THE LIFE HISTORY OF CULTURE LEARNING
IN A FACE-TO-FACE SOCIETY

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ABSTRACT

This paper identifies the temporal sequence during which important cultural beliefs (food taboos) are transmitted to individuals in an oral society living in the Democratic Republic of Congo. Results are based on patterns of correlation in scaled measures of cultural similarity between same-household and same-clan members. In the first phase of the cultural life history (0-10 years-of-age), individuals are innocent of food taboos. In Phase Two (11-20 years-of-age), when most taboos are acquired, parents dominate the enculturation of the young. Phase Three (20+ years-of-age) consists of a less intense period of changing beliefs transmitted from individuals outside the family. This adult learning is usually ignored in socialization studies, but has a significant impact on cultural population dynamics. Since this sequence of early family-based and later more broadly-based cultural influences reflects the temporal expansion of the social universe of individuals everywhere, this life history is probably representative of how cultural traits are generally acquired. Further, the timing of this ontogenetic process mirrors changes in the influence of family environment on cognitive ability in behavioral genetic studies. This parallel suggests that both cultural and psychological traits evolve similarly in response to age-related changes in the social environment. Finally, comparing studies based on statistical models of cultural similarity with those based on reported transmission pathways suggests that the latter, which indicate overwhelming parental influence, probably reflect normative response biases.
Conventional ideas about socialization into cultural life are quite rudimentary. While it is recognized that individuals are not born with knowledge of how to behave like a member of their cultural group and therefore must acquire this competence, the means by which they do so typically continues to be conceptualized as a disembodied and abstract process which magically endows succeeding generations with the group’s cultural heritage.\(^1\) Strauss (1992:9) calls this the “FAX model” of enculturation.

This is obviously unsatisfactory as a theory of how cultural knowledge persists over time. In particular, there is a conspicuous lack of attention -- in standard social theory generally -- to information as a distributed resource (Thompson 1995). Recognition of this simple fact has many ramifications. I will concentrate here on three. First, it urges us to identify the agents behind cultural transmission. Second, it implies not everyone has equal access to cultural knowledge, which in turn suggests that intra-cultural variation may be significant. Third, by emphasizing the need for beliefs and values to spread, it forces attention on the psychology of information acquisition, since only internalized knowledge is likely to be further transmitted. In the following, I first discuss each of these implications in turn. I then detail a study designed to address many of the issues arising from the recognition that knowledge must diffuse through cultural groups.

Whom should we expect to ensure that the accumulated wisdom of previous generations is perpetuated? The presumption in developmental psychology is that parents are all-important early in life, but that peers become increasingly significant role-models as children go to school, and particularly during adolescence (e.g., Schaeffer 1996). However, this is based primarily on the general observation that the amount of time spent with parents versus age-peers decreases with age, and secondarily from self-reports about the relative importance of these social relationships. A small number of empirical studies have suggested that, at least in easier-to-study traditional populations, socialization takes place primarily within families, largely through the agency of parents (e.g., Hewlett and Cavalli-Sforza 1986; Ohmagari and Berkes 1997).

The general conclusion that parents should dominate in the teaching of culture, especially early in life, is consistent with an independent viewpoint: evolutionary theory. Parents and offspring share genetic interests, so there should be cooperative signalling between them. Since parents have similar microenvironments to offspring, but greater experience, information should be passed from them to the younger generation (Cronk 1991). More particularly, in species with low certainty of paternity mothers should show greater concern with the well-being of offspring than fathers. Consequently, in most animals, it is mothers that dominate education of the young (Caro and Hauser 1992). Thus, cultural transmission should mimic genetic transmission, with information passing "vertically" from parents to offspring. Further, if there is any critical period for learning culture, and this period occurs relatively early in life, then it is reasonable to suppose that much of this learning comes from those who dominate the social environment of individuals at such ages: parents and other close relatives. The cultural alternatives then presented to learners would not be random but artfully put together by these experienced kin, who would profit from adaptively constraining their children’s choices. Perusse et al. (1994) call this hypothetical process "teaching bias."

However, Harris (1999, 1995) has recently mounted a significant attack on the received wisdom that parents largely bear the burden of indoctrinating the young, arguing that the literature on parental influence has been oversold. She contends the evidence is highly conflated with genetic factors and excludes the possibility of reverse socialization of parents by children. Further, most such studies only examine behavior within the home, where parental constraints are most effective. Indeed, her most important argument is that all socialization is context-dependent: when at home, children behave according to one set of

\(^1\) For example, a recent text (Schaffer 1996:247) suggests that “socialization refers to the transmission from one generation to another of a society’s standards of beliefs and behavior.”
rules; when at school, they follow another, because the rewards and punishments differ in these varying environments. To her mind, the reason behavioral genetic studies show such a trivial effect of common family environment is that much of social modeling looks to individuals outside the household, from the peer group. There are evolutionary reasons to expect such "horizontal" or intra-generational transmission as well. Peers are highly similar in their social positions, so if there is rapid change in the social or ecological environment, they are the individuals most likely to have tracked such changes, and so should provide the best information about current conditions (Boyd and Richerson 1985).

There seem to be substantial areas in which the expectation of non-parental transmission is fulfilled. For example, parents generally seem unwilling to educate their offspring regarding sexual matters -- as exemplified in one subsistence-level society, where men almost always report learning about sexually-transmitted disease from peer group members, particularly older male sibs or cousins (Bailey and Aunger 1995:210). In more complex societies, professionals (e.g., school-teachers) have taken over the role of enculturation to a greater or lesser degree. It therefore seems that no general proposition concerning socialization can be applied to all kinds of knowledge in all kinds of societies; in fact, responsibility for indoctrinating the young may be distributed throughout the local community.

Nevertheless, there is considerable interest in determining the roles various sources of cultural information play in society. This is because the distribution of knowledge depends on both access to, and variation in abilities to interpret, alternative cultural choices. Cultural dynamics in turn depend on the distribution of knowledge, at least in structured populations (Lowen and Dunbar 1997).

We therefore need to address the second implication of knowledge as a distributed resource: intra-cultural variation. Such variability has been significant wherever it has been studied (Pelto and Pelto 1975). How are we to explain it? Harris’ model of socialization by peer groups would suggest a high degree of cultural uniformity, at least within age groups, and so is not likely to characterize all cultural learning. On the other hand, if it is allowed that occasional mistakes creep into the cultural transmission process, any such differences would then persist within the family-based lineages produced by parent-offspring learning. Over time, the accumulation of such mistakes could lead to significant intra-cultural differences. It therefore seems reasonable, from this basis alone, to argue that most societies rely to some degree on the parental transmission of cultural beliefs.

But this conclusion still does not indicate what role individuals might play in their own education. Education involves not just teachers, but also pupils. Exposure to novel ideas is not sufficient for their adoption. Schwartz (1981), for example, recognized that individuals are active participants in the transmission of cultural knowledge, and incomplete as human beings until they acquire this inheritance. However, the "acquisition of culture" is not perfect, so the idioverse of each individual can be somewhat idiosyncratic, distilled from their unique set of cultural experiences. This is because cultural knowledge is not just transmitted information but the internalized derivatives of others’ social inputs. This internalization depends on the entire personalities of each individual: cognitive, evaluative and affective. Through this process, some cultural information acquires emotional and directive force, and thus determines an individual’s behavior.

Other anthropological research has shown, however, that the nature of culture acquisition is also determined by the social context in which transmission occurs. In particular, the social practice school (e.g., Lave 1988, Suchman 1987) emphasize that internalization is itself incomplete; much knowledge is implicit, and can only be acquired through practice. So personality alone is not an accurate predictor of how cultural acquisition “takes,” as Schwartz and others have argued. Competence is slowly acquired, and not just in episodes where information is transferred from the expert to the novice. For information to become embodied knowledge, the individual must engage in the everyday use of that new knowledge, so that feedback from experience can produce understanding.

Thus, over time, socialization (or FAX theory) has given way to an emphasis on the active filtering of cultural inputs (internalization), which in turn has been replaced by activity-in-context as the dominant paradigm within which the reproduction of social systems is understood. The picture has become progressively more complex as new types of
considerations have been added. The unit of analysis has advanced from the abstract group, to the passive individual (the recipient of culturally transmitted information), to the actively appraising individual (internalization theory), to the socially situated individual, to a cluster of behaving individuals (novices, experts and their tools) within a field of practice. The notion of culture itself has followed these changes in perspective -- going from being a bucket poured into empty mental reservoirs, to the product of an active engagement between individual minds and a circulating complex of knowledge. Individuals are seen as gaining access to this knowledge within a specific social context and incorporating it in their own inimitable fashion.

Existing empirical studies of socialization or enculturation are not well-suited to addressing the issues raised by these theoretical advances. Several problems can be identified. First, few take a life-span perspective; in particular, cultural learning among adults is almost universally ignored. This is because socialization has traditionally been presumed to end at adolescence. However, significant changes in social roles and self-perceptions continue into adulthood, as individuals enter new social arenas (e.g., work), and become spouses and parents (Durkin 1995:629). Levinson’s (1978, 1986) influential account of stages in adulthood (including the "mid-life crisis") points out that within each decade of an individual’s life reassessments of social place and a revision of the life narrative can take place, depending on differences between expectations and actual achievements (e.g., "I never wrote the Great American Novel"). As a result, it is difficult to determine the relative significance of the various possible pathways of cultural transmission during the life course, since the sources of learning later in life may be different from those characteristic of the early years.

Second, socialization studies almost exclusively rely on either association patterns or reported transmission events. However, the former does not measure transmission -- because attention to, and absorption of, information can take place during a nonrandom portion of the time spent in the presence of others -- while the latter may not reflect true patterns of cultural learning if there are biases in the recall or social acknowledgement of transmission episodes.

Third, interest has concentrated primarily on the development of personality and social role-playing abilities (e.g., emotional control, gender roles, and prosocial behaviors), or the competences necessary for everyday life (e.g., parenting and childcare), rather than the transmission of cultural beliefs and values per se. Such proficiencies tend to involve physical or social skills rather than simply semantic knowledge. As a result, such traits can exhibit significant genetic rather than cultural inheritance. In fact, behavioral genetic models tend to find low vertical cultural transmission within families of traits such as social attitudes (e.g., Martin et al. 1986), emphasizing instead positive assortative mating between parents. It is only when cultural beliefs themselves (such as religious affiliation) are investigated that parental cultural transmission appears significant (e.g., Eaves et al. 1990). Thus, the few behavioral genetic studies of cultural traits are in accord with the scant anthropological evidence. Secondarily, if skills are acquired through individual practice, questioning an informant about the transmission of such skills from others becomes confusing.

My objective in this paper is to present a case study of cultural transmission which alleviates these problems. The study concerns an oral society of horticulturalists and foragers living in the Ituri Forest of the Democratic Republic of Congo (DRC, formerly Zaire). First, by focusing on a set of beliefs themselves (avoidances concerning the consumption of particular foods), any confound with behavioral practices -- and hence genetic influence -- is avoided. Second, transmission is inferred using statistical methods based on partitioning variation in the beliefs themselves rather than simply on calculating proportions of informant recalls concerning where they learned something. This avoids possible biases in the reporting of transmission pathways (e.g., in favor of normative authority figures). Third, a nearly complete sample of the local population is used, including individuals from a wide range of ages. I cannot assess the role of practice in the acquisition of this domain of cultural knowledge since the relevant social activities were not rigorously observed. Nevertheless, this approach permits an estimation of the overall significance of different social relationships in the transmission of information, and particularly the importance of learning in later life.

In fact, results from the pattern of correlations between members of households and within villages in the study population suggest the degree of non-parental transmission is
Insignificant in this belief system, at least during the early years of life when most food avoidances are acquired. Thus, it is true that parents are important figures in the maintenance of these cultural traditions. This may be particularly the case for aspects of culture which are closely tied to personal identity, such as food avoidances. Some avoidances are also linked to a norm that such beliefs should be acquired specifically from parents.

However, even here, it is possible to see a discrepancy between norms and practice: especially as individuals age and come under the influence of people outside their close family, they continue to learn about their culture, obliterating to some degree the traces of knowledge acquired earlier from parents. In effect, socialization is not a simple process and continues throughout life, with only the early, normative part involving high parental input. I further argue that other empirical studies reporting overwhelming parental influence probably reflect normative biases in reported transmission.

Finally, the fact that individuals turn to age-peers for guidance just when they are supposed to play the role of teacher to their own children has important implications for cultural change. It suggests that children may not learn what their parents learned when they were young (from grandparents), but instead what the parent more recently heard from someone outside the family. The population dynamics of this latter possibility are quite different: rather than resulting in independent family-based lineages, cultural relationships become blurred, with exchanges of knowledge producing complex networks of cultural affiliation. This is the situation found here in the analysis of cultural correlations between members of the same village. Further, the occurrence of some intra-generational ("horizontal") transmission between episodes of inter-generational transmission introduces the possibility of non-adaptive learning, as documented elsewhere for the Ituri food avoidance system (Aunger 1994a). Thus, while non-vertical transmission may not be the means by which a high proportion of all beliefs learned, it nevertheless has a strong influence on the distribution of beliefs in the population. The significance of non-vertical transmission is thus intimately tied to its timing in the life history of cultural learning. I therefore conclude that the distribution of cultural information depends not only on the relative strengths of the various links along which information is exchanged in a social network, but also on network dynamics -- the temporal relationship between episodes of cultural learning (or relearning) and of transmission by individuals in that network. I conclude by discussing the social and cultural context within which transmission takes place in this society.

**BACKGROUND**

Several groups of both horticulturalists and foragers coexist in the Ituri Forest of the DRC, where this study was undertaken. All of these groups speak either a Sudanic or Bantu language. There is very little mechanized transportation in the area, and population density is low. Further, at the time of fieldwork in the early 1990s, very few individuals had radios, and there were no newspapers and only a few books (primarily Bibles) in circulation. Given this effective illiteracy (except among those few with governmental roles), it is fair to say the population was primarily oral, with cultural transmission therefore requiring personal interaction, either through vocal communication or the imitation of observed behaviors.

The analyses in this study concern the cultural reasons for avoiding nutritious foods, primarily among Sudanic horticulturalists (including the Lese and Mamvu ethnic groups). These people live in small, clan-based villages of under thirty individuals, situated along a single dirt road. Residence among these horticulturalists is primarily virilocal, which obviously influences who might be available to instruct others about cultural things. Gardens are quite small, and food is supplemented through exchanges of garden produce for meat captured by the forager group with whom each clan has a traditional relationship. Avoidances against consumption primarily concern the forest-dwelling animals obtained through these economic exchanges. These avoidances effectively determine behavior as well, since individuals reject foods they report as restricted to them when the opportunity arises (Aunger N.d.c).

Beliefs about food edibility were reported by individuals during formally structured interviews, conducted either by the author or a local assistant. Interviews consisted of a
sequences of probes respecting the edibility of a fixed list of animal foods identified in the informant’s mother tongue. For example, the interviewer would ask "Can you eat yama [tree dassie]?” The respondent would typically reply "yes," at which point the interviewer would probe whether there were any restrictions on consumption. This might elicit a response such as "Well, if my wife is pregnant, then I must refuse it because [my consumption of] it will cause the baby to be born with only three fingers." These responses were then coded by the author using a self-devised coding scheme. Over three hundred different types of reasons for avoiding foods were reported by this population. Nearly complete samples of the food-related beliefs of geographically-confined populations were produced in this fashion.

For the purposes of this paper, all informant responses were grouped into one of three major classes of food avoidance. The first two types constitute taboos; consumption results in dangerous, culturally-defined illnesses. One group of taboos revolve around pregnancy and child-rearing, being effective only at such times. Consumption of the specified items by pregnant or lactating women (and sometimes their spouses) leads offspring to acquire some anomalous trait of the offending animal (e.g., a long, floppy nose if an elephant’s trunk is eaten). As a result, I call them Homeopathic Taboos. For example, "Kelikofu [a type of hornbill] is bad for parents of children to eat, for when a child is sick, it shakes just as the bird, when comes out of its hole [in a tree trunk], is cold and shakes."

Another taboo class is given weight by appeal to the authority of ancestral prohibitions against consumption. Violation of these Ancestral Taboos often leads to a quick death caused by some incompatibility between the lineage’s "blood" and that of the animal. For example, "Wepinga-pinga [Long-nosed mongoose] is koukou [men’s food] from the old religion of before; our grandfathers didn’t eat it together. If brothers ate it together, all of them would become old in one year, so each brother eats a different koukou." Or again: "Male children [in our family] can’t eat boku [a type of catfish]; it bends them over [like an old person] and they die."

The last type of restriction I call Other Avoidances. They tend to concern low-quality foods which individuals in a group find distasteful, disgusting or simply "not food." For example, "Oku [Long-tailed pangolin] has something black inside its body that makes it bitter when it dies." This reaction is often conveyed in emotional terms, and may rely on some previous experience with consumption of that food (e.g., "Kiterere [rice locust] is mchafu [dirty]: it scratches your throat.")., or other kinds of experiences: "If tati [a type of millipede] lands in the water, it becomes a kebi [catfish]. My dad saw this one day, watched as it changed, shedding its skin and getting fat by drinking water right away. Since then, dad hasn’t eaten." No overt cultural sanctions are placed against the consumption of such items.

Besides the general arguments mentioned in the Introduction, there are additional, specific conditions in Ituri society favoring strong vertical (or parent-offspring) transmission of food avoidances. The first, and perhaps most important, is that in the Ituri people themselves have a normative model that these beliefs should be vertically transmitted. Indeed, the primary reason people should acquire food taboos is this "transmission norm." This rule grants each individual the authority officially to transmit such beliefs to specific others in the social group. Among Sudanic horticulturalists, who dominate the study population, the rule is that parents should transmit these beliefs to their offspring of the same gender.

Sudanics generally believe that when a child reaches about seven years of age, ("when the child begins to have some sense"), the same-gender parent begins to opportunistically present the child with samples of a particular food item, with instruction that this item cannot be eaten. Often, some rationale is also provided, such as: "My parent did not eat this food; neither can you. It is our tareta [restriction]." The parent repeats these instructions, with or without the benefit of an example of the food item, while impressing on the child the necessity of continued transmission ("This is our tareta; you must not let your child eat this food or it will become sick"). The child remembers these avoidances throughout life, and at the appropriate point in his/her own childrens’ lives goes through the same instructional process with them. Thus, each individual should avoid those foods that his/her same-gender parent told him/her not to eat; this parent was in turn taught by his/her own parent. A primary objective of this paper is to determine how realistic this emic view is of actual transmission practice. Note that the cultural lineage implicitly defined by the
transmission norm is different for men and women. For males, the cultural lineage is equivalent to the clan, since Ituri society is patrilineal. For females, the normative female-to-female cultural lineage is not tied to a particular kin-group, since the women of each generation typically marry into different clans.\(^2\) Which foods are avoided by members of these geneologically-defined lineages can be different.

In conclusion, finding significant non-vertical transmission in this case would be surprising because it would counter a norm, contradict the empirical trend of cultural transmission studies, and subvert the expectation from evolutionary theory.

**INFERRING TRANSMISSION PATTERNS**

The basic methodological problem of this study is to infer the past history of taboo transmission events in the Ituri population, given present variation in belief about the edibility of foods. However, given that data was collected at a single point in time, it becomes necessary to make a simplifying assumption about the consequences of cultural transmission on reported beliefs. The assumption is that the result of cultural transmission between individuals should be increased similarity in what they believe -- because when one individual learns something from another, they then have a belief in common which they did not previously share. High degrees of cultural similarity can therefore be taken to indicate a history of either direct transmission, or of a relatively short transmission chain, between members of that dyad -- otherwise, given the likely high rates of mutation in cultural information, a mutation in content would have obscured the transmission pathway. The fundamental assumption of my analysis, then, is that the cumulative consequences of the past history of transmission in a population can be seen in the present pattern of variation between individuals.\(^3\)

One problem with previous attempts to measure transmission patterns in the Ituri at larger scales -- based on phylogenetics (Aunger N.d.a) or multiple quadratic assignment regression (Aunger N.d.b) in two representative samples of roughly 100 geographically-contiguous individuals -- is that the pattern of transmission estimated for these beliefs may be distorted by the absence of potentially significant individuals in the analysis. Two classes of such individuals in particular may be important for the transmission of food taboos: parents of those in the sample who have died, and members of the natal villages of women who married into the study area but who themselves fall outside the purview of the geographical sample. Thus, I am unable to reconstruct the memberships of natal households for individuals who are presently living in marriage or old-age households (i.e., almost everyone over, say, 30 years of age). As a result, the influence granted to the household is probably underestimated by the previous models. Nevertheless, some insight into what likely happens

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\(^2\) Such a norm probably had to arise historically because of the need to keep the costs of the taboo system (in terms of nutrition and fertility) under control, and to minimize the abilities of particular individuals to force such costs on others. If such a relationship was not normalized, no one would learn taboos. If transmission authority was legitimated too widely, individuals would acquire too many onerous beliefs, leading to increased social conflict. So a specific transmission pathway probably had to be settled on. In a society that recognizes few types of authority, the transmission of taboos naturally piggybacked on the primary social authority relationship functioning in other domains -- that between parents and offspring (which represents the conjunction of the two most powerful and universal lines of social authority: kinship and generational seniority).

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\(^3\) A virtue of this technique is that it does not require individuals to report from where some piece of information was learned, but simply to report what they know—a first-order rather than second-order retrieval-from-memory problem. Presumably, errors in reporting knowledge are smaller than those resulting from reporting knowledge about knowledge.
in households can be determined from a more detailed investigation of complete households current at the time of data collection.

A second reason to examine variation only within households has to do with the confound of time: I want to concentrate here on the social units in which the bulk of cultural transmission is occurring at the time of sampling. Since individuals are primarily enculturated during adolescence (Aunger N.d.b), the natural focus of investigation is contemporary households. Aunger (N.d.b) also showed there was significant social bias in the adoption of these cultural traits. The household and local village are the units within which these biases should see expression, relatively uninfluenced by proximity and other social role variation.4

For this study, it was desirable to use the largest possible sample of households who share ethnicity, and thus the same avoidance vocabulary and cultural traditions, including transmission norm.5 Individuals from this sample were assigned to households and villages according to their primary residence during the period of fieldwork. Thus, I constituted all known households with individuals in the Sudanic horticulturalist population sample (N = 248). However, in the absence of information about kinship relations, geneological dyads were determined by an algorithm based on individual differences in age and gender with other household or village members. Since they are inferred, such relationships (e.g., "father/daughter," "female sibs") appear in quotations in Tables 1 and 2. However, relative numbers in the different categories are close to what would be expected by simple demographic assessment in this population (e.g., roughly twice the number of opposite as same-gender sibships; a dearth of young women in residence due to out-marriages; a significant proportion of childless marriages6). I first restrict attention to members of the same household, and only one generational difference, to keep ontogenetic effects to a minimum. Next, geneologically related pairs of individuals from the same village (but different households) are examined, to get at extra-familial kin-based transmission.

Several problems attend the statistical estimation of cultural transmission patterns based on similarity in reported beliefs. First, particular kinds of belief are likely to be learned from specific people, resulting in unique patterns of inheritance. However, similarity with respect to a single belief is simply a binary value (yes/no), which doesn’t provide a sufficient measure of variation to establish degrees of cultural relationship. On the other hand, aggregating over all reported avoidances results in the agglomeration of beliefs with different patterns of inheritance. Further, if differences are simply counted up, information concerning the nature of disagreement is lost. To measure the degree of similarity in reported taboos between individuals, optimal scaling was used because it retains considerable information about the nature of differences in belief while also reducing the overall complexity of the comparison. Pairwise similarity measures were calculated as the Euclidian distance between

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4 It is also my hope that this analysis will clear up the confusion regarding the significance of temporal trends (i.e., effects associated with informant ages) in the epidemiological analysis (Aunger N.d.b), thanks to there being fewer possible interpretations here and more points of contrast with which to tease temporal effects apart.

5 The sample includes both Populations A and B from Aunger (N.d.a), as well as another neighboring clan, and effectively constitutes the entire population along a contiguous twelve mile stretch of the primary road through the Ituri. Even though the analysis in the previous study (Aunger N.d.b) shows significant variation in the transmission structure between the two sub-populations making up this selection of households, it is likely that within households there is much less room for variation in pattern, because household composition and cultural milieu do not vary as greatly at this scale as these influences on the pattern do when estimated for entire populations.

6 Childless marriages in this non-contracepting population appear to be due to high rates of secondary sterility caused by sexually-transmitted diseases (Bailey and Aunger 1995).
the individual values from the three dimensional solution of the scaling analysis. Separate models were also calculated for each of the three major types of food avoidance.\footnote{The SPSS 4.0 OVERALS routine, which performs optimal scaling based on an alternating least squares algorithm, was used. Categorical responses to 140 questions served as input; multiple nominal measurement levels were assumed (i.e., linear relationships among variable states were assumed to be independent for each dimension of the resulting solution). Animal-specific beliefs were grouped into the same twenty sets as used in Aunger (N.d.a). Nine or ten different subtypes of food avoidance were allowed in each model. More details and the results of this analysis are presented in Aunger (N.d.b).}

Second, reports concerning belief are subject to a wide variety of biases (Aunger 1994b). If used without correction, reports would cause error in the estimation of similarity, and hence of the relative importance of transmission pathways. The dyadic similarity measures were therefore corrected for methodological effects using a standard OLS regression model.\footnote{Since the earlier epidemiological results (Aunger N.d.b) showed a high degree of similarity in significance pattern to those from parametric regression for the two populations composing this larger sample, use of more powerful and familiar parametric methods is justified. Main effects as well as any significant two-way interactions involving the interviewer were determined by backward multiple regression (N = 60025), with critical \( p = .001 \). All variables from the epidemiological study except those concerning contact periods (Childhood Village, Adolescent Village, “Time-Shared”) were admitted into the regression procedures. The following interactions with Interviewer were significant: for Ancestral Taboos: Clan, Phratry, Gender, “Under 25” and Work History (\( r^2 = 0.01969 \)); for Homeopathic Taboos: Ethnicity, Phratry, Gender, Generation, “Under 25”, “50 Plus”, Reproductive History, Education, Marital History and Work History (\( r^2 = .05748 \)); for Other Avoidances: Ethnicity, Clan, Phratry, Generation, “50 Plus” and Work History (\( r^2 = .01426 \)). See Aunger (N.d.b) for definitions of these variables.}

Thus, the measure of cultural similarity actually used was calculated as the residual from the regression model (i.e., reported values minus the value predicted by these methodological factors).\footnote{That is, \( \hat{Y} = Y_{\text{obs}} - \sum X_i \), where \( X_i \) = interviewer-based effects with \( p \leq .001 \).} These residual distances were then reversed and rescaled to a range of 0 to 1.

The primary objective here is simply to compare the average degree of cultural similarity among those sharing particular relationships within households or villages (i.e., clans) from the Sudanic population. Some way of calculating whether the measured differences in belief are significant is required. After average (scaled residual) cultural similarity for each type of geneological relationship is computed, the Tukey-Cramer method was used to make multiple comparisons of means from each possible pairing of relationships when the means are based on unequal sample sizes (Sokal and Rohlf 1981:251-2).\footnote{Two means are significantly different at the critical probability \( \alpha \) if their difference exceeds the minimum significant difference (MSD\(_{ij}\)), defined as

\[
\text{MSD}_{ij} = m_{\alpha[k^*,v]}\left\{s_i + s_j\right\}/2 \right)^{1/2},
\]

where \( s_i \) is the standard error of the mean for relationship \( i \) (calculated from a pooled variance), \( k^* \) is the number of comparisons (= \( k[k-1]/2 \), where \( k \) is the number of means), \( v \) is the degrees of freedom (= \( \sum [n_i - 1] \)), and the critical value \( m_{\alpha[k^*,v]} \) is derived from the two-tailed studentized range table. In Tables 1 and 2, \( \alpha = .05 \).}
Results from the comparison of means tests are presented in Tables 1 and 2, for households and villages, respectively.\(^{11}\) Given that significant methodological bias has been removed from the estimates, and that at least some differences in each comparison are statistically significant (the Tukey-Cramer test is quite conservative), I will examine the general pattern of differences between means, many of which should be socially meaningful. As the ranks among average values are difficult to determine from the Tables, I present them here (with double inequalities indicating larger gaps between values). First, within households:

**Ancestral Taboos:** female sibs << father/daughter << mother/son < spouses < mother/daughter < opposite sibs << male sibs << father/son;
**Homeopathic Taboos:** opposite sibs << father/son << mother/daughter < female sibs < father/daughter << spouses < mother/son << male sibs; and
**Other Avoidances:** father/son << opposite sibs << mother/daughter < female sibs << male sibs < spouses < mother/son << father/daughter.

The relationships within villages are:

**Ancestral Taboos:** female cousins << aunt/boy < aunt/girl << opposite cousins << uncle/boy < uncle/girl < male cousins;
**Homeopathic Taboos:** female cousins < male cousins < aunt/boy < uncle/boy < uncle/girl << opposite cousins < aunt/girl; and
**Other Avoidances:** aunt/boy << male cousins << uncle/boy < uncle/girl < opposite cousins << female cousins < aunt/girl.

I next detail the implications of these results for our picture of cultural transmission in the Ituri.

### Ancestral Taboos

According to the Sudanic norm of same-gender parent-offspring transmission, high correlations should be seen in same-gender pairings, while mixed-gender correlations should be low. If we look first within the household, this normative expectation seems to hold: the mixed-gender relationships (father/daughter, mother/son, spouses and opposite sibs) are all of intermediate value. Further, for the two all-male pairs, the father/son pairing exhibits the highest observed average similarity, and male sibs the next highest value, as expected. The same relative relationship is observed among females: female sibs have a lower correlation than the mother/daughter pair because of varying degrees of cultural incompetence. But female sibs have the lowest similarity value of any pairing, while the mother/daughter pair is of intermediate value (with many other relationships intervening). If the transmission norm holds, why are female sibs much less similar to each other, and much less close in belief to their ostensible cultural mentor, than their male counterparts?

One explanation is paternal transmission to daughters: fathers teach some Ancestral Taboos to offspring of both genders. The justification for such transmission (which does require legitimation in the eyes of those being taught, given their costly observation) is supported by a second normative belief: the "blood" theory. Those foods particularly dangerous to a man because of his clan-specific taboos might also be dangerous to those that share his blood, even if female. This reasoning might lead a father to refuse his daughter to eat foods prohibited by strong Ancestral Taboos. A husband cannot restrict his wife's consumption using the same argument, so a high spousal correlation cannot be expected from this theory.\(^{12}\) In fact, this blood tie is what makes the transmission norm applicable only to

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\(^{11}\) Differences in mean values appear below the diagonal, and the proportion of the Tukey-Cramer test critical difference is available above the diagonal as a measure of the degree of separation between means. Values greater than one are significant at p < .05.

\(^{12}\) Although if marriage is within the phratry, there may be some overlap between the wife's Ancestral Taboos acquired from her father (rather than mother), and those exhibited by her husband, acquired from his father.
Ancestral Taboos (which refer explictly to the family in the rule, as in "We don’t eat..."), and hence the only category where the norm seems to actually constrain transmission (cf., Auenger N.d.b). Thus, it appears the Sudanics are influenced by the normative transmission model held by those around them (which supposes paternal transmission to all offspring), although they espouse another as their own. However, the fact that female and opposite-gender sibs have low degrees of similarity suggests some maternal transmission, as does the fact that the mother/daughter pair has a higher value than mother/son. So the Sudanic norm is also in effect.

In fact, I argue that paternal transmission to both offspring coupled with transmission from mothers to daughters can explain nearly all the observed values: Female sibs are very low because they have input from both parents (and they may have different mothers as well, increasing their difference from each other), while boys in the same family only get taught by their father (whom they almost always share). Inter-generational pair correlations are reduced by the unilateral ignorance of the younger members, but mother/daughter is lower than father/son because the daughter has learned from her father -- training the mother does not receive. Mother/son is lower than mother/daughter because sons pay no attention to their mothers, receiving their taboos only from fathers.

I have thus invoked three principles to explain the ancestral results within households: 1) gender-specific transmission from mothers; 2) general inter-generational transmission from fathers; and 3) ignorance among the young. The same principles help explain the very significant differences in cultural similarity at the village level (see Table 1), although they must be augmented to account for inter-household differences. For example, the uncle/boy value is lower than the value for male cousins (the reverse of the household-based results for these the inter- and intra-generational all-male pairs) because of variation in belief among older men within the village. The correlations with aunts are generally lower than those with uncles because aunts arrive in the village through in-marriage with their own Ancestral Taboos. There is no presumably no transmission from aunts to offspring in other families.

Overall, the greater cultural variation within villages than households suggests there are household-specific factors in the transmission of these taboos, such that transmission leads to inter-household differentiation. This is contrary to the case for the other two types of food avoidance (discussed below), where variation is considerably lower within villages. Thus, culturally naive individuals pay fairly strict attention to their own parents, in preference to other models, even those in close proximity, who are also related to them. This produces some drift in the suite of beliefs between families, and implies that although oblique transmission (inter-generational transmission between families) occurs -- primarily from uncles -- it is less important than vertical transmission.

Homeopathic Taboos

There is considerably less variation in these measures than was the case for Ancestral Taboos: the largest pairwise difference within households is only 62% the size of that for Ancestral Taboos. Nevertheless, greater statistical significance is seen here, and the epidemiological study (Auenger N.d.b) indicated there was significant similarity in belief.

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13 The greatest variation was also seen in these Ancestral Taboo data in the epidemiological study (Auenger N.d.b). Although the epidemiological study results suggested a somewhat different transmission pattern, that model was hampered by being restricted only to main effects. This suspicion is confirmed by results from Auenger (N.d.c) using MANOVA, which shows that the same interactions which characterize social structure within households (i.e., age and gender differences) also characterize large-scale transmission patterns, with nearly every possible interaction proving significant. The MANOVA study also indicates that greater structuring is retained for Ancestral Taboos than for the other categories of belief at this larger scale. I therefore place greater weight on the present result than that from the epidemiological study.
among household members -- only for these taboos. The pattern of variation is thus real, and requires explanation.

Within the household, I would argue, we now have a reversal of the Ancestral Taboo case: mothers transmit to both sexes of offspring, but fathers only to daughters (coupled again with ignorance effects -- young people simply aren’t informed of these beliefs because they are irrelevant to them prior to becoming reproductive). Because Homeopathic Taboos relate to reproductive matters, women may be given some control over this knowledge, so that maternal dominates paternal influence. The high value of the mother/son and male sib pairs suggests strong maternal transmission, especially since they are significantly higher than any other pairing (except spouses). The mother/son value can only be high if young males have good knowledge of Homeopathic Taboos, because adult women certainly do. This explains the relationship in values among sib-based pairs (males < females < opposite-gender): male sibs acquire knowledge only from mothers; daughters are influenced by both parents, and so are somewhat similar to each other as well as to those parents; while the mixed-gender sib correlation is lowest because the single influence on males is being compared to females’ double cultural parentage. The father/son value is particularly low because fathers don’t bother with sons, men having a smaller role in parenting. However, spouses tend to communicate about reproductive matters, since their mutual offspring are at risk if they do not, explaining their quite high cultural similarity (a higher ranking than for Ancestral Taboos). In effect, spouses must be choosing a family policy of which Homeopathic Taboos to follow from among those they have together encountered.

At the village level, differences in Homeopathic correlation values wash out almost completely (only 16% of the range exhibited by Ancestral averages at this level); no comparison even approaches statistical significance. This is the opposite of the Ancestral Taboo case. Indeed, Homeopathic Taboos are the category with the strongest intra-household, but weakest intra-village variation. This can only arise if the mother strongly influences what is known within the family, each becoming acquainted with a roughly random sample of animals which could be avoided from this perspective. This is because these women learned their Homeopathic Taboos from their mothers (during adolescence) before they married into their present village. The variety of such women within a village, each heading a family tradition, explains how all inter-household dyadic correlations, regardless of gender and generational composition, can become roughly equal in magnitude. This is a nice counterpoint to the case of Ancestral Taboos, where consistency of belief between families is produced by the continuity of residence among the men who dominate the dissemination of those beliefs.

Thus, the general picture of transmission for Homeopathic Taboos is of inter-generational transmission from mothers during childhood and adolescence, but later, more indiscriminant transmission from people later in life, with a particular boost in knowledge being seen among those who themselves give birth (and so feel a greater need to protect their children), and further contact-based similarity among those with shared life experiences (from the epidemiological model -- Aunger N.d.b). In effect, the closed world of the household is only effective during an individual’s early life, with later transmission being more horizontal, and in particular, quite unrelated to commonalities of kinship. This suggests there is a kind of "hear it -- believe it" rule for such beliefs. This intrinsic believability is based on a fundamental cognitive principle: the law of sympathetic magic as applied to the act of consumption ("you are what you eat") (Rozin and Nemeroff 1990).

**Other Avoidances**

14 Although the father/daughter value is higher than that for mother/daughter, the difference in values is very small and quite insignificant.

15 Males are only subject to Homeopathic Taboos if they believe that, through intercourse, their semen becomes part of the mother’s milk, thus transmitting the essence of what they eat to a fetus.
Previous analyses (Aunger N.d.a,b) have suggested that Other Avoidances reflect some degree of social similarity (primarily at the clan/village level), despite the general expression of these rules as purely personal opinions with no direct sanctioning, since these beliefs are not backed by a social authority system (as in the case of the two taboo types). Why then such group-level patterning?

Answering this question definitively is made more difficult by the reduced structuring of variation for this category (this is the only type of avoidance which did not show a significant household result in the epidemiological study of Aunger N.d.b). Within the household, variation is even smaller for Other Avoidances than for the other two categories (51% of the range for Ancestral Taboos at the household level), with statistical significance being considerably lower than in the two previous cases (only three differences even approach statistical significance). Thus, results here are a bit mixed, and consequently more difficult to interpret.

Within the household, the comparisons between the father/son, father/daughter and mother/son pairings are most different. In particular, an important task is to explain how the father/son pair can have the lowest similarity value while father/daughter has the highest. Same-gender inter-generational values are low, but opposite-gender inter-generational ones high. All-female pairs have the same general ranking, but all-male pairs do not. No single principle is likely to explain such a confluence of results. Not only that, but any explanation must be consistent with the fact that more patterning is retained at the village level than was the case for Homeopathic Taboos (45% of the range in Ancestral Taboo averages among households). Nevertheless, I believe it is possible to explain these results, using principles quite different from those used in the case of taboos, which are (after all) quite different kinds of belief.

Remember that the kinds of foods involved in Other Avoidances are generally lower-quality animal foods such as rodents, reptiles and insects. Studies suggest that animal phobias, which typically involve invertebrates (e.g., spiders) or so-called "fear-relevant" animals (e.g., predators, bats, snakes), are significantly higher in women than men (Fredrikson et al. 1996; Davey 1994; Tucker and Bond 1997), and in younger than older individuals (Fredrikson et al. 1996). These fears appear to result from genetic predispositions coupled with specific triggering experiences early in life, rather than the cultural transmission of fear reactions (Kendler et al. 1992; Fredrikson et al. 1997; Davey et al. 1993), and so are probably universal. Animal phobias are also associated with a greater proneness to disgust reactions (Tucker and Bond 1997). Finally, females are more susceptible to experience disgust than males (Haidt et al. 1994). Thus, there is considerable evidence (at least from Western populations) that young women are much more likely both to experience general fears of animals, and disgust at the thought of consuming those animals, than young men. So I argue that girls in the Ituri initially reject a wide variety of low-salience animals, but then later become reconciled to their consumption as more desirable meats are increasingly forbidden to them. In effect, as more food taboos begin to become effective, less room remains available for individual choice about what to eat; preferences erode as hunger sets in.

Second, adult men in the Ituri are also fastidious eaters; they can afford to be because food taboos channel to them the greatest variety and choicest cuts of meat. Further, as they tend to sit about, discussing politics and other matters of social import, they come to consider themselves the harbingers of good taste. Indeed, the ability to refuse a wider variety of low-quality foods than others may be seen as an emblem of prestige. However, their sons are generally off in the forest, practicing their hunting skills and eating widely, ignorant of the use of food avoidances for social approval.

Thus, as they mature, the two sexes go through quite opposite ontogenetic processes: males acquire Other Avoidances while females lose them. This, coupled with the fact that what animals are actually avoided for this reason is quite individualized, can explain the

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16 This coincides with the epidemiological result (Aunger N.d.b) showing significant similarity of belief between households within the clan (or village) -- quite the opposite of Homeopathic Taboos.
apparent anomalies referred to above. For example, the relationship among sib-based values is the reverse of the Homeopathic case: opposite-gender < female < male. Mixed-gender sibs are lowest because we are comparing gender with high interest to one with low interest in the function of these avoidances: female sibs are middling because they have chosen different items to be disgusted by (they create these beliefs on their own, after all); male sibs are quite similar in having few of these avoidances. The father/son correlation is very low because fathers, as mature males, have many such avoidances, while their sons have very few; father/daughter is very high because the daughter may actually look to her father as the guiding light for her process of acquiring etiquette. Mothers and daughters are of only middling similarity because they are at different stages of life. Spouses can only be of mid-range similarity if there is some concern among wives that they be acceptable to their new social group, and so adopt, at least to some degree, the peculiar disgust reactions of those around them. But this too is reasonable, given the inherent insecurities such women face when moving into a new group with no local allies.

At the village level, the lower overall variation and changed rankings of same-category pairs are presumably due to aggregating over avoidances that are chosen on a somewhat haphazard basis, and hence more idiosyncratic. Apparently, what is relatively fixed is the differences by gender in psychological sensitivity to disgust reactions; what is actually avoided for this reason seems to reflect some degree of social imitation, since the epidemiological model shows significant geographic and kinship patterning in these avoidances at a small scale -- between villages (Aunger N.d.b). In effect, since neither of the taboo categories exhibit geographic patterning, and since male kinship is tied to geography (because villages are patriclans), any consistent residential effect must reflect patterning among women. Thus, the more specific conclusion from these results, when coupled with the epidemiological model, is that women are imitating each other in their choice of the animals to avoid for Other reasons. This is not transmission due to social sanctioning for ignorance or the willful disobediance of cultural rules, but merely the spontaneous mimicking of others deemed to be similar to oneself. Thus, the highest correlations within villages are between women, regardless of generation or family. On the other hand, the lowest correlation is between a boy and his aunt, because this pairing represents the combination of two differences (between genders and generations) with the relatively low probability of inter-familial transmission.

In conclusion, one type of taboo is largely dominated by paternal transmission because it is tied to ancestral authority; these taboos serve both as social norms and group identifiers. Homeopathic Taboos are also parentally transmitted, but with mothers serving as the primary role model for learning. Nevertheless, such taboos are seen largely as laws of nature, because the consequences of rule violation work through the magical transformation of the human form through consumption of similar, but anomalous, animal substances. Other Avoidances are somewhat hybrid beliefs: largely reflecting individual psychological predispositions concerning the consumption of various foods, but also manifesting shared choices about which animals to forego. Thus, each type of belief is quite different -- having a social, physical or individual function -- although arising through a relation to the same kind of object (animals-as-food), and culminating in the same behavior (avoidance).

**REPORTED TRANSMISSION VERSUS STATISTICAL MODELS**

The previous statistical analyses can be compared to what informants themselves believe about their personal cases. Informants were asked during avoidance interviews where they had learned their food taboos. The vast majority mentioned a single individual, although such a constraint was not imposed on informant answers. Table 3 summarizes responses, by implied transmission mode, from the Sudanic sample population.17

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17 Eighty-nine interviews have missing data because this question was not asked early in the fieldwork. However, these are roughly distributed in accordance with composition of sample composition by ethnicity and age of informant.
Inspection shows that reported learning experiences are significantly closer to normative expectations than to the pattern determined by statistical analysis. Since informants were not questioned with respect to particular classes of taboo, direct comparison to taboo-specific tests cannot be made. However, it is clear that the reported pattern significantly underestimates the intra-generational and inter-familial transmission estimated for even the most normative class of belief, Ancestral Taboos (see also Aunger N.d.b). In particular, reports of parental transmission largely specify same-gender parents (60.9% of all reports; 79.8% of parental reports), as expected of a predominantly Sudanic sample population attentive to their transmission norm. The suggestion is therefore that individuals tend to bias reports in favor of what is expected of them, probably in order to legitimize their beliefs. The fact that informants usually referred to their teacher by kinship category rather than name also suggests an implicit awareness of the transmission norm (which specifies a relationship, not individual) at the time of the report. Thus, such figures may reflect a general tendency to report authority figures, rather than specifically recalled events.

Two previous studies have also examined intra-cultural transmission in subsistence-level societies, relying on informants’ own reports about from whom they learned a variety of skills and cultural information: Hewlett and Cavalli-Sforza’s (1986) study of Aka pygmies in Cameroon, and Ohmagari and Berkes’ (1997) study of Cree Indian women from subarctic Canada. Hewlett and Cavalli-Sforza (1986) estimate that about 80% of transmission is from parents, with another 5% from other family members. The comparable figures from Ohmagari and Berkes’ study (1997:211) are 72% vertical (from parents), and 90% inter-generational, intra-familial transmission. Despite differences in subsistence technologies (foraging versus horticulture), interview technique (formal versus informal), type of trait (skill versus belief), and sample sizes (from twenty to several hundred), there is considerable congruence in the importance of vertical transmission in these three studies, supporting Cavalli-Sforza’s (1986:425-6) contention that the typical mode of transmission -- at least in traditional societies -- is largely intra-familial and inter-generational.

However, this pattern is not reflected in the statistical models presented here, where greater horizontal and oblique transmission is evident. Further, Chen et al. (1982) showed that both parents, an older sib and a self-identified friend were of approximately equal (and additive) importance in the transmission of a variety of cultural beliefs in the domains of religion, leisure, and hygiene for a large sample of university students in Taiwan. These Taiwanese results, as here, were derived through statistical means rather than direct questioning of informants, and show a concomitant increase in the importance of non-vertical transmission. Comparing results using these two methodologies suggests that reports

18 Ohmagari and Berkes (1997) report values from two Cree groups; I use those from the one less subject to acculturation pressures and therefore more comparable to the Aka and present studies.

19 In a fascinating parallel to the Ituri, both the Aka and the Cree informants showed significant tendencies to mention parents of the same sex as themselves (Hewlett and Cavalli-Sforza 1986:931; Ohmagari and Berkes 1997:211), even though neither of these studies suggest a norm specifying same-gender parents as the legitimate source of cultural information in their respective societies. This confluence of a normative emphasis on same-gender parental transmission is consistent with theoretical expectations supporting vertical transmission (discussed earlier), together with a bias (which may be cultural) to prefer the same-gender parent.

Both of these other studies also indicate that subsistence skills are learned early in life. In Ohmagari and Berkes’ (1997:210) study, reported average age for acquiring bush skills ranged from 7 to 13 in the more traditional group, while Hewlett and Cavalli-Sforza (1986:929-30) estimate that by age 10 Aka children have already learned most of what they will ever learn about foraging. Food taboos appear not to be learned so early, but it might be expected that children would concentrate on those skills vital to subsistence in populations living on the ecological edge.
concerning the learning of socially important beliefs often reflect a variety of normative influences rather than practice, and hence tend to emphasize parental transmission. But since statistical models are designed to fit the results of transmission (i.e., the actual pattern of intra-cultural variation in belief), they should be preferred over informants’ own reports as models of cultural dynamics. In particular, the present paper -- which, together with Aunger (N.d.b) allows the comparison of reported to estimated transmission in the same population -- suggests that self-reports concerning where cultural information was learned may not be reliable.

DISCUSSION AND CONCLUSION

This paper seeks to infer the structure of transmission in a face-to-face society of horticulturalists and foragers in the Democratic Republic of Congo (formerly Zaire) from cultural similarity data. Intra-cultural variation in belief among individuals known to share specific households or villages is used to infer where people learn cultural beliefs about the edibility of foods.

Results indicate that the three different types of food avoidance considered have quite different patterns of transmission, which likely reflect their distinct linkages to other socio-cultural systems. First, Ancestral Taboos consistently exhibit the greatest social structuring, suggesting there are shared tendencies that result in significant organization of transmission channels. I suggest this shared tendency reflects the operation of another belief concerning the source of kinship: shared blood. This shared blood, which is strongest in the paternal line (backed by the named clan), gives fathers the right to confer Ancestral Taboos on children of both sexes (since daughters also have paternal blood). Side-by-side with the blood theory, however, is a norm for learning taboos, which specifies same-gender parent-offspring transmission. This directive overlaps with the blood theory in the case of males, but not females. In conformity with the transmission norm, there is also evidence of mother-daughter transmission. So both theories seem to direct behavior in this case, with the overlay of blood and transmission theories making paternal transmission dominant. Further, a recent change in the robusticity of the taboo system suggests these taboos held greater importance in previous generations, as argued previously from a study of acculturating factors associated with the presence of missionaries in the area (Aunger 1996), as well as analysis in Aunger (N.d.b).

Homeopathic Taboos, the second avoidance category, are dangerous, but not classified together with Ancestral Taboos by local people; in particular, they are not subject to the transmission norm. Rather, because they protect pregnant women from consuming dangerous foods that might transform their fetus through magical contagion, the content and transmission of these beliefs is largely controlled by women. Within households, mothers are strong influences on what children of both sexes learn, while fathers attempt to direct the learning of their daughters, who are more directly involved in the production of their grandchildren than sons. Homeopathic Taboos are learned over a period of time, but unlike other categories of avoidance, cross ethnic and gender boundaries freely due to their intrinsic psychological appeal ("you are what you eat") (Aunger, N.d.b). In essence, they are viewed as physical laws describing transformative processes beyond human control. However, once the reproductive career has ended, they are discarded as being largely irrelevant to life as an older person in the Ituri.

Third, reflecting their common expression as attitudinal rejections (e.g., "I detest rats"), and the lack of explicit social consequences to transgression of the rule, Other Avoidances are not social beliefs at all but rather individual psychological reactions to perceived anomalies in the behavior or morphology of particular animals. These manifest themselves in a fear of specific animals and consequent disgust at the thought of consuming them. Which animals stimulate such responses may be socially learned, however. Nevertheless, a major difference with taboos is that such avoidances may arise without explicit interpersonal communication. These avoidances, since they are quite arbitrary responses to the combination of individual perceptions and particular experiences with animals, do not reflect clan membership, but rather consideration of individualized feelings.
This highlights the importance of distinguishing socially-enforced beliefs such as taboos from personal beliefs, however acquired (called here avoidances). Processes which vary consistently with population structure (e.g., by gender and age cohort, due to gender-specific ontogeny) can produce significantly patterned variation which mimics the distribution of information through social transmission processes. Since variation due to both kinds of processes are susceptible to the same statistical analysis, discriminating between communication and imitation requires independent knowledge about the kinds of information involved. Each category of avoidance thus has not only a unique etiology, but also social distribution pattern.

I also compared the pattern of transmission implied by informants’ own reports about from whence they learned their food avoidances to the outcomes from our statistical models. Reported transmission in this study is highly consistent with the findings of other studies based on informants’ own reports -- emphasizing vertical transmission almost exclusively -- but is inconsistent with the pattern estimated from the various statistical models for the same population. I conclude that the reports are biased because they reflect the normative response. Certainly, in Western populations, adolescents continue to rate parents as significant influences, even after association patterns become peer-dominated (Durkin 1995:529). Thus, neither normative expectations nor self-reports need provide accurate information about the actual transmission pattern of these beliefs. This constitutes a substantial warning to those who would rely on such information, as has been standard practice in social science, including previous studies of intra-population transmission in traditional societies (e.g., Hewlett and Cavalli-Sforza 1986; Ohmagari and Berkes 1997). Thus, this study avoids the pitfalls of using recalled transmission events or ethnographic intuition to make judgements about the distribution of cultural knowledge, and thereby places the study of everyday, intra-population cultural transmission on a firmer empirical footing.

In fact, analysis presented here and elsewhere suggests there are three phases in the normal life course of social learning with respect to food taboos in the Ituri. The first phase is one of cultural innocence, during roughly the first ten years of life, when all foods are viewed as potentially edible because no social restrictions have yet been placed on them; personal preferences rule behavior. Children are simply considered too naive and thoughtless to bother trying to socialize.

In Phase Two, occupying approximately the next decade of an individual’s life, the first phase of transmission takes place, largely from parents. Becoming culturally competent takes time; many individuals do not acquire a full complement of taboos until well into their twenties (Aunger N.d.a,b). No explicit demarcation is required to set these events apart from everyday life; it is sufficient for someone invested with parental authority to tell another something which is quite foreign to their experience -- animals suddenly becoming dangerous -- in a way that begins with "what we do...". Although this inter-generational, intra-familial pattern is that expected by the transmission norm, it is likely that -- at least for Homeopathic Taboos and Other Avoidances -- it simply reflects the importance of nuclear family members

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20 From a methodological perspective, although many individuals who were potentially important to those presently living in the sample population were not themselves sampled (because the informants grew up elsewhere), their absence did not seem to significantly influence the estimated pattern of transmission -- given the degree of consistency observed between results from these studies. This suggests that the geographical and temporal bias in the sample may not have significantly influenced the estimated pattern of transmission. This does not mean such individuals -- primarily the kin of women who married into the sample population -- were unimportant cultural influences, for the statistical results suggest that considerable learning of avoidances occurs at that time of a person’s life from such people. More likely is that missing individuals had a randomized influence on the estimation process.

21 This analysis depends heavily on a comparison of the present results with those from the epidemiological model in Aunger (N.d.b).
to young individuals and the concentration of social contacts in that narrow sphere during the early years of life.

The third and final life history phase consists of a longer but less intense period of cultural transmission -- this time with significant extra-familial inputs. This largely constitutes relearning, or changing one type of knowledge for another. This distinction between Phase II and III (seen here in the difference between household- and village-level patterns) is mirrored in the importance of both early association and familial transmission variables, as well as life experience and contact variables, in the epidemiological study (Aunger N.d.b). Since this transmission takes place outside standard lines of authority, indirectly (in response to changed attitudes or social experiences), and hence without specific transmission events being involved, informants are both less willing and less able to report such changes. Indeed, the changes are perhaps largely unconscious. This accounts in part for the inability of transmission studies based strictly on informant reports to recognize such later changes in what individuals believe. Indeed, the existence of this third Phase is only recoverable through a quantitative analysis such as that undertaken here (unless a prospective study is undertaken).

Perhaps the most interesting general result of the present analysis is the greater cultural variation within households than between households from the same village. This suggests that variation in the pattern of transmission between households generally blurs smaller-scale structures or belief-clusters. This is an indication that, as individuals get older, they look not just to parents and sibs, but to those outside the household, for cultural models. Thus non-vertical transmission is important during some part of individuals’ lives for most (or all) of these avoidance types, and is consistent with the results from behavioral genetic studies concerning the importance of shared family environment early in life, as well as the eventual significant differentiation of sibships as they age (Plomin and Daniels 1987; Plomin 1994). Such studies show that shared familial environment is not a significant contributor to adult offspring attributes (Rowe 1994; Scarr 1993; Plomin and Daniels 1987). In fact, parents provide genes to their offspring, but variation in parenting styles or knowledge have a relatively trivial impact on later variation in childrens’ characteristics.

In fact, the parallel between the cultural life history suggested above and the pattern of ontogenetic change in the heritability of behavioral phenotypes is substantial. In particular, shared family environment is responsible for about one-quarter of variation among young sibs in the best-researched psychological trait, IQ. The reason for this structural variation within families is presumably due to sibs’ varying abilities to learn from experiences arising from their shared membership in a household (Rowe 1994). For example, brighter children are more likely than their duller sibs to seek out -- and to absorb -- experiences provided by parents that enrich intellectual growth (Rowe 1997:140). However, by adolescence, children of the same family are similar only because of their common genetic endowment; any differences due to the practices unique to individual families have faded away (Plomin et al. 1997:447). Extra-familial experiences thereafter differentiate intellectual achievement, making IQ roughly fifty percent heritable in adulthood (Plomin and Petrell 1997:64). The same story can be told for other cognitive abilities (i.e., spatial, verbal, speed-of-processing and memory skills), leading behavioral geneticists to argue that environmental influences outside the family (e.g., friends, teachers) are important in adult cognitive development (Plomin et al. 1997:447). Similarly, the present case suggests that shared family environment is important in childhood (due to parent-offspring transmission) -- leading to the differentiation of sibs from different families, but that experiences outside the family (i.e., transmission from extra-household village members) dominate after adolescence, producing a homogenization of the adult population. The timing of this ontogenetic process resembles that from the behavioral genetic studies of cognitive ability; the only difference is that it is cultural rather than genetic "heritability" which is under discussion here. This parallel suggests that similar evolution

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22 Presumably the same is true for models that look at even higher levels of social organization, such as the epidemiological study (Aunger N.d.b), which exhibited low $r^2$ values.
The Life History of Culture Learning

takes place in both cultural and psychological traits in response to the changes which arise in
the social environment as individuals age.

In summary, I have been able to show the pattern of cultural transmission within
households varies between types of beliefs, and also that the importance of extra-familial
cultural learning grows during adulthood. I believe both of these findings are novel. This is
because one problem with these behavioral genetic and social scientific studies of
socialization is that they have concentrated primarily on the development of personality and
social role-playing (e.g., emotional control, gender roles, and prosocial or aggressive
behaviors). The transmission of cultural beliefs and values per se has been largely ignored.
Even the anthropological literature has tended to focus on the influence of parenting style or
the influence of variation in childhood activities on children's later personality traits (Whiting
and Child 1953 and Whiting and Whiting 1975, respectively). It is therefore a virtue of the
present study that its results extend the general conclusions concerning transmission vectors
from these literatures to this other substantive domain.

In dynamic terms, it makes sense to argue that parents significantly constrain the
potential impact of peers. Parents have control over the degree and nature of peer
interactions, and can also lay in certain kinds of preferences for peer relationships earlier on
in the child’s life (Schaffer 1996:359). This could at least partly explain why the timing of the
change in the cultural importance of extra-familial teachers considerably lags that of their
social importance, suggesting there is a continued preference for transmission from --if not
association with -- normatively authorized figures. Thus, while individuals begin to strongly
identify and associate with peer group members and others outside the family during
adolescence, it is only in adulthood when non-family are sought out for cultural information
concerning the edibility of foods. This delay in the adoption of traits from those outside the
family circle is presumably due to normative inertia, or a continuing preference for acquiring
information with the stamp of social authority.

So what is the answer, then, to our question concerning the overall importance of
vertical transmission? Unfortunately, a somewhat complicated response is required.
Certainly we saw good evidence for vertical transmission within households, at least to the
youngest generation. But the strong indications of ontogenetic change from the
epidemiological study (Aunger N.d.b), and the failure of phylogenetic analysis to account for
cultural variation (Aunger N.d.a), together imply considerable room for non-vertical
transmission. The epidemiological analysis suggests the influence of individuals outside the
family, with whom one comes into contact later in life, while the phylogenetic study implies
the existence of multiple teachers for each individual. The degree of reliance on vertical
transmission seems to decrease for each individual as the number of alternative sources of
cultural information increases. Thus, we can conclude that vertical transmission is
significant, although to differing degrees by type of avoidance, but also in terms of the life-
course: other patterns become more important as individuals leave the natal household and
become aware of a larger universe of cultural opportunities. Further, since the vertical
transmission norm significantly influenced actual learning patterns -- at least for Ancestral
Taboos -- individuals would probably have turned more frequently to non-parental sources of
information, even about these central aspects of their culture, in the absence of such a norm.
More generally, vertical and horizontal transmission are directly linked by parents’ control
over the degree and nature of peer interactions, and indirectly linked by the parents’ having
laid in certain kinds of preferences for peer relationships earlier on (Schaffer 1996:359).

But a major question remains: which other vector of transmission is more important in
later life: oblique (i.e., inter-generational learning from individuals other than parents) or
horizontal transmission? Oblique transmission remains quite conservative because it links
generations -- and also families -- together. On the other hand, horizontal transmission
would make possible significant gaps in belief between coexisting generations -- essentially
splitting the population into potentially conflictual age-specific cohorts. It also means that
knowledge can more readily be lost as generations age and acquire new sets of beliefs.
However, these traditional beliefs have proven quite durable, even in the face of acculturating
forces (Aunger 1996); they also vary systematically with respect to spatial and kinship
relationships (Aunger N.d.b). Therefore, it is probably oblique rather than horizontal
transmission which is more important in the Ituri.
The question important to cultural dynamics is when this oblique transmission occurs: before or after parents have discharged their obligation to socialize the young? If extrafamilial learning occurs after adults have encultered their offspring, such mutant beliefs reach a dead-end and die with those who play host to them, becoming irrelevant to population dynamics. In this case, each generation would learn whatever is current in their local environment and there would be no cumulative change in the belief system. To answer this question, we must look again at the pattern of variation within the Sudanic population for traces of cumulative effects. Purely vertical transmission would create truly independent cultural lineages following family geneologies. On the other hand, the transmission of information acquired (later in life) from close kin would produce larger-scale patterning (since clans are arranged into super-clans on the landscape), like ripples in a pond, the effects of which would decrease with distance. Since earlier work (Aunger N.d.b) shows super-clan clustering of both types of taboo as well as Other Avoidances, it appears that obliquely learned information is transmitted to children by parents. This produces the considerable cultural variation seen at all scales of analysis, and the recombinations of belief necessary to produce the observed degree of maladaptation in the system as well (Aunger 1994a). Because it is likely that much adult learning is subconscious, individuals are not aware of the changes in belief they have undergone, and so are not sensitive to increases in cost -- in terms of both lost nutrition and fertility -- generated by the cultural package they bequeath to their descendants. Thus, cultural dynamics are influenced in this case by changes in the availability of individuals who should learn such beliefs. The loss of individuals to fill slots in the transmission chain is in turn partly a consequence of the practice of these beliefs by earlier generations. In effect, several links appear to be important: population biology influences social networks, which in turn affect the cultural information available for learning by future generations.

How well do the conclusions derived here concerning beliefs about food transfer to other domains of belief in the same population, or to other populations? Since the sequence of early family-based and later, more broadly-based, cultural influences reflects the temporal expansion of the social universe of individuals everywhere (Durkin 1995; Schaffer 1996), it might be taken as representative of cultural life-histories quite generally. The same general transmission pattern is, after all, characteristic of Ancestral and Homeopathic Taboos as well as Other Avoidances -- which serve as social norms, "physical" laws and individual beliefs in the Ituri population, respectively.

However, there are also reasons to suspect that the applicability of this case to other topical domains or societies may be limited. First, other kinds of belief may not be transmitted through the same kinds of mechanisms. These mechanisms include both the sensory modality through which information is transmitted (such as speech versus gesture), as well as social context of the transmission event itself (such as ritualized versus "everyday" performance).

Most food taboos are probably stored as procedural rules acquired through verbal reports from others, perhaps in situations which are somewhat marked off from other situations, but not formally ritualized. Thus, the emic view that one sits one’s child down to pass along the ancestor’s wisdom concerning foods probably holds at least for the avoidances which are taboos. Such verbally expressable cultural knowledge is also likely to be easier to acquire than knowledge dependent on, say, the direct observation of behavior by an expert is some skill or craft. This is because everyone is a natural expert in language, whereas few can hand-make complex artifacts. So acquiring gossip takes only a few minutes, but becoming a smith requires long-term apprenticeship.

On the other hand, the context of transmission is not one of elaborate ritualization either. There is no equivalent of the much-anticipated, multi-media adolescent rite of passage. On such occasions, with a variety of sensory channels simultaneously being barraged with unusual and highly stimulating inputs, profound internalization can immediately result (Whitehouse 1995). On the contrary, there is no pressing need to understand what is being transmitted when food taboos are learned -- the food item is not present, so no behavioral response is required at the time; the context is one of relatively low affect and motivation. The low-key nature of transmission in the Ituri is most obvious in the case of Other Avoidances. Acquiring these beliefs seems to depend on quite another kind of mode of acquisition: a
combination of individual experimentation and a general eye to the behavior of others. "Transmission" of these beliefs is implicit at best.

The observed patterns of cultural transmission may also depend on the social conditions of this population. In the Ituri, there is little constraint on who may interact socially. In a more hierarchically-arranged group, learning from peers, for example, might be frowned upon. This would obviously influence the probability of belief adoption, and hence the relative importance of various kinds of models for acquiring culture. There is also no taboo on who may know your food taboos. Indeed, informants delighted in playing their tape-recorded interviews for whoever happened to be around. In societies where constraints on broadcasting such knowledge exist, one would expect reduced access to such rules and hence greater intra-group variation in these beliefs.

There is one aspect of social life in the Ituri which might influence transmission: residence patterns. If mothers are important role models to daughters, then the tendency for marriages to be somewhat short-term can mean that a daughter’s mother is married to another man some distance away when it comes time for her to learn her food taboos. Her mother’s sister, who should also be a holder of the maternal lineage’s cultural knowledge, is also unlikely to be resident in the same village. For this young girl, the result of virilocality is the loss of an emically appropriate role model.

But the factor which most importantly influences the transmission of these beliefs is the fact that they are highly normative. This constitutes a kind of cultural context to their transmission. Food taboos are backed up by threats. The result is that they are well-internalized and hence quite strictly followed: when the opportunity arises, there are few occasions on which individuals do not heed the cultural imperative they have been handed, and refrain from consuming the tabooed animal (Aunger N.d.c). For cultural beliefs which are not so central to social functioning or individual identity, such a tight relationship between the duty to transmit, the willingness to believe and conformist behavior may not be observed. In such cases, one can expect that cultural transmission might be more willy-nilly, with acceptance of the belief and performance of the expected behavior being based much more on individual idiosyncracies than in the present case.

Thus, changes in either the cultural significance of the belief system, the social context of its transmission, or the psychology of the mode in which individuals acquire the information might result in patterns of cultural transmission quite different from those observed here. Determining how robust the present findings are depends on others performing similar studies in the future.

ACKNOWLEDGEMENTS

This research has been supported by grants from the National Science Foundation and Sigma Xi, and fellowships from the University of California, King’s College, Cambridge and the National Institutes of Mental Health. Many thanks to Gillian Bentley, Kevin Laland, Rob Foley, David Sloan Wilson and anonymous referees of this journal for reading previous versions of this paper. The field study would not have been possible without the long-term investment of Robert Bailey, who directs scientific investigations at the research site. The cooperation of many people in the Ituri was obviously necessary for the present study to be completed: I thank them heartily.
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Thompson, John B.


Tucker, M., and N. W. Bond

Whitehouse, Harvey

Whiting, Beatrice B., and John W.M. Whiting

Whiting, John W.M., and I. L. Child
Table 1. Average Residual Cultural Similarity For Dyads Within Households*

Ancestral Taboos

<table>
<thead>
<tr>
<th></th>
<th>&quot;Male Sibs&quot; (N = 24)</th>
<th>&quot;Female Sibs&quot; (N = 14)</th>
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<th>&quot;Father / Daughter&quot; (N = 34)</th>
<th>&quot;Mother / Son&quot; (N = 66)</th>
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Homeopathic Taboos

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<th>&quot;Father / Daughter&quot; (N = 34)</th>
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Other Avoidances

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* Values below the diagonal are differences in means ($\bar{Y}_j - \bar{Y}_i$), while values above the diagonal are the proportion of critical difference, $\frac{|\bar{Y}_i - \bar{Y}_j|}{MSD_{ij}}$ (see text for explanation). Note that values above the diagonal at i,j correspond to values below the diagonal at j,i.
### Table 2. Average Residual Cultural Similarity For Dyads Within Villages*

#### Ancestral Taboos

<table>
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<tr>
<th></th>
<th>&quot;Male Cousins&quot; (N = 39)</th>
<th>&quot;Female Cousins&quot; (N = 20)</th>
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<th>&quot;Uncle/Girl&quot; (N = 60)</th>
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#### Homeopathic Taboos

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#### Other Avoidances

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<tr>
<td>&quot;Opposite-Gender Cousins&quot;</td>
<td>-0.0108</td>
<td>0.0124</td>
<td>0.0722</td>
<td>0.0294</td>
<td></td>
</tr>
<tr>
<td>&quot;Uncle/Boy&quot;</td>
<td>-0.0075</td>
<td>0.0157</td>
<td>0.0033</td>
<td>0.0386</td>
<td></td>
</tr>
<tr>
<td>&quot;Uncle/Girl&quot;</td>
<td>-0.0093</td>
<td>0.0139</td>
<td>0.0015</td>
<td>-0.0018</td>
<td></td>
</tr>
<tr>
<td>&quot;Paternal Aunt/Boy&quot;</td>
<td>0.0199</td>
<td>0.0431</td>
<td>0.0307</td>
<td>0.0274</td>
<td></td>
</tr>
<tr>
<td>&quot;Paternal Aunt/Girl&quot;</td>
<td>-0.0273</td>
<td>-0.0041</td>
<td>-0.0165</td>
<td>-0.0198</td>
<td></td>
</tr>
</tbody>
</table>

* Values below the diagonal are differences in means ($\bar{Y}_j - \bar{Y}_i$), while values above the diagonal are the proportion of critical difference, $|\bar{Y}_i - \bar{Y}_j| / \text{MSD}_{ij}$ (see text for explanation). Note that values above the diagonal at i,j correspond to values below the diagonal at j,i.

**Note:** Analysis excludes same-household pairs.
Table 3. Reported Transmission Mode

<table>
<thead>
<tr>
<th>Transmission Mode</th>
<th>Percent Of Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vertical</strong></td>
<td></td>
</tr>
<tr>
<td>Parental</td>
<td>76.3</td>
</tr>
<tr>
<td>Grand-Parental</td>
<td>5.8</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>82.1</strong></td>
</tr>
<tr>
<td>Oblique</td>
<td>14.7</td>
</tr>
<tr>
<td>Horizontal</td>
<td>3.2</td>
</tr>
</tbody>
</table>