

## **Ethnic Boundaries and Cultural Change in an Amazonian Population**

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### **INTRODUCTION**

#### **Overview**

This 26-month investigation examines the relationship between inter-ethnic interactions, perceptions, and the cultural content of ethnic groups. Evidence from ethnography, psychological experiments, and evolutionary models supports the intuition that inter-ethnic interactions among individuals play an important role in the changing “cultural content” of an ethnic group, i.e., the norms (beliefs about what is acceptable behavior) and the symbolic markers (dress, language, etc.) perceived to be shared by co-ethnics. However, the mechanisms underlying this relationship remain poorly understood. This study asks the question: **How do patterns of interaction among people of different ethnicities relate to the actual and perceived distributions of ethnic-typical norms of behavior and symbolic markers across an ethnic boundary?** This question is addressed in two ways. First, ethnographic and experimental methods are used to explore correlations among these variables in the field. Second, agent-based models are developed to explore causal mechanisms underlying the observed patterns. The study population consists of indigenous Matsigenka and majority Mestizo ethnic groups in the Manu region of southeastern Peru. Although limited, Matsigenka-Mestizo interaction is increasing in both scope and frequency in the region, spurring intense debate within the Matsigenka communities as well as among regional authorities about how such interaction leads to change in traditional Matsigenka behavioral norms (e.g., Shepard et al. 2010; Terborgh 1999). This study contributes to the discussion by producing new insight and clarifying uncertainty about the roles of inter-ethnic interaction, markers, and out-group perceptions in cultural change across an ethnic boundary.

This proposal is a resubmission of a 2011 proposal with the same name, for which the NSF review panel recognized “a significant strength”, namely that “the hypotheses are well developed, with clear links to theory”, the testing of which “is likely to generate interesting knowledge.” However, the panel expressed concern that: 1) the PI might not have enough ethnographic experience, despite a 2010 pilot study; 2) it is difficult to identify norms and markers; 3) it is difficult to learn the Matsigenka language; and 4) an indigenous federation should be consulted. **All of the previous NSF panel’s concerns are addressed in the present proposal.** In 2011, Bunce gained additional experience working as an ethnographer for an illness-perception study directed by Dr. N. Ross (Anth., Vanderbilt) and Dr. J. Maupin (Anth., Arizona State) designing, conducting, and analyzing 90 hour-long ethnographic interviews in Spanish with Mexican immigrants in Nashville, TN. He then conducted a second five-month pilot study in the Matsigenka study community of Tayakome, where he identified important norms and markers (below). Bunce is now conversational in Matsigenka (although he can find no institution with authority to certify his skills) and has conducted over 100 formal interviews in the language. Tayakome is affiliated with the Native Federation of the Madre de Dios River and its Tributaries (FENAMAD). In a 2011 meeting with Bunce, the secretary of FENAMAD expressed support for this project and an interest in the final results, which Bunce will provide.

#### **Theoretical Background**

##### **Definitions and Relationships among Terms**

An **ethnic group** is here defined as a social group to which individuals ascribe themselves and to which they are ascribed by others, based on a perception of shared ancestry

and, usually, a range of subjectively important shared norms (beliefs about what is appropriate behavior) and symbolic markers (language, dress, etc.) (adapted from: Barth 1998[1969]; Gil-White 1999; Weber 1968). A **boundary** between two ethnicities is usually characterized by a sharp division of perceived ancestry, norms, and markers between individuals identifying with different ethnic groups. People who can credibly claim membership in more than one ethnic group tend to choose to identify with only one at a time (Alba 1990; Nagel 1996; Waters 1990), or to create a new separate ethnicity (Nagata 1981), thereby preserving boundaries.

Boundaries between ethnicities can be maintained despite the fact that the norms and markers of ethnic groups may change over time. In particular, norms held by individuals of two frequently-interacting ethnic groups may evolve to become similar in the contexts of interaction, as shared norms tend to make coordinated interactions more mutually beneficial (Barth 1998[1969]; McElreath et al. 2003). For example, shared beliefs about what constitutes “fairness” make exchanges more efficient. **Norms** are broadly defined as beliefs about what is appropriate behavior, and encompass the personal, descriptive, and social norms of Bicchieri (2006). Norms can have important behavioral consequences (Schultz et al. 2007), and much inter-ethnic behavioral variation in a given context is here assumed to result from the application of different norms. Such norm differences may often result from inter-ethnic differences in knowledge (Atran et al. 2002), though they need not. A **coordination interaction** (“interaction” below) is an interaction in which all actors receive a greater (though not necessarily equal) benefit if they act in concordant rather than discordant manners, and, by extension, hold concordant rather than discordant norms in the domain of interaction (McElreath et al. 2003). Examples include interactions between employers/employees, buyers/vendors, and spouses.

Choosing interaction partners with suitable norms is often difficult, as many norms are unobservable until they are put into practice (e.g., norms of spousal and parenting behavior: Nave 2000). One potential mechanism allowing individuals to bias interactions toward others who share similar, though unobservable, norms is the use of arbitrary markers (e.g., dress, language, etc.) that covary with, and can thereby signal, the norms of interest (McElreath et al. 2003). For example, in lowland Peru, most Mestizos habitually speak Spanish (a marker) and, as Christians, are averse to polygynous marriages (a norm). In contrast, most indigenous Matsigenka habitually speak Matsigenka and are not necessarily averse to polygyny (Rosengren 2004). In a mixed Matsigenka-Mestizo population, high norm-marker covariance would mean that an unmarried person’s language is a good indicator of her/his as yet unobservable marriage norm. As it is used here, a **marker** is simply the manifestation of a norm (usually a descriptive norm: Bicchieri 2006) that is readily observable without any significant interaction needing to occur between individuals. Norm-marker covariance refers to covariance between a marker and a different, less easily observable norm that has important consequences for a particular type of interaction (e.g., a language marker covarying with a marriage norm).

### Evolutionary Models: Inter-Ethnic Interactions and Markers

McElreath et al. (2003) developed an agent-based cultural evolutionary model to illustrate a mechanism by which groups of people with distinctive norms and markers can evolve from an initial population where such group distinctions do not exist. Under the assumptions, among others, that individuals can modify their markers and that people tend to bias coordination interactions toward others with similar markers, the model demonstrates that such group structure can develop provided there is some mixing of interaction partners (termed

“migration”). The basic predictions of this model have been upheld in controlled experimental games with human participants (Efferson et al. 2008).

To better approximate the study population in the current investigation, Bunce conducted simulations of the McElreath et al. (2003) model using initial conditions modified to represent interacting minority and majority groups with initially distinct distributions of norms and markers. Under the assumptions of the original model, these simulations revealed that when interactions across the inter-group boundary are present but low, distinct norm distributions can be maintained in both minority and majority groups, and norm-marker covariance is high among individuals engaging in inter-group interactions. Both results are due to frequency-dependent selection. However, with even moderate increases in the level of inter-group interaction, distinctive norms and markers of the minority group are quickly lost from the population.

This model generates two important predictions in need of testing in the field: 1) change in the norm and marker distributions of an ethnic group can be mediated through peaceful inter-ethnic coordination interactions (also predicted by Barth 1998[1969]); and 2) ethnic markers play an important role in structuring coordination interactions, particularly for those individuals at an ethnic boundary (i.e., people with high levels of exposure to both co-ethnics and foreigners) .

### Social Psychology: Importance of Out-Group Perceptions

When people are divided into social groups, they tend to perceive individuals in out-groups as: 1) more similar to each other than are members of the in-group (the out-group homogeneity effect: Ostrom & Sedikides 1992); 2) more different from members of the in-group than individuals within the in-group are from each other (social accentuation: Tajfel 1982); and 3) inferior to and less worthy of resources than members of the in-group (inter-group bias and discrimination: Tajfel 1982). Thus, where an ethnic boundary exists, one might predict that individuals in each ethnic group would perceive the norms and markers of the out-group as homogeneously distributed, different from, and inferior to those of the in-group. Even if not objectively accurate, these perceptions may influence people’s inter-ethnic interaction behavior.

However, several other factors also influence out-group perceptions. Wilder (1978) demonstrated that discrimination against the out-group decreases when out-group members are perceived as individuals rather than as members of a group (“individuation”), and Tajfel (1982) suggested that such individuation might be achieved through increased personal inter-group interactions. The nature of inter-group interactions may also influence perception. Ricketta and Sacramento (2008) show that people more readily project characteristics of themselves onto members of the out-group when the out-group is perceived as cooperative rather than competitive. This is true even when the projected characteristics are unrelated to the domain of cooperation or competition. Thus, where an ethnic boundary exists, one might predict that as inter-ethnic coordination interactions (a form of cooperation) increase, people perceive out-group individuals as more similar to themselves, even in domains where no inter-ethnic interaction has yet taken place. Such perceptions may lead individuals to expand inter-ethnic interaction into these new domains, thereby exposing new norms to the possibility of cultural change.

The **relative status** of social groups may also affect perceptions of the out-group. Brauer (2001), interpreting the results of several studies, proposed that, all else being equal, high status groups may be perceived by both in-group and out-group members as more heterogeneous than low status groups. This may be because everyone pays more attention to (i.e., more readily individuates) successful high status people compared to low status people (e.g., indirect bias:

Boyd & Richerson 1985). Status may be determined in the context of coordination interactions with unequal payoff structures, such that the individual perceived to be receiving the most benefit from an interaction is the lower-status party. Power (resulting in high status) may rest with the individual receiving the least benefit, as refusing the interaction would cost her/him less than it would cost the lower-status individual. For instance, from his experiences in 2011, Bunce learned that beer bought in Mestizo stores is a rare and valued commodity for Matsigenka, who can get it nowhere else. However, for a Mestizo, selling beer to a particular Matsigenka (versus selling it to anyone else) may yield only a small benefit (in terms of time), especially if there are many other customers waiting to buy beer. Refusing to sell beer to a Matsigenka would cost the Mestizo little, but would cost the Matsigenka a valued commodity. These unequal payoffs result in greater power for the Mestizo in this interaction, which, in general, may translate into higher Mestizo status. Thus, both Matsigenka and Mestizos may more readily individuate Mestizos, resulting in less discrimination against Mestizos by Matsigenka, but not vice versa. This may, in turn, affect future inter-ethnic interaction, and thus the degree to which cultural change is likely.

### Emic Perspectives of Boundaries and Norms

Anthropological and sociological work on ethnicity emphasizes the importance of emic perspectives of ethnic boundaries. All individuals have multiple (often nested) social identities (e.g., Amazonian Indian, Peruvian, Matsigenka, Manu resident) that can be invoked in different contexts for different purposes (de la Cadena 1992; Marggraff 2004; Nagata 1981; Tilly 2005; Wimmer 2008). For any two domains of coordination interaction (e.g., marriage versus trade), the relevant in-group versus out-group distinction, and the norms and markers of importance, may be different. Thus, a researcher must take care that the ethnic boundary of interest is in fact the social boundary perceived to be most relevant to the subjects in the context under study (Degregori 1998; García 2000), and that the subjects and the researcher perceive the boundary in the same way. This is particularly important for indigenous perceptions of indigenous-Mestizo and other ethnic boundaries (e.g., de la Cadena 1992; 2005; Gow 1993; Rosengren 2003).

The effect of inter-ethnic interaction on cultural (norm and marker) change may depend strongly on the meanings people attribute to their own norms and markers. An individual may be much less willing to change his/her norm or marker to match that of a frequent interaction partner, despite substantial benefits for doing so, if that particular norm or marker is well articulated into his/her worldview (e.g., Varese 2006). For instance, bracelets made of lizard (manke) skin were identified for Bunce by several Matsigenka interviewees as a Matsigenka ethnic marker. In 2011, Bunce was told by an elder that the bracelets also serve to ward off snake bites, as manke is the friend of snake (maranke). People who believe in the bracelet's protective power may be unwilling to remove it, even in situations where it would jeopardize a potentially beneficial interaction, e.g., a potential Mestizo employer who perceives the bracelet as a marker covarying with a norm of "laziness" (a common Mestizo criticism of the Matsigenka).

### Ethnographic Complexities: Inter-Ethnic Interaction and Cultural Change

In general, the ethnographic record supports the hypothesis that, where ethnic boundaries exist, inter-ethnic interactions can have an important influence on cultural change within ethnic groups. However, as shown below, this influence is often complex and unpredictable.

Gans (1979) argued that, for descendants of European-American immigrants to the U.S., behavioral (i.e., norm) differences among ethnic groups tend to be attenuated as interaction

across ethnic boundaries increases each generation. However, the unique identity of these minority ethnic groups can be maintained by emphasizing a few minimally-costly symbolic markers perceived as ethnic-typical (e.g., Irish-Americans wearing green on St. Patrick's Day). In support of this theory of "symbolic ethnicity", Waters (1990) and Alba (1990) present evidence that, in contrast to the extensive ethnic community-oriented norms of European immigrants to the U.S., their European-American descendants tend to express more personal and symbolic ethnic commitments which have little impact on everyday behavior. Thus, increasing inter-ethnic interaction has, for many European-Americans, resulted in the loss of distinctive norms governing important interactions, and the decoupling of ethnic markers from those norms.

The effect of inter-ethnic contact on the norms and markers of ethnic groups is not always unidirectional or predictable, however. Nagel (1996) argues that attempts by the U.S. government to eliminate distinctive Native American cultural behavior by forcing their assimilation into the "mainstream" of U.S. society, actually laid the groundwork for the Native American ethnic and cultural resurgence of the 1960s and 1970s. This movement consisted of a reemphasis, rediscovery, and, in some cases, reinvention of the distinctive symbolic markers and behavioral norms characterizing tribal (ethnic) groups. Similarly, when inter-ethnic interaction is present but limited to certain domains, changes in norm and marker distributions can be difficult to predict. For instance, Huntington and Hostetler (2002) show how Hutterite ethno-religious groups have been remarkably successful at preserving their distinctive set of norms for over 400 years by restricting inter-ethnic interactions in some domains (e.g., friendships) while encouraging them in others (community economic exchange). Thus, inter-ethnic contact need not relate in a straightforward way to changes in the norms and markers of ethnic groups.

**For indigenous Amazonian groups, cultural change is often a strategic choice.** For over four and half centuries, missionaries (Rosengren 2004; Varese 2006), governments (Varese 2006), rubber (Varese 2006) and oil companies (Rosengren 2004; Valdivia 2005), populist movements (Degregori 1998; Delgado 1996), and development NGOs (Rosengren 2004) have attempted to force native Amazonians to modify their culture by adopting "progressive" norms of monotheistic spirituality, hierarchical political organization (Espinosa 2009; Rosengren 2004; Smith 1996; Urteaga Crovetto 2007), capitalism, sedentary settlement patterns, and intensive agricultural techniques (Rosengren 2004; Varese 2006) in return for technological, educational, medical, and economic benefits. Many have strategically adopted majority-culture norms in order to secure benefits (or simply survive) in a world dominated by such norms. For instance, in a representative example, Harakmbut indigenous groups in lowland Peru have strategically adopted destructive gold mining practices and entrepreneurial norms as a way to secure access to resources on their land before government-backed Mestizo miners do (Urteaga Crovetto 2007).

Recently, an alternative strategy to secure benefits has also become a viable option. By emphasizing how different they are from the majority culture, indigenous groups can often enlist the support and protection of governments and cultural and conservation NGOs. However, this strategy usually entails conforming to majority-culture stereotypes regarding what it means to be "indigenous" (e.g., Balslev Clausen 2008; Jackson 1989; 1995). For instance, Manu National Park was created in lowland Peru in 1973 in an area occupied by several hundred Matsigenka. Some Matsigenka opted to remain in the park, where, in exchange for the right to live in an area protected from Mestizo colonization, they were forced to readopt or maintain subsistence practices considered by park authorities to be "traditional" (Marggraff 2004; Shepard et al. 2010; Terborgh 1999, Bunce, pers. obs.). There is considerable debate and uncertainty among

Matsigenka both inside (Bunce, pers. obs.) and outside the park (Baer 2004; Rosengren 2003; 2004), about how to balance the adoption of new norms with the maintenance of “traditional” norms, and what benefits or sanctions these strategic choices would elicit from majority-culture power structures, such as governments and NGOs (e.g., Holt 2005; Valdivia 2005).

### **Motivation for the Proposed Study**

As shown above, the relationship between inter-ethnic interaction and cultural change is complex. Few field studies, however, have yet attempted to explicitly measure several variables that are believed, on the theoretical grounds presented above, to play important roles in the complex relationship between inter-ethnic interaction and cultural change. These variables include: 1) individual variation in the frequency and nature of inter-ethnic interactions; 2) covariance of markers and norms important in inter-ethnic interactions; and 3) individual variation in perceptions of out-group norm and marker distributions. The results of several pioneering studies of populations with ethnic boundaries suggest that important relationships exist between cultural norm, knowledge, and behavior distributions and several of these variables, e.g., market integration (inter-ethnic interaction) (Godoy et al. 2009; Henrich et al. 2010), cross-ethnic social networks (inter-ethnic interaction) (Atran et al. 2002), and perceived out-group norm distributions (Ross et al. 2007). This study, however, will be the first to measure all three variables in the same population, and can thus evaluate the relative importance of the roles played by each in cultural change.

### **OBJECTIVES AND HYPOTHESES**

The overall aim of this investigation is to determine the effects of inter-ethnic interactions on the actual and perceived norm and marker complements of individuals on either side of a Matsigenka-Mestizo ethnic boundary. Specific objectives, with corresponding hypotheses, are:

**Objective 1:** Identify and ethnographically describe a set of behavioral norms and ethnic markers in each ethnic group, and a corresponding set of intra- and inter-ethnic coordination interactions.

**Hypothesis 1A:** There exists a set of norms in each ethnic group that govern interactions between individuals, and, in some contexts, these norms are signaled by markers.

**Hypothesis 1B:** Norms and markers differ in the degree to which they are integrated into the worldviews of individuals.

**Hypothesis 1C:** The Matsigenka-Mestizo ethnic boundary is perceived by individuals of both groups to be a salient boundary structuring a set of inter-ethnic interactions.

**Objective 2:** Measure the distributions of identified norms, markers, and interactions among individuals of each ethnic group.

**Hypothesis 2A:** The distributions of norms and markers differ across the ethnic boundary, i.e., Matsigenka and Mestizo cultural content differs at the population level.

**Hypothesis 2B:** Within each ethnic group there is inter-individual variation in norm and marker complements, as well as in the frequency and nature of intra- and inter-ethnic interactions involving those norms and markers.

**Hypothesis 2C:** The norms of individuals will match those of their most frequent or most important interaction partners, regardless of whether those partners are co-ethnics or belong to the out-group.

**Corollary 2C:** Individuals perceived to receive the most benefit from a particular interaction (low-status individuals) will change their norms to match those of individuals perceived to receive less benefit from the particular interaction (high-status individuals). When inter-ethnic interactions are frequent, the Matsigenka (lower-status) tend to adopt Mestizo (higher-status) norms, and not vice versa.

**Hypothesis 2D:** When exposed to a range of potential interaction partners with coinciding and conflicting norms, individuals will signal their norm with a marker. This results in high norm-marker covariance.

**Corollary 2D:** The highest norm-marker covariance will be found in the subset of Matsigenka and Mestizos with intermediate levels of inter-ethnic interaction, as these individuals run the highest risk of choosing an interaction partner with conflicting norms. The norms of individuals with high levels of inter-ethnic contact will match those of the out-group (Hypothesis 2C) so the risk of mis-coordination, and the importance of markers, for such individuals is reduced.

**Hypothesis 2E:** As the importance of particular norms and markers in the worldviews of individuals increases, the less likely people are to modify them in response to changing interaction partners.

**Objective 3:** Compare the actual and perceived distributions of norms and markers, in relation to inter-ethnic interactions.

**Hypothesis 3A:** The greater the frequency or importance of an individual's inter-ethnic interactions, the more she/he "individuates" the out-group, and thus the more accurate (less stereotyped) is her/his perception of the out-group norm and marker distributions and norm-marker covariance, in domains both related and unrelated to the interactions.

**Hypothesis 3B:** Members of the lower-status ethnic group (Matsigenka) will, in general, have more accurate perceptions of norm and marker distributions in the out-group than will members of the higher-status ethnic group (Mestizos).

**Objective 4:** Use the patterns encountered in this population to develop general agent-based evolutionary models illustrating causal mechanisms of cultural change among ethnic groups.

## **METHODS**

### **Study Population**

This study takes place in the indigenous Matsigenka community of Tayakome (October 2011 population: 75 adults in 35 households) located inside Manu National Park (MNP), and the nearby Mestizo town of Boca Manu (approximately 30 households) located just outside the park boundary in lowland tropical forests in the Department of Madre de Dios, Peru.

Within MNP, approximately 400 Matsigenka live in settled communities, of which Tayakome is the oldest and second-largest (Ohl-Schacherer et al. 2007; Shepard et al. 2010). The Matsigenka and other groups in the region had only sporadic contact (e.g., trade) with outsiders until the rubber boom of 1895-1917, when many fled into the forest away from rivers to avoid slave raids. Missionaries of the Summer Institute of Linguistics (SIL) founded Tayakome in the 1960s and attracted dispersed Matsigenka families with the promise of education, healthcare, technology, and economic opportunities. SIL was forcibly removed when MNP was founded in 1973 (Shepard et al. 2010). The Matsigenka were allowed to continue living in MNP on the condition that they maintain or readopt "traditional" subsistence practices of swidden

horticulture, gathering, hunting, and fishing (Johnson 2003), which are thought to be less detrimental to the park's biodiversity (Levi et al. 2009; Ohl-Schacherer et al. 2007; Ohl et al. 2008; Shepard et al. 2010). Cash-cropping, livestock (other than chickens), firearms, and the selling of forest products are prohibited (Shepard et al. 2010). Some Tayakome residents habitually travel outside the community and the park to participate in ecotourism (Ohl-Schacherer et al. 2008), wage labor, secondary education, and limited purchasing. The vast majority of inter-ethnic interactions occurs outside of the community, as non-Matsigenka cannot enter Tayakome, or the park, without a government permit. Most residents speak some Spanish.

Boca Manu is a 2-3 day boat trip from Tayakome and the first community encountered upon leaving MNP's one principal entrance/exit. Residents are mostly Spanish-speaking Mestizos of Andean ancestry, with some indigenous Matsigenka and Yine. The economy of Boca Manu depends on the regional ecotourism and boat-building industries (Shepard et al. 2010). Nearly all Tayakome residents have visited Boca Manu at least once in their lives, and many of the younger men have worked there for several months. Boca Manu also contains a boarding secondary school for Matsigenka, where four Tayakome boys are studying.

**Tayakome and Boca Manu constitute an excellent study population** for investigating the relationship between inter-ethnic interactions and changing norm and marker distributions. Because these communities are small and isolated, with little exposure to mass media (Tayakome has one sporadically-functioning television in the president's house), Matsigenka-Mestizo interactions are, on the whole, relatively limited in scope, easy to monitor, and easy for people to recall. Additionally, in Tayakome, there is much individual variation in the extent of inter-ethnic interaction with Mestizos, and similar variation in inter-ethnic interaction experience is expected in Boca Manu. Such variation is necessary to evaluate Hypotheses 2B-D and 3A.

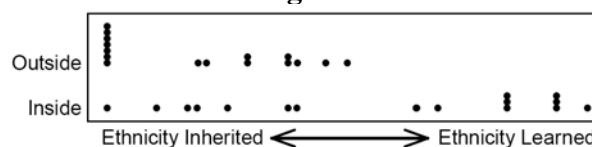
### **Pilot Studies**

Bunce conducted two pilot studies in Tayakome (Jun-Jul 2010 and Jun-Oct 2011). In these seven months of fieldwork, he conducted semi-structured personal history interviews in the Matsigenka language (back-translated for accuracy) with 59 of the 75 resident adults (35♀, 24♂), including at least one member from 33 of the 35 households occupied during the study period. He also conducted 105 structured interviews with adults on focused topics relating to ethnic identity and specific norms and markers. To examine the distribution of a social norm specifying a man's obligations to the community versus his obligations to his family, interviewees (12♀, 21♂) were presented with a vignette in which a man decided to skip a community work party ("obligatory" community function) so that he could stay at home to construct arrows (necessary for family food acquisition). Interviewees indicated whether the hypothetical man's behavior was acceptable (*kameti*) or unacceptable (*tera kameti*). Results (**Table 1**) suggest that, of those who believe the man in the vignette is wrong to shirk his community obligations (Unacceptable), most have lived or worked outside of Tayakome in a Mestizo town at some point in their lives (Outside). Of the two people who have never lived among Mestizos but who also disapproved of the hypothetical man's behavior (Inside, Unacceptable), one was a woman whose parents, siblings, and husband had all spent considerable portions of their lives among Mestizos. One explanation (among several) for this pattern is that increased interaction with Mestizos is associated with a change from Matsigenka family-centered norms (Johnson 2003) to more community-oriented norms typical of Mestizos.



**Table 1.**

	Acceptable	Unacceptable
Outside	10	6
Inside	15	2

**Figure 1.**

To examine the distribution of ideas regarding Matsigenka ethnicity, the same sample was presented with a series of vignettes about a hypothetical adoption situation (e.g., a Matsigenka baby adopted by Mestizos, a Mestizo baby adopted by Matsigenka, etc.) where respondents indicated whether the adoptee, once grown, would be a Matsigenka or not. Using non-linear PCA methods (Michailidis & de Leeuw 1998), Bunce reduced responses to a score on a single component axis (x-axis in Figure 1) that could be interpreted as the degree to which a respondent believed that ethnicity is inherited from biological parents versus acquired (e.g., consists of norms that are learned) from adoptive parents. **Figure 1** shows considerable variation in interviewee responses, both for those who have lived among Mestizos (Outside) and for those who have not (Inside). One interpretation of these data is that most people perceive a salient ethnic boundary in which at least some fundamental differences between Matsigenka and Mestizos consist of cultural characteristics (e.g., norms and markers) that can be learned by children (i.e., all people are not clustered at the “Ethnicity Inherited” pole).

Bunce has identified several Matsigenka norms and ethnic markers through extensive participant observation in community life. For instance, Bunce participated in familial swidden horticultural practices, including clearing (5 fields), burning (1 field), and planting (4 fields). In one family, the wife did not participate in planting manioc and believed it to be her husband’s job. In three other families, wives planted manioc to an equal or greater extent than their husbands, and believed it to be the job of both spouses. Thus, variation in norms of spousal obligation (not explainable by contact experience with Mestizos) is apparent in Tayakome. These, as well as other norms (e.g., gender-segregated meals) and markers (e.g., women’s shaved heads) identified in the pilot studies, constitute a considerable advance and a promising point of departure for the proposed investigation. Additionally, Bunce spent 23 months between 2003 and 2006 conducting his dissertation fieldwork on primate ecology along the Manu River between Tayakome and Boca Manu. His experience in the region greatly facilitates his current research.

In Tayakome, Bunce is joined by his wife Caissa Revilla-Minaya, a Peruvian and advanced Cultural Anthropology Ph.D. student at Vanderbilt U, conducting her dissertation research on Matsigenka environmental perceptions. Revilla-Minaya is applying for independent funding for her research, and the current project includes no funding for her. During the 2010-2011 pilot studies, both found that their marital status greatly facilitated ethnographic research in this family-level society, especially Bunce’s interviews of women. Bunce and Revilla-Minaya visit households together and conduct simultaneous independent interviews for their respective studies. They engage in many participant observation opportunities (e.g., social visits, manioc planting, barbasco fishing) as a married couple, following the example of Matsigenka couples.

### **Proposed Investigation: Data Collection**

#### **Phase 1: Identification of Mestizo Norms and Markers (15 Aug 2012 – 31 Dec 2012)**

Bunce will live in Boca Manu for five months. During the first four months he will use participant observation to identify domains (contexts) of coordination interaction, such as: 1) employment (e.g., in Mestizo agricultural fields, in Mestizo logging outfits, or as boat crews); 2)

commerce (e.g., among the small general stores in town); 3) education (e.g., in the town's boarding secondary school for Matsigenka boys); and 4) healthcare (in the town's regional health post), as well as the norms and markers that structure such interactions (**Hypothesis 1A**). Participant observation is facilitated by Bunce's fluency in Spanish (advanced oral and written fluency certified by exam in the Dept. of Linguistics, Univ. Nacional Mayor de San Marcos, Lima, Peru 2011), and his informal familiarity with these interaction domains gathered over several years of work in the region. Bunce will select a **purposive sample of four key Mestizo informants** (an older woman and older man, and a younger woman and younger man). An additional key informant will be sought from among the small number of Matsigenka who live in Boca Manu. Bunce has interacted frequently with several potential key informants in Boca Manu since 2003. He will use semi-structured interviews (Bernard 2006) to explore how, and in what domains, these informants distinguish Matsigenka from Mestizos, i.e., when/if this ethnic boundary is meaningful for them (emic boundary perspectives - **Hypothesis 1C**). With these informants, Bunce will also discuss the reasons behind the norms and markers he observes during participant observation (**Hypothesis 1B**), e.g., are observed norms related to Christian or Matsigenka beliefs? In addition, key informants will be asked to recount their life stories, with emphasis on their personal history of interaction across the ethnic boundary (e.g., Oakdale 2008). Particular attention will be paid to cross-cultural competence, where individuals temporarily change their norms depending on the ethnicity of their interaction partner. All formal interviews are confidential and will be recorded for transcription. Interviewees (in all project phases) are read a statement of informed consent and assured of their right to stop an interview at any time.

During the final month of Phase 1, Bunce will **identify norms and markers** through structured interviews with a **random sample of 30 adults** (names drawn at random from a pool of willing participants). This pool of Boca Manu participants may include some resident Matsigenka, and their responses will be analyzed separately from those of Mestizo residents. The interview schedule is based on that of the pilot studies (above), and will result in sampling of approximately half of the community adult population. Interviewees will free-list behaviors they think are appropriate, i.e., their personal norms of behavior (Norm Free-list), and the observable characteristics they would use to distinguish a Matsigenka from a Mestizo (Marker Free-list), in a set of six domains of coordinated interaction identified during participant observation and prior interviews. For example, for the marriage domain, interviewees may be asked:

What characterizes a good husband? (Possible Mestizo Norm Free-list responses: provides for his family, drinks responsibly, etc.). What characterizes a good wife? (Possible Mestizo Norm Free-list responses: cooks, raises children, etc.). Imagine your son marries outside of Boca Manu, and then returns with his wife. When you first meet her, how can you tell that she is a Mestiza and not a Matsigenka? (Possible Marker Free-list responses: she speaks excellent Spanish, she wears shoes, metallic jewelry, etc.).

Bunce will choose six domains where the key informants perceived the Matsigenka-Mestizo ethnic boundary to be salient. Three of the six domains will be chosen from among those identified during pilot studies in Tayakome, where Matsigenka-Mestizo interactions tend to be rare, e.g., marriage, meal sharing, community participation, etc. The remaining three domains will be chosen from among those identified in Boca Manu, where inter-ethnic interactions are more frequent. Correspondence between free-listed and practiced behavior of interviewees will be observed opportunistically. The most frequently mentioned norm in all Mestizo interviewees' Norm Free-lists and the most frequently mentioned marker in all Mestizo interviewees' Marker

Free-lists will be designated the Mestizo Popular Norm and the Mestizo Popular Marker, respectively, for each of the six interaction domains. Thus, six Mestizo Popular Norms and six Mestizo Popular Markers will be identified (norms and markers may be duplicated across domains). The use of free-lists minimizes observer bias by requiring the norms and markers under investigation to be those most salient to the subjects, rather than to the investigator.

Each of the 30 interviewees will be asked about the frequency and nature of their interactions across the Matsigenka-Mestizo ethnic boundary, and their interactions within their own ethnic group, for each of the six interaction domains. Particular attention will be paid to whether the interviewee was satisfied or dissatisfied with each interaction, whether the interaction was perceived as necessary or important, and whether an interaction with another person could have accomplished the same thing according to the interviewee. Such responses suggest the subjective payoff structure of the coordination interaction. In each domain, the frequency of reported out-group interactions (discounted by the number of in-group interactions, and weighted by the relative subjective importance of out-group versus in-group interactions, if appropriate) will be used to calculate an **out-group interaction index** for each interviewee, for each interaction domain. In addition, each interviewee will be asked to: 1) name any number of people who she/he considers to be knowledgeable about each domain of interaction; 2) to rank order this list in terms of knowledge; and 3) to order the list in terms of people with whom she/he socializes the most (not necessarily in the domain of interaction). This ego-centered **social network data** (Wasserman & Faust 1994), will be used to identify groups of socialization partners, e.g., close friends, and also prestigious individuals with disproportionate influence on community norms. This grouping variable will be included in subsequent analyses to control for the possibility that an individual's norms and perceptions are influenced by frequent socialization partners outside of the interaction domains in which the norms of interest apply. Phase 1 will result in a set of six Mestizo Popular Norms and six Mestizo Popular Markers for Boca Manu, as well as six out-group interaction index values and six social network group designations (one for each of the six identified interaction domains) for each of the 30 Boca Manu participants.

#### Phase 2: Identification of Matsigenka Norms and Markers (15 Jan 2013 – 31 Dec 2013)

Bunce will repeat the procedures of Phase 1 in Tayakome. Twelve months are required in order for Bunce to assure (through extensive participant observation and discussion with informants) the accuracy of his interpretations of the many unique Matsigenka norms and markers. The four key informants in Tayakome will be representative individuals with whom Bunce has already developed important relationships during the pilot studies. Interaction domains for the Norm Free-lists and Marker Free-lists will match the six domains used in Phase 1. Phase 2 will result in a set of six Matsigenka Popular Norms and six Matsigenka Popular Markers for Tayakome, as well as six out-group interaction index values and six social network group designations for each of the 30 Matsigenka participants. During the final month of Phase 2, a Matsigenka assistant will be hired to back-translate the structured interview questions, as well as to discuss possible variations of presentation for interviews, and (along with the key informants) to be available to discuss any unexpected ethnographic observations.

#### Phase 3: Measurement of Norm and Marker Distributions (1 Jan 2014 – 28 Feb 2014)

A binary-choice vignette (Bernard 2006) will be designed for each of the six Matsigenka Popular Norms and six Mestizo Popular Norms (12 total vignettes). Each vignette will describe a

hypothetical interaction corresponding to one of the six interaction domains chosen in Phase 1. There will be two vignettes for each domain, one illustrating violation of the Matsigenka Popular Norm, and the other illustrating violation of the Mestizo Popular Norm for that domain. During re-interviews with the 30 Tayakome and 30 Boca Manu participants, interviewees will indicate either approval or disapproval of the action portrayed in each of the 12 vignettes, along with a narrative explanation of how they arrived at their conclusion (i.e., how the illustrated norm relates to their beliefs/worldview – for testing **Hypothesis 2E**). The set of 12 responses (approval/disapproval) constitutes a participant's **Norm Complement**. In Tayakome, the Matsigenka assistant will again be hired for back-translation and presentation suggestions. During each interview, Bunce will record whether the interviewee physically displays the Matsigenka Popular Marker and/or the Mestizo Popular Marker identified for each of the six interaction domains (12 total markers). If a particular marker is ephemeral (e.g., face paint rubs off), the interviewee will be asked to recall whether he/she displayed the marker during his/her last interaction in that domain. The set of markers displayed by the interviewee, from among the set of 12 identified markers, constitutes a participant's **Marker Complement**. Distributions of particular norms and markers, as well as norm-marker covariance, both within ethnic groups and across the ethnic boundary, are taken directly from the individual-level Norm and Marker Complements and are used, with the out-group interaction index, to address **Hypotheses 2A-D**.

#### Phase 4: Perceptions of Norm and Marker Distributions (1 Mar 2014 – 30 Apr 2014)

The Norm and Marker Complements of each of the 60 study participants (Tayakome and Boca Manu) will be recorded on index cards (without names). During re-interviews with the 30 Tayakome participants (aided by a local assistant for back-translation and presentation suggestions) and the 30 Boca Manu participants, interviewees will be re-familiarized with the vignettes from the previous series of interviews and: 1) Choose an index card at random, and, without looking, guess the 12 recorded answers of the card's Norm Complement (each of the card's answers corresponding to one of the 12 vignettes from the previous series of interviews), knowing only to which community the card belongs. Guesses indicate the norms the interviewee perceives to be held by most members of the card's community. 2) Repeat 1, but now the interviewee is told the card's Marker Complement as well as the card's community. Modifications to guesses dependent on marker indicate that the interviewee perceives norm-marker covariance among members of the community to which the card belongs.

To motivate deliberated responses, interviewees will receive a compensatory reward for each correct guess (12 possible rewards for each of the two cards drawn per interviewee), similar to the "guess game" of Gurven et al. (2008). In practice, the "strategy method" of Camerer and Fehr (2004) will be used, so that interviewees make guesses about a card's Norm Complement under all possible combinations of the card's community membership and Marker Complement, before a card is actually drawn. The interviewee then draws a card at random and rewards are calculated based only on those guesses that pertain to the card's actual characteristics. Interviewees will be asked to explain each of their guesses, e.g., Does your guess of "disapprove" for norm 5 indicate that you believe that all people in Tayakome would disapprove of this vignette, that most would disapprove, or that you don't know and guessed at random?

Phase 4 will result in a set of perceptions (guesses), for each of the 60 participants, about the most common norms in the in-group and the out-group under differing marker complements, as well as a qualitative approximation of perceptions of variance in those norms (from the

explanations of guesses). These perceived norm distributions and norm-maker covariance will be compared to actual distributions and covariance in order to address **Hypotheses 3A-B**.

#### Phase 5: Development of Agent-Based Evolutionary Models (6 May 2014 – 30 Sep 2014)

Bunce will spend five months at UC Davis developing a formal model relating inter-ethnic coordination interactions to changing norm and marker distributions in ethnic groups. He will use the model of McElreath et al. (2003) as a starting point, but will incorporate new insights gained through analysis of the field data. Particular attention will be paid to the **incorporation of unbalanced payoff structures** in coordination interactions, i.e., coordinating on norms yields different net benefits to the two interaction participants. This modification is addressed only briefly by McElreath et al. (2003), and may be an important aspect of Matsigenka-Mestizo interactions, relating to a difference in status between the two ethnic groups. The relevance of an unbalanced payoff structure in the study population will be assessed by using data from Phases 1, 2, and 3 to address Corollary 2C.

A second modification of the McElreath et al. (2003) model will be the **incorporation of agents' perceptions** of norm and marker distributions and norm-marker covariance. The new model will explore the effects of such perceptions on the frequency of out-group interaction, and, by extension, on changes in actual norm and marker distributions. The frequency of out-group interactions will also be allowed to affect perceptions. These effects will be incorporated into the model based on analyses using perception data from Phase 4 to address Hypotheses 3A-B.

The value of formal model development lies in the unique insights into **causal mechanisms** that can be gained by making relationships explicit between variables that are hypothesized to be important to the dynamics of the system (i.e., changing norm and marker distributions). A long-term goal of this research program is to collect a dataset of cultural change across the Matsigenka-Mestizo ethnic boundary that can be used to compare the original model of McElreath et al. (2003) with the new model(s) that will be formulated in this investigation. These comparisons will determine whether the proposed modifications to the model actually add to our understanding of cultural change. Such a dataset requires a temporal dimension, and thus the data collected in this investigation will constitute a baseline, to be augmented in the future.

This phase of the project will include the **collaboration of an advanced Ph.D. student** in the Anthropology or Ecology graduate program at UC Davis who is trained in the development and simulation of evolutionary models. This student collaborator will be appointed to a half-time Research Assistant position, will work closely with Bunce, and will co-author resulting publications as appropriate. This collaboration will enrich the research experience of a graduate student, provide valuable assistance, and bring new perspectives to the project.

#### Data Analysis

**Hypotheses 1A-C**, that norms (signaled by markers) govern a set of coordination interactions, are tied to people's beliefs/worldviews, and define a salient Matsigenka-Mestizo ethnic boundary that structures a set of inter-individual interactions, will be examined through content analysis (Bernard 2006) of the transcribed and coded ethnographic data collected during Phases 1 and 2 (e.g., field notes, informal interviews, and autobiographical narratives).

Inter-ethnic and inter-individual differences in norm and marker distributions will be examined using principal components-based methods on data from Phase 3. For instance, individual responses to the 12 norm vignettes (Norm Complement) can be reduced to component

scores using non-linear PCA (Michailidis & de Leeuw 1998). Inter-ethnic norm differences (**Hypothesis 2A**) would be indicated if Matsigenka and Mestizo individuals cluster in two separate groups when their component scores are plotted. The extent of inter-individual variation (**Hypothesis 2B**) would be indicated by the spread of the plotted scores within each group.

Multilevel logistic regression (Gelman & Hill 2007) will be used to examine the effect of predictor variables such as out-group interaction index, ethnic group, worldview, age, and sex on individuals' binary responses to a particular norm vignette (an outcome variable). The importance of out-group interaction index and ethnicity as predictors of vignette response might suggest that people's norms match those of their most frequent interaction partners (**Hypothesis 2C**). An (out-group interaction index)\*(ethnicity) interaction might suggest that inter-ethnic interaction has a larger effect on the norms of one ethnic group than on those of the other (perhaps due to status differences: Corollary 2C). If holding a particular belief about a norm (worldview) is a stronger predictor of vignette response than is the out-group interaction index, such results might support **Hypothesis 2E** (norms strongly linked to beliefs are less likely to be modified by interaction). In these regressions, the social network grouping variable is included as a random effect to control for social influences on individual Norm Complements. The accuracy of perceptions (guesses from Phase 4) about norm and marker distributions can be expressed as a binary outcome variable [ $1 - |\text{guessed response} - \text{mode}(\text{observed responses})|$ ] and included in similar multilevel models to examine the effect of worldview, out-group interaction index, and ethnicity (and their interactions) on perceptions (**Hypotheses 3A-B**). The relationship between norm-marker covariance and out-group interaction index (**Hypothesis 2D**) can be examined by comparing the fit of quadratic versus linear equations to a plot of these two variables.

### **Work Schedule**

<u>Phase 1: Identification of Mestizo Norms and Markers</u>	15 Aug 2012 – 31 Dec 2012
Location: Boca Manu	
<u>Phase 2: Identification of Matsigenka Norms and Markers</u>	15 Jan 2013 – 31 Dec 2013
Location: Tayakome	
<u>Phase 3: Measurement of Norm and Marker Distributions</u>	1 Jan 2014 – 28 Feb 2014
Location: Tayakome (January), Boca Manu (February)	
<u>Phase 4: Perceptions of Norm and Marker Distributions</u>	1 Mar 2014 – 30 Apr 2014
Location: Boca Manu (March), Tayakome (April)	
<u>Phase 5: Development of Agent-Based Evolutionary Models</u>	6 May 2014 – 30 Sep 2014
Location: University of California, Davis	

During Phase 5 and data analysis (Oct - Dec 2014), Dr. Mark Grote, Senior Statistician (Anth., UC Davis) will serve as a consultant, advising and trouble-shooting as needed while Bunce, who has prior experience using all of the proposed analytical methods, designs the models and conducts the analysis. Bunce has worked with Dr. Grote on several previous projects.

### **SIGNIFICANCE**

#### **Intellectual Merit**

The major contribution of this study will be to forge connections between the broad historically-based descriptive explanations of cultural change provided by Socio-Cultural Anthropology (e.g., Varese 2006), the understanding of how perceptions influence inter-personal and inter-group behavior provided by Social Psychology (e.g., Tajfel 1982), and formal models

of cultural evolutionary theory (McElreath et al. 2003). This study is the first to formally test hypotheses of cultural change by relating inter-individual interactions, norm and marker distributions, and perceptions of these distributions across an ethnic boundary. Even more importantly, by operationalizing and incorporating concepts such as status differences, and the integration of norms and markers into individual worldviews, this study creates a conceptual link between the historical processes that contributed to such inter-group differences in status and worldview, and the effect of these differences on the individual decision-making processes that result in cultural change at the population level. This study is transformative because it **unites disparate social science fields into a new approach for understanding general processes of cultural change** as they apply to an ethnically-stratified human population. The proposed study constitutes the first step in a long-term research program, where replication and expansion of this methodology to other Matsigenka and Mestizo populations will produce a longitudinal dataset appropriate for comparing historical and evolutionary models of cultural change.

### **Broader Impacts**

As field anthropologists, it is impossible to study cultural change without influencing the process under study (Davies 1999). We have a duty to insure that this influence is beneficial (e.g., García 2000; Said 1989), yet we have no authority to decide what constitutes beneficial cultural change or maintenance (Jackson 1989). As an answer to this challenge, the goal of this study is to understand the mechanisms of cultural change at work among both Matsigenka and Mestizos, and use this knowledge to empower both communities to take control of the process to the extent that they wish. Cultural change is important to the Matsigenka of Tayakome, but Bunce witnessed uncertainty about the mechanisms by which it occurs when, in 2010, a debate erupted in a communal meeting about whether to permit an adolescent girl to accompany a teacher for a two-week vacation in the city of Cusco. At issue was whether the girl would lose her Matsigenka customs. Thus, there is need for a clearer understanding of how inter-ethnic interactions affect the loss of ethnic-typical norms. With such knowledge, the Matsigenka (and other indigenous groups) might design effective cultural management plans to limit the loss of norms and markers that they collectively want to preserve. Having such a plan might place the Matsigenka in a stronger position to negotiate with park authorities over reform of paternalistic policies to “protect indigenous culture” (Shepard et al. 2010). At the conclusion of fieldwork, Bunce will discuss his findings and interpretations at communal meetings in Tayakome and Boca Manu. In addition to scientific publications, technical reports (in Spanish) and focused summaries (in Spanish and Matsigenka) of the results will be deposited with each community, the park administration, FENAMAD, and the Pontificia Universidad Católica del Perú (Lima).

This study **integrates research and teaching**. At the request of Tayakome, Bunce teaches English classes one day per week for Matsigenka adults and children. The idea for these classes originated from within the community (not from Bunce), and places the children on a more even footing with their Mestizo peers in Boca Manu who learn English as part of their standard curriculum. The classes in 2011 were rewarding for both Bunce and the community, and Bunce has been asked to expand them in 2013 to include math and reading for adults. In Boca Manu, Bunce will offer instructional support and seminars to local middle- and high-school students and adults on the region’s cultural and biological diversity. Phase 5 of this study includes the collaboration of a graduate student, with an aim of advancing his or her research expertise and professional development through training in methods, analysis, and publication.

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