumed that production technologies could exhibit a positive association with leisure because technology should reduce the amount of time allocated to work, potentially increasing the time devoted to leisure. A test of the assumption showed a positive association between technology and solitary, but not social, leisure. A potential explanation for these different associations lies in findings from the work of Rubin et al. (1986). In an article regarding the adaptive qualities of leisure among four Amazonian groups, Rubin and colleagues found that the four groups worked relatively similar amounts of time although two lived in relatively rich environments and the other two in relatively degraded environments. The authors argue that the four societies used leisure to compensate for caloric intake, with two groups spending more time in passive leisure while the other two spent more time in active leisure. If we equate our definition of solitary and social leisure with Rubin et al.’s definitions of passive and active leisure, the association between solitary leisure and technology might be interpreted as two responses to a third factor: environmental condition. Thus, the Tsimane™ might be using solitary leisure and technology as complementary adaptive mechanisms to the environment. The explanation remains a hypothesis, however, because we did not collect data on caloric intake to test it.

We conclude with a suggestion for further research on the link between leisure time and subjective well-being. Researchers need to pay more attention to subjective, or emic, definitions of social and solitary leisure. Solitary time might not always be equated with leisure, and productive activities taking place in a group might be a substitute for social leisure. Future research could investigate, for example, whether people who perform productive activities more frequently in groups are happier than those who more frequently work alone. This type of research might help determine whether it is social leisure, or simply being social, that is associated with happiness.

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