

Signaling by consumption in a native Amazonian society[☆]

Ricardo Godoy^{a,*}, Victoria Reyes-García^{a,b}, Tomás Huanca^a, William R. Leonard^c,
Thomas McDade^c, Susan Tanner^c, Vincent Vadez^a, Craig Seyfried^a

^aHeller School for Social Policy and Management, Brandeis University, Waltham, MA 02454-9110, USA

^bICREA and Institut de Ciència i Tecnologia Ambiental, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Spain

^cDepartment of Anthropology, Northwestern University, Evanston, IL 60208, USA

Initial receipt 22 February 2006; final revision received 18 August 2006

Abstract

People signal status by producing, distributing, or consuming goods. Behavioral ecologists working with foragers stress signaling by production (e.g., supply of wildlife), whereas economists working in industrial economies stress signaling by individual consumption or expenditures. As foraging economies experience economic transformations, one expects greater reliance on individual consumption compared with production to signal status. We test two hypotheses: if people signal by individual consumption, they will allocate a higher share of their monetary expenditures to luxuries or to visible durable goods (Hypothesis 1) and the propensity to signal by individual consumption will be more salient among people closer to market towns (Hypothesis 2). To test the hypotheses, we draw on data from a native Amazonian society of foragers and slash-and-burn farmers in Bolivia (Tsimane') undergoing increasing exposure to the market economy. The sample included 161 women and 257 men 16+ years of age in 13 villages. The dependent variable was the share of total monetary expenditures allocated to different types of durable goods (e.g., clothing, luxuries, highly visible and less visible goods) during the previous year. Separate OLS regressions were used for women and men. We found support for Hypothesis 1. Higher levels of total monetary expenditures bore a positive association with the share of expenditures allocated to luxury goods and a negative association with expenditures allocated to less visible durable goods. Only among women did we find a positive association between total expenditures and the share of expenditures allocated to highly visible goods. We found no support for Hypothesis 2.

© 2007 Elsevier Inc. All rights reserved.

Keywords: Signaling; Tsimane'; Bolivia; Status; Consumer expenditure

1. Introduction

Because people form part of social groups stratified by status, they spend time and resources communicating their status to others. In relatively simple economies, people equate status with reproductive potential and spend time and resources signaling their reproductive potential by displaying their skills as providers of food (Gintis, Smith, & Bowles, 2001; Hagen & Bryant, 2003; Hawkes &

Bliege Bird, 2002; Henrich & Gil-White, 2001; Scaglione, 1999; Sosis, 2003). In industrial economies, people equate status with earnings potential and signal their earnings potential through public displays of monetary wealth and monetary income.

To communicate their status, people can rely on several strategies, including producing or consuming goods and services or doing acts with cultural visibility (e.g., warfare). Behavioral ecologists working in foraging societies have focused on how people signal their status through production or through the public supply and distribution of wildlife (Bliege Bird & Bird, 1997; Bliege Bird & Smith, 2005; Blurton-Jones, 1984; Patton 2005; Smith & Bliege Bird, 2000; Wilson, 1998; Winterhalder, 1996).

In contrast, a long tradition of economists, from Marx and Veblen to contemporary researchers doing marketing studies (Van Boven, 2005) in industrial economies, has

[☆] Research was funded by grants from the programs of Biological and Cultural Anthropology of the National Science Foundation (0134225, 0200767, and 0322380).

* Corresponding author. Heller School for Social Policy and Management, Brandeis University, Waltham, MA 02454-9110, USA. Tel.: +1 781 736 2784 2770; fax: +1 781 736 2774.

E-mail address: rgodoy@brandeis.edu (R. Godoy).

focused on how people use individual consumption or expenditures to signal status. In a recent paper, Heffetz (2004) provides a formal test of the idea that people in the United States signal by individual consumption. Heffetz notes that because people form part of social groups, they derive satisfaction both from the direct act of individual consumption and from how others perceive their individual consumption. Heffetz develops a culturally specific index of expenditure visibility for 31 goods and services in the United States that captures how fast respondents reported noticing a neighbor's expenditure on a good or service. He found that people invested in positional or luxury goods with greater cultural visibility; the cultural visibility of goods explained 20% of the variation in total expenditures.

Here, we build on insights from behavioral ecologists and economists and present a theory and hypotheses about how signaling might work in a foraging–farming economy as it experiences lifestyle changes from market exposure. The contribution fills a gap in signaling research because prior studies have focused either on small-scale preindustrial societies or on industrial societies, not in societies undergoing change from a preindustrial to an industrial and service base.

Market exposure should produce changes in what people signal and in how they signal it. In small-scale preindustrial societies, people signal their reproductive potential through public displays of their skills as producers or their ability to supply and distribute goods. Because people produce what they consume and consume what they produce, a focus on production as a way of signaling probably captures accurately a person's social status. However, as societies and economies grow in complexity, production and consumption diverge. Most people stop producing goods and instead earn monetary income from employment in industries and services. As a result, the chief way of signaling status in industrial economies will center on public displays of the uses of monetary wealth and income. With increasing market exposure, one expects less reliance on signaling through production than consumption. The two forms of signaling will likely coexist in any economy, but their relative importance will vary as we move along an idealized preindustrial-to-market continuum.

Market exposure should produce ambiguity in what and how to signal status. People in small-scale preindustrial societies experiencing rapid lifestyle changes might be unclear about the type of productive activities or consumption patterns to use to signal their status. As economies modernize, one expects a shift in both what people decide to signal—skills as producer or reproductive potential versus monetary wealth and monetary income—and in how they signal it (production vs. individual consumption). Thus, a comprehensive understanding of signaling in societies undergoing economic transformations will require attention to both production and consumption; an exclusive focus on one or on the other will yield a partial view.

2. Aims and hypotheses

The goal of this article is to examine whether adults in a transition economy from foraging and slash-and-burn farming to cash cropping and wage labor use monetary expenditures in durable goods to signal their status. We focus on monetary expenditures because we do not have information on production or on the purchase of services at the level of the individual. As a dependent variable, we use the share of monetary expenditures allocated to different durable goods during the year before the day of the interview. We focus on durable goods to minimize random measurement errors from recall bias because durable goods have greater salience than other consumption goods; they are larger, more visible, and often more expensive than nondurable consumption goods (e.g., food).

Drawing on data from the Tsimane', a foraging and farming society of native Amazonians in Bolivia, we test two hypotheses:

Hypothesis 1. If people signal by consumption, then people should allocate a higher share of their monetary expenditures to durable goods with visibility or to luxury goods compared with monetary expenditures allocated to durable goods with less visibility or to necessities.

Hypothesis 2. People nearer market towns will be more likely to signal by consumption than people farther away from market towns.

3. Empirical strategy

3.1. Estimation strategy

Since we had only cross-sectional information on yearly expenditures among adults (16+ years of age) for 1 year, 2004, we use Expressions (1) and (2) to test the hypotheses. We ran separate regressions for women and men because research suggests that women and men differ in their uses of monetary income (Duflo & Udry, 2003). To test Hypothesis 1, we estimate the parameters of the following expression:

$$Y_{gihv} = \alpha + \lambda \text{expenditures}_{ihv} + \theta \text{age}_{ihv} + \sigma \text{wealth}_{ihv} + \rho \text{village}_v + \beta \text{size}_{hv} + \varepsilon_{gihv}. \quad (1)$$

In Expression (1), Y is the dependent variable and stands for the share of yearly monetary expenditure in category g of durable goods made by person i of household h in village v . By category, we mean a class or type of durable goods (e.g., clothing, transport); the Appendix contains a list of the categories used. Covariates of the person include the person's total monetary expenditures in all durable goods during the previous year, the age (in years) of the person who made the expenditure, and the person's wealth, which we equate with the monetary value of a basket of physical assets owned by the subject. The variable village stands for 12 village dummy variables ($n = 13 - 1 = 12$), which we use to purge estimates from the possible effect of village prices,

lending or borrowing rates, or any other fixed attribute of the village that might bear a link with total monetary expenditures and with the share of expenditures allocated to different categories of goods. The variable size stands for the number of people living in the household at the time of the survey. We express wealth, total expenditures, and household size in logarithms to facilitate the reading of coefficients. ε is an error term with standard properties.

We test Hypothesis 1 by examining the association between (a) the dependent variable (Y)—the share of a person's monetary expenditures allocated to highly visible durable goods or to luxuries—and (b) the level of total monetary expenditures made by the person as an explanatory variable. If Hypothesis 1 is true, then a regression with the share of monetary expenditures allocated to *highly visible* durable goods as a dependent variable (Y) should produce an estimate for λ larger than zero. If Hypothesis 1 is true, then a regression with the share of monetary expenditures allocated to *less visible* durable goods as a dependent variable (Y) should produce a lower estimate for λ than in the previous case. Furthermore, a regression with the share of monetary expenditures allocated to luxury goods as a dependent variable (Y) should produce a coefficient of total monetary expenditures, λ , significantly different from zero.

To test Hypothesis 2, we add an interaction term to Expression (1) and test whether the coefficient of the interaction term is significantly different from zero. To create the interaction term, we interacted the variable expenditures with a dummy variable for market exposure (market) that took the value of 1 if the person lived near the market town, and 0 otherwise. If Hypothesis 2 is true, then δ in Expression (2) should be greater than 0, particularly when we restrict the analysis to luxury goods.

$$Y_{gihv} = \alpha + \delta \text{expenditure} \times \text{market}_{ihv} + \lambda \text{expenditures}_{ihv} + \theta \text{age}_{ihv} + \sigma \text{wealth}_{ihv} + \rho \text{village}_v + \beta \text{size}_{hv} + \varepsilon_{gihv} \quad (2)$$

3.2. Potential biases

We next note three biases in the estimations. First, 28 of the adult men (9.82% of the sample of men), 128 of the adult women (44.29% of the sample of women), or 156 of all 574 adults interviewed (27.18% of the total sample) did not make monetary expenditures in durable goods during the year before the day of the interview; hence, we excluded them from the analysis. These people likely borrowed durable goods or acquired them permanently through barter, gifts, or theft, none of which we measured. We did not have a variable that (a) bore no association with the dependent variables and (b) predicted whether a person would have spent money on durable goods. As a result, our results might contain a selectivity bias because we could not predict Y conditional on the probability of spending any money. Second, people might have reported monetary expenditures

with random error owing to faulty recall, and since monetary expenditures enter both the left and right sides of Expressions (1) and (2), the error would inflate λ and δ (Deaton, 1997). The focus on durable goods will reduce but will not eliminate random measurement error in expenditures. Third, we asked about expenditures on durable goods during the last year. People will likely remember the large items with signaling potential; thus, we might see a bias in favor of large items.

4. Survey and variables

4.1. Survey

Data come from a survey done during May–August 2004 among all households ($n=236$) in 13 Tsimane' villages straddling the Maniqui river in the province of Beni in the Bolivian Amazon. Villages differed in their proximity to the market town of San Borja (population, ~19,000). The 2004 survey formed part of a panel study that started in 1999 (Godoy et al., 2005). We started collecting expenditure data in 2004; hence, we can only draw on one cross-sectional survey for the analysis. Experienced interviewers and translators who had been part of the panel from the start did the 2004 survey. We collected data on monetary expenditures only from adults or people 16+ years of age because younger people typically do not earn or use money on their own. We included people less than 16 years of age if they headed a household. The final sample included 161 women and 257 men.

4.2. Measure of expenditures in durable goods

To estimate monetary expenditures in durable goods, we asked people to list all the monetary expenditures in durable goods they had made during the year before the day of the interview and to indicate the quantity and the value in *bolivianos* of each expenditure (1 US\$=7.92 *bolivianos* in 2004). We did not impose restrictions on what respondents could list. When they finished listing durable goods, we prompted their memory by reading to them a list of durable goods common in the area that we had assembled over the years. We used the prompt to reduce omissions from faulty recall and used the same list to prompt all participants.

The total monetary value of expenditure in durable goods (expenditure) enters the right side of Expressions (1) and (2). We used shares of expenditure—rather than levels of expenditures—as a dependent variable and do so for several reasons. Because better-off people are likely to allocate more expenditure to all types of goods, a focus on the level of expenditures will not reveal the economic importance of the expenditure for the person making the expenditure. For example, at low levels of income, people allocate a large share of their income to buy food. As incomes rise, expenditures on food rise as well (e.g., people buy better-quality food), but expenditures on food as a share of total income declines because people spend more of their income

in other goods and services (e.g., recreation). This is why in studies of consumption, economists routinely use expenditure shares for various classes of goods in relation to explanatory variables such as income, total expenditures, and schooling (Deaton, 1997).

4.3. The classification of durable goods

For the analysis, we grouped durable goods into the following categories: (a) domesticated animals, (b) clothing, (c) materials for home improvements, (d) health and hygiene, (e) luxury, (f) school supplies, (g) tools, (h) transport, and (i) goods related to cooking and the kitchen. The Appendix contains a list of all the goods people mentioned.

We define luxury or positional goods in two ways: (a) goods that people might consciously use to signal status and (b) goods that account for a high share of expenditure among better-off people compared with less well-off people (Deaton & Muellbauer, 1980). In the Appendix, we use our long-term ethnographic understanding of the Tsimane’ to identify durable goods people use as status markers [Definition (a)]. We realize that this is a subjective definition of luxury. This is why later, in Table 2, we present descriptive statistics to more objectively identify goods that account for a high share of monetary expenditures among better-off people compared with less well-off people [Definition (b)].

We use the two definitions of luxuries discussed in the previous paragraph, but we also reclassified durable goods

into highly visible and less visible goods. To reclassify goods by their visibility, we excluded investment goods (e.g., tools) or goods associated with savings (e.g., animals) and we then split the remaining goods into those that were highly visible and those that were harder to spot. For example, the Tsimane’ have little trouble knowing who are the owners of metal pots or rifles, but they find it harder to know who are the owners of smaller objects (e.g., school supplies). Again, we relied on our long-term ethnographic experience with the Tsimane’ to classify goods by their physical visibility.

4.4. Other explanatory variables

To measure wealth, we asked people to list the quantity of 22 durable assets they owned that captured the range of physical assets owned by most people and households. The assets included a mix of durable goods obtained from the market (e.g., metal fishhooks), durable goods produced in the village (e.g., canoes), and durable goods obtained from the market or the village (e.g., domesticated animals). We did not adjust for the quality or age of the physical assets when estimating wealth. We multiplied the quantity of each asset by the village price to arrive at a value of the asset, and we then added the value of different assets to arrive at an estimate of a person’s total individual wealth. The village price is the price at which villagers currently sold the asset. Table 1 contains definitions and summary statistics of the variables used in the regression analysis.

Table 1
Definitions and summary statistics of variables used in main regression analysis

Variables	Women			Men		
	n	Mean	S.D.	n	Mean	S.D.
A. Dependent (percentage of item in total individual monetary expenditures; Appendix)						
Animals	161	.008	.084	257	.007	.057
Clothing	161	.418	.423	257	.320	.354
Home improvement ^a	161	0	0	257	.006	.078
Kitchen	161	.372	.417	257	.128	.230
Health and hygiene	161	.054	.176	257	.065	.174
Luxury	161	.037	.154	257	.154	.274
School	161	.001	.019	257	.003	.022
Tools	161	.081	.211	257	.252	.327
Transport	161	.025	.133	257	.061	.203
B. Explanatory (individual level)						
Age (years)	161	36.881	17.84	257	37.016	17.17
Wealth: value of total individual wealth in bolivianos (1 US\$=7.92 bolivianos in 2004) based on a total of 22 locally produced (e.g., bows) and commercial physical assets (e.g., metal fishhooks). In regression entered in logarithms	161	790	596	256	1755	1670
Expenditure: total value of expenditures in bolivianos in durable goods over last year. In regression entered in logarithms	161	137.2	254.9	257	388.1	694.3
	n		Mean		S.D.	
C. Explanatory (household level)						
Size: total number of people in household at time of survey. In regression entered in logarithms	236		6.139		2.740	
D. Explanatory (village level) for Hypothesis 2						
Market: 1 if village is located below the median value (3.5) of travel time in hours from town of San Borja to village	13		8.11		9.33	

^a Excluded in regressions because there were no data for women.

5. The Tsimane'

In recent publications (Godoy et al., 2004; Godoy, Reyes-Garcia, Byron, Leonard, & Valdez, 2005), we provide historical and ethnographic description of Tsimane' culture, society, and economy, including the recent socioeconomic changes they have experienced as they transition from a society based on foraging and slash-and-burn farming to one based on cash cropping and wage labor. As a result and for brevity, we discuss here two aspects covered lightly in previous publications that bear directly on this article: settlement pattern and physical visibility of goods and patterns of monetary expenditures in durable goods.

5.1. Settlement pattern and physical visibility of goods

Tsimane' house construction, attitudes toward physical assets, and preferential marriage rules make it easy for Tsimane' to see most durable goods acquired by others in the village.

Like many native Amazonian societies, the Tsimane' live in small riparian villages with much face-to-face daily interaction. The typical village in our sample contained 24 households (S.D.=10), with an average of six people per household (S.D.=2.7). Within a village, houses lie scattered, with related families often living around an open courtyard. Houses have four sides and, in remote villages, often lack walls. In villages closer to market towns, people have started to put walls around their houses and even locks on their doors; thus, goods inside the house are less likely to be seen by people on the outside. During a survey of the same households in 2002, we counted the number of walls on the outside of each house. We found that in remote villages, houses had an average of 2.5 walls (S.D.=1.6), but a quarter of houses had no walls. In villages closer to market towns, houses had an average of 3.3 walls (S.D.=1.2), and only 9.0% of the houses had no walls. The ease of visibility is higher than these figures suggest because Tsimane' keep many durable goods in their kitchens and 71.43% of kitchens had no walls in 2002.

Tsimane' take a lax attitude toward their physical assets; tools, cutlery, and clothing often lie thrown open in courtyards or inside the house. Domesticated animals roam the village freely feeding on food scraps. Even apparel we might consider private and nonvisible, such as underwear, is visible since people sun-dry clothing in the open.

The marriage pattern of Tsimane' makes it easier for them to gather information on new purchases by people in other households of the village. Like other native Amazonian societies, the Tsimane' have a preferential system of cross-cousin marriage, meaning that a woman often marries her father's sister's son and a son often marries his mother's brother's daughter. Cross-cousin marriage creates a thick and wide web of kin linked by blood and marriage living in the same village. Consequently, people not only find it easy to see who owns what but also have an extensive and deep

network of kin to provide information about intimate details, including the latest purchases. We have no data on whether Tsimane', in fact, use kin network to gain information.

5.2. Patterns of monetary expenditures in durable goods

As is true with other native Amazonian societies (Hugh-Jones, 1992), Tsimane' value a wide range of durable commercial goods, some, such as metal tools, for their utilitarian value, and others, such as watches, radios, and small backpacks, as commercial markers of status. When they visit market towns, the more acculturated Tsimane' will often shun using locally made cotton carrying bags and instead use backpacks. For reasons discussed earlier having to do with recall error, we focus only on expenditure on durable goods to signal status, but we should note that Tsimane' signal status by other types of expenditures that we did not measure. For example, Tsimane' closer to market towns invest in birthday parties for their children, and men who work for wages in logging camps will often buy commercial liquor for their peers while in town.

Jewelry aside, no good has an exclusively utilitarian or a status function. For example, Tsimane' use radios to learn about local events. Tools serve a practical function, but Tsimane' also admire commercial tools and equipment. Ethnographic observations suggest that markers of status include commercial goods such as bras, watches, radios, jewelry, backpacks, some types of clothing (e.g., baseball caps), and shoes. To acquire commercial goods, Tsimane' barter farm and forest goods or else buy commercial goods with money. Transactions take place in villages when itinerant traders arrive in the village or in stores in towns when Tsimane' go there.

In Table 1, we present summary statistics of the share of monetary expenditures made by women and men in different categories of durable goods during the year before the day of the interview. The evidence suggests that women and men allocated monetary expenditures to different ends. The highest share of monetary expenditures among women and men went to clothing (women, 41.8%; men, 32%). Clothing aside, the ranking of the rest of the goods differed between women and men. After clothing, the ranking of goods by their share in total monetary expenditures among women was as follows: kitchen goods (37.2%), tools (8.1%), health (5.4%), luxuries (3.7%), and transport goods (2.5%). The ranking for men was as follows: tools (25.2%), luxuries (15.4%), kitchen goods (12.8%), health goods (6.5%), and transport goods (6.1%). Monetary expenditures for home improvement, school supplies, and domesticated animals accounted for $\leq 1\%$ of total monetary expenditures among either women or men. Women allocated a higher share than men to clothing (women, 41.8%; men, 32%) and kitchen goods (women, 37.2%; men, 12.8%), whereas men allocated a higher share than women to luxuries (men, 15.4%; women, 3.7%), tools (men, 25.2%; women, 8.1%), and transport goods (men, 6.1%; women, 2.5%).

In Table 2, we present the mean share of monetary expenditures in different durable goods across different levels of total monetary expenditures in durable goods to identify luxury goods, defined as goods that account for a high share of expenditures among better-off people compared with less well-off people. Ideally, we should have stratified by yearly personal income, but since we did not have reliable estimates of yearly personal income, we used total monetary expenditures in durable goods as a proxy variable for yearly personal income.

Table 2 suggests that five groups of goods fell in the category of luxuries because they accounted for a large share of mean monetary expenditures among people in the top expenditure bracket (Column C) compared with people in the bottom expenditure bracket (Column D). Animals, health, luxuries proper, tools, and transport accounted for 2%, 4%, 20%, 21%, and 13% of mean total monetary expenditures among the better-off people, respectively. Among less well-off people, expenditure in animals, health, luxuries proper, tools, and transport accounted for 0% (animals and transport), 1% (health), 3% (luxury), and 16% (tools) of mean total monetary expenditures.

We analyzed the share of monetary expenditures allocated to highly visible and less visible durable goods and found that in the pooled sample, 63% of monetary expenditures went into highly visible durable goods and only 12% went into less visible durable goods, with the balance going to durable goods associated with investments or savings. We found no difference between women and men in the share of monetary expenditures allocated to highly visible durable goods; 61% and 65% of total monetary expenditures of women and men went to durable goods with high visibility, respectively ($t=1.10$; $p=.25$). Nevertheless, women allocated 22% of their monetary expenditures to less visible durable goods, whereas men allocated only 5% of their monetary expenditures to these goods ($t=6.45$; $p=.0001$).

Table 2
Mean percentage of monetary expenditure in durable goods in relation to total monetary expenditures in durable goods among Tsimane, 2004

Category	Mean percentage of monetary expenditure in durable goods in relation to total monetary expenditures		
	A. Bottom half of total monetary expenditures ($\leq 50\%$), $n=132$	B. Second quarter of total monetary expenditures ($50\% < x \leq 75\%$), $n=144$	C. Top quarter of total monetary expenditures ($\geq 75\%$), $n=142$
Animals	0	0.6	2
Clothing	40	42	24
Kitchen	38	18	10
Health	1	11	4
Luxury	3	8	20
School	0	0.4	0.2
Tools	16	17	21
Transport	0	0.4	13

6. Regression results

In Table 3, we present parameter estimates for Expression (1) and Hypothesis 1, and in Table 4, we present parameter estimates for Expression (2) and Hypothesis 2. Because women made no expenditures in durable commercial goods for home improvements (Table 1), we exclude the category in the comparison.

6.1. Hypothesis 1

Hypothesis 1 says that people signal social status by consuming highly visible goods and luxuries. We begin by examining the association between total monetary expenditures and the share allocated to luxury goods using the two definitions of luxury.

Column E of Table 3 suggests that among both women and men, total monetary expenditures bore a positive association with the share of monetary expenditure allocated to luxury goods, where luxury corresponds to our ethnographic understanding of goods people use as status markers. A 1% increase in total monetary expenditures was associated with an increase of 2.0 percentage points in the share of monetary expenditure allocated to luxury goods among women ($t=2.35$, $p=.020$) and with an increase of 3.8 percentage points in the share of monetary expenditure allocated to luxury goods among men ($t=2.72$, $p=.007$).

Recall that animals, health, luxuries, tools, and transport accounted for the largest shares of monetary expenditure among the better-off people compared with the less well off. The results of Columns A, D, E, G, and H of Table 3 suggest that these goods are generally luxuries; that is, higher levels of total monetary expenditure in these goods tend to be associated with an increase rather than with a decrease in the share of monetary expenditures allocated to the goods. However, some of the results were statistically insignificant at the 10% level, and except for expenditure on luxuries and durable goods related to transport, results differed by sex. Among women, a 1% increase in total monetary expenditures in durable goods was associated with an increase of 3.7 percentage points ($t=3.03$, $p=.003$) in the share of monetary expenditure allocated to health, an increase of 2.0 percentage points ($t=2.35$, $p=.02$) in the share of monetary expenditures allocated to luxuries, an increase of 3.0 percentage points ($t=1.94$, $p=.055$) in the share of monetary expenditures allocated to tools, and an increase of 3.3 percentage points in the share of monetary expenditures allocated to durable goods associated with transport ($t=2.40$, $p=.017$). Among men, a 1% increase in total monetary expenditure in durable goods was associated with an increase of 3.8 percentage points in the share of monetary expenditures allocated to luxury goods ($t=2.72$, $p=.007$) and with an increase of 5.0 percentage points in the share of monetary expenditures allocated to transport goods ($t=4.49$, $p=.001$).

In Columns I and J, we present regression results with the share of monetary expenditures allocated to highly visible

Table 3

Association between shares of monetary expenditure allocated to different durable goods and total monetary expenditures for Tsimane' women and men, 2004: regression results (Hypothesis 1)

Explanatory variables	Dependent variables—percentage of total monetary expenditures in:								Visibility	
	A. Animals	B. Clothing	C. Kitchen	D. Health	E. Luxury	F. School	G. Tools	H. Transport	I. High	J. Low
A. Women (n = 161)										
Expenditure	.012 (.010)	-.016 (.031)	-.118*** (.030)	.037*** (.012)	.020** (.008)	.001 (.001)	.030* (.015)	.033** (.013)	.069** (.035)	-.146*** (.025)
Age	-.0005 (.0004)	-.006*** (.001)	.003 (.002)	.0009 (.0009)	-.0006 (.0006)	1.21e-6 (.00002)	.004*** (.001)	-.0009** (.0004)	-.006*** (.002)	.003** (.001)
Wealth	.014 (.012)	-.142** (.057)	.150*** (.056)	.005 (.018)	.022 (.022)	-.004 (.004)	-.030 (.026)	-.015 (.018)	-.023 (.057)	.053 (.041)
Size	.015 (.011)	-.049 (.061)	.002 (.060)	.031 (.026)	.016 (.019)	-.002 (.002)	-.025 (.025)	.011 (.020)	.006 (.057)	-.008 (.045)
R ²	.097	.246	.251	.113	.083	.073	.224	.168	.18	.40
B. Men (n = 256)										
Expenditure	.005 (.004)	-.024 (.016)	-.055*** (.013)	-.008 (.006)	.038*** (.014)	.0001 (.0006)	-.010 (.020)	.050*** (.011)	-.002 (.020)	-.047*** (.012)
Age	-.0002 (.0002)	-.001 (.001)	.0004 (.0009)	-.0008 (.0007)	-.002** (.001)	-.00008 (.00006)	.006*** (.001)	-.001** (.0006)	-.005*** (.001)	.0005 (.0006)
Wealth	.004* (.002)	-.099*** (.028)	.045** (.021)	.002 (.010)	.026 (.021)	-.001 (.001)	.018 (.024)	-.006 (.016)	-.032 (.028)	.005 (.013)
Size	-.007 (.009)	.103*** (.038)	-.053* (.028)	-.007 (.021)	-.030 (.029)	-.0008 (.002)	-.003 (.037)	-.002 (.026)	.025 (.044)	-.015 (.025)
R ²	.094	.210	.190	.091	.113	.122	.160	.193	.136	.201

Regressions are OLS with robust standard errors (in parentheses). Regressions include constant and 12 village dummy variables (not shown).

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 4

Association between (a) shares of monetary expenditure allocated to highly visible and less visible durable goods and (b) total monetary expenditures for Tsimane' women and men, 2004: regression results (Hypothesis 2)

Explanatory variables	Dependent variables—percentage of total monetary expenditures in:								Visibility	
	A. Animals	B. Clothing	C. Kitchen	D. Health	E. Luxury	F. School	G. Tools	H. Transport	I. High	J. Low
A. Women (n = 161)										
Expenditure×Market	.022 (.020)	-.054 (.051)	.037 (.051)	.008 (.027)	-.011 (.020)	.0001 (1.73e-6)	-.035 (.028)	.032* (.016)	-.062 (.060)	.042 (.042)
Expenditure	-.002 (.003)	.018 (.040)	-.143*** (.037)	.032 (.021)	.027** (.013)	.001 (.001)	.053** (.023)	.012 (.008)	.110** (.047)	-.173*** (.034)
R ²	.122	.251	.254	.114	.085	.073	.233	.189	.193	.409
B. Men (n = 256)										
Expenditure×Market	-.003 (.009)	.013 (.030)	-.016 (.025)	-.002 (.012)	.014 (.025)	.003* (.001)	-.062 (.038)	.042* (.022)	.025 (.039)	-.013 (.024)
Expenditure	.007 (.007)	-.030 (.022)	-.048*** (.017)	-.007 (.007)	.032* (.018)	-.001 (.001)	.016 (.024)	.032*** (.011)	-.013 (.027)	-.041** (.016)
R ²	.096	.211	.200	.091	.114	.129	.174	.210	.138	.204

Same legend data and covariates as in Table 3, except for the fact that we added the interaction term Expenditure×Market here.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

and less visible durable goods as dependent variables. The evidence suggests that women might use consumption to signal status more than men. Among women, a 1% increase in total monetary expenditures in durable goods was associated with an increase of 6.9 percentage points in the share of monetary expenditures allocated to highly visible durable goods ($t=1.99$, $p=.049$; Column I) and with a reduction of 14.6 percentage points in the share of monetary expenditures allocated to less visible durable goods ($t=5.79$, $p=.001$; Column J). Among men, a 1% increase in total monetary expenditures bore no significant statistical association with the share of monetary expenditures allocated to highly visible durable goods (Column I) but was associated with a reduction of 4.7 percentage points ($t=3.78$, $p=.001$) in the share of monetary expenditures allocated to durable goods with low visibility (Column J).

In sum, we find support for Hypothesis 1 that people signal by consumption. Total monetary expenditures bore a positive association with the share of monetary expenditures allocated to luxuries, whether one uses an ethnographic or an economist's definition of luxury. If one uses an ethnographic definition of luxury (Column E), one sees that among both women and men, higher levels of total monetary expenditures go with a higher share of monetary expenditures allocated to goods such as watches and backpacks. If one follows an economist's definition and if one defines luxury as goods that account for a high share of total monetary expenditure among better-off people (Columns A, D, E, G, and H), then one also sees that higher levels of total monetary expenditures are associated with a higher share of expenditures allocated to those goods. Furthermore, total monetary expenditure in durable goods bore the expected negative association with the share of monetary expenditures allocated to less visible durable goods (Column J), but only among women did it bear the expected positive association with the share of monetary expenditures allocated to visible durable goods (Column I).

6.2. Hypothesis 2

Recall from our earlier discussion that to test Hypothesis 2, we care chiefly about the coefficient δ in Expression (2). The coefficient δ captures the differential effect between people who live near and far from the market town from a 1% increase in total monetary expenditures in durable goods. We had hypothesized that propinquity to the market town would bear a positive association with the propensity to allocate monetary expenditures to highly visible goods or to luxury goods.

The most striking results of Table 4 is that the coefficient of the interaction term bore almost no strong statistical association with luxuries—whether we use an ethnographic definition of luxury (Column E) or an economist's definition of luxury (Columns A, H, E, G, and H)—or to goods of high or low visibility (Columns I and J). The weak results applied to women (Table 4A) and

men (Table 4B). The results suggest that people who lived near the market town were no more likely to use monetary expenditures to signal status than people who lived far from the market town.

The only consistent, statistically significant result had to do with monetary expenditures in durable assets related to transport (Column H). The results shown in Table 4B suggest that a 1% increase in total monetary expenditures in durable goods was associated with an increase of 4.2 percentage points in the share of monetary expenditure allocated to transport goods among men near the market town compared with men far from the market town ($t=1.87$, $p=.062$). Among women (Table 4A), the same increase in total monetary expenditure was associated with an increase of 3.2 percentage points in monetary expenditures in transport goods among women near the market town compared with women far from the market town ($t=1.93$, $p=.055$).

Since we include a full set of village dummy variables (village) to purge the estimates of any fixed heterogeneity in the village, the use of the variable market will produce multicollinearity and higher standard errors for δ in Expression (2), thereby favoring the null in Hypothesis 2. For this reason, as a check, we also reestimate all the regressions of Table 4 without the use of the full set of village dummies and found essentially the same results as those just discussed. In fact, even bivariate regressions with only village-to-town distance on the right side produce virtually nonstatistically significant results.

7. Robustness

Since we found stronger confirmation for Hypothesis 1 than for Hypothesis 2, we report sensitive analyses to assess how well the results of Table 3 held up to changes in econometric specifications in this section. To save space, we report the results but do not show the regression output.

We first reestimated the regressions of Table 3 using male-adult equivalents to estimate household size and also added the person's maximum schooling level because expenditures may be sensitive to how one expresses household size and estimates of the determinants of consumption generally include variables related to schooling (Deaton 1997). After introducing the changes, we found essentially the same results as those reported in Table 3. We reestimated the regression of Table 3, limiting the analysis to the female and the male head of the household under the assumption that young adults might use different activities or goods to signal status. Again, we found generally the same results, except that the coefficient for expenditure among women in Column I of Table 3 declined from .069 to .051 and became statistically insignificant ($t=1.22$, $p=.225$).

We reestimated the regressions of Table 3 by clustering observations within a village under the assumption that observations within a village might not be independent of

each other. We found slightly stronger statistical results for Table 3. Clustering by village produced essentially the same results for men as those shown in Table 3, but it produced weaker results for women. After clustering by village, the coefficient for expenditures in Column I became statistically insignificant ($t=1.12$; $p=.28$).

8. Discussion and conclusions

8.1. Strengths and limitations of analysis

Strengths of the article include the use of multivariate analysis, detailed ethnographic knowledge of the population accumulated as part of the panel study in progress since 1999, analysis of all durable goods bought during the previous year, a relatively large sample size by the standards of studies in cultural anthropology, and the use of a wide range of robustness tests. The explicit focus on the use of consumption rather than production to signal status in a small-scale preindustrial society in transition is novel. Limitations of the article included the absence of data on production, on the supply and distribution of wildlife, or on other activities (e.g., social leisure) that people might use to signal status. Since 27.18% of the sample had not spent money to buy durable goods during the previous year, an analysis that focuses on purchased goods might only tell part of the story of signaling by consumption. We say “might” because even those who spent no money to buy commercial goods could have still used durable commercial goods to signal status if they acquired those goods through barter.

8.2. Discussion

Quantitative studies in anthropology and in economics on signaling by consumption are in their infancy but show promise, as Bliege Bird and Smith (2005) recently pointed out and as Heffetz's (2004) recent work illustrates. Small-scale preindustrial societies in transition provide an ideal laboratory to examine signaling by consumption because much of the consumption is highly visible to everybody, as we have argued; thus, one can focus on cultural visibility without the confounders that plague more complex economies.

The most significant finding is the positive association between total monetary expenditures and the share of monetary expenditures allocated to luxury durable goods. The results of the analysis were fairly robust to the definition of luxury.

8.2.1. Ethnographic definition of luxury

At higher levels of total monetary expenditures, people allocated a higher share of monetary expenditures to those goods ethnographic observations suggested fell under the category of luxuries (e.g., watches, backpacks). The magnitude of the association was almost twice as high among men than women (coefficients: men=.038;

women=.020), suggesting that men might be more likely to use expenditure in luxuries to signal status than women.

8.2.2. Economic definition of luxury

At higher levels of total monetary expenditures, people also tended to allocate a higher share of monetary expenditures to goods that economists would consider luxuries because the goods accounted for a higher share of expenditures among better-off people. The goods had to do with health, luxuries (as just defined), tools, and transport. We found differences in expenditures between the sexes. Unlike men, women at higher levels of total monetary expenditures tended to allocate a higher share of their monetary expenditures to durable goods related to health and to tools. At higher levels of total monetary expenditure, both women and men allocated a higher share of the monetary expenditures to luxuries and to transport, but the magnitude of the association was higher for men than for women. In sum, we find suggestive evidence that women and men might differ in the bundle of consumption goods they use to signal status.

8.2.3. Luxury as visibility

If we define luxury by the physical visibility of a good, then we find strong support for the idea that at higher levels of total monetary expenditures, people will allocate a lower share of their total monetary expenditures to goods with less physical visibility. Only among women did we find support for the idea that higher levels of total monetary expenditures were associated with higher levels of expenditures in visible durable goods. The results again hint at the idea that women and men might differ in the bundle of consumption goods they use to signal status.

We have no convincing explanation for the lack of support for Hypothesis 2. Perhaps our sample may not have contained sufficient variation in distance from village to town. The three closest villages were only about 2 h away by walking from the nearest town, whereas the three more remote villages were about 20 h away.

8.3. Future directions

Future studies of signaling in societies in transition would profit from using cultural consensus analysis (Romney, 1999) to identify what people want to signal and how they want to signal it. One might hypothesize that in relatively isolated small-scale preindustrial societies, people share a cultural model of what requires signaling, but as societies grow in complexity, one might expect greater heterogeneity and confusion about what people should signal and perhaps greater choices in how to signal status. A hurdle to overcome in future work will center on the construction of valid indices of cultural visibility for different goods and activities. For reasons discussed earlier, we equated cultural with physical visibility in this study, but the two need not go together.

Acknowledgments

Thanks go to J. Cari, S. Cari, E. Conde, V. Cuata, B. Nate, D. Pache, J. Pache, P. Pache, M. Roca, and E. Tayo for their help in collecting data and for logistical support. Thanks also go to the Gran Consejo Tsimane’ for their continuous support throughout this research project, to Ori Heffetz for fruitful discussions on the topic, to three anonymous reviewers of EHB, and to Ruth Mace, editor of EHB.

Appendix A. Classification of durable goods bought with money in previous year by adult (16+ years of age) Tsimane’, 2004

Category	Durable good
A. Classification for Columns A–H of regressions, Tables 3 and 4	
Animals	Cows, chickens, pigs, and roosters
Clothing	Clothing (e.g., pants, shirts), shoes, brush for clothing, cotton and wool thread, blanket, cloth, and iron for clothing
Home improvement	Nails and tin roof
Kitchen	Aluminum tub and pot, plastic water container, chair, dish case, table, plate, jug, metal cup, drinking glass, pail, shopping bag, metal spoon, and knife
Health and hygiene	Walker, mosquito net, and plastic comb
Luxury	Watch, radio, TV, toy, musical instrument, mobile telephone, antenna, battery, flashlight, stove, gas tank, backpack, solar panel, light bulb, and ice cooler
School Tools	Book, pencil, eraser, and notebook Pick, chemical sprayer, mill, rake, seeder, wheelbarrow, shovel, fishing line, bullet, saw, fishhook, cartridge, shotgun, axe, machete, fishing net, and rifle
Transport	Canoe, bicycle, motorcycle, tire, and air pump
B. Breakdown of durable goods by visibility for Columns I and J of Tables 3 and 4 (excludes goods associated with investment or savings)	
High	Clothing (e.g., pants, shirts), shoes, blanket, iron for clothing, aluminum tub and pot, plastic water container, chair, dish case, table, pale, walker, mosquito net, watch, radio, TV, musical instrument, mobile telephone, antenna, battery, stove, gas tank, backpack, solar panel, and ice cooler

Low	Clothing brush, cotton and wool thread, cloth, plate, jug, metal cup, drinking glass, shopping bag, metal spoon, knife, plastic comb, toy, flashlight and battery, light bulb, book, pencil, eraser, and notebook
-----	---

References

Bliege Bird, R., & Bird, D. (1997). Delayed reciprocity and tolerated theft. *Current Anthropology*, 38, 49–78.

Bliege Bird, R., & Smith, E. A. (2005). Signaling theory, strategic interaction, and symbolic capital. *Current Anthropology*, 46, 221–248.

Blurton-Jones, N. (1984). A selfish origin for human food sharing: Tolerated theft. *Ethology and Sociobiology*, 5, 1–3.

Deaton, A. (1997). *The analysis of household surveys*. Baltimore, MD: Johns Hopkins University Press.

Deaton, A., & Muellbauer, J. (1980). *Economics and consumer behavior*. Cambridge: Cambridge University Press.

Duflo, E., & Udry, C. (2003). *Intra-household resource allocation in Cote D’Ivoire*. Cambridge, MA: Bureau for Research in Economic Analysis of Development.

Gintis, H., Smith, E. A., & Bowles, S. L. (2001). Cooperation and costly signaling. *Journal of Theoretical Biology*, 213, 103–119.

Godoy, R., Byron, E., Reyes-García, V., Leonard, W. R., Patel, K., Apaza, L., Pérez, E., & Valdez, V. (2004). Patience in a foraging–horticultural society. *Journal of Anthropological Research*, 60, 179–202.

Godoy, R., Reyes-García, V., Byron, E., Leonard, W. R., & Vadez, V. (2005). The effect of market economies on the well-being of indigenous people. *Annual Review of Anthropology*, 34, 122–138.

Godoy, R., Reyes-García, V., Huanca, T., Leonard, W. R., Vadez, V., Valdés-Galicia, C., & Zhao, D. (2005). Why do subsistence-level people join the market economy? *Journal of Anthropological Research*, 61, 157–178.

Hagen, E. H., & Bryant, G. A. (2003). Music and dance as a coalition signaling system. *Human Nature*, 14, 21–51.

Hawkes, K., & Bliege Bird, R. L. (2002). Showing off, handicap signaling, and the evolution of men’s work. *Evolutionary Anthropology*, 11, 58–67.

Heffetz, O. (2004). *Conspicuous consumption and the visibility of consumer expenditures*. Princeton, New Jersey: Department of Economics, Princeton University.

Henrich, J., & Gil-White, F. (2001). The evolution of prestige. *Evolution and Human Behavior*, 22, 165–196.

Hugh-Jones, S. (1992). Yesterday’s luxuries, tomorrow’s necessities. In: C. Humphery, & S. Hugh-Jones (Eds.), *Barter, exchange and value: An anthropological approach* (pp. 42–74). Cambridge: Cambridge University Press.

Patton, J. Q. (2005). Meat sharing for coalitional support. *Evolution and Human Behavior*, 26, 137–157.

Romney, A. K. (1999). Culture consensus: A statistical model. *Current Anthropology*, 40, 103–115.

Scaglione, R. (1999). Yam cycles and timeless time in Melanesia. *Ethnology*, 38, 211–225.

Smith, E. A., & Bliege Bird, R. L. (2000). Turtle hunting and tombstone opening. *Evolution and Human Behavior*, 21, 245–261.

- Sosis, R. (2003). Why aren't we all Hutterites? *Human Nature*, 14, 91–127.
- Van Boven, L. (2005). Experimentalism, materialism, and the pursuit of happiness. *Review of General Psychology*, 9, 132–142.
- Wilson, D. S. (1998). Hunting, sharing, and multilevel selection. *Current Anthropology*, 39, 73–97.
- Winterhalder, B. (1996). A marginal model of tolerated theft. *Ethology and Sociobiology*, 17, 37–53.